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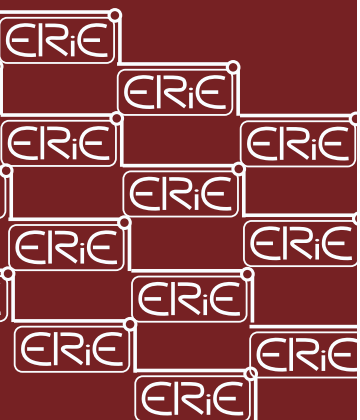

Czech University of Life Sciences Prague
Faculty of Economics and Management

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IMPACTS OF CANCELLATION THE ENTRANCE EXAMINATIONS ON COURSES ECONOMICS

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Abstract

The current demographic situation, declining quality of applicants and the surplus of free places at universities leads to cancellation entrance examinations at some universities. This paper deals with the impact of cancellation entrance examinations at university to a bachelor level. The main goal of this paper is to consider how this change (cancellation entrance examinations) influenced the results of students in the area of economics (microeconomics and macroeconomics) at the Faculty of Economics of the University of South Bohemia in České Budějovice. It was found that there is a statistically confirmed significant difference between students (courses Microeconomics I) who took entrance examinations and those who did not. The main result of the paper is that the cancellations of examinations have a negative impact on the results students in first semester of economics (Microeconomic I).

Keywords

Entrance examinations, university, economics, education

Introduction

The current demographic situation, a declining quality of applicants and inferior policy from The Ministry of Education, Youth and Sports in the field of university education in the Czech republic have been creating problems within the area of accepting new students at university. On the one hand there is a university surplus and on the other side a lack of quality students. The Faculty of Economics of the University of South Bohemia decided to solve this problem with the help of cancellation entrance examinations and accepting students according to results achieved at secondary school.

The main goal of this paper is to find out, with usage of statistical methods, the influence of entrance examination cancelation on exam results and quality of students in the economics area (microeconomics and macroeconomics). Obviously the word quality is little bit stilted and abstract, which cannot be measured. By the "quality of students" authors meant mainly results of exams, number of attempts needed to pass exam, success of passed admission.

There are many methods for university entrance. The standard method of the entrance process is an entrance test (multiple-choice test or open-ended test questions) (Becker, 2000). In Tokyo university the admissions process consisted of three main requirements: (1) a written exam; (2) a personal statement and (3) an oral interview for candidates who passed the written exam and application letter (Myskow and Gordon, 2012). Konečný et al. (2012) recommend to use a university entrance examinations model based on program-specific knowledge and an alternative model relying on general study aptitude (GSA) in the context of a strongly stratified educational system. Kono (2002) recommend that an entrance examinations system should be investigated from a theoretic point of view. Here,

the theoretic point of view means that subjects will choose the possible alternatives under "rationality". Other ways for university entrance for adult students could be to recognize labour competences (Rodriguez et al., 2012). In Turkey the importance of the university entrance examinations is exacerbated and is growing, due to the insufficient number of free places at universities or in the alternative to higher education and providing access to a career. The entrance examinations also play a determining role in the Turkish education system. Thus, all aspects of secondary education are shaped by the exam. In short the content of the entrance examinations impacts upon classroom teaching practices (Bastürk 2011). Entrance examinations in Brazilian universities influence education production efficiency (Zoghbi, Rocha and Mattos, 2013).

Within tertiary education the situation varies in different countries. On the one hand, the lack of free places in universities and on the other hand, in some countries a declining interest in studying at universities (mainly in technical fields). The next problem is a declining quality of applicants. The trend in the decline in the quality of university applicants in Czech Republic was proved by Maryska, Doucek and Mikovcova (2013). The analysis in University of Economics Prague shows declining number of points acquired while maintaining the unchanged difficulty of the entrance examinations in mathematics (Beranek and Remeš, 2012). Filipkowski (1993) suggested that the situation with the declining quality of applicants and interest of study at university, can solved by cancellation entrance examinations.

Materials and Methods

This paper deals with the impact of cancellation of entrance examinations at university to bachelor study. There are two courses taught at the Faculty of Economics of the University of South Bohemia in České Budějovice, which are so called profile courses, because every student who starts to study at the Faculty of Economics has to enroll and pass an exam on these courses. These are Microeconomics I and Macroeconomics I. These two courses, their enrolment, results of exam (marks) were taken as a key factor in research point of impacts given by entrance examinations and its cancellation in 2011. During the first semester of study microeconomics is taught, whilst macroeconomics is taught in the second semester.

All information about courses, number of students, passed admission and exams have been mainly mined from records of teachers, students system used by the Faculty of Economics of the University of South Bohemia in České Budějovice called STAG. Data of years 2007 – 2012 were taken. The word "admission" is meant to be a translation of the Czech world "zápočet", which basically does not exist in English. The admission is mostly representing by the written test, semester work and attendance at seminars. If the students fulfil these requirements, they gain admission from teacher (pass admission) and can take an exam as the next step. This system of two steps passing exams is valid at Faculty of Economics of the University of South Bohemia in České Budějovice.

The test of hypotheses on relative frequency was used for verifying the validity of stated hypotheses. Relative frequency is a measure of what proportion or percent of the data values fall into a particular class. A straightforward calculation determines the relative frequency from the frequency. All that we need to do is add up all of the frequencies. We then divide the count from each class by the sum of the frequencies (Bissell, 1994). The tests of hypotheses enable a decision to be made on the principle of the tested hypothesis H_o and the alternative hypothesis H_A, which reject it. The decision results from the value of test statistic. The set of permissible values splits into two parts: rejection region containing

values of test criterion benefitting H_A and sector of acceptance containing values of the test statistic accepting H_o. The borders between them are called the critical values. For individual sectors the hypothesis was tested on the premise that the difference between relative frequencies π_1 of a particular variant set 1 and set 2 is 0. Null hypothesis is:

$$H_o: \pi_1 - \pi_2 = 0.$$

H_1 hypothesis is given by

$$H_1: \pi_1 > \pi_2 = 0.$$

which has, if the hypothesis H_o is valid, an approximately standard normal distribution, where *p* is the relative frequency (Hindls et al., 1999).

Testing statistic is given by:

$$U = \frac{(p_1 - p_2) * \sqrt{n_1 n_2}}{\sqrt{\overline{p}(1-\overline{p}) * (n_1 + n_2)}} \quad (1)$$

Weighted arithmetic mean:

$$\overline{p} = \frac{(p_1 n_1 + p_2 n_2)}{(n_1 + n_2)} \quad (2)$$

Relative frequency is given according to following formula:

$$p = \frac{n_i}{N} \quad (3)$$

Significance level α is 5% and rejection criterion is:

$$U > u_{1-\alpha} \quad (4)$$

For our sample following rejection criterion can be used U >1.645.

Results and Discussion

The main objective of our research has been to explore the importance of entrance examinations and its relevance on the results of exams. The presumption which was mentioned above is, that students who passed entrance examination test reached better results in courses economics (microeconomics, macroeconomics), had less attempts at exams and achieved higher marks.

The table 1 and 2 show an overview of number of the students who have demonstrated Microeconomics I and Macroeconomics I. The tables are sorted by year (2007 represents academic year 2007/2008) and show how many students in each year of the 2007-2012 courses Microeconomics I and Macroeconomics I have occupied. As a special feature of the table is the sum of the students who enrolled for the course per year and have passed the admission and passed the exam. For example, in year 2007 the total number enrolled was 310. From this number 230 students passed admission. Total number of students who passed exam was 160. For each year can be calculated percentages as given in tables 1 and 2. We can see that the number of students who enrolled on the courses is increasing on both courses. The differences between the total numbers of students within the same academic year might be given by the number of students who repeat the course. Detailed analysis of this fact is part of another research goal.

Following table 1 and 2 represent number of attempts (try) of exam, number of students who succeed to gain admission and number of students who succeed to pass the exam. We have to say that there have been no significant changes in level of tests, scope of

curriculum, contents of course or any other considerable changes in these two courses within years 2007 – 2012.

Year	Total	Admission	Exam	Passed admission	Passed exam after admission	Passed exam	Total number of attempts
2007	310	230	166	74.19%	72.17%	53.55%	491
2008	269	215	117	79.93%	71.42%	43.49%	490
2009	311	242	178	77.81%	69.55%	57.23%	470
2010	307	249	162	81.11%	65.06%	52.77%	532
2011	496	406	217	81.85%	53.45%	43.75%	931
2012	403	298	161	73.95%	51.03%	39.95%	707
Overall	2096	1640	1001	78.24%	61.04%	47.76%	3621

Tab. 1: Course Microeconomics I

Year	Total	Admission	Exam	Passed admission	Passed exam after admission	Passed exam	Total number of attempts
2007	296	191	163	64.53%	85.34%	55.07%	339
2008	265	156	133	58.87%	85.26%	50.19%	302
2009	328	222	179	67.68%	80.63%	54.57%	411
2010	324	241	191	74.38%	79.25%	58.95%	481
2011	512	372	321	72.66%	86.29%	62.70%	666
2012	349	297	219	85.10%	73.74%	62.75%	610
Overall	2074	1479	1206	71.31%	81.54%	58.15%	2809

Tab. 2: Course Macroeconomics I

With reference to table 1, it can be derived this result of falling percentage of students who passed exam after admission. This result is significant at course Microeconomics I where the 72.17% in year 2007 dropped to 49.03% in 49.03%, and average percentage change is 7.25%. This trend is not at Macroeconomics (shown in table 2. This point is ancillary to the main conclusion of this paper, as is given in following paragraphs.

Another observed information was results and average mark of exam. Results and average marks of exam are shown in table 3. There are basically no prestigious consequences in this point of view. Detailed inquiry has not brought any relevant connection among marks, in which try the student passed, courses and years before and after cancelation of entrance examination. This statement was confirmed by statistical calculation of median, standard deviations etc. After mentioned statistical calculations the need of longer time series has been proved.

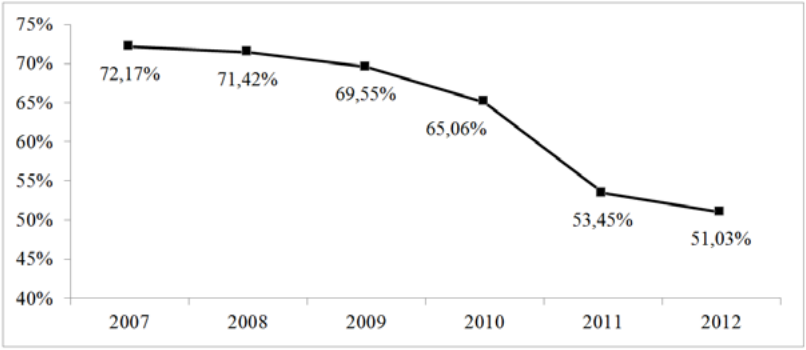

Fig. 1: Trend of passed exam after admission in %, course Microeconomics I

Microeconomics I

Year	Try 1	Try 2	Try 3	Average mark try 1	Average mark try 2	Average mark try 3	Average mark
2007	21.61%	20.97%	10.97%	2	2.23	2.5	2.19
2008	20.82%	15.99%	6.69%	1.96	2.08	1.78	1.97
2009	30.87%	19.61%	6.43%	1.91	2.08	2.3	2.01
2010	26.38%	17.26%	9.12%	1.97	2.33	2.5	2.18
2011	21.77%	14.31%	7.66%	1.85	2.24	2.42	2.08
2012	17.37%	11.66%	10.92%	2	2.18	2.34	2.15

Macroeconomics I

Year	Try_1	Try_2	Try_3	Average mark try 1	Average mark try 2	Average mark try 3	Average mark
2007	31.08%	15.88%	7.77%	2.19	2.52	2.48	2.33
2008	24.91%	12.83%	12.45%	2.1	2.06	2.33	2.15
2009	30.18%	17.38%	7.01%	2.35	2.48	2.7	2.44
2010	28.40%	17.90%	12.65%	2.12	2.3	2.51	2.26
2011	35.16%	17.58%	9.96%	2.1	2.31	2.37	2.2
2012	28.94%	22.64%	11.17%	2.32	2.22	2.49	2.31

Tab. 3: Results and average marks - courses Macroeconomics I and Macroeconomics I

As was given in the part Materials and Methods of this paper the statistical method called test of hypothesis about matching of relative frequency on two samples was used to test impact of entrance examinations cancelation on the students the years 2009 and 2010, years when entrance examination was applied and years 2011 and 2012, after cancelation of entrance examinations. Relevant data are shown in the tables 4 and 5.

The hypothesis which were set are these:

H_o: $\pi_1 - \pi_2 = 0$, represents, that there is no difference between sets

H_1: $\pi_1 > \pi_2 = 0$, represents, that portion of successful students is higher

π_1 is set of students data in years 2009 and 2010

π_2 is set of students data in years 2009 and 2010

With the references to equations 1 – 4 and data from tables 4 and 5 we calculated following results for course Microeconomics 1.

Value U is (according to equation 1) 4.9711, so at significance level α is 5% and rejection criterion is U > 1,645. This can be explained like this. Value of test statistic is in rejection criterion and test at significance level α = 5% proved that in population is portion of successful students (students who passed exam), who took entrance examinations is higher. So the null hypothesis is rejected and hypothesis H_1 is proved. In other words, students who had to take entrance examinations reached better results. This result is valid only for course Microeconomics I.

The different situation has come out with the course Macroeconomics I. Value U is (according to equation 1) -2.3485. Based on this result we fail to reject the null hypothesis. Given rejection criterion U > 1,645 is not valid. The result can be described as a fact, that there is no difference between students (passed exam) who took entrance examinations and those who did not.

Year	Total	Admission	Exam	Try_1	Try_2	Try_3
2009	311	242	178	96	61	20
2010	307	249	162	81	53	28
Sum	618	491	340	177	114	48
2011	496	406	217	108	71	38
2012	403	298	161	70	47	44
Sum	899	704	378	178	118	82

Tab. 4: Course Microeconomics I

Year	Total	Admission	Exam	Try_1	Try_2	Try_3
2009	328	222	179	99	57	23
2010	324	241	191	92	58	41
Sum	652	463	370	191	115	64
2011	512	372	321	180	90	51
2012	349	297	219	101	79	39
Sum	861	669	540	281	169	90

Tab. 5: Course Macroeconomics I

Conclusion

The main goal of this paper was to find out, with usage of statistical methods, the influence of entrance examination cancelation on exam results and quality of students. Authors attempt was as much as possible objectively reflect mentioned influence. The most significant result is that there is a statistically confirmed difference of students of course Microeconomics I (the first semester of economic) who took and did not take entrance

examinations. On the other side, there is no difference at course Macroeconomics I (The second semester of economics). The basic explanation for this is following. The course Microeconomics I is held in the winter term of academic year, the course Macroeconomics I is held in summer term. The entrance examinations were replaced by a system of accepting process, which is mainly based on average marks reached at secondary school. This fact can mean that there are a number of students who simply do not reach a required quality and fail to pass exams, tests etc. This kind of natural selection results into the fact, that in the summer term there are better students who proved required quality.

It is also necessary to put the question, what next factors could cause these differences. The system of classwork can be ranked these among factors. Here we urgently point out that the the system of learning and examination didn't change over the years and is in both courses Microeconomics I and Macroeconomics I is identical. Other possible factors are staffing change, range learning or expressive increase number students in groups for seminars. Authors also reject these factors because how personal structure of teachers, so number students in groups over the years didn't change. There was also no change in range (content) of learning.

On the contrary as a positive factor for reducing differences, can be taken in recent years usage of new electronic support for learning (tutorial videos, graphic microeconomics and macroeconomics models and next e- learning supports), which improve results of learning (Buntean, Andreica, 2010). The fact is, that mentioned e-learning supports can be considered as a main factor influencing results of students. The authors realize these facts, which are going to be point of next research and farther topic for discussion. This paper is to be the first step in deeper analyses.

From our point of research goal, there is no significant difference in the course Macroeconomics (as explained above). The future attempt of authors is to carry on with an observation of results, repeat the research in a couple of years and confirm the conclusion of this paper.

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EFFICIENCY ASSESSMENT OF STUDENTS THROUGH DATA ENVELOPMENT ANALYSIS

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Abstract

Assessment of efficient learning is essential for the efficient allocation and use of educational opportunities for teachers. In this paper, Data Envelopment Analysis (DEA) is used to evaluate the relative efficiency of university students attending the specific subject – Operations research. At first, inputs and outputs suitable for measurement the efficiency of university students were identified. Each university student is finally modelled as a linear system with five inputs and six outputs. Since the one input is identified as ordinal, the classical DEA models could not be used. So the modification – IDEA models are used for this paper. This model is tested and analysed on specific data of 554 students. An application of DEA allows scholars to identify deficient activity in a given subject or to change access for a specific group of students and to take appropriate action for improvement. The designed model was implemented in GAMS software.

Keywords

CCR model, DEA, IDEA, ordinal number, students

Introduction

This paper presents a case study where students from VŠB-Technical University of Ostrava, Faculty of Economics were evaluated via the Data Envelopment Analysis. This approach was used in many researches before, e.g. Sinuany-Stern et al (1994) used CCR model to evaluate departments at University Ben-Gurion and Kuah and Wong (2011) used DEA approaches to allocate and utilize the educational resources and Staníčková et al (2013) used this type of DEA method for measuring the efficiency of student research projects. The efficiency of learning which is analysed in this paper should help teachers to allocate and use the educational procedures within the course "Operations research".

Data envelopment analysis (DEA) is a non-parametric linear programming based technique for measuring the relative efficiency of a set of similar units – Decision Making Units (DMUs). Since the work of Charnes et al (1978), DEA has been demonstrated as an effective technique for measuring the relative efficiency of a set of homogenous DMUs. In this applications, DMUs may include universities, university departments, students of some course etc. CCR model is considered to be the basic variant of DEA method. It is formulated for constant returns to scale (CSR) situation. Banker at al. (1984) extended this model to variable returns to scale (VRS) situation. There are other types of DEA models. In this paper is used CCR model with special case of inputs and outputs. These are IDEA models where ordinal inputs and outputs are included. IDEA models as well as any other DEA models are looking for an efficient frontier that envelops all data. Due to these models all DMUs are classified as efficient i.e. located on the efficient frontier, or as inefficient i.e. not located on the efficient frontier. Particularly for this paper, IDEA

models are solved by the method of change of the ordinal number to exact number, this method was used by Zhu (2002).
An essential topic in DEA is how to choose the appropriate inputs and outputs. Many studies focusing on this problem exist. Input and outputs for this paper were chosen on the basis of analysis and discussion performed by teachers of the course.
The analysis in this paper is performed in several ways. At first, the analysis of efficient units was performed and then these efficient students were compared with the average students. After it the efficient units were compared among themselves to find out the efficiency degree.

Materials and methods

In this chapter, materials are summarized and methods with their specifics for this research are described.

Data envelopment analysis (DEA) and imprecise DEA (IDEA)

Data envelopment analysis (DEA) is non-parametric approach for measuring the relative efficiency of decision making units (DMUs) when the data for multiple inputs and outputs are known exactly. Suppose that there is a set of T peer DMUs, (DMU_k for $k = 1, 2, \ldots, T$), with multiple inputs x_{ik} ($i = 1, 2, \ldots, R$) and multiple outputs y_{jk} ($j = 1, 2, \ldots, S$), respectively. Also, u_i ($i = 1, 2, \ldots, R$) and v_j ($j = 1, 2, \ldots, S$) are the weights of i^{th} input and j^{th} output, respectively. Mathematically, the relative efficiency score of DMU_k can be define as:

$$\text{for } k = 1, 2, \ldots, T. \tag{1}$$

Charnes et al. (1978) proposed the very first DEA model – CCR ratio model for measuring the efficiency score of under evaluation unit, DMU_Q where $Q \in \{1, 2, \ldots, T\}$:

$$\begin{aligned} \max e_Q &= \frac{\sum_{j=1}^{S} v_j y_{jQ}}{\sum_{i=1}^{R} u_i x_{iQ}}, \\ \text{s.t.} \quad & \frac{\sum_{j=1}^{S} v_j y_{jk}}{\sum_{i=1}^{R} u_i x_{ik}} \quad k = 1, 2, \ldots, T, \\ & u_i \geq 0, \quad i = 1, 2, \ldots, R, \\ & v_j \geq 0, \quad j = 1, 2, \ldots, S. \end{aligned} \tag{2}$$

This model (2) can be transformed into the following CCR multiplier problem:

$$\begin{aligned} & \max e_Q = \sum_{j=1}^{S} v_j y_{jQ}, \\ \text{s.t.} \quad & \sum_{i=1}^{R} u_i x_{iQ} = 1, \\ & \sum_{j=1}^{S} v_j y_{jk} - \sum_{i=1}^{R} u_i x_{ik} \leq 0, \quad k = 1, 2, \ldots, T, \\ & u_i \geq 0, \qquad\qquad\qquad\quad i = 1, 2, \ldots, R, \\ & v_j \geq 0, \qquad\qquad\qquad\quad j = 1, 2, \ldots, S. \end{aligned} \tag{3}$$

When x_{ik} (for any i) and y_{jk} (for any j) are imprecise and unknown decision variables as bounded and ordinal data, see Cook et al (1993, 1996), model (3) becomes a non-linear and non-convex program, and it is called imprecise DEA (IDEA), see e.g. Zhu (2002, 2003).
The bounded data can be expressed as

$$\underline{y}_{jk} \le y_{jk} \le \overline{y}_{jk} \text{ and } \underline{x}_{ik} \le x_{ik} \le \overline{x}_{ik}, \tag{4}$$

for $j \in BO$ and $i \in BI$, where $\underline{y}_{jk}$ and $\underline{x}_{ik}$ are the lower bounds, and y_{jk} and x_{ik} are the upper bounds. *BO* and *BI* are the associated sets. These sets contain bounded outputs and inputs, respectively.

The weak ordinal data can be expressed as

$$y_{jk} \le y_{jl} \text{ and } x_{ik} \le x_{il} \quad \forall k \ne l, \tag{5}$$

for $j \in DO$ and $i \in DI$, or to simplify the presentation,

$$\begin{aligned} &y_{j1} \le y_{j2} \le \ldots \le y_{jl} \le \ldots \le y_{jn} \quad (j \in DO), \\ &x_{i1} \le x_{i2} \le \ldots \le x_{il} \le \ldots \le x_{in} \quad (i \in DI), \end{aligned} \tag{6}$$

where DO and DI represent the associated sets containing weak ordinal outputs and inputs, respectively.

The strong ordinal data can be expressed as:

$$\begin{aligned} &y_{j1} < y_{j2} < \ldots < y_{jl} < \ldots < y_{jn} \quad (j \in SO), \\ &x_{i1} < x_{i2} < \ldots < x_{il} < \ldots < x_{in} \quad (i \in SI), \end{aligned} \tag{7}$$

where SO and SI represent the associated sets containing strong ordinal outputs and inputs, respectively.

Model (3) involving (4) – (7) then changes into the following model:

$$\begin{aligned} &\max e_Q = \textstyle\sum_{j=1}^{S} v_j y_{jQ}, \\ \text{s.t.}\ &\textstyle\sum_{i=1}^{R} u_i x_{iQ} = 1, \\ &\textstyle\sum_{j=1}^{S} v_j y_{jk} - \sum_{i=1}^{R} u_i x_{ik} \le 0, \quad k = 1, 2, \ldots, T, \\ &(x_{ik}) \in \theta_i^-, \qquad\qquad i = 1, 2, \ldots, R, \\ &(y_{jk}) \in \theta_j^+, \qquad\qquad j = 1, 2, \ldots, S, \\ &u_i \ge 0, v_j \ge 0. \end{aligned} \tag{8}$$

Where $(x_{ik}) \in \Theta_i^-$ and $(y_{jk}) \in \Theta_j^+$ represents any of or all of (4) – (7). The model (8) with the (4) – (6) can be solved by the standard linear DEA models via concerning the bounded and ordinal data into exact data, Zhu (2002).

The model (8) when Θ_i^- and Θ_j^+ are in forms of (6) and obtain a set of optimal solutions y^*_{jk} and x^*_{ik} with the optimal e_Q^* is the following:

$$\begin{aligned} &e_Q^* = \max \textstyle\sum_{j \in DO} v_j y_{jQ} + \sum_{j \notin DO} v_j y_{jQ}, \\ \text{s.t.}\ &\textstyle\sum_{i \in DI} u_i x_{iQ} + \sum_{i \notin DI} u_i x_{iQ} = 1, \\ &\textstyle\sum_{j \in DO} v_j y_{jk} + \sum_{j \notin DO} v_j y_{jk} - \sum_{i \in DI} u_i x_{ik} - \sum_{i \notin DI} u_i x_{ik} \le 0, \quad k = 1, 2, \ldots, T, \\ &u_i \ge 0, v_j \ge 0, \quad i = 1, 2, \ldots, R, j = 1, 2, \ldots, S, \\ \text{where}\ &0 \le y_{j1}^* \le y_{j2}^* \le \ldots \le y_{jl}^* \le \ldots \le y_{jn}^* \le M \quad (j \in DO), \\ &0 \le x_{i1}^* \le x_{i2}^* \le \ldots \le x_{il}^* \le \ldots \le x_{in}^* \le M \quad (i \in DI), \end{aligned} \tag{9}$$

where M is sufficiently large, more accurate information are at articles by Zhu (2002, 2003). Note that in this case, model is no longer a non-linear program, but a linear CCR model.

Determination of inputs and outputs for measuring efficiency of students

The model (9) was verified using the data set of 554 students. The data are taken from the university information system. There are a lot of information about students and their studies which could be considered as inputs and outputs but not all these data are available. In case that the efficiency of student increases together with the value of a given factor, this factor is considered to be an output, and vice-versa. Finally, five inputs and six outputs were selected. Chosen inputs and outputs are summarized in Table 1.

Inputs	Outputs
grade	task 1
attempt	task 2
mark	task 3
average grade from high school	task 4
average grade	exam
	points

Tab. 1: Identification of inputs and outputs

The grade represents the year of school which each student is enrolled in. The course which is analyzed should be attended in the second grade. Generally, most of students attend this course in the second year, but there are some students which have to repeat this course in the next year. This variable is also the only one ordinal and this is the reason why the IDEA model is used. The attempt indicates how many times the student had attended the exam before the course was finished. This variable is moving from 1 to 4, where 4 means that the student did not finish the course. The mark evaluates the result of the course, again this variable is moving from 1 to 4, where 4 represents that student did not pass through the course. The average grade from high school is moving from 1.00 to 3.18, the smaller average is better. The average grade is the grade from the university for whole period of study. This average is moving from 1.31 to 3.00 and the smaller average is better.

Task 1 to task 4 represent the number of points of the four written credit tests. These credit tests have to be fulfilled at least at 50% before the final test and they can be repeated only once (one regular and one corrective term. The score is from 0 to 7, 8 or 15, depending on the type of the test. The more received points, the better. The exam represents the number of points from the final exam test. This score is moving from 0 to 51, where 0 means that the student did not pass the exam and 51 means that student achieved the highest possible rating in final test. Points represent score of each student which was received during the admission process to university. The lowest possible score was 323 and the highest was 3232.

Table 2 shows the basic descriptive statistics of inputs and outputs of all 554 students. Average values of inputs should be as smaller as it is possible for the interval of the input. On the other hand, average values of outputs should be as higher as it is possible.

For further analysis, it is possible to involve other ordinal variables – p. e. type of high school, which can be considered as another important factor of students' efficiency because of different levels of knowledge provided by different type of high schools.

Inputs	Mean	Mode	Median	Std.deviaton	Max	Min
grade	2.10	2	2	0.30	3	2
attempt	2.87	4	3	1.23	4	1
mark	3.19	4	3	0.88	4	1
average grades from high school	1.94	2.06	1.94	0.44	3.18	1
average grade	2.37	2.50	2.38	1.94	3	1.31
Outputs	Mean	Mode	Median	Std.deviaton	Max	Min
task 1	5.25	7	5	1.74	7	0
task 2	8.54	7	9	4.64	15	0
task 3	7.22	7	7	4.88	15	0
task 4	5.49	5	6	2.29	8	0
exam	17.16	0	28	17.33	51	0
points	1471.26	1395	1422	406.48	3232	323

Tab. 2: Descriptive statistics of inputs and outputs of all students

Results and discussion

In this chapter is the estimation of the relative efficiency by IDEA.
Expertly chosen inputs and outputs which have been already mentioned before are used in the model (9). One input – grade is the ordinal number, which takes values two or three. For this specific application, the model is as follows:

$$\begin{aligned} & e_Q^* = \max \textstyle\sum_{j \notin DO} v_j y_{jQ}, \\ \text{s.t.} \quad & \textstyle\sum_{i \in DI} u_i x_{iQ} + \sum_{i \notin DI} u_i x_{iQ} = 1, \\ & \textstyle\sum_{j \notin DO} v_j y_{jk} - \sum_{i \in DI} u_i x_{ik} - \sum_{i \notin DI} u_i x_{ik} \leq 0, \quad k = 1, 2, .. \\ & u_i \geq 0, v_j \geq 0, \quad i = 1, 2, ..., 5, j = 1, 2, ..., 6, \end{aligned} \tag{10}$$

where the set of ordinal variables *DI* contains only one variable - grade (x_1) because other involved inputs and outputs are nominal.

After solving the problem using the GAMS software, the relative efficiencies of university students are summarized in Table 2. There are calculated the primary elements of the descriptive statistics.

Table 3 shows that there are 239 students, who are efficient, the rest of students is inefficient. That means that around 43% of all student are efficient. The mean value of the efficiency is equal to 0.867, so it can be assumed that even if any student is inefficient, there is high number of students which are close to be efficient. Maximum value of efficiency is equal to 1, these are the efficient students – 239. Minimum value of efficiency is equal to 0.148. So we can say that there is no one who is totally inefficient.

IDEA model	
Number of efficient students	239
Mean	0.867
Mode	1.000
Medium	0.895
Std. Deviation	0.125
Maximum	1.000
Minimum	0.148

Tab. 3: Descriptive statistics of relative efficiency for efficient students

Table 4 describes the average value of inputs and outputs just for efficient students. These statistics may be called as the example of the prototype of the average efficient student and they are further compared with the average value of inputs and outputs of all students which are shown in Table 2.

inputs		outputs	
grade	2.06	task 1	6.54
attempt	2.60	task 2	10.44
mark	2.83	task 3	9.28
average grades from high school	1.83	task 4	6.74
average grade	2.36	exam	22.31
		points	1511.00

Tab. 4: Average values of inputs and outputs of efficient students

Table 5 shows four groups of efficiency. The first group are students who are efficient. The second group are students who are highly efficient. Moderately efficient students are in the third group and little efficient or inefficient students are in the last group.

Degree of efficiency: in interval	in words	IDEA model
1.00	efficient	239
0.99-0.85	highly efficient	132
0.84 – 0.70	moderately efficient	89
0.69 – 0.00	little efficient and inefficient	94

Tab. 5: Degree of efficiency

Table 5 shows that 239 students are efficient and 132 students are highly efficient, 89 students may be called as the moderately efficient students and the rest of students are classified as little efficient (it was already mentioned that no student is inefficient). More than 43% of students were identified to be effective. That means that these students are not dominated by any others and thus they reach the best value at least at one of factors. The Figure 1 shows the information from Table 5 in a graphical representation in percentage terms.

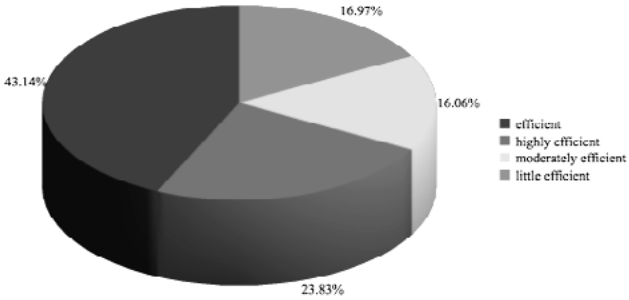

Fig. 1: Degree of efficiency

Conclusion

In this paper, efficiency of students from VŠB-Technical University of Ostrava in performing the subject Operations research in the year 2013 was estimated. There are used five input and six output indicators, namely the grade of the students, attempt to the exam, examination mark, average grade from high school and average grade from the university as inputs and points achieved for task 1 to task 4 and the exam and also points for the admission procedure as outputs. One of the inputs is defined as ordinal while the rest of the indicators are nominal. In order to calculate the student efficiency scores' measurement there are used the DEA approaches, especially DEA approach for ordinal inputs and outputs, e.g. IDEA method. The designed model was verified using the data on students from the year 2013 acquired from the university information system. The results of our approach showed that more than 43% of students were efficient in performing the subject Operations research. These students are not dominated by any others. A non-dominancy is caused by the fact that an effective student reaches the best value at least at one of involved factor.

This research can be further extended. The designed model can be enriched by other inputs and outputs to provide or confirm gained results and possibly improve the accuracy of this model.

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E-LEARNING FOR VETERINARY STUDENTS

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Abstract

This paper brings information about innovations in Bachelor study program at FVHE, VFU Brno. The students of combined study program "Food Safety and Quality" started to use e-learning in their studies. They used MOODLE to solve different tasks during three months in winter semester and three months in summer semester. The tasks were focused on active usage of study materials and Internet for creating sets of the test questions and genetic examples, for finding animations of biological events and to create own models of DNA or chromosome. At the end of the semester, the students were asked to fill in questionnaire for obtaining their feedback. This form of study was positively evaluated by 100% of students and they also recommended using e-learning in other years.

Keywords

Active guiding, evaluation, hygiene, MOODLE, innovations, knowledge

Introduction

There are three faculties at the University of Veterinary and Pharmaceutical Sciences Brno (VFU Brno) in the Czech Republic. However, there is only one Bachelor study program "Food Safety and Quality" at the Faculty of Veterinary Hygiene and Ecology (FVHE) that is offered to students as a combined form of study. This form of study provides an effective combination of full-time and distance learning, which in addition to self-study brings students into a direct contact with teachers. Combined study in the Czech Republic usually consists of self-studying and weekend tutorials that are organized once a month. This way of organization would be problematic in case of veterinary studies, that is why there are differences. The students of combined study have 2 weeks of intensive learning (practical trainings and lectures) in each semester for three years. During these two weeks, the students obtain a lot of theoretical and practical information. The lecturers offer them their Power Point presentations and recommend the other study materials (books and handbooks). After that, the students have free time for their individual work. They should write protocols, study and prepare for written credit tests and final examinations that could be in form of written test or oral examination or its combination. The study is very hard and there is usually small number of students that successfully finish their study. Since we want to change this trend, we started to help the students with their study.

During years 2009 – 2012, we did many innovations (new practical courses, new handbooks, creation of multimedia guides etc.) in subjects of Master´s study programs. Bártová et al. (2010) presented the experiences with innovations in Biology. For Bachelor study program, there is a project «Innovation of Bachelor and Continuing Master Study Program in Field of Food Safety and Quality» for period 2012 – 2015.

As defined by Clark and Mayer (2011), e-learning uses various media elements to deliver the needed content (words, pictures, videos, sounds, presentations, CD-ROMs) and

includes the instructional methods (examples, practice, feedback) to promote e-learning. Some authors did not prove the impact of e-learning on improvement of study results (Manochehri and Young, 2006; Popelkova and Kovarova, 2013), however if the teaching of e-courses should be effective, it must be done with an active learning (Renkl et al, 2002; McKeachie and Svinicki, 2006; Milková, 2011). That is why e-learning should include not only materials (lectures, animations, videos etc.) but also the ways of active learning such as regular individual work of students controlled by teachers and writing the control and credit tests.
The aim of this paper is to introduce our experience with innovations (active form of e-learning) designed for students of Bachelor study program at FVHE.

Material and Methods

Starting from the year 2012, the teachers of different subjects have been working on innovations for students of Bachelor study program. They have been writing new handbooks, preparing new lectures, creating multimedia instruments and using e-learning. Especially e-learning is very important instrument for combined form of study. At VFU Brno, there is a MOODLE system used for creating courses for students of different programs and study years. First, the teachers attended training on different possibilities of MOODLE. After that, the teachers prepared courses for the students that are accessible at this webpage: https://amos.vfu.cz/moodle/login/index.php with a password.
There was also one course created for Biology and genetics. We decided to use e-learning for active work of students. It means, that every month, the students have to solve some tasks (two for one month). Here are the examples of tasks:

1. Go through the lectures (that are available in MOODLE) and prepare set of questions with one or more correct answers (three questions from each lecture) and mark the correct one.
2. Use Internet and find out at least 5 different photos of secondary structure of DNA in real life.
3. Use Internet and find out at least 15 different animations (3 for each topic) of some biological phenomenons such as replication of DNA, gene expression, PCR etc.
4. Use Internet or make up the set of 15 genetic examples (3 for each topic), that are different from those used in practicals.
5. Create own model of secondary structure of DNA and chromosome with crossing-over (you can use different material).

At the end of month, the teachers evaluated the students´ work (max. 50 points for one task) and added new tasks for next month. At the end of semester, the students had to pass the credit test that was also created in MOODLE. The students had to be successful in answering the questions (70%) in test and had to obtain at least 150 of 200 points from tasks. The students were also asked to fill in questionnaire with 9 questions to obtain their opinion and feedback about e-learning.

Results and Discussion

There is a major concern with combined form of study at FVHE, VFU Brno. There are about 73 – 131 students that start to study each year, but only 5 – 8 students graduate each year. It means that only 5 – 9.2% students successfully finish their study (Table 1).
There are many reasons of this problem; the study is hard, time-consuming, the students are not supported by their employers etc. Another reason is also that the students absolve

two weeks of intensive learning and training, and the other study is based on their self-studying. That is why, it is important for them to have the opportunity to use high quality learning materials, to be in contact with the teachers and to be continuously evaluated.

Academic year	Application	No. of students that started their study	No. of students that graduated (%)
2012 – 2013	385	73	6 (6.6%)
2011 – 2012	358	131	8 (9.2%)
2010 – 2011	316	91	5 (5%)
2009 – 2010	195	87	8 (9.2%)
2008 – 2009	226	101	7 (8.3%)
2007 – 2008	202	91	
2006 – 2007	242	84	

Tab. 1: Statistic of study at combined form in study program "Food Safety and Quality"

Since 2012, the teachers have started to work on innovations for Bachelor study program and tried not to use only traditional methods of learning and education, but to enhance it with new forms and learning methods using the electronic technologies. They have been preparing new materials, writing new handbooks and creating multimedia web pages. However, the best form of learning materials for combined study is e-learning (virtual education), that is ideal for distance learning where course content is delivered by various methods such as course management applications, multimedia resources and videoconferencing; the students and teachers communicate via these technologies (Kurbel, 2001).

At VFU Brno, e-learning courses were created for many subjects and one of them was also Biology and genetics. In winter semester 2013, 18 students logged in course and started to fulfill tasks that were designed for them to help them with continual study. During the first semester, 5 students interrupted their study from different reasons, and only 12 of them continued. They had to use lectures to create control tests for individual topics. The sets of questions and answers were checked by the teachers and inserted in MOODLE for self-evaluating the students' knowledge. The other tasks were focused on working with Internet and finding web pages with animations of different biological phenomenons. The teachers created list of animations based to topic and inserted it also in MOODLE for students. The third set of tasks were focused on creating of models (DNA, chromosome), that would help the students to understand the composition of biological structures. The students created very nice models and used different materials (paper, cotton, buttons, beads, candy etc.). You can see some models of DNA and chromosome in Figures 1 and 2, respectively. The photos of models were sorted and inserted in MOODLE.

At the end of the semester, the students (n = 12) fulfilled the questionnaire and all the students (100%) evaluated MOODLE as well-arranged and sufficient, 100% of students were satisfied with this form of study and positively evaluated the tasks of finding the animations on Internet that helped them to understand the principle of biological phenomenons. In total, 92% (11/12) of students thought that creation of questions and answers helped them to go through the lectures and study the topics, 75% (9/12) thought that creating of models helped them to understand the structure of DNA or chromosome,

83% (10/12) of students thought that this way of study was not time-consuming and all students recommended to use such form of study in following years. However we have also constructive criticism that helps us with optimalization in following years, because for example 75% (9/12) students thought that it was not beneficial to search the picture of DNA in real life on Internet.

Based on the reaction of students, we can evaluate e-learning as a useful form of study similarly as Aberson et al (2002) and Law et al (2010) that marked interactive materials useful during the education process. The advantage of multimedia learning is an increased accessibility to information, simplicity of distribution and updating content compared to printed materials (Chu and Chan, 1998; Ward et al, 2001).

Fig. 1: Model of DNA created by students (Herkusová K., Šroubová P., Šebestová B., Koutníková L.)

Fig. 2: Model of chromosome (crossing-over) created by student (Tassanyi N.)

Conclusion

This paper brings information about using e-learning in Bachelor study program at FVHE, VFU Brno. The students of combined study program "Food Safety and Quality" started to use e-learning for study of biology and genetics. They used MOODLE as a source of materials but also to solve tasks such as creating tests from lectures, using Internet to find web pages with animations of biological phenomenons, creating models of DNA and chromosome from different material (paper, cotton, buttons etc.). Their work was regularly evaluated by teachers. Finally, the students used MOODLE to write credit test. At the end of the semester, they fulfilled the questionnaire and all the students evaluated MOODLE as well-arranged and sufficient, they were satisfied with this form of study

and positively evaluated the tasks of finding the animations on Internet. In total, 92% of students thought that creation of questions and answers helped them to go through the lectures and study the topics, 75% thought that creating of models helped them to understand the structure of DNA or chromosome. All students recommended using such form of study in following years. E-learning follows the long-term plan of VFU Brno focused on the modernization of education system, creation of electronic learning texts and easy access to modern information resources. In the following years, we can evaluate the effect of active using e-learning on the study success.

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SUPPORT OF STUDENTS' ENGAGEMENT USING WIKI TECHNOLOGY IN THE SUBJECT E-COMMERCE

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Abstract

A course dealing with e-commerce is an important part of college education for students focusing on practical business activities. In this article, we will describe an experiment with the use of wiki technology in order to support students' engagement and activities in the course E-commerce. Using qualitative data, the findings reveal that students perceived the wiki application as only moderately supporting collaboration efforts and learning and engagement. Wiki application is perceived by students differently compared with other social technologies and this can discourage students from adoption of wiki technologies. It emerged also from experiments that detailed rules for the use of a wiki application must be strictly specified and course content must be modified around wiki application. The paper provides some information to the other teachers who are considering the inclusion of wiki teaching into their courses.

Keywords

Electronic commerce, wiki, education, active learning, social technologies

Introduction

The improvement of students' approach to learning in the subject E-commerce is our unceasing goal. If the teaching of the course E-commerce is to be effective, it must include a component of active learning, see for example Renkl et al (2002), Williams et al (2006), McKeachie and Svinicki (2006), Nerguizian et al (2011), or Milková (2011). E-commerce is a practical discipline. Active learning puts less emphasis on the transmission of information by means of lectures and instead focuses on developing analytical and critical thinking of students. Although the transmission of information through lectures is important for the teaching of e-commerce, rapid development in technology leads to many changes in topics and new themes often have to be inserted in the course of teaching a class (Beranek, 2013). Web technologies are developing constantly and it is difficult to cover all possible technology changes due this development. It means that teachers must be able to show students how they can find relevant information and how they can work with this information. But it means that students can contribute with their knowledge and experience to the content of the course as well. An important part of our approach in the e-commerce course is the working on projects in students' teams. This is the way students learn to cooperate with each other in finding and processing information. Based on these facts, we decided to incorporate collaborative software wiki into your course. The inclusion of wiki technology into our course was also influenced by the fact that this technology is used by business (especially by technological) companies in practice.

Generally, collaborative social software support knowledge sharing and collaboration (Sigala, 2007; Volek and Alina, 2013). It allows to create a flexible learning environment (Alavi, 1994; Tlusty and Binterova, 2013). Social software includes web applications

such as blogs (on-line narrative), wiki (sharing of content and knowledge), discussion forums (exchange of information) and other. Distinguishing factor of social software technologies is that users become publishers rather than just consumers of information.
In this paper, we focused on the practical experience of using a wiki technology to promote student activity and their involvement in the course E-commerce. Positive attributes typically associated with using a wiki are: cooperation, organization, operation and cognition (Biasutti 2011; Cole, 2009; Guth, 2007). Wiki supports better organization of information through the creation of a website referencing between pages (Schwartz et al., 2004). Wiki can also promote discussion among students which has been shown to promote higher levels of cognitive engagement (Kanuka, Rourke and Laflamme, 2007), critical thinking (Richardson and Ice, 2010) and collaborative learning (Beranek, 2012a). The objective of our paper is to examine the effectiveness of the use of wiki in the course E-commerce. The question is: can wiki technology be used to improve students' engagement? Engagement was defined as active participation in class and subject. We also wanted to find out if the wiki technology could be used to create a repository of knowledge at the course level. This means, can wiki be used to create a meaningful course content suitable for evaluation?
Overview of the characteristics of wiki technology together with methodology overview is given in the next section. This is followed by an overview of the of action research dealing with integration of wiki into E-commerce course. The paper ends by presenting a series of reflections on the appropriateness of educational incentives and course content design and offers some knowledge for the other teachers who are considering the inclusion of wiki teaching.

Materials and Methods

Description of wiki technology

Wiki (wiki means fast in Hawaiian language) is a website (hypertext documents) that allows users to add content, as in Internet chat rooms, but in addition, it also allows users to modify existing content. Using a simple HTML markup language, users are able to add and edit content using any web browser without prior programming knowledge. To avoid undesired modifications of wiki documents changes are recorded. If an inaccurate or inappropriate content occurs wiki administrator can go back to the previous version (Parker and Chao, 2007). Content is added to the individual topics, users gradually improves and extends the other posts. This has led some commentators to suggest that the wiki is a useful tool for building communities of practice (Gowin-Jones, 2003). Wiki is also used by workgroups in business practice. Educational use of wiki provides several learning advantages (Fountain, 2005): evolutionary knowledge building and progressive problem solving, possibility to explain the various and often contradictory ideas, clear definition and evaluation synthesis, critical questioning and reflection and the ability to avoid premature decisions and engage in a comprehensive analysis of the others work. Despite the potential positive qualities wiki, there are a number of complicating factors that must be also considered (Cole, 2009). These factors relate to design issues, personal aspects of participants or wiki maintenance. If a wiki should work well clear guidelines and expectations must be defined (Zydney et al., 2011). Wiki is an online both synchronous and asynchronous tool depending on how students use it.

Methodology

Basic methodological framework is based on the theory and practice of action research. Action research is a cyclical process of reflective practice particularly suited to educational settings (Klein, 2012). Action research is a continuous series of events for collecting data on the functioning of the system examined in relation to the set objectives and goals. It is also a process involving the processing of these data within a system of feedback which is usually a result of a plan for further actions aimed at changing the selected system variables. A process of implementation of planned actions based on jointly formulated hypotheses and follow-up results of the evaluation processes is a part of action research as well.

Our wiki activities in the class were based on wiki software module which is a part of e-learning system Moodle (Moodle, 2014). Moodle provides all necessary tools and wiki functionality. It is important that it is compatible with existing virtual learning environment used at our university. It only needs to make minor adjustments in the relevant software modules to adjust the software for our purposes.

Data were obtained from the second year undergraduates studying the course E-commerce. The number of students was 32 students. Students were acquainted with the use of wiki at the beginning of semester in October 2013. One seminar was devoted to the explanation how to handle wiki, what students can expect from wiki, what it is for.

The inclusion of wiki into the course E-commerce also needed some pedagogical changes before the start of the course. The course has been changed from weekly instruction. Discussion on lectures and seminars occurred on predefined alternate time. It gave students ample time to discover and publish new material to the class wiki. Presentation course material now became part of the wiki materials. For example, lectures presentation including images that helped students consider questions on wiki. These materials also provided links to additional reading resources.

It was established that the use of wiki was optional at the beginning. However, since the amount of wiki posts was only a few, we conducted in the middle of the semester interviews with students to gain a deeper understanding of student attitudes to the wiki. Participation was voluntary, and responses were recorded manually. Then it was announced that the active use of the wiki will be evaluated and will affect the final grade in the subject of e-commerce. In January 2014 we performed final interviews. We investigated the students' opinions on the wiki after they had finished the course.

Results and Discussion

Optional phase of the use of wiki

There were overall twelve students' posts on the wiki after six weeks (mid-semester teaching). While student participation in seminars took on average about 75 % of the total group, students had only interested in participating in traditional educational activities. Hence an open questionnaire was administered in the middle of the semester to determine whether the lack wiki use was simply a student disinterest in technology or reflect broader concerns about the dispatch of the material or other.

Out of thirty-two responses indicated that four-fifths of them visited the wiki. But they did not mostly add any contribution. The reasons ranged from lack of time due to the tasks of other courses (educational limitations) to difficulties with the use of wiki (technical limitations), and finally, complete to lack of interest. As can be seen in Fig. 1, almost a half of respondents (42 %) cited problems with the use of technology as a reason for not

posting anything wiki. Regarding these technical problems, students generally argued that the use of the wiki in the e-learning system Moodle was not intuitive like in other social technologies they used. Nearly a quarter of respondents (24%) reported full-year terms from other courses to prevent them from making wiki posts. It was interesting that 12% of respondents highlighted doubts about the quality of their contributions as a reason for not making any wiki posts. Some these respondents argued that they were not in a position to send informed answers to the wiki because they did not study the topic thoroughly. The remaining 22 % of respondents simply did not care about posting on wiki.

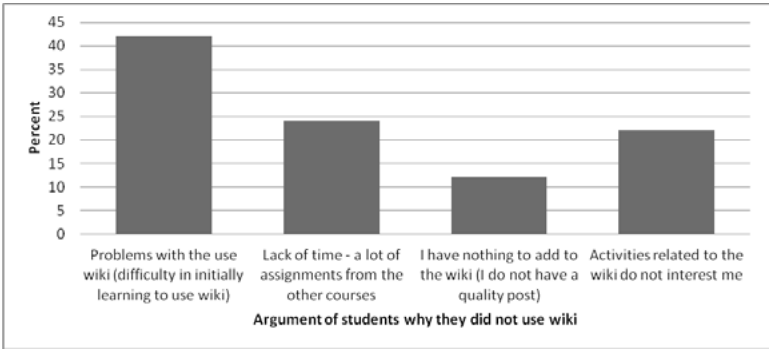

Fig. 1: Arguments of students why they did not use wiki

Mandatory phase of the use of wiki

As already mentioned, in the middle of the semester, it was stated that the active use of the wiki will be evaluated and contributions to the wiki will affect final grade in the subject E- commerce. Then, of course, the number of contributions increased substantially. We encouraged students to write posts and to use wiki within the team so that it helped them in solving their tasks.

We investigated the students' opinions concerning the use of the wiki with the help of questionnaires after they had finished the course in January 2014. We examined how the students perceived wiki after finishing the course. For example, did it support collaboration and collaborative interaction between peers? To which degree did wiki activity support learning?

Views on the use of wiki improved compared with the previous survey. Students had to deal with technical problems and eventually they got used to the wiki environment. Students rather appreciated the team cooperation via the wiki and in the end they felt the wiki beneficial for their learning. We give some results of our research below:

The majority (n = 27) of students (83%) reported contributing their own ideas or resources to the wiki 4-5 times in the second half of the semester while the majority (n = 28) of students (86%) posted 0 or 1-3 times in the first semester (see Fig. 2).

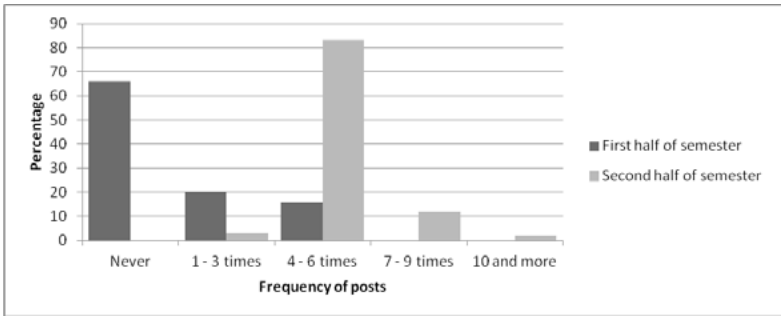

Fig. 2: Frequency of posts during semester

Number of editing and changing information in wiki occurred less often than posting original information. Five students (17%) stated that they never edited or reviewed information in wiki. Twenty-four students (75%) did so 1-3 times and three students (8%) did so more than 7 times.

As Riel and Polin (2004) describe in their paper the fewer changes that are made to the wiki pages, the less likely students will feel they are collaboratively working toward co-constructing knowledge and information. Such students perceive the wiki as a static information collection and dissemination tool rather than a dynamic, knowledge-based learning community.

We chose more difficult assignments which students have to solve within the course (Beranek, 2012b; Stastny 2011). Hence these assignments required more collaboration among the team members. Surprisingly though, minority of students reported perceiving the wiki as a technology that eases collaboration with peers. Though students mostly perceive the wiki to neither help nor prevent or to be difficult to handle properly now, seventy-one percent of the students perceived the wiki as neither helping nor preventing collaboration (see Fig. 3).

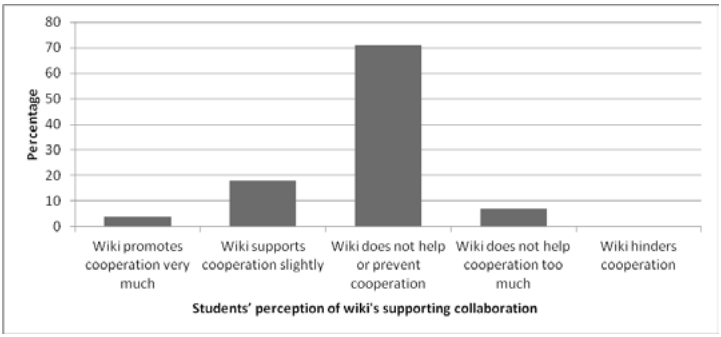

Fig. 3: Students' perception of wiki's supporting collaboration

We wanted also understand if students perceived the wiki activities supporting their learning of course content, regardless of its ability to support collaboration. A majority (n = twenty-nine) of students (92%) felt that the wiki was moderately effective in helping

them learn/engage with the course, and only one student felt it was very effective (see Fig. 4).

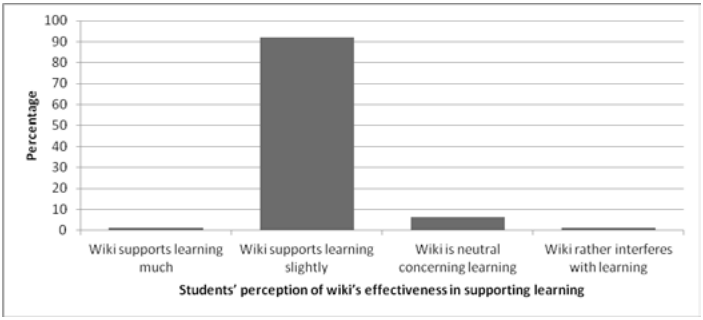

Fig. 4: Students' perception of wiki's effectiveness in supporting learning

The results are interesting and can be inspiring for other teachers who are considering using wiki technology in education:

- It is important to manage behavior and expectations in relation to use wiki. It is not enough simply to add a wiki to course and to expect that students will automatically participate. The course must be designed with regard to the use of wiki. For example, specially designed team exercises proved to be very useful. Wiki posts could relate to any aspect of individual and group work, and even support overlapping of teaching and learning through annotated contributions within students' teams. Teachers must be clear about intended results of the technology used.
- Findings suggest that student motivation for using social technologies seems to be linked to their perception of entertainment. Comments are active between friends (like for example when students use the Facebook). Also important is usefulness, what useful information can students get from wiki. These aspects must be considered when creating an educational context.
- Wiki helps in the processing of group projects. Students can post the message for group discussion and comment. The content created by one member is visible and can be edited by the others. Wiki is used then to supplement other publishing and communication tools in the process of collaborative learning (team assignments solving).

Conclusion

In this paper, we concentrated on understanding the potential of the use of Wiki in our E-commerce classrooms. We supposed that the use of wiki in the E-commerce classroom could improve learning of individuals in the group as well as the whole class. We introduced into the E-commerce course team activities in which Wiki became a useful tool in supporting collaboration and communication.

Wiki enables easy authoring of web content, open access or unrestricted collaboration. It is clear that wiki can contribute to the improvement of teaching and learning practices. However realizing the wiki potential in education is far from trivial. Effective utilization requires from teachers thoughtful, deliberate planning and creativity. The perception of

some students, who currently sees little value in wiki technology as a tool for learning, may be altered in the case of properly suggested course content.

In future research, we want to perform more observations to get a useful frame for understanding the respondents' views of how the wiki may or may not be playing a role in collaboration among students and teachers. Technical aspects of wiki technology may have an influence on the students' perceptions of the wiki for learning and collaboration. In future research of wiki use, we want also to collect data and track students' contributions so that research might correlate frequency and type(s) of wiki activity with students' perceptions of the wiki's role in collaboration and learning. In that way, the research might identify specific profiles of use that lead to greater gains in learning.

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SELF-TEST AND EXAM TEST RESULTS IN THE SUBJECT APPLIED MATHEMATICS FOR IT

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Abstract

The two forms of the tests in the subject "Applied Mathematics for Informatics" are used. The self-tests provide periodically scheduled testing to verify student's knowledge and to improve their knowledge based on tests findings. The exam-tests purpose is to assess the student's knowledge of the subject before the oral exam.
In this paper the scores of periodic self-tests scores and exam-tests scores of the subject "Applied Mathematics for Informatics" from the last 3 years have been analysed. The main goals of this paper are to determine whether the scores of self-tests and exam-tests scores have had the similar tendency and analyse the relationships between the scores of self-tests score and exam-tests.

Keywords

Self-tests, exam-tests, analysis of variance, f-test, student's t-test

Introduction

Exams and grades, periodic testing and test scores are a very important part of the pedagogical work. The purpose of the periodic tests is to periodically verify student's knowledge and to improve their knowledge based on tests findings. The purpose of final test is to assess the student's knowledge of the subject.
Two types of the tests are used in the subject "Applied Mathematics for Informatics" - the self-tests and the exam-tests. The students have to receive at least 60% of self-tests points to obtain credit. The student's course grade is generally based on the scoring on the exam-tests and the oral examination. The basic statistical methods can be used to compare the relationships between the results of self-tests score and exam-tests score.
Basic statistical analysis of tests results is a method often used in many study information systems or e-learning systems which include also test modules, but these tools give only summary results, more detailed study is done for instance for mathematics courses or for entrance tests at University of Economics in Prague (Kaspříková, 2011, 2012a, 2012b, Klůfa 2012, 2013), or for distance programs courses at CULS Prague (Jarkovská et al., 2012).
The aim of this paper is to analyse the basic characteristics of the self-tests scores and the exam-test scores in the subject of Applied Mathematics for Informatics (AMI). This article follows the work of the authors (Brožová and Rydval, 2013) in which the exam results of the subject AMI from the years 2009/10, 2010/11 and 2011/12 were analysed. This analysis was performed because the students considered the exam-test to be very difficult and because the students' grades were too low.
In this article the exam results analysis are extended including the analysis of the self-tests results and the analysis of the relationships between the scores of self-tests and exam-test. The main questions which need to be answered are:

- Have the results of self-tests and exam-tests had the tendency to worsening in the last 3 years?
- Is there any relationship between the results of self-tests and exam-tests?

Material and Methods

Description of the self-tests and exam-tests

The subject Applied Mathematics for Informatics (AMI), is in the curriculum as specialization of Informatics in regular and distance study programs in the Faculty of Economics and Management Czech University of Life Sciences, Prague. Within the completion AMI, the students have to pass the six self-tests and the final exam consists of written and oral part. In the last 3 years the test results of this subject has not reached the satisfactory level.

The main topics of the subject are covered by the lectures and seminars, definitions and steps of algorithms are highlighted during the teaching. Hour duration of the course is two hours of lecture and one hour of a seminar a week. It places great emphasis on individual preparation of students. During the course the students have to periodically fill out six self-tests covering the main subject topics.

The self-tests have the form of multiple choice test. Each self-test is scored and the total possible score is 100 points. Students have 5 attempts to complete each the self-test within a certain period of time. The best score is included into the final score. The maximum score from all self-tests is 600 points. The students have to receive at least 360 points (60%) to get credited and be allowed to take the final exam.

During the last lecture the brief recapitulation of the subject content is made and the structure of the exam is described together with the scoring and grading system.

The exam tests are tests with open questions –in the form of essay or in the form of mathematical question. The exam-test is scored and the total possible score is 100 points. The minimum amount of points necessary for the oral part of exam is 50 points. The grading system uses three grades: 60 – 73 points is a good grade, 74 – 86 points is a very good grade and 87 – 100 points is an excellent grade. During oral examination students have to confirm their knowledge, or may increase their score and improve their grade.

For the analysis of self-tests and exam-tests results, the total scores of tests and the final grading have been collected from the last 3 years (2010/2011, 2011/2012, 2012/2013) and from all students, regardless of the number of attempts. Together we have analysed 356 self-tests and 750 exam-tests.

Statistical methods used for analysis of the average received points in self-tests and exam-tests

Firstly we have done some basic statistics i.e. minimum, maximum, measure of location (mean), measure of variability (variance, standard deviation) (e.g. Bassett, Bremner and Morgan, 2000). Then to verify the presumption of conformity with the variance based on the sample data we used F test. The Null hypothesis says that the variances in the population are identical (Gravetter and Wallnau, 2009). After F-test we have tested hypotheses about the mean values conformity (two-sample test). The Null hypothesis says that the group means are the same. We assume that the variances of population are unknown, but 1) sample variances could be equal (based on the F-test), then the Student's t-test was used, 2) sample variances couldn´t be equal (based on the F-test), the different t-test criterion was used (Osborn, 2006).

To test whether or not the differences between means of several groups of data are significant we used one-way (one factor) analysis of variance (ANOVA). The Null hypothesis says that the means are identical in each group. Chosen factor was a year. Post hoc analysis was done by Tukey´s test (Peck and Devore, 2012). The decomposition of effective hypothesis is shown by box plots. There are vertical bars which indicate confidence intervals of means with ration 0.95.

Results and Discussion

The main questions which this study wants to answer are:

- Have the results of self-tests and exam-tests had the tendency to decline in the last 3 years? In this case the two Null hypotheses are formulated as follow:
  - $H1_0$: Average score gained from self-tests in three reporting periods are not significantly different
  - $H2_0$: Average score gained from exam-tests in three reporting periods are not significantly different.
- Is there any difference between the results of self-tests and exam-tests? In this case the Null hypothesis is formulated as follow:
  - $H3_0$: Average score in both tests is not significantly different.

Analysis of the tests results

The main characteristics of the scores in the both tests are in Tab. 1.

Variable	Sample	Mean	Minimum	Maximum	Variance	Standard deviation
Self-test 2010/2011	356	66.105	10	95	227.104	15.070
Exam-test 2010/2011	265	48.234	0	97	616.884	24.837
Self-test 2011/2012	99	63.192	10	90	364.209	19.084
Exam-test 2011/2012	193	46.570	0	93	546.694	23.381
Self-test 2012/2013	165	64.990	10	86	138.918	11.786
Exam-test 2012/2013	292	40.935	0	100	600.652	24.508
Self-test2010/2013	356	66.105	10	95	227.104	15.070
Exam-test 2010/2013	750	44.964	0	100	601.714	24.530

Tab. 1 Basic analysis of the both tests results

Using ANOVA test it has been shown that the average results of self-test in the years 2010/2011, 2011/2012 and 2012/2013 are not identical ($p=0.000$; $F=6731.422$) and between at least one pair there is a statistically significant difference at the chosen significance level 0.05.

A more detailed analysis (Tukey's test) shows that a statistically significant difference exists between the years 2010/2011 and 2011/2012 ($p=0.000515$) and 2010/2011 and 2012/2013 ($p=0.003334$). Among the years 2011/2012 and 2012/2013 statistical difference doesn't exist ($p=0.604219$). Graphically, the differences are evident in the plots (Fig. 1).

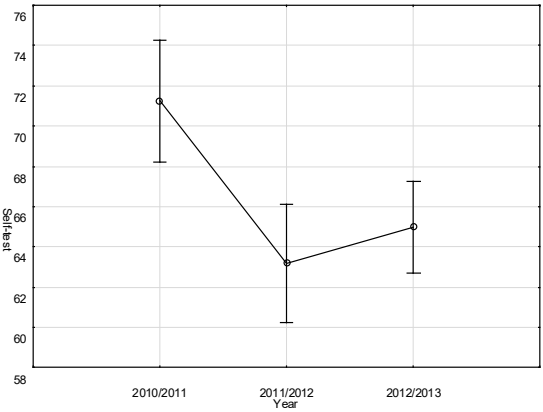

Fig. 1 Average results of self-tests in the analysed years

Similarly, the average results of the exam-tests between 2010/2011, 2011/2012 and 2012/2013 are also identical (p=0.000; F=2511.880) and between one pair only exists statistically significant difference at the chosen significance level 0.05 (Fig. 2). Post-hoc analysis (Tukey‘s test) shows that a statistically significant difference is only between the years 2011/2012 and 2012/2013 (p=0.033663) and 2010/2011 and 2012/2013 (p=0.001201).

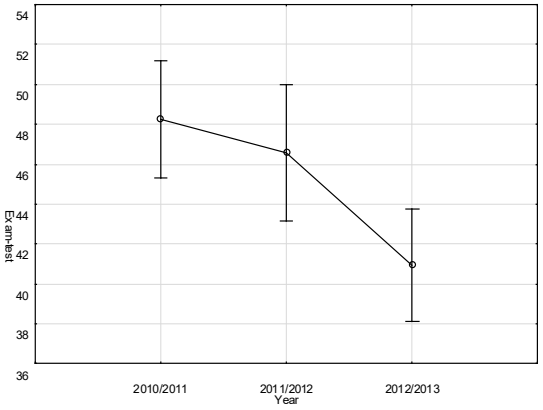

Fig. 2 Average results of exam-tests in the analysed years

In the year 2010/11 students gained on average more points in self-test than in the exam-tests (Fig. 3). Although variances of scores are statistically different (p=0.144291; F=1.360992), their average is significantly different, (p=0.000166; t=3.840800).

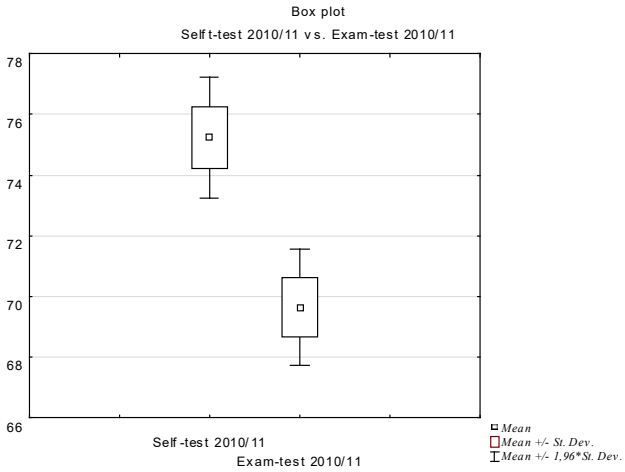

Fig. 3 Self-tests and exam-tests in the year 2010/2011

Also in 2011/12, the average number of points in the self-test is higher than in the exam-tests (Fig. 4). Variances are significantly different (p=0.001253; F=2.075) as well as averages are statistically different, (p=0.010318; t=2.595116).

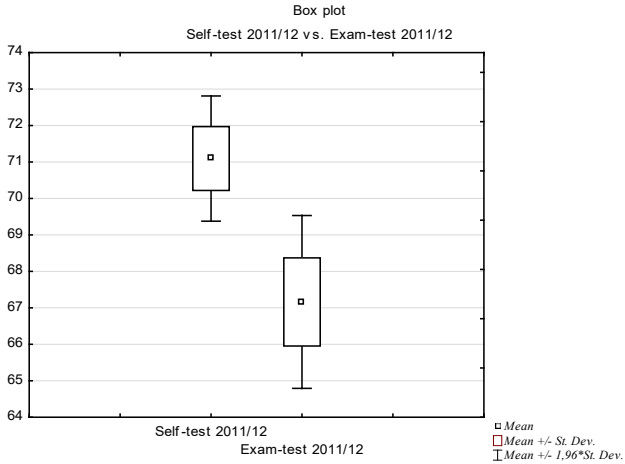

Fig. 4 Self-tests and exam-tests in the year 2011/2012

In contrary the students received in the year 2012/13, the same average score in the self-tests and the exam-tests (Fig. 5). Variances are statistically different (p=0.000; F=3.047), but the average is not statistically different (p=0.058757; t=1.898690).

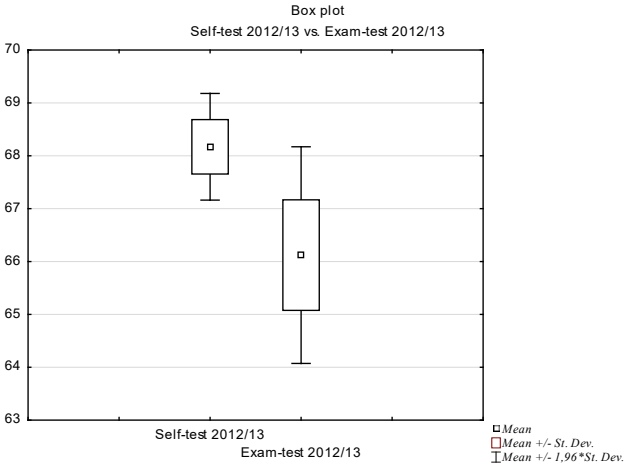

Fig. 5 Self-tests and exam-tests in the year 2012/2013

These results and analysis show that students results are worsening during the years and that the results of the self-tests (used for crediting students) are better than the results of the exam-tests. It seems, that selected testing system in the AMI subject is suitable and distinguishes good between crediting and examination of students.

The scoring and grading system (including entrance knowledge testing in form of self-test) is widely used for students´ evaluation. There are many possibilities how to evaluate the knowledge of students. Some of them are multiple-choice tests, which are often applied for entrance examinations in mathematics (Klůfa, 2011), essays and mathematical questions, which are mostly used to evaluate the final knowledge of students in mathematical courses (Kaspříková, 2011).

Multiple choice tests results can be evaluated easily for large number of students and this kind of students testing is suitable for entrance knowledge testing. On the other hand, many students can obtain number of points in the test just by guessing the right answer, this problem pointed out Zhao (2005, 2006). Standards tests results are complicated to evaluate for large number of students and this kind of tests is suitable for final knowledge testing. On the other hand, students cannot obtain points in the test just by guessing the right answers. Students have to demonstrate their knowledge through complex answers. That is the reason for using the exam-test in form of essays and mathematical questions.

Conclusion

The main findings of this study can be formulated as follows.

- The results of self-tests and exam-tests have had the tendency to decline in the last 3 years. Average score gained from self-tests or from exam-test in three reporting periods are significantly worth although the tests are identical. This tendency is more evident when viewing the results in the last 10 years (Brožová and Rydval, 2013)
- There is a significant difference between the results of self-tests and exam-tests except the year 2012/2013. The results of self-tests are better than the results of

the exam-tests. The reason may be that the students compiled test at home, have unlimited time and maybe use the help of any resource, even a friend.

For the future research we plan to use the paired t-test for comparison of the students results in both types of tests. We also want to evaluate quality of the test items in the self-tests using its proper characteristics.

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DEVELOPING TPACK: A CASE STUDY ON ICT INTEGRATION IN AN EFL CLASSROOM

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Abstract

With a significant increase in information and communication technology (ICT) in schools there is a need for subject specific teacher education on integrating technology into their teaching. Such education must be methodologically well-developed and relate to the local context. To find an efficient and effective way to organize teacher professional development courses, we carried out a study to evaluate the impact of an ICT integration course for in service high school English teachers. In this article we inform about a case study focusing on one of the participants. This case study is a part of the overall evaluation to show us how the teacher training courses reflected on their teaching. We used the Technological Pedagogical Content Knowledge (TPACK) framework for explaining the results. We have also identified barriers in integrating technology in this particular case. In the discussion part we suggest several changes to improve the training course and eliminate the barriers.

Keywords

CALL, EFL, ICT, technology barriers, TPACK

Introduction

In the context of the Czech Republic, Information and Communication Technology (ICT) has become available to every teacher (Carbová, 2012). By access to ICT we mean for example connection to the Internet, a computer for the teacher, computers or laptops for students, the interactive whiteboard, learning software etc. The key factor determining whether the technology will or will not have an impact on the learning process of the students is the teacher, their skills and beliefs (Ertmer, 2005). The focus of studies on integrating technology has thus shifted on studying how teachers use technology, how they integrate it into the curriculum and how this changes the teacher's role. In our research we wanted to see the impact of a course focusing on how to integrate ICT into English as a Foreign Language (EFL) teaching. The case study we present here is a part of a more extensive project with the aim of finding a most efficient way of training in-service teachers on integrating technology into EFL lessons in the context of high schools in the Czech Republic (Carbová&Betáková, 2013).

The teacher, who volunteered to become the subject of this case study, is a graduate of a Teaching English for Secondary Schools study program, who has worked as an English teacher at a high school for five years. The class observations were carried out at a school situated in a city of 100,000 inhabitants. The students there are offered to attend a grammar school or a specialized high school with an Information Technology major. In the classes we have observed there were a minimum of five and a maximum of twelve students. The classroom settings were quite untypical because the school has a one to one notebook policy meaning that each student has their own device. This effort goes so far that the

students do not use printed books anymore. In the classrooms where we were present there was no data projector, although this hardware was available in another classroom. The Internet connection was provided in the whole school building.

While we were collecting data for this case study, several issues occurred. Because of the somewhat unique classroom settings of one-to-one technology integration, we need to consider which affordances are typical for laptops. The topic of affordances in integrating technology into education deals with what are the characteristic benefits of a particular technology since they are not obvious (Koehler and Mishra, 2008). So if a person is given a laptop, it is not clear how to use it for a specific purpose. In order to find out affordances of a particular device, we have to explore it (Gaver, 1991). It is believed that the affordances of mobile devices include the option of using specialized interactive websites for teaching content, the availability of educational apps, other apps for users that are not specifically designed for education but can be used in classes (reading, note taking apps, presentation software), supplemental functions (the Internet, online dictionaries) and the ability to switch between single programs very quickly (Golland, 2011). Building on the knowledge of affordances it is desirable to change the way of teaching and learning. There are three important questions to ask: "What course content is suitable for transmission to mobile computing devices?" "What is the rationale for implementing mobile learning technologies?" and "How will the instructor role change?" (Corbeil and Valdes-Corbeil in Golland, 2011:13)

Another important topic that comes up in the related literature is the degree of student engagement. That is defined by investment of physical and psychological energy (Astin, 1984). The underlying theory claims that the more engaged the students are the more they learn. Some researchers claim that just the presence of one-to-one technology itself can make a difference in enhancing learning motivation, developing cognitive skills, improving learning strategies and planning for learning in daily activities (Li and Pow, 2011).

The last topic, which stood out during the class observations and the interviews, are technology barriers. Alkawaldeh (2013) identified fifteen barriers in utilizing ICT for educational purposes. These barriers are usually interconnected. They all can be divided into five groups: barriers related to the expected consequences of use, habit, social norms, facilitating conditions and barriers that cannot be associated directly with antecedents of utilization (lack of ICT skills, difficulty of integrating ICT into education, training teachers who then change jobs). In their case study Park and Ertmer (2008) identified different barrier areas to implementing ICT. The most important was called "Vision sharing". While the school administration implemented technology as a tool for increasing student-centred learning, the faculty involved in the project believed that ICT was a means to promote pedagogical change through student-centred approach to instruction. The next barrier was lack of feedback from the administrative leading to the idea that it makes no difference whether and how the teachers implemented technology in their lessons. The other barriers fell under lacking knowledge and skills, motivation, rewards and incentives and tools and environment.

Materials and Methods

Let us first look at the organization of this training course. It was spread out over a time span of one month and consisted of five workshops. Each workshop focused on a different topic and each was led by a different teacher. All teachers leading the workshops were experienced in teaching English as a foreign language and integrating ICT into their

teaching practise. The partakers were not required to attend the whole series so their presence depended on their choice and individual possibilities. Except for learning how to work with the technologies, we also focused on how to integrate the new ideas into English lessons. After every workshop there was a task to work on at home with feedback from the teacher afterwards. The workshop was conducted in a form of blended learning. The online course, which accompanied the face to face lessons, contained manuals on the relevant ICT tools tailored to the purpose of this course, assignments and a forum to share students' experiences. As the participants were at different levels of experience with using ICT, the teaching method combined the instructional approach with assignments for students that required them to create materials for their own teaching purposes. They got feedback to their assignments from the single instructors and at the end of the course they completed a written assignment, which required them to reflect on the knowledge and skills developed in the training course. The course included 5 four hour long sessions, which focused on using the interactive whiteboard, word processing, Web 2.0 tools, a classroom and learning management system (MOODLE) and an e-testing system.

To evaluate the impact of our training course we used the TPACK framework. The acronym stands for Technological Pedagogical Content Knowledge, which is a system for understanding a teacher's conscious and subconscious way of organizing the curriculum, approaching the students, managing the classes and integrating digital technology into the whole process (Kohler and Mishra, 2008). Since teachers do not separate the pedagogy, content and technology domains when they prepare for, teach and reflect on their classes but rather manage the teaching process intuitively, a complex approach is needed to identify the progress in the single areas and how they interconnect. The TPACK framework makes it possible to break down the seven areas of Technological Pedagogical Content Knowledge in order to describe the teacher's way of connecting pedagogy, content and technology and track their development in these areas. Let us now look at the overview of the individual areas.

- **Content Knowledge (CK)** is the subject matter of what the teacher is delivering to the students. We can also call it the level of proficiency in the subject.
- **Pedagogical Knowledge (PK)** is an area the teacher needs in order to pass content knowledge on to their students. Those are general skills, which are not subject-specific, like classroom management, pedagogical approaches, assigning task, guiding students and evaluating their progress.
- **Pedagogical Content Knowledge (PCK)** connects the previous two areas. If it is well developed, the teacher can organize and represent subject-specific content in a way that is most suitable to the students. They also know about common typical mistakes and misconceptions and can apply strategies to avoid them.
- **Technological Knowledge (TK)** represents the knowledge of appropriate tools for delivering content, practicing skills and evaluating students' knowledge and skills. It includes learning to use new technologies and the ability to troubleshoot technical problems.
- **Technological Pedagogical Knowledge (TPK)** connects various pedagogical approaches and strategies with the choice of the most suitable technology. Also the teacher's reactions to pedagogical situations while using technology or solving pedagogical problems in those situations belong to this domain.

- **Technological Content Knowledge (TCK)** is needed to find the best technology to represent and share content. Also organizing the content appropriately with the use of technology belongs to this area.
- **Technological Pedagogical Content Knowledge (TPACK)** is the area where all previous domains come together. If the teacher becomes experienced in it, the use of technology throughout the curriculum is taken to a different level recreating the content and methods used.

Three methods were applied to evaluate the impact of the training course. To find out about the teacher's subjective perception of their development in the single TPACK areas, they were given a specially developed questionnaire (Carbová and Betáková, 2013). This questionnaire inquired about the teacher's background, education, and years of practice in the first part. The next section contained questions based on the seven TPACK areas, which were adjusted to suit teaching the English as a Foreign Language subject. The last part consists of questions indirectly asking about the teacher's beliefs. In this paper we will deal only with the teacher's results who took part in the case study.

The second method of collecting data was by doing classroom observations. These started while the teacher was attending the training course and continued one month after it had finished. Eight ninety minute long lessons were observed in total. In the classes we focused primarily on the teacher's behaviour. After the one month period all the observation reports were coded in the seven TPACK areas, observed obstacles in using technology and any other evidence pointing to the influence of technology on the teaching and learning process. Each category was then analyzed in terms of changes as they happened chronologically, which allowed us to trace the teacher's development in that particular area.

The last part of data was collected in semi structured interviews with the teacher, which happened after each observed class. The teacher was always asked about the goal of the lesson and their overall impression. After that they were asked to comment on each activity that took place in the lesson and especially when it contained using ICT, the teacher was encouraged to tell us about the origin of the activity, its intended goal, whether it happened as expected and if the teacher would repeat it next time in the same way, make some adjustments or not use the activity at all. At the end of each interview, the teacher was given some space to express any other ideas related to the context. Triangulating the data collection process by using questionnaires, carrying out class observations and conduction interviews helped us get more accurate data about the impact of the training course.

In this chapter, author(s) provide the description of used method(s), characteristics of data files, etc. If author(s) are stemming from previous work(s), please they should be described here shortly too.

Results and Discussion

In order to understand any changes in the teacher's way of preparing materials and teaching we need to understand their level of pedagogical content knowledge. We did not address that area directly in the training course. From what we could observe the teacher was quite experienced and felt comfortable in his teaching role. Using the communicative language method he spoke English almost all the time and when there was a technical problem with ICT he quickly found a solution by changing the assignment to go around the piece of technology that was not working. He also kept the didactic rule of successiveness (pre-

task, explaining the task, students working on their own, checking results and a post-task). Often he made cross subject references, connecting EFL with other content (ICT, History and Literature). When the students were working on their own, he was walking around the classroom checking on their progress and helping them. He allowed students to negotiate the way of evaluating their results to some extent thus supporting their learning autonomy. The teacher also gave students positively framed feedback to every activity. He attracted their attention by asking the students about topics of their interest. We could also see that the teacher was intentionally switching from Czech to English according to the situation.

Area	changes observed in the lessons	changes discovered from interviews
Technological Knowledge	• The teacher was able to troubleshoot a technical problem when a PDF file was illegible. • The teacher started to import vocabulary databases into MOODLE.	• The teacher learned to use the drag and drop function in MOODLE.
Technological Pedagogical Knowledge	• The teacher started to use multiple choice exercises in MOODLE for listening tasks. • The teacher used PDF files as a replacement for textbooks. • The teacher did not hold control over the ways students were using their laptops. • When the students were working on a task on MOODLE, the teacher took up the role of a facilitator. • The teacher used ICT for correcting exercises so each student got feedback instantly. • The teacher used drag and drop exercises for developing speaking by scaffolding activities. • The teacher gave students practise test as home assignments. • The teacher used technology to enable students to work on their own pace. • In the lessons students worked only as a group together or on their own. (There was almost no work in pairs or in small groups.) • The teacher assigned a task in which students made use of the affordance of note taking when they were doing interviews.	• The teacher is aware of ICT causing difficulty in class management. He would prefer to do fewer exercises online because “too many of them cut the lesson into pieces”. • The teacher perceives automatic correction of exercises as positive because the students “have to submit the results and work on their own”.

Area	Changes observed in the lessons
Technological Content Knowledge	• The teacher transferred exercises from the textbook to an interactive (drag and drop) form. • The teacher shared content online so that students could revise it at home. • The teacher used ICT to create tests. • Sometimes the students were asked to work on a task assigned in a PDF file but then have to hand in the outcome in a Word document. • The teacher used email for assigning homework.
Technological Pedagogical Content Knowledge	• The teacher started using drag and drop activities for multiple purposes. This activity type leverages the affordances of technology. • The teacher guided students who have finished a task earlier to study on their own on a website offering excellent resources and practise opportunities. • The teacher systemized tests for students to revise repeatedly for an exam in the e-learning course. • The teacher encouraged the students to find resources online, use spellchecking functions, online dictionaries etc. • The teacher assigned students to create a vocabulary database using online tools and he embedded it into the elearning system.

Tab. 1: The teacher's development in the TPACK areas

To develop in TPACK means to make continual progress. In some of the lessons we have observed several missed opportunities. For example in lesson number seven, the students were learning language related to presentations and multimedia. Considering the context of a high school specializing in technology, the topic matches a project based learning-by-doing approach. That would show development in the TPACK area. However, the teacher was only speaking with the students about the topic with no visual support or context.

We have observed situations where the technology became an obstacle in pedagogical situations. During one of the activities in the first observed lesson the teacher was walking around the classroom holding an open laptop in his hands. The class was reading an article, students taking turns in reading. The text in a PDF format was distributed online in a MOODLE course and not even the teacher had it available in a printed version. This made it difficult for the teacher to walk around the classroom, call on different students and orient himself in the text having to scroll down the screen as they proceeded. In one activity during the third lesson the students were supposed to be working on their own. The teacher wanted to see how they proceeded. In order to see what was happening on their screen, he had to move some of their desks. This must have made it very difficult for him to manage the class. On one occasion the teacher was working with a printed textbook and the students were reading a text from their laptops. That created slight imbalance as the students had access to more information than the teacher.

In multiple lessons we could see students distracted by technology using online social media instead of focusing on the task they should have been paying attention to. They were typing even in moments when they were supposed to be fully engaged in what was going on in the classroom. There also seemed to be lack of eye contact from the students, making it difficult for the teacher to speak to individual students. Also at the end of the second lesson when the teacher ended the lesson, the students did not look up from their laptops to say goodbye to him.

From one of the interviews we found out that the school was equipped with laptops, a data projector and a content learning management system. However, the students did not have any printed books or digital textbooks, which meant a noticeable lack of resources for the teacher as well as the students. Such an environment can lead to problems with copyright rules. Reading longer texts on a screen makes it also difficult to keep track of the text, especially when there is no software for taking notes (Ill-Chull , Kyoung Sung and Jaeyool, 2003). In one situation it was obvious that the text was hardly legible and the brightness of screens was not sufficient. This made it difficult for the students to read new vocabulary. We also noticed that there were times when the activity in the class was quite inert. This became obvious especially when the students were given a longer task using technology from the beginning of the lesson, which set the tone for the whole lesson.
The teacher proved to be aware of classroom management issues. Not surprisingly, he referred to lack of time, saying that the time investment needed to prepare materials for the e learning course for every lesson was so huge that there was not enough space to prepare a step-by-step lesson scenario. He acknowledged that doing exercises online was more convenient for the students. Also, he tried to use ICT as a tool to manage the classroom. From his answers in our questionnaire it follows that the only changes he perceived after participating in the training course have occurred in the TPACK area (changes in 4 items out of 6) and Teacher's beliefs (2 items out of 7).

Conclusion

To share our insights on technology barriers, we agree with Ertmer (2008) that, in order to integrate ICT into the curriculum, there must be a shared vision of the administration and the teachers. It is not efficient and effective to replace printed resources with laptops and not change the goals and pedagogy at the same time. As the teacher is the key factor in the process of teaching and learning, there needs to be systematic training and a clear set of incentives and rewards. Collaboration among teachers would help to overcome many difficulties. The extra work load connected with preparing online courses must be taken into account by the employer. Also purchasing classroom management software would help the teacher keep students focused on the task.
The main purpose of this case study was to evaluate the impact of our training course. One of the main phenomena discovered here is that the teacher did not make use of any other workshops than those which focused on working with a content learning management system. This might be due to the school equipment (there was no interactive whiteboard) or because of the teacher's beliefs. We have observed development mainly in the TK, TPK and slightly in the TPACK area. In order to achieve more development in the TPACK area, we are planning to implement work in teams, more project based content but, in the first place, much more emphasis on the pedagogical aspects of integrating ICT into EFL lessons.

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RELATIONSHIP BETWEEN EXPECTED FUTURE EMPLOYMENT AND PRESENT FIELD OF STUDY

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Abstract

Human capital is the complex of knowledge and skills of a firm‘s or organization‘s employees, and one of the cornerstones of its successful operation. The aim of the paper is assessment students´ job preferences within the context of particular subject they took chosen field of study. The data for our analysis was obtained through quantitative research, with the help of a questionnaire survey conducted among full-time students enrolled at the Faculty of Economics and Management of the Czech University of Life Science. The results have shown a close connection between students‘ future employment aspirations and the concrete course program in which they are enrolled within the general field of economic studies. This has repercussions in terms of how students evaluate the said subject which they are being taught in college, and in terms of the jobs taken on by students during their studies.

Keywords

Graduated, knowledge, student, tertiary education, work position

Introduction

The unemployment rate in the Czech Republic has been decreasing over the last year, though it has not been larger than 8% for a long time (in February 2013 it was on the level of 7.3%, the same month in 2014 it reached 6.7%). Putting it into context, the value remains below the EU average where the unemployment rate was 10.9% in February 2013 and 10.6% the same month in 2014 (CSO 2014, Eurostat 2014).

For a college graduate to successfully and smoothly integrate into work life, it is indispensable that the knowledge and skills which they acquired during their studies be brought into line with the needs of potential employers. In other words, the system of college education must reflect the demands imposed by professional practice, and make sure that college graduates are prepared to satisfy the needs of the job market to the greatest possible degree.

Theoretical Background

Information, education, knowledge, science, and technology are terms delineating the pillars of today’s society, which for this reason is commonly referred to as a knowledge-based society (Urbancová, 2010).

Tertiary education is defined by the 1997 International Standard Classification of Education (ISCED), which has created a framework for comparing international data on an international platform.That being said, drawing comparisons among national education systems on a global scale remains a complex problem (Kerckhoff, Ezell and Brown; 2002, Marks, 2006; Reimer, Noelke and Kucel, 2008). Tertiary education includes all standard education which builds upon a complete secondary education and which leads to the acquisition of capacities of higher learning. In line with this classification, tertiary

education in the Czech Republic includes studies at all types of (public, private, and state) colleges and universities, studies at technical and vocational colleges, and continued studies at conservatories (upon completion of a high school-level education). The term ISCED is used similarly also in other OECD and EU member countries (OECD, 1999).
In the case of the Czech Republic, the figure for first-time enrollments across the entire sector of tertiary education has roughly doubled between 2000 and 2011, i.e., that part of the general population which embarks on tertiary studies in the Czech Republic is twice as high today as it was at the beginning of the last decade (Koucký and Bartušek, 2011).
Human capital represents the human factor in a firm or organization. It is a combination of intelligence, skills, and experience, i.e., it is created by "the human element" - individuals who are capable of learning, changing, innovating, and creative effort (Bontis et al, 1999). Human capital may also be seen to give an organization its competitive edge (Urbancová, 2012). Human capital is the sum total of abilities, knowledge, and skills of people, and thus gives rise to intellectual capital (whereas the goodwill, or total value, of any firm is the combination of its financial and its intellectual capital. Intellectual capital is an intangible asset (Bygdas, Royrvik, and Gjerde, 2004).
The declining birth rate in the Czech Republic in the first half of the 1990s is behind the demographic downturn of college enrollments in 2012-2014 (CSO, 2014), and will eventually manifest itself in lower numbers of college students and graduates. The upcoming decade will thus show a trend of low numbers of students enrolled in an average year of age cohort (corresponding to the age group of today's freshmen), in the range from 90 to 95 thousand. Between 2023 - 2025, the number of college students ought to increase slightly, to around 110 thousand students per study year within the decade (Koucký and Bartušek, 2011).
A characteristic phenomenon in today's developed economies is the overall improvement of the population-wide level of education. In conjunction with the continuing globalization and internationalization of companies, this has led to increased demands on the part of employers as far as specific skillsets are concerned. In demographic terms and in the long run, the population of the developed world will age, years will be added to the working life of individuals, and the structure of employment in various industries will change considerably as well.
The objective of this paper is to assess the job preferences of students at the Faculty of Economics and Management at the Czech University of Life Sciences. The preferences will be assessed within the context of the particular accounting class students took and within the context of their chosen field of study.

Materials and Methods

The theoretical underpinnings of this paper were developed based upon an analysis of secondary sources, i.e., in particular, topical scientific articles and supplementary statistical sources of relevance in the examined field.
The questionnaire survey was conducted electronically during the summer semester of the academic year 2013/14.
The basic group of respondents consisted of full-time students at the Faculty of Economy and Management of the Czech University of Life Science in Prague, which is currently attended by approx. 15,000 students (FEM, 2014). A selected subset of respondents was drawn from students majoring in Public Administration and Regional Development (in the second grade of Bachelor study degree), and Business and Administration

(in the second grade of Masters study degree), respectively, who during the period of our survey attended the course Accounting for Non-Profit Organizations.

The Business and Administration course was designed to meet the needs of business sector. The Public Administration and Regional Development course implements a system of professionally-oriented training especially in the areas of public administration and regional development.

Participation in the questionnaire survey was strictly voluntary. From those majoring in Public Administration and Regional Development, 72 of altogether 212 enrolled students (34%) participated, and from those majoring in Business and Administration, 37 of altogether 50 enrolled students (74%) participated.

In both disciplines equally 81% females and 19% males took part in the survey. A conclusive statistical analysis based on gender was not possible due to a small number of male respondents.

The results were processed using the methods and tools of descriptive and inferential statistics.

A contingency table is used to test the mutual degree of association of (usually) a pair of variables that can only take a small final number of values. In its simplest form, which compares only binary values, this table is also called a four-field table (or 2x2). The tested criterion is the sum of normalized differences of the marginal frequencies and their translated values, which in the case of independency has an asymptotic distribution of χ^2. The calculated value is then compared to the critical value χ^2 (α) with (r-1)(s-1) degrees of freedom, where α = required probability level of the test, r = number of rows of the table, s = number of columns of the table (Anděl, 1985, Hendl, 2009).

The potential correlation (or absence thereof) was tested by way of contingency tables, with an χ^2 test at the 0.05 level. Various coefficients may be used to measure the strength of correlation; we have opted for Cramér's V (Hendl, 2009).

There were tested the null hypotheses:

H0A: The current work position (in the case of employed respondents) does not depend on one's field of study.

H0B: The position within the job hierarchy which the student expects to hold in the future does not depend on their field of studies.

H0C: The field of employment in which the student expects to work in the future does not depend on their field of studies.

The spreadsheet software Microsoft Excel was used to process and evaluate the data.

A list of the abbreviations used in this paper follows: BAA = Business and Administration, CSO = Czech Statistical Office, CULS = Czech University of Life Science, EU = European Union, FEM = Faculty of Economics and Management, ISCED = International Standard Classification of Education, OECD = Organization for Economic Cooperation and Development, PARD = Public Administration and Regional Development, PR = Public Relations.

Results and Discussion

In the form of a questionnaire survey, we compared the job preferences of students of two different majors within the same field of economics who are enrolled in the second year of their B.S. or first year of their M.S. studies, respectively. Both examined subsets of students find themselves at a comparable stage in their lives, given that they are expected to complete their studies within roughly one year from now.

Only one fifth of all students pursues no gainful work whatsoever (18% in the case of

PARD, 24% in the case of BAA). As their studies progress, the proportion of occupational jobs and summer jobs as a way to generate income drops (62% PARD and 43% BAA), and regular (part-time or full-time) employment becomes more common (19% PARD and 32% BAA). None of those majoring in BAA self-reported as an entrepreneur, which may appear surprising, given the profile of this study program, but can on the other hand be explained away by the relatively smaller number of respondents in this group.

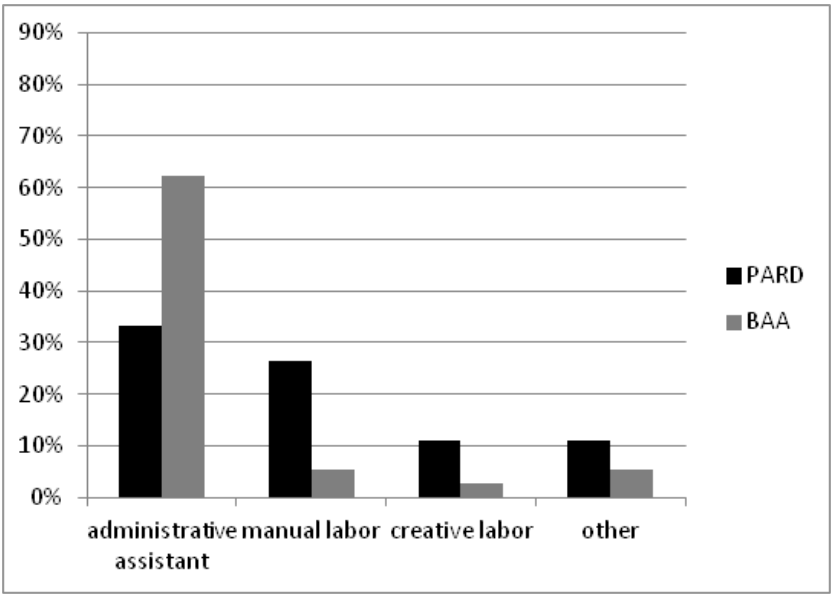

Fig. 1: Current work position, by field of study

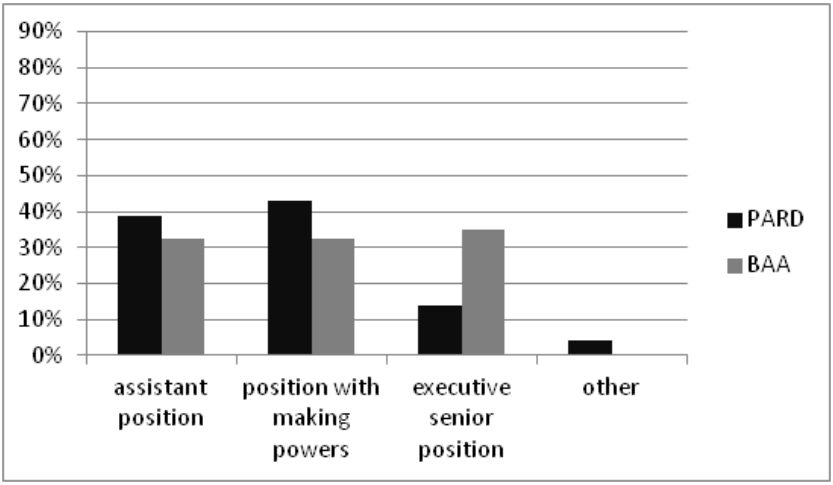

Fig. 2: Anticipated future position after graduation, by field of study

Regarding their current work situation (see Fig. 1), 33% of respondents in the bachelor's program stated that they worked as administrative assistant/intern; among master's students, the figure is already as high as 62%. The reverse tendency can be observed in the area of manual labor, where the proportion of those who work as unskilled (manual) temp worker dropped from 27% to 5% in the higher year of study.
Upon being asked at what level within the job hierarchy (see Fig. 2) they expect to be employed after graduating from university, an "assistant position" was the answer of 28 respondents among the 2nd year PARD students (39%). Balanced expectations prevailed among the group of respondents who are in their 4th year of BAA students; the same number (32%) expects to work in an assistant position or the position of an employee with independent decision-making powers. A whole 43% of surveyed B.S. students expect to secure a position with independent decision-making powers. The attitude taken by the more senior students may be considered more realistic.
35% of M.S. students and 14% of B.S. students expect to secure an executive or senior position at their future employer, which may be understood to be an expression of the trust which FEM CULS students put in the prestige of a college degree, and of their awareness of the importance of qualifications. In other words, attending college is understood by these students to be a means towards attaining a better position in the job market.

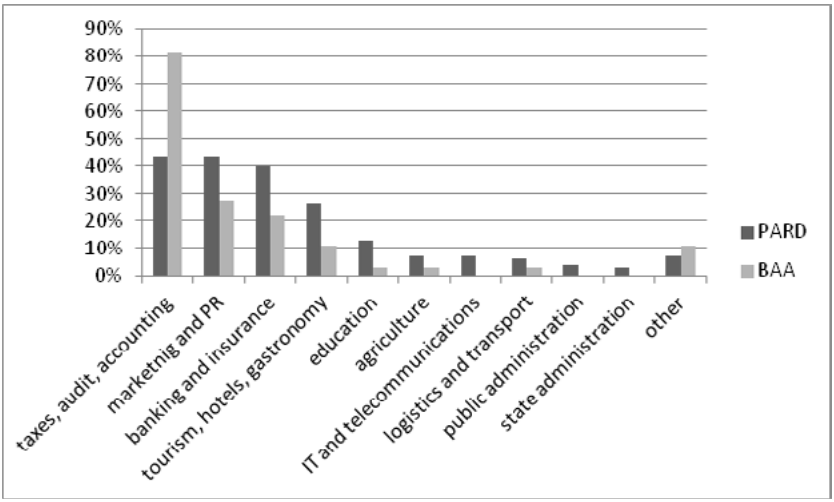

Fig. 3: Preferred field of future employment, by field of study

The unambiguous preference of students in terms of their future field of employment after graduation (see Fig. 3) is the field of tax, auditing, and accounting (43% PARD and 81% BAA), which is testimony to the social prestige of jobs in this field, and to the expectation of above-average earnings that is attached to this prestige. Among those who pursue a master's degree, the number of students who prefer the above-mentioned professional specialization is roughly twice that of bachelor's students with the same preference.
Respondents majoring in PARD show a relatively balanced preference for the following fields of employment: tax, auditing, and accounting (43%), marketing and PR (43%), banking and insurance (40%). 26% of them are interested in employment in the tourist industry, hotel and catering business.

Other fields of employment (academia, agriculture, IT and telecommunication, transport and logistics, public and state administration) draw rather marginal interest among FEM CULS students.

The authors find it quite baffling that only a very small number of students in Public Administration and Regional Development of the surveyed total profess a preference to be employed in the sphere of public and state administration after graduation (7% in PARD and nobody for BAA). After all, PARD is focusing on this particular sphere, and the graduate profile all but anticipates future employment by the government/public sector.

The individual figures show how the preferences of students are distributed depending on their field of study.

The data presented graphically in the text above were analyzed by contingency tables. They yield the following results:

The chi-square value of 13.50 for data presented in Fig. 1 is larger than the critical value of 5.99. Thus, the null hypothesis H0A should be rejected. The Cramér's V coefficient value of 0.39 indicates a moderate correlation.

The jobs held by university students differ substantially depending on the field of study: PAA students are significantly more often employed in administrative positions - the very subject matter of study of the surveyed students.

The chi-square value of 6.08 for data presented in Fig. 2 is just a bit over the critical value 5.99. The null hypothesis H0B should be rejected at the level of 0.05. An association between those values is measured by the Cramér's V coefficient with the value of 0.24 indicating a relatively weak correlations.

In other words, while the position which the student expects to hold in his or her future work life may have an impact on their chosen field of study, the effect is at the limit of statistical significance.

The incidence rates from Fig. 3 in poorly represented fields of studies were merged for the purposes of our analysis, so as to ensure that the contingency table method yields conclusive findings. It was also necessary to recalculate incidence rates because there were more possible answers from every student.

The chi-square value of 17.46 is again larger than the critical value of 5.99 refuting the null hypothesis H0C. The Cramér's V coefficient value of 0.29 can be interpeted in terms of moderate correlations, i.e. the choice of one's future field of employment does depend moderately on one's field of study.

For the university educated population the level of unemployment is relatively low in the Czech Republic. According to CSO, it was 3,2% for the age group of 15-64 old in the 3rd quarter of 2013 (CSO, 2013).

The obtained results were compared with figures on real employment of the graduates in the REFLEX 2010 project. Our results demonstrate that the students‘ ideas about their future employment in managerial positions (32%) are in correspondence with a real situation on the labour market. There, 38% of the graduates in economics state that they are working in such positions within 5 years after getting their diploma. Quite similar figures (39%) are also given by the CULS graduates (Ryška and Zelenka, 2011).

On the other hand there are discrepancies between the ideas and reality in case of bachelor graduates. While in general 37% graduates in economics get a managerial job within 5 years after getting their diploma and the number is as high as 66% for the bachelor graduates at the CULS, our results show that only 14% of the survey respondents believe that they will be in such a position (Ryška and Zelenka, 2011). New data from the follow-up REFLEX 2013 project are not yet fully available. Similar conslusion were drawn by

Alesi, Schomburg and Teichler (2010).
According to CSO (2012), tourism, gastronomy and hotel industry are fields that lack employees which is at odds with the results of our survey. Our student respondents mark this field as 4th in terms of their job preferences. In our opinion the disagreement may be explained by a significant fluctuation of employees and by seasonal oscillations in job demands that are common in these fields.

Conclusion

The results of the questionnaire survey show that the structure of preferences for certain fields and jobs in which students work (or, as the case may be, in which they wish to be employed after graduating) changes over time, as students progress in their studies. Also noticeable is a change of attitudes with respect to the level of one's future position within the job hierarchy in various fields of employment after graduation, which is testimony to the realistic self-assessment of senior students when it comes to their prospects in the job market.
The the field of study has significant impact not only on the choice of one's future line of work but also on the choice of occasional jobs with which students supplement their income during studies. While the impact on students' expectations regarding their future position is not substantial.

Acknowledgements

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UTILIZATION OF SOCIAL MEDIA AND THEIR POTENTIAL IN TERTIARY EDUCATION - MYTHS AND REALITY

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Abstract

The goal of this paper is to map real situation relating to utilization of social applications with focus on students´ active cooperation and collaboration in them. The sub-goal aims at potential of selected applications perceived entirely by students.

The paper is based on the survey followed by semi-directed discussions which were conducted with two groups of students at the Faculty of Informatics, University of Hradec Králové in 2014. 106 questionnaires were collected bringing data encompassing five core areas: personal utilization of social applications, their utilization for study purposes, placing own contributions based on tutor´s instructions and demands, placing contributions voluntarily and finally student´s opinion on potential of social applications in education.

Social software applications are seen in accordance with literature review in their features that enable a wide range of interaction, collaboration and sharing between users. But findings from the survey do not prove it and call for further discussion.

Keywords

Communication, cooperation, education, LMS, potential, social software applications

Introduction

Two key actors dominate, mingle and influence each other in the worlds of social media; those are social and technical aspects. Social media are predominantly perceived as channels enabling new ways of communication among participants where cooperation and interaction are highlighted.

The issue of social nets in the process of education has been analysed and discussed by academicians for more than a decade, as for other software applications covered in by Web 2.0 phenomenon the history goes back to 1999. Positive outcomes prevail and endless potential is highlighted. Researchers approach the issue of social applications in higher education from various perspectives. We enumerate just a limited number of them just with respect to various approaches. Deep insight into the issue of Web 2.0 and practice of teachers in Higher Education was done by Greener (2012); she reviewed peer-reviewed journal articles since 2006. Net generation and potential of social software for study purposes is discussed in the paper of Valtonen et al. (2011). Real educational activities and their modelling in an on-line setting are worked out by Balogh, Turčáni, and Burianová (2010). As for the last example of a different perspective a widely discussed issue of learning styles has been selected; Poulová, Šimonová and Janečka (2010) present in their paper design, creation and application of a software application supporting individual learning styles in e-learning.

As for characteristics of Web 2.0 and its appropriateness for teaching learning purposes it encourages sharing and construction of information; it is participative (Greener,

2012). She states that faculties are supposed to stay up to day to benefit from tools like social networking, blogging, learning management systems, publishing, etc. *The most underlined potential is seen in cooperation and collaboration*. As an example of inhere presented enthusiasm can be blogs, Agosto (2012) brings a deep review into collaboration and knowledge sharing fields and explains how to stimulate even maximize students collaboration on the fundaments of framework of factors, see more Zach and Agosto (2009).

Findings gained from the review prove strong belief in real active cooperation and sharing knowledge via social media. But our findings from previous surveys where mapping of awareness and utilization of selected social applications in higher education didn´t indicate students´ willingness to contribute to the virtual space in terms of educational purposes, (Černá and Poulová 2012). No boundless enthusiasm and persuasion in "painless" or voluntary cooperation was revealed in the following year as well.

This paper is a logical continuation of the previous contribution on social media landscape which was presented last year (Černá and Svobodová 2013), this time the aspect of real cooperation is examined. The *study problem* is again *social media in higher educatio*n but now with focus on active effort of students.

The goal of this paper is to map real situation relating to utilization of social applications with focus on students´ active cooperation, sharing, creating and developing materials in them. The sub-goal aims at potential of selected applications perceived entirely by students.

The paper is based on the survey followed by semi-directed discussions which were conducted with two groups of students at the Faculty of Informatics, University of Hradec Králové in 2014. The survey stems from a long term survey on utilization of software apps; this one is based on a short list of 8 relevant applications.

Materials and Methods

This chapter brings description of a research sample, a research tool and a way of data processing.

The research accessible sample consisted of two groups of full-time students from the second year of their studies. In the first group there were 71 students of subject Basics of Finance, from the Financial Management Bachelor programme, the other group was made of 35 students of Professional English, from Information Management and Applied Information Bachelor programmes. The gender issue was not examined.

106 questionnaires were distributed and collected bringing data encompassing five core areas plus one extra area for students of Professional English so that their tutor could gain up-to-date technical data:

- personal utilization of social applications,
- their utilization for study purposes,
  - utilization of social applications for studying languages
- placing own contributions based on tutor´s instructions and demands,
- placing contributions voluntarily
- and finally student´s opinion on potential of SA in education.

The questionnaire itself was based on questionnaire that was applied in previous surveys, but it was modified heavily. Out of 17 applications only 8 appropriate ones were selected to fit the focus of the survey.

- Out of the wide scale of social nets only Google+, Facebook were selected, as Twitter and other social nets still are not frequently visited by our students.

- YouTube has always been popular with our students; it has been widely utilized for both study and leisure purposes. YouTube is an application enabling sharing predominantly music recordings as well as presentations and instructions from various areas. It might be expected that students will contribute into this space.
- Wiki platform is a social application that is one of essential apps for cooperation purposes, as it enables sharing knowledge, it enables developing common knowledge (Schroeder 2010). It is popular with students, they drain materials from it nearly daily (Černá and Svobodová 2013). But what is their active contribution into it? Aren´t they only passive users?
- Skype as exclusively social communication application has been selected as well, but ICQ has been excluded.
- Blog as a form of online reflective diaries must have been listed, as literature review has proved its potential in spite of the fact that there was quite a high scepticism with researchers in utilization of this application by students.
- Completely the same reasoning was for selection of social–bookmarking. In literature its great potential for study purposes is described (Schroeder, Minocha and Schneider 2010). But we were aware of the fact that this app doesn´t belong to the menu of our students´ applications. Social-bookmarking is used for storing and sharing web-links, so it is a promising tool for cooperation.
- As for learning management systems (LMS) no one was specified, neither commercial nor open was named. In the questionnaire there was just stated LMS. Our students are familiar with this system as it has been embedded at our faculty since 2001 and its utilization forms a standard way of learning teaching process mostly in the blended way of learning/teaching. Currently Blackboard is used.

Hard copies of questionnaires were distributed; it took about 3 minutes to complete them by respondents then the follow-up discussion came and lasted about 20 minutes. So the whole process of distributing and collecting data was short. Rate of questionnaires´ return was 100% as researchers personally distributed the questionnaires and discussed the issue with respondents. Then the process of processing the data came; it was time consuming as it was necessary to insert all the data into spreadsheets. Gained findings were enriched with graphs so that the readers could visualize the findings.

Results and Discussion

Both groups that formed the research sample had the same background; they were from the Faculty of Informatics and Management. There was a presumption that both groups were comparable and that it would be possible to put them together and create only one group. But there were such discrepancies in findings that it was necessary to work with each group separately and consequently compare findings relating to individual categories and applications between these two groups of Basics of Finance and Professional English.

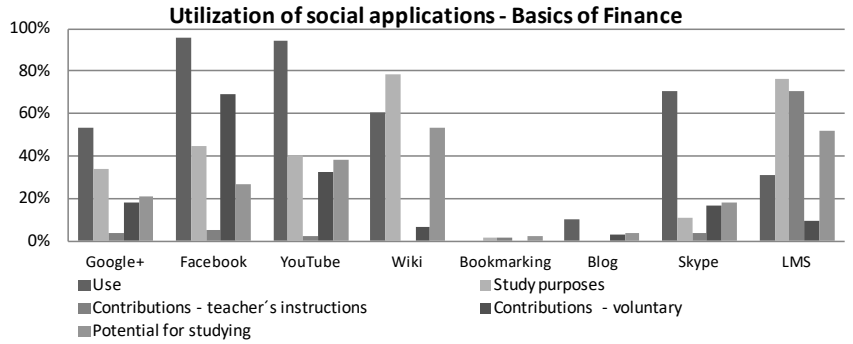

Fig. 1: Utilization of Applications by group 1 (Basics of Finance)

Figures 1 and 2 provide readers with a general view of all five examined categories in utilization of individual apps.

The first bar in both figures shows whether the application is *used*. The second bar in both graphs shows how many respondents use the app for *study purposes*. The third bar in graph 1 represents key findings related to placing contributions into app on the basis of teacher´s instructions. The fourth bar illustrates the other core issue; it illustrates number of *contributions that are placed by students voluntarily*. The last bar reflects *students´ view of the potential of discussed applications*.

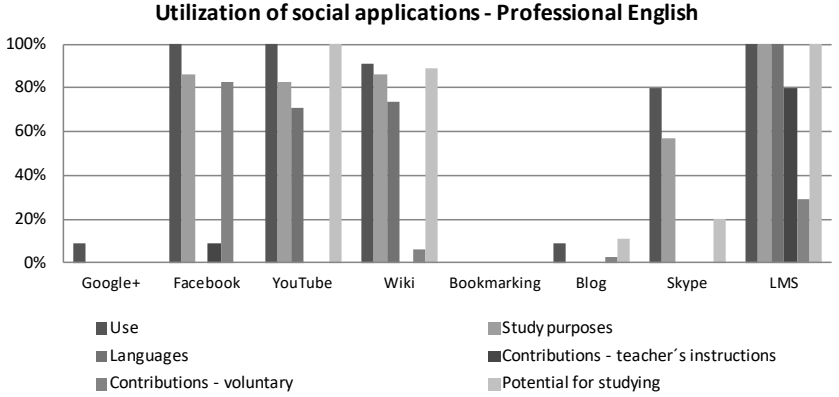

Fig. 2: Utilization of Applications by group 2 (Professional English)

Figure 2 has extra category *´Use for studying languages´* which is represented by the third bar. One of the researchers was a language teacher and so was inquisitive what the situation is like in her field so that she could get inspiration and modify her teaching activities accordingly.

- All students use Blackboard platform and
- astonishing three quarters of students use YouTube and Wiki in studying languages.

The fourth bar shows percentage of students who place *contributions* as assignments on the basis of teacher´s instructions, the fifth one reflects *voluntary activity* in apps and the last sixth one shows the *perceived potential* of discussed applications *in the process of education*.

Three more graphs are used to illustrate examined areas. As a starting point a comparison of utilization of applications is taken, see Fig. 3.

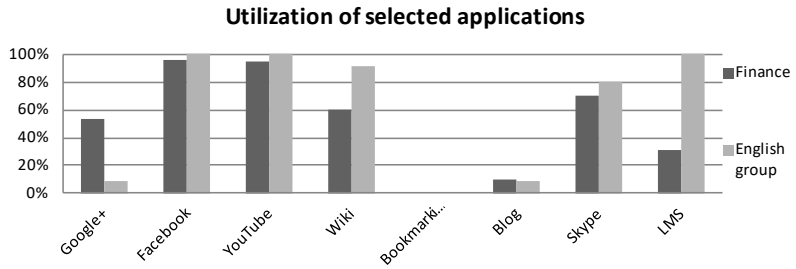

Fig. 3: Comparison of utilization of applications by both groups

- Utilization of Facebook and YouTube is nearly identical, it reaches astonishing 100%. and Skype 70% to 80%.
- Blog is utilized by comparable but limited number of respondents reaching only 10% and 9%. Findings are the same as in previous survey (Černá and Svobodová 2013).
- Key discrepancy from the point of view of learning/teaching is seen in utilization of Blackboard learning management system (LMS), everybody from the group 2 uses it but as for group of Financial management only one third uses it.
- Surprisingly the first group uses Wiki platform much less than the other group; to be precise it is 61% to 91%.
- As for Bookmarking which is considered to be a beneficial tool for cooperation, for sharing materials (Weller 2010), our sceptical expectations have been right. None out of 106 students uses this application.

Two more graphs deal with the core issue of this paper. Fig. 4 and 5 depict real active contributions that enable developing materials, their editing and enriching. Reality doesn´t correspond to great expectations and literature review, to promised opportunities and challenges to cooperate even collaborate (Agosto 2012), (Valtonen, T. et al. 2011).

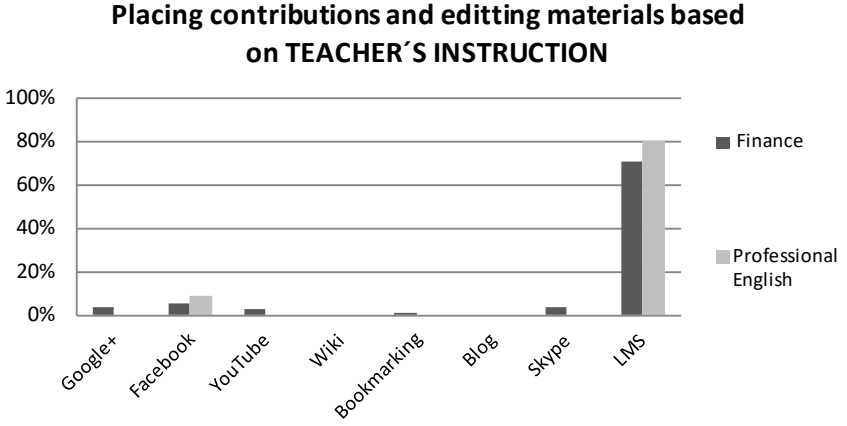

Fig. 4: Contributions based on teacher´s instruction

- As for contributions and cooperation that are run in accordance with teacher´s instruction only LMS is worth mentioning, see Figure 4. LMS is used by 70% of respondents in the first group and 80% by the other group of students. It proves both students´ and teachers´ involvement and established practise.
- Only 6% and 9% enter social nets to cooperate.

These findings clearly show that implementation of social applications into the process of education basically depends on teachers´ involvement.

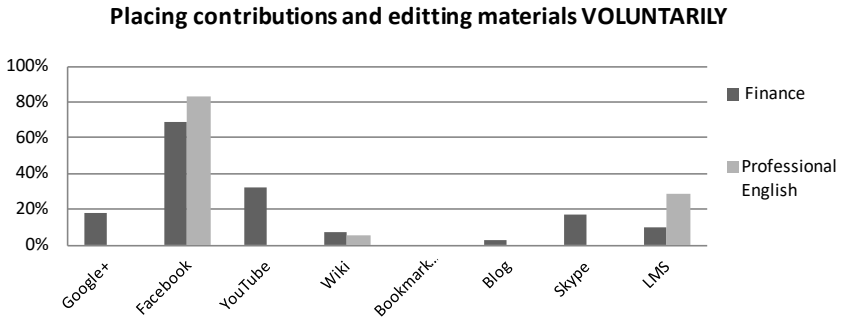

Fig. 5: Contributions placed voluntarily

Significant findings relating to cooperation and active involvement into developing materials in social media can be seen in Fig.5.

- `Finance group` contributes into all apps except bookmarking and reaches higher results in Google+, YouTube, Blog and Skype.
- 69% from the first group and 83% from the other group of students actively contribute to Facebook.
- 32% from `Finance` group contribute to YouTube which is praiseworthy and represents a positive not usual trend in our settings.
- Positive is that students are used to contribute freely into LMS.

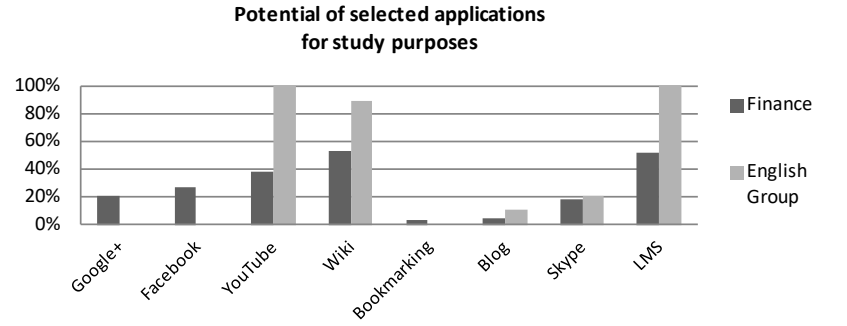

Fig. 6: Potential of social applications for study purposes

The last findings relate to potential seen by students.

- The more active `Finance group` is much more open to utilization of applications in education on wide scale.
- As for the `English group` students believe in YouTube and LMS in astonishing 100% and in Wiki in 89%.

- No potential is seen in Bookmarking and Blog. Students don´t use them, they say that currently plenty of applications merge and one application can serve several roles.

Conclusions

In spite of the fact that research sample consisted of students from the same faculty there were few discrepancies in utilization, active development of study materials and seen potential in social applications. One group was formed by students of Basics of Finance subject from the Financial Management bachelor programme and the other group consisted from students of Professional English from Information Management and Applied Information bachelor programme.

There were nearly *identical findings reaching 100% utilization of Facebook and YouTube* in both groups, comparable results related to *Skype 70% to 80%* in favour of English group.

Key discrepancy from the point of view of learning/teaching was in utilization of Blackboard learning management system (LMS), everybody from the English group used it but as for group of Financial Management only one third used it. The answer for active utilization of LMS by the English group can be found in systematic work and in motivation; students are encouraged to contribute and cooperate in this platform.

The other discrepancy was found in utilization of Wiki platform 61% to 91% in favour of English group. As for editing in Wiki, findings were marginal in both groups.

Our students are mostly passive users. But when they are instructed how and where to place contribution, they don´t find it difficult or bothering as was proved in the English group.

Main trend can be seen in a great increase in utilization of YouTube for study purposes.

There can be seen *no increase in active developing materials* in the applications. There is complete ignoring of Bookmarking. Blog is of minor importance, to be precise 10% to 9 % as well as Wiki 7% to 6% in slight favour of Finance group.

So there is a key topic calling for discussion – should teachers take an active role and utilize the promising features of social applications in the educational process themselves?

Acknowledgements

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THE CORRELATIONS BETWEEN THE PARTIAL AND FINAL GRADES IN MME II

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Abstract

The goal of this study is to verify whether the partial evaluation has some relation with the final exam grades. Results of 268 students enrolled in the compulsory course "Mathematical methods in Economy II" were recorded during the semester and during the final exam. The written part of the final exam consisted of a theoretical part and practical cases, the oral part included two questions. Statistical analyses of the mutual dependencies indicated that the results during the semester and the results of the written test had influence to the final examination grade. The dependencies on the teacher, branch of study and gender were not statistically important. These results were discussed with some other authors´ findings.

Keywords

Oral exam, written test, partial evaluation, final grade, dependencies

Introduction

Many researchers have viewed a positive correlation between student grades and scores on student course evaluations as evidence of greater knowledge transmission, assuming that grades reflect learning. However, it is not clear that higher course grades necessarily reflect more learning (Beleche, Fairris and Marks, 2012). The students of higher education courses went usually through several evaluation steps before they get the final grade. While the results of each course and the study itself depends on many factors as social status, high school experiences, gender, race, family background, motivation and personality (Moorgat, 1996 in Lakhal, Sévigny and Frenette, 2013), the question is to which extent the final grade can be used as a measure of the transmission of knowledge in a course and how the partial evaluation corresponds with the final grade.

The evaluation methods investigated in this study are: multiple choice questions, calculation of examples, written theoretical test with open answers and oral exam. The result of the exam can be influenced not only by the knowledge acquired but also by the student's ability to cope with a particular evaluation method.

The personality factors influence not only the students' preferences towards evaluation methods but also the results of the study (Lakhal, Sévigny and Frenette, 2013). The results of Furnham, Batey and Martin (2012) show that the multiple choice questions are preferred by bright, less open candidates; oral exams are better for stable, low conscientious students with a deep learning style.

The factor of gender seems to be important however its effect is not understood in the same way in different studies. By Lakhal, Sévigny and Frenette (2013) the female students tend to have a greater preference for written exams, multiple choice tests and practical work and male students prefer to be assessed by oral exams. Chamorro-Premuzic et al., 2005 found that males tended to have more positive attitudes towards written examinations

than did females, whilst self-assessed intelligence was positively related to preference for written exams (notably in male students).Female students are on average rewarded significantly better during the course, relative to the exam, than male students. It might be because of arguably a more competitive environment at a final exam than at partial tests (Falch and Naper, 2013). The assumption that future grades are a valid measure of learning in the prior class is at best weakly correlated with the experience (Beleche, Fairris and Marks, 2012).

Using different evaluation methods in partial evaluation allow the students to show their knowledge. The goal of this conception is to help the students to overcome their pour handling with a particular evaluation method. On the other hand, using multiple step evaluation is demanding for time and work of both students and teachers. If the result of some partial evaluation is not taken into consideration properly, it should be either skipped or its contribution to final graded should be reappraised.

This study deals with the students of the Czech University of Life Sciences in Prague, Faculty of Economics and Management, with the majors "Economics and Management" and "Business and Administration" in the course "Mathematical methods II". During the course they go through a partial evaluation every week of the semester and the final exam is both written and oral. The goal of the study is to find the correlations between the different parts of the evaluation and prove the importance of each part for the final grade. The study does not use self evaluation and survey methods; it is based only on the evaluations given by teachers or in electronic tests.

Materials and Methods

Participants

The basic data set consists of 278 investigations. This set was consisted of 268 undergraduate students. There were 110 males and 168 females, 109 students of the major "Business and Administration" and 169 "Economics and Management".

A smaller number of students than the number of observations were given by repetition of the exam. 10 students took the exam twice.

Students were chosen randomly out of totally 1000 students of the course. 961 of these students got the credit and 599 passed the exam in total.

Evaluation procedure

All participants completed 11 on-line tests during the semester without the presence of the lecturer. In each test, it was possible to get 100 points, 1100 all together. The students with minimum 660 points got the credit and were allowed to proceed to the final exam. The students with more than 900 points received at maximum 20 bonus points (1 bonus point for each 10 points over 900) which were added to their first written examination test results.

The final exam consists of written and oral part. The written test (in the presence of a lecturer) had two parts: theoretical (40 points) and practical (60 points), i.e. calculation of examples. The candidates with less than 50 points did not move further to the oral exam and failed. Another condition was to get at least 20 points from the practical part of the test.

The oral exam consists of asking two questions.

Total number of observations	Did not pass the practical part of the test	Did not pass the test	Got to the oral exam
278 (100 %)	56 (20.1 %)	86 (30.9 %)	186 (66.9) %)

Tab. 1: Students removed from further assessment due to poor results in the written test

The categories "Did not pass the test" and "Got to the oral exam" are not equal in sum 100% because of the absence of the students in an oral exam despite passing the test.

Data

The data for each student were recorded during the oral exam by the lecturer. Before the oral exam starts, the lecture wrote down:

- name of the students (the gender in Czech language follows from the name),
- branch of study,
- the number of points from the semester,
- the number of bonus points,
- the number of point from the practical part of the test,
- the number of points from the theoretical part of the test.

For the oral exam, the lecturer recorded:
The questions 1 and 2 (numbers of question from the list),
Evaluation of both questions (by point from the 1-10 scale, 10 was the best).
These full sets of data were collected for 186 students who got to the oral exam; 163 of them were successful and passed the exam (out of original 268 included into the study).

Hypotheses

For meeting the objectives of the study following working hypotheses were used:

$H1_0$: The final exam grade does not depend on the examiner.
$H2_0$: The final exam grade does not depend on the bonus of the student.
$H3_0$: The result of the written part of the exam does not depend on the bonus of the student.
$H4_0$: The final exam grade does not depend on the result of the written part of the exam.
$H5_0$: The final exam grade does not depend on the field of study.
$H6_0$: The final exam grade does not depend on the gender of students.

Applied statistical methods

The data proceeding was realized in several consecutive phases. First, the check of complete record was made. The single dimensional and multi-dimensional statistical analyses followed.
The single dimensional statistical analysis was based on the relative frequency tables. The values n_j in the frequency distribution tables are the absolute values of the incidences of the observed sign values. The relative frequencies p_i represents the proportion of the concrete sign values to the total extent of the file.
The final grade could be: 1 Excellent, 2 Very good, 3 Good, 4 Failed.
It was decided to make an observation of the dependency between the selected pairs of variables. The null hypotheses were specified and the chi-square test was used to prove the hypotheses. The significance level $\alpha = 0.05$ was set for the analysis. The multiple dimensional analyses were based on the Cramer's contingency coefficient which can have values from the interval <0; 1>. The value 0 means statistical independence of variables, the value under 0.3 means weak dependence, 0.3-0.5 medium dependence, 0.5-0.7 high

dependence, over 0.7 means very high dependence.
The practical calculations were made with MS Excel and the statistical software SPSS version 21.

Results and Discussion

Simple analysis

The results of the single dimensional statistical analysis are in following Table 2. The table deals with the absolute and relative frequencies of the observed signs. It contains the basic characteristics of the data file. The first part of the table gives the overview of the final grades and gives the reasons of failure. The second part contains data which are used for the dependency analysis further on.

Characteristic	Absolute frequencies	Relative frequencies
Total number of observations	278	100%
Passed	163	58.6%
Excellent	34	12.2%
Very good	45	16.2%
Good	84	30.2%
Did not passed	115	41.4%
Failed due to the written part	83	29.9%
Failed due to the practical part of the test	56	20.1%
Failed due to the oral exam	32	11.5%
Failed due to the other reasons (cheating etc.)	5	1.8%
Sex		
Male	110	39.6%
Female	168	60.4%
Field of study		
Business and Administration	109	39.2%
Economics and Management	169	60.8%
Bonus from the semester		
With bonus	191	72.6%
No bonus	72	27.4%
Examiner		
Ludmila Domeova	142	51.1%
Jiri Fejfar	136	48.9%

Tab. 2: Basic characteristics of the set

Dependency analysis

The goal of the analysis was to confirm or reject the hypotheses $\mathbf{H1_0}$ **-** $\mathbf{H6_0}$.
The results of statistical testing are included in the following table (Tab. 3). The Cramer's V was calculated only for the cases where the null hypothesis was rejected.
For the hypotheses **H1, H5**, and **H6**, the null hypotheses were not rejected, so that the

dependency between the tested signs was not proved. It means: (1) the final grade do not depend on the examiner; (2) the final grade do not depend on the branch of study; and (3) the final grade do not depend on tender. These results give evidence of objectivity of the evaluation. The dependencies on the factors which are out of the control of the student were not proved.

Only a weak dependency was proved for the **H2** hypothesis: The final exam grade is only weakly dependent on the bonus of the student. The medium dependency was proved for the **H3** hypothesis and the strong for **H4**. The strongest dependency in the investigation was for the H4, it means the final grade depends on the result of the written part.

Null hypothesis	Chi-Square test	Rejection/Acceptation	Cramer´s V
$H1_0$	0.609	Acceptation	-
$H2_0$	0.006	Rejection	0.217
$H3_0$	0.000	Rejection	0.388
$H4_0$	0.000	Rejection	0.581
$H5_0$	0.803	Acceptation	-
$H6_0$	0.132	Acceptation	-

Tab. 3: Results of the statistical testing

The null hypothesis **H2** was rejected that means the dependency between the final grade and the evaluation during the semester. The students with some bonus points[1] were more successful. The dependency is weak – for more details see the table 4.

The grade 4 was the most frequent for the students without bonus (who did not work well during the semester) – got 40 students, better grade got 32 students. The students with bonus were successful in 127 cased (grades 1,2,3); 64 failed. It follows from these results that the students with bonus are more likely to pass the exam.

	Final exam grade				Total
	Excellent	Very good	Good	Fail	
No bonus	4	11	17	40	72
	11.80%	25.00%	21.00%	38.50%	27.40%
With bonus	30	33	64	64	191
	88.20%	75.00%	79.00%	61.50%	72.60%
Total	34	44	81	104	263
	100.00%	100.00%	100.00%	100.00%	100.00%

Tab. 4: Contingency table between final exam grade and the bonus receiving

The null hypothesis H3 was rejected because the dependency between the bonus from semester and the result of the written test was proved. The dependency is medium, more details see in the table 5.

The null hypotheses H4 was rejected and the alternative hypothesis „The final exam grade depends on the result of the written part of the exam". The dependency was proved as strong, (with the highest value of the Chi-Square test – see Table 3) more details see in the table 6.The bold numbers means the relative number of students who got the same final grade as was their test result. It is always the highest value in the line. The weak result of test means grade 3-4.

[1] Number of observation was 263 (n = 263) in the tables 4 and 5. 15 students were extracted from the data set due to the reason of acceptation of the credit from the previous year.

	Result of the written part					Total
	Excellent	Very good	Good	Weak	Fail	
No bonus	3	4	16	15	34	72
	5.9%	8.7%	26.2%	46.9%	46.6%	27.4%
Bonus	48	42	45	17	39	191
	94.1%	91.3%	73.8%	53.1%	53.4%	72.6%
Total	51	46	61	32	73	263
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Tab. 5: Contingency table between result of the written part and the bonus receiving

Excellent		Final exam grade				Total
		Very good	Good	Fail		
Result of the written part	Excellent	27	17	6	1	51
		79.4%	37.8%	7.1%	0.9%	18.3%
	Very good	6	13	23	5	47
		17.6%	28.9%	27.4%	4.3%	16.9%
	Good	1	12	36	13	62
		2.9%	26.7%	42.9%	11.3%	22.3%
	Weak	0	3	19	13	35
		0.0%	6.7%	22.6%	11.3%	12.6%
	Fail	0	0	0	83	83
		0.0%	0.0%	0.0%	72.2%	29.9%
Total		34	45	84	115	278
100.0%		100.0%	100.0%	100.0%	100.0%	100.0%

Tab. 6: Contingency table between final exam grade and result of the written part

The strong dependency between the partial evaluation and the final grade demonstrated that the partial evaluation is important and gives a priori information both to students and the teachers.

The gender gaps were not proved maybe due to combination of several examination methods.

The better evaluation during the semester may also raise the student's self-assurance.

By Sedlačik, Čechová and Doudová (2013) if a student approaches a subject thinking that he or she is not very good at it, he or she may not work as hard to master and it may affect his or her ability to learn it.

The partial evaluation was made only in the computerized-testing environment without the presence of the teacher what can be taken as positive. Elimination of the in-class return of computerized test is one negative perception, the exams cannot be returned or reviewed in-class because each student's exam is unique (Apostolou, Blue and Daigle, 2009).

Conclusion

The research on 278 cases confirmed that the final grade is highly dependent on the partial evaluation of the students. The proved dependencies show that the students who have worked well (and got good evaluations) are more likely to get more points from the written part and pass the exam. The strongest dependency was proved between the written test and the final grade. In many cases the evaluation of the test was the same as the final grade.

The question is if the oral exam is then necessary. The tendency in many subjects is to take only the written tests, if possible on-line with automatic evaluation. The benefit of this process is definitely saving time of the teachers and possibly more objective results.

In the investigated subject the teacher check- ups the test personally so that they are able to see the mistakes not only in the final results but also in the applied methods. The oral exam is then a valuable feedback both for the students and the teachers.

The oral exam helps to reveal cheating during the test and it is an irreplaceable training of speaking, presentation of own ideas and use of specialized language.

The subjective influence of the teacher's person was not proved; maybe also because the evaluation is done in several steps and the teacher usually does not know the students personally before the exam. The disadvantage of the process is the labour-intensity which is compensated with a personal approach.

The focus on the written tests might be unjust for students who are better in the oral exams. To improve the balance between the written test and the oral exam would be a goal for further investigation not only in the described course but also in other mathematically based subjects.

The final grades might be dependent on some other factor, e.g. nationality, type of personality, etc. These dependencies should be investigated in the following research.

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DEVELOPMENT OF ENGLISH KNOWLEDGE OF APPLICANTS FOR STUDY ON UEP

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Abstract

We analyze the results of the entrance examinations for the University of Economics, Prague (UEP) in the subject of English. The paper presents outputs of the analysis of the study requirements for the UEP. Presented results are based on anonymous data acquired from the material submitted for the admission procedure and from the results of the admission tests. Conclusions are based on time series for the years 2010-2013.

A further analytical output is the overview of the points acquired from the entrance exams arranged according to the country of origin of the applicants for study. The conclusions then point to better results in the admission tests found in the case of foreign students and the declining number of points acquired in time for all applicants. Apart from this it is interesting that there was identification of a declining number of points in time. Overall the analysis may be evaluated as a declining number of points acquired while maintaining the unchanged difficulty of the examination.

Keywords

Knowledge, english, education process

Introduction

With the stunning development of Information and Communication Technology (ICT), it has been widely applied in the field of electronic commerce, social network and e-government, which has a widespread and profound influence on social life.

The present economic situation and its changes, globalization, the general level of education, the demographic development predetermining the number of potential students and other factors, formulate the requirements for the knowledge and skills that graduates of individual levels of education should have at their command. In this category we include not only graduates in the system of tertiary education, but also those graduating from secondary schools and apprentice training establishments. For the requirements of this paper we are concentrating solely on the sphere of tertiary education, meaning institutes of higher education and universities.

One of the key topical problems of higher education in the Czech Republic is the declining number of students completing secondary school, which means a drop in the number of potential high-quality applicants for university studies. (Kuncova, Vojackova, 2013) This problem is intensified by the method used for the remuneration of universities, based on capacity payments for students. If, then, the universities wish to maintain their incomes, based on a stable or rising number of students admitted, there must necessarily be a reduction in the demands made on potential students entering the system of tertiary education. Let us add, however, that the decline in the number of students from the Czech Republic is partly compensated by the growing number of applicants from abroad, from countries such as Slovakia, Russia, Ukraine, Kazakhstan, Vietnam and so on. This

trend is visible from the structure of applicants for university studies at the University of Economics, Prague (Maryska, Doucek and Novotny, 2012).
We feel that the facts presented in (Finardi, Fischer, 2011) and the above-mentioned changes in the economy and in the population must influence the overall approach and structure of the education system in the Czech Republic, not excluding the level of higher education. Similar conclusions were also reached by (Vltavska, Fischer, Schatral, 2013; Kunstova, 2012; Fiala, Langhamrová, 2010).
All the activities presented in this paper are the result of a research project aimed at finding answers to the following questions:

- What is the level of knowledge of secondary school leavers applying to study at the University of Economics, Prague (UEP) in mathematics and also in languages?
- Does any relationship exist between the result of the entrance examination – the number of points acquired – and the result of the GCSE Exam (General Certificate of Secondary Education) or the results of exams taken by students in the course of their studies?

We are documenting the method used for this analysis only with the use of the results of the entrance examination in the English language.
The starting points for the proposed models and analyses were in particular studies (Psacharopoulos, 1995; Reflex, 2007; Hanclova, 2011) and the experience gained at the University of Economics, Prague from earlier projects with a similar theme (Scholleová and Mikovcová, 2011) and research on the education systems of European countries (Maryska and Doucek, 2011). Other aspects of this problem as for example the wage modelling of graduates of universities are presented and discussed for example in (Hanclova, 2006; Marek 2010)

Material and Methods (Data Collection)

The basic source of data for the entire research became the central data systems of the University of Economics, Prague, in which data are stored both on all applicants for study, and in particular on the complete histories of all applicants who became, thanks to success in the entrance examination, students of the University of Economics, Prague. For the needs of this paper the key results are those of the entrance exam in English Language, which we further analyze in detail.
In the Czech Republic Law No. 101/2000, on the protection of personal data, applies. Due to this law we had to anonymize all the data processed. Anonymisation was carried out at several levels. We anonymized all the information that might lead to identification of a concrete student. We therefore removed such data as the name and surname of applicants, birth numbers and the unique identifier of the student/applicant in the study information system. None of the further information acquired from primary systems enabled the unequivocal identification of an applicant for study or a student. The outcome of the anonymisation was the allocation of a numerical designation to each applicant for study who participated in the entrance examinations. This artificial identifier was then also used in the data on the results of study. Retrospective identification of the individual student is not possible.
There are six faculties on University of Economics, Prague at this time - Faculty of Finance and Accounting (FFA), Faculty of International Relations (FIR), Faculty of Business Administration (FBA), Faculty of Informatics and Statistics (FIS), Faculty of Economics (FE), Faculty of Management (FM).

The entrance examinations for the UEP are specific to the individual faculties of the UEP. Each faculty may select the way of arranging and even omitting the entrance examinations. At the UEP two basic approaches are used:

- Admission of students on the basis of the entrance examination (including the possibility of exemption on the basis of success in secondary school studies).
- Admission of study applicants on the basis of the results of SCIO tests.

The first variant, admissions on the basis of an entrance examination, are used by the faculties FFA, FIR, FBA, FIS and FM. The second variant – admission exclusively on the basis of the results of SCIO tests – is used only by the Faculty of Economics, whereas FIS and FM offer students the possibility of alternative choice.

With regard to these two approaches to the realization of the entrance examinations, the data are not available for all faculties and all fields of study. Data are available only for the faculties in the first group, meaning for FFA, FIR, FBA, FIS and FM.

A further factor influencing the completeness of the data is the inaccessibility of the results of the leaving certificate examinations of foreign students. "Artificial" records were generated for them so as to create at least an environment enabling the analysis of the results of entrance examinations and results of tests from current studies. These students are omitted from correlative analyses of the leaving certificate examinations.

Due to the extensive and complex natures of the analyses only the results of the analyses of selected characteristics are presented in the following text.

Methodology

The acquired data was processed with the use of technology enabling work with a large volume of data. For the processing of data we used the platform Microsoft SQ Server 2008 R/2 (MS SQL). Extracts of data from primary systems were made in two forms: in the form of text files and in the form of extracts in Microsoft Excel format.

In the MS SQL Server database system the data model DWH (data warehouse) was prepared in the traditional architecture of DWH Stage and DWH Core. The filling of the proposed DWH was realized by means of import and transformation processes, known as ETL (Extract Transform Load). These ETL instruments, called Microsoft Integration Services, are a standard part of the MS SQL platform.

For analytical work an analytical layer was built up over the data model and the data were prepared in it in Microsoft Analysis Services, which are also part of MS SQL. Data blocks and dimensions were prepared within the framework of SSAS.

The blocks represent the pre-calculated data acquired from the data warehouse (DWH), which it is possible to look at from various aspects (dimensions). In this context dimensions are represented by number registers, which enable the analysis of values in analytical blocks.

The entire solution observes, to the greatest possible extent, the principles of the proposal and the implementation of data warehouses as described, for instance, in (Kimball & Caserta, 2004; Imhoff, Gelammo & Geiger, 2003), (MacLennan, Tang, Crivat, 2009).

The H_0 hypothesis was formulated for this research – „Development of the obtained point is similar in pair comparison of UEP faculties (FFA, FIR, FBA, FIS and FM). For pair acceptance or rejection of the H_0 hypothesis were used P test Two samples at 5% level of significance.

With regard to the user-unfriendliness of the instruments mentioned so far, the user layer was created in Microsoft Excel.

Results and Discussion

This paper is aimed at the analysis of the results of the entrance examinations in English Language of applicants for study at the University of Economics, Prague. The subject of the paper is the identification of the level of knowledge that applicants have at their disposal on the basis of their secondary school studies.

In this contribution we present the historical development of the data as the data are for four consecutive periods.

With a view to the clarity of the paper we have divided the structure of this chapter into two parts:

- The basic characteristics of the source data (number of students, dividing up of students, etc.)
- Analysis of the results of the entrance examinations in English Language.

In the analysis we take various views of the data into account. Those we consider to be key aspects are: the time aspect and the aspect according to faculty and fields of study selected by applicants when taking the entrance examination.

General Data Characteristics

The general characteristic of the Czech Republic society is fundamental change in perception of education. More and more students are graduating at high schools and then almost the same number of students is applying for universities studies and they are accepted.

Except this trend we see another trend – declining number and knowledge of students from the Czech Republic and increasing number and knowledge of students from other countries. (Kunstova, 2011).

During years 2010-2013 the UEP receive 34,505 applications for study with structure as follows:

- Applications for study from Grammar School: 16,264
- Applications for study from Business Academy: 5,890
- Applications for study from Vocational School: 4,509
- Applications for study from other school (especially applications from abroad): 7,842

The structure of applications is not surprising. Graduates from grammar schools are prepared for study at universities on contrary to graduates from other kind of schools that are primarily prepared for practice.

Initial knowledge of English

The set of data and general results from the entrance exams in “English” base on the type of high school has the basic statistical characteristics given in Table 1.

2010-2013	N	Avg.	Med.	Mod.	Min.	Dev.	Var.	Skew	Kurt.
Grammar School	16,264	71.89	74.00	80.00	15.00	15.31	234.36	-0.50	-0.28
Business Academy	5,890	58.09	58.00	60.00	11.00	16.33	266.80	0.04	-0.60
Vocational School	4,509	55.61	54.00	50.00	4.00	17.49	306.03	0.14	-0.66
Others	7,842	71.48	74.00	80.00	10.00	16.49	271.91	-0.64	-0.10

Tab. 1: Entrance Exams in “English” According to the Type of High School

The results presented in Table 1 provide interesting information. The highest score in median and average indicators on grammar school has been expected. Very important are results in group "Other" where are included applicants from foreign countries and applicants from other type of schools in the Czech Republic. The score from entrance exams from English is in this group almost the same as in group of applicants from Grammar School. This means that graduates from foreign countries has obviously higher knowledge level in English than graduates from high schools in the Czech Republic.
Next three tables also describe applicants´ knowledge level. These data are analyzed with accent on different views. The first is time (according the year of entrance examination) – Table 2, the second one is according to the faculty and the last one is selected study specializations.

Year	N	Avg.	Med.	Mod.	Min.	Dev.	Var.	Skew	Kurt.
2010	4,096	72.54	74.00	78.00	16.00	15.29	233.76	-0.56	-0.21
2011	4,264	71.25	74.00	80.00	15.00	15.59	243.11	-0.49	-0.30
2012	4,198	71.71	74.00	80.00	22.00	15.14	229.11	-0.43	-0.41
2013	3,706	72.12	74.00	80.00	15.00	15.17	230.07	-0.53	-0.19

Tab. 2: Grammar Schools - Entrance Exams in "English"

The UEP has six faculties, as it has been mentioned before, and we have prepared analysis of knowledge level for student applying for each of these faculties. There is only one exception in the following Table 3. We have not been able to prepare analysis for the fifth faculty which has entrance examination based on different systems. The fifth faculty use national testing system SCIO as a substitute of their own testing system.
The Table 3 shows that the best results in English are on the FIR. The average score is 72 points from 100. The worst result is on the FM. The applicants for study gain only 53 point in average from 100 and the second worst result is on the Faculty of statistics and informatics. Very interesting is the difference in amount of points between FM and the FBA which has similar subject field as FM but the number of points gained on the FBA is higher for more than 14 points in average.

2010-2013	N	Avg.	Med.	Mod.	Min.	Dev.	Var.	Skew	Kurt.
FFA	8,452	66.16	68.00	76.00	14.00	17.83	318.02	-0.32	-0.65
FIR	10,286	72.09	75.00	80.00	10.00	16.40	269.12	-0.69	0.03
FBA	10,469	67.26	68.00	70.00	12.00	16.39	268.70	-0.32	-0.57
FIS	4,056	62.07	62.00	66.00	4.00	17.61	310.10	-0.13	-0.71
FM	1,242	53.24	52.00	56.00	14.00	17.06	290.88	0.28	-0.59

Tab. 3: Entrance Exams in "English" According to Faculty

The Table 4 is focused on selected study programmes provided by above mentioned faculties. The subjects of studies are sorted by average point gained by applicants from English during their entrance examination. There are big differences among average scores gained by applicants on each of analyzed study programme. We have identified the lowest number of points on FIS - study programme "Business Information System"

and the highest scores were identified on the Faculty of International Relations - as could be expected.

Study programme 2010-2013	N	Avg.	Med.	Mod.	Min.	Dev.	Var.	Skew	Kurt.
FIS: Business Information Systems	514	58.85	59.00	52.00	18.00	18.11	328.01	-0.04	-0.85
FIS: Statistical Methods	136	59.94	60.00	70.00	18.00	15.57	242.43	-0.16	-0.17
FIS: Applied Informatics	1,993	60.83	60.00	60.00	18.00	17.15	294.24	-0.06	-0.70
FIS: Statistics and Econometrics	78	61.78	62.00	62.00	26.00	17.26	297.75	-0.05	-0.59
FFA: Taxation and Tax policy	563	62.27	62.00	56.00	16.00	17.10	292.50	-0.10	-0.55
FFA: Accounting	3,155	63.52	64.00	56.00	14.00	18.19	331.01	-0.15	-0.77
FFA: Banking and Insurance	1,737	65.26	68.00	68.00	18.00	17.83	317.96	-0.33	-0.64
FIS: Mathematical Methods in Economy	240	65.72	66.00	78.00	12.00	17.16	294.43	-0.35	-0.33
FIS: Multimedia	947	66.81	70.00	66.00	20.00	17.98	323.10	-0.36	-0.72
FBA: Corporate Economics and Management	8,708	67.74	70.00	78.00	12.00	16.45	270.58	-0.35	-0.54
FIR: Politology	166	68.78	70.00	80.00	18.00	15.69	246.10	-0.82	0.60
FFA: Finance	2,893	70.88	74.00	76.00	16.00	16.45	270.61	-0.54	-0.27
FIR: International Business	4,374	74.66	77.50	80.00	17.50	14.96	223.90	-0.74	0.18
FIR: Diplomacy	1,963	75.79	78.00	90.00	15.00	15.25	232.61	-0.75	0.06

Tab. 4: Entrance Exams in "English" According to Study Programme

At the end, we investigated the differences among results of students applying for different faculties. We used for this comparison the p-values at 5% level of significance. Results of p-values and rejection or acceptance of the H_0 hypothesis for faculties contents following Table 5.

Fac./Fac.	FFA	FIR	FBA	FIS	FM
FFA	X	X	X	X	X
FIR	3.80*10-16- Reject	X	X	X	X
FBA	1.50*10-16- Reject	0.46 - Accept	X	X	X
FIS	0.17 – Accept	1.50*10-16- Reject	1.50*10-16- Reject	X	X
FM	0.02 – Reject	0.03 - Reject	0.03 - Reject	0.08 - Accept	X

Tab. 5: p values[1]

[1] The p-values matrix has symetric character.

Conclusion

The analysis made of the data acquired in the course of the entrance examinations for the University of Economics in Prague identified differences in the knowledge levels of students applying for the individual faculties and fields of study. Apart from this it also identified differences in the levels of knowledge of applicants coming to study at the UEP from various types of secondary schools. This research follows on from the research, which focused primarily on analysis of the relationship between the result of the GCSE Exam and that of the entrance exam, within the framework of which minimal correlation was identified between the results of the GCSE Exam and the entrance exam.

On the basis of the analysis of the entrance examination in English Language we arrived at the following conclusions:

The differences among the students applying for the individual faculties are significant and for pair comparison at 5% level of significance for faculties have been reached values presented in Table 5.

- Conclusions for Table 5 are that there are no similarities for pair comparison of following faculties – FFA – FIR, FBA –FFA, FIS – FIR, FIS – FBA, FM – FFA, FM- FIR and FM – FBA. Similarities were identified for pair comparison of FFA – FIS, FM- FIS and FBA – FIR. It represent that English knowledge are similar for applicants at accounting, management and quantitative methods at FIS. The strongest similarity was identified for applicants at business administration and international relations studies[2].
- The best results achieved were those of applicants for study at the Faculty of International Relations and the worst, on the contrary, were the results of applicants for study at the Faculty of Informatics and Statistics.
- Taking into account the time factor in the analysis of the results of the entrance examination did not reveal any fundamental change over the past four years in the volume of the number of points acquired by applicants in the entrance examination.

Open issues of the research are focused on getting more data in time for time series analysis and evaluation of admission examination data not only according to faculties but also according to specializations.

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[2] Results and its further discussion are not presented detailed in this contribution due to the strong limited number of pages for it.

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HOW TEACHING STAFF MOTIVATION CAN IMPROVE PROFESSIONAL SATISFACTION AND PERFORMANCE?

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Abstract

In the knowledge-based society, the high competition between schools and the test-based accountability are common solutions in educational change efforts to improve educational systems performance. Two dynamic forces influence teaching performances: the global educational reform and the increasing external expectations that schools should be more competitive. Hence, these should be accompanying by an efficient and effective transformational leadership of the schools managers. In this context, we shall present a research on how teachers' motivation (intrinsic and extrinsic) and collective efficacy perception can affect professional satisfaction and furthermore teachers' performance. A survey based on a questionnaire was developed in order to investigate the state of the secondary educational system in Romania, West Region. Furthermore, the research results are expected to play an important role for improving teaching quality. The statistical data process will be debated by considering the research hypothesis and the empirical model related to motivation – satisfaction – performance interdependence.

Keywords

Empirical research, motivation, professional satisfaction, collective efficacy, performance

Introduction

Work performance is an essential concept in the organizational psychology literature, with major implications for human resource management practices. Employee assessment aims to identify strengths, weaknesses, and then design professional development programs to increase work performance. Then, managers use their employees' performance data for their supervision, reward or their motivation. According to the performance-integrated approach, references connect this with employee's activities, behaviours, and results that contribute to achieve organizational objective. (Kuncel et al, 2004) recognized that work performance is the result of several employee behaviours (similar to: Druskat et al, 2013; Schmidt, 2014). On the other side, researches on the human resources performance related to the educational system have proved that pupils/students' education success depends, to a high degree, on the level of teachers motivation, as well as on their degree of professional satisfaction (Jonsson and Rudolphi, 2011; Allen and Burgess, 2013). In those schools where teachers' have high levels of motivation (intrinsic and extrinsic), invest more into their activity, are more creative and more efficient in educational problem solving (Eyal and Roth, 2011; Rzejak et al, 2014).

In this article, we shall present a research on how teachers' motivation (intrinsic and extrinsic) and collective efficacy perception can affect professional satisfaction regarding the general workplace conditions and how satisfaction influences teachers' performance. This study (survey based on a questionnaire) was developed in order to investigate the state of the pre-university educational system (secondary education level) in the West

Region of Romania (sample consist of 158 respondents/teachers). Furthermore, there have been discovered attributes related to human relations and transformational school leaders that are expected to play an important role for improving teaching quality. The statistical data process will be debated by considering the research hypothesis validation/ invalidation/partial validation and the empirical model related to motivation – satisfaction – performance interdependences.

Materials and Methods

Aspects of Research Methodology. Research Objectives and Hypothesis

The research objective is to investigate the influence of secondary schools teachers' motivation and satisfaction at work on their work performance. First, the research focuses on measuring the actual teachers' level of motivation and satisfaction and the factors determining their workplace satisfaction (hypothesis H1 - There is a direct relation and statistically significant between motivation (intrinsic and extrinsic nature) and employee's professional satisfaction within the workplace). Secondly, the research focuses on identifying the satisfaction effects and the motivation level, respectively the level of collective efficacy on human resources work performance (hypothesis H2 - There is a direct relation and statistically significant between employee's professional satisfaction and job performance) (Figure 1). The proposed research hypotheses test various variables interdependencies, and which might influence satisfaction at the work place, on group and individual performance and on their intention to move to a different work place. Furthermore, these research hypotheses were used to test the validity of the conceptual model proposed in the present study, in the context of secondary educational system in Romania, West Region. Thus, there has been defined a number of nine research hypotheses which target the connections assessment that exist between the professional satisfaction exogenous variables at the workplace (organization - employee compatibility, intrinsic and extrinsic motivation, collective efficacy), the construct satisfaction at the workplace and the resulted variables (individual and group performance and the intention to change job).

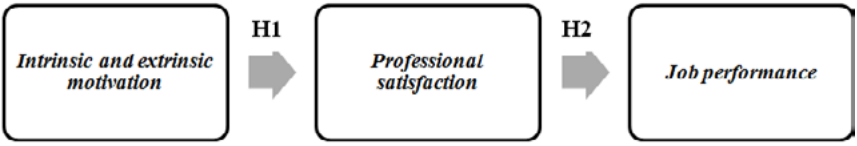

Fig. 1: The proposed research conceptual model

The proposed methodology used in this research consists of the following steps: (1) constructs operationalization that define the conceptual model and the measurement scales; (2) sampling settings and (3) the statistical data analysis plan design.

For the purpose of this research, to operationalize the intrinsic motivation construct we have studied the approaches of (Karatepe and Tekinkus, 2006) and we considered the work commitment as a marker of intrinsic motivation, by adjusting certain items of the scale proposed by (Klassen et al. 2012). The research described by (Watt et al, 2012) have been considered, regarding the influence factors in choosing a career in the education field, by considering social value motivational factors as intrinsic factors. Seven items defined the intrinsic motivation construct and six items defined the extrinsic and motivation construct. Professional satisfaction construct assessment was based on the

preliminary study of three scales: (1) Overall Job Satisfaction Scale (OJS) with 18 items (Schleicher et al, 2004); (2) Minnesota Satisfaction Questionnaire (MSQ) that evaluate cognitive aspects of the work; (3) Job Diagnostic Survey (JDS). Other important studies in the field of job satisfaction have been considered for this preliminary research activity (Crossman and Abou-Zaki, 2003; Schleicher et al, 2004). The operationalization of the employee's professional satisfaction construct was measured with 25 proposed items. For the job performance concept operationalization we use the self-evaluation process of each teacher in order to characterize the self-perception about his/her own performance as shown in previous studies as (Campbell, 1990). The self-evaluation sheet designed by the Romanian Ministry of Education and included in the annual evaluation methodology of teaching staff (Romanian Offical Monitor, 2011) have been use for this assessment. The construct operationalization includes six evaluation dimensions (fields) and in totally 31 items.

In order to demonstrate the general validity of the constructs and of the scales used for their operationalization, we aim to investigate and validate them in the case of the secondary educational system of Romania. In the present research, the total number of Romanian secondary education units (schools from the West Region, only) defines the investigated statistical population (the sample subjects were teachers of secondary schools). The research variables were age, gender, seniority or his/her education status within the institution analyzed. Since the sampling techniques vary in relation with the accuracy and reliability, (Malhorta et al, 1996) states that there is recommended to use several sampling techniques. In this research, we use the convenience sampling (based on a list with teachers' contacts known by the authors) and "snowball" sampling type (the preliminary list with teachers' contacts will be extending using their contacts lists and so on). As a data collection method, we use the survey based on a questionnaire (quantitative research). The data (from the fill-up questionnaires) were collected from March to September 2013 using: the on-line questionnaire available on the Google Drive platform (http://goo.gl/ZzLX3) face-to-face interview. In totally, there were contact 500 teachers and the respond rate was 31% (158 questionnaire were processed), but some questionnaires have been not validated in some parts of them (for some variables, the number of responses considered in the statistical analysis was less than 158); SPSS software solution was used for the data process and analysis.

Results and Discussion

For the hypothesis testing there were calculated: the correlation coefficient (R), determination coefficient (R^2), regression function standard coefficient (b), and the significant level (p). The H1 hypothesis was partially confirmed (Table 1). A statistically significant relation was identified between the intrinsic motivation and workplace satisfaction, satisfaction related to the workplace characteristics, cognitive satisfaction, and affective satisfaction in the case of secondary education teachers ($p = 0.000$). Following this analysis, we considered that the relationship between extrinsic motivation and workplace satisfaction is not statistically significant ($p = 0.056$, slightly exceeds the threshold of 0.05). The nature of the relationship between these two variables is positive ($\beta = 0.415$, Table 1). The research results in this case show a statistically significant relation between intrinsic motivation and cognitive satisfaction ($\beta = 0.219$ at a significance level $p = 0.309$). The relationship between intrinsic motivation and affective satisfaction is positive ($\beta = 0.653$). Regarding the nature of the relationship between extrinsic motivations and affective satisfaction, it is negative ($\beta = - 0.346$).

The H2 hypothesis was confirmed because the link between workplace satisfaction and workplace performance is statistically significant (p = 0.000) as the research results show in Table 2 and 3. In addition, it can be seen that the nature of this relationship is positive because β = 0.636 > 0. Therefore, the increase of workplace satisfaction will increase work performance and vice versa. Furthermore, there are two statistically significant relations, namely that between workplace satisfaction and work performance and between affective satisfaction and work performance (p = 0.000); both dependencies are positive (β = 0.374, β = 0.456, respectively). The relation of the workplace satisfaction and the work performance six dimensions are confirmed (p = 0.000 for all the relationships, Table 2). The survey results demonstrate that the nature of these relations are positive because the standardized coefficient of the regression function β values are positive for each relationship (Table 2).

Dependent variable	Workplace satisfaction				Satisfaction - workplace characteristics			
Independent variable	R	R2	b	p	R	R2	b	p
Intrinsic motivation	0.451	0.204	0.549	0.000	0.439	0.193	0.415	0.000
Affective motivation			- 0.183	0.056			0.035	0.716
Dependent variable	Cognitive satisfaction				Affective satisfaction			
Independent variable	R	R2	b	p	R	R2	b	p
Intrinsic motivation	0.166	0.027	0.219	0.039	0.500	0.250	0,653	0,000
Affective motivation			- 0.139	0.189			- 0,346	0,000

Tab. 1: Research Results in the case of the H2 Hypothesis

Dependent variable	Work performance			
Independent variable	R	R^2	b	p
Workplace satisfaction	0.698	0.488	0.636	0.000
Satisfaction - workplace characteristics			0.374	0.000
Cognitive satisfaction			- 0.011	0.873
Affective satisfaction			0.456	0.000

Dependent variable	Activities design				Activities development			
Independent variable	R	R^2	b	p	R	R^2	b	p
Workplace satisfaction	0.611	0.374	0.611	0.000	0.543	0.295	0.543	0.000
Dependent variable	Pupils achievements evaluation				Classroom management			
Independent variable	R	R^2	b	p	R	R^2	b	p
Workplace satisfaction	0.430	0.185	0.430	0.000	0.518	0.268	0.518	0.000

Dependent variable	Professional development and leadership				School development and promotion			
Independent variable	R	R^2	b	p	R	R^2	b	p
Workplace satisfaction	0.488	0.238	0.488	0.000	0.436	0.190	0.436	0.000

Dependent variable	Performance – activities design			
Independent variable	R	R^2	b	p
Satisfaction - workplace characteristics	0.636	0.404	0.319	0.000
Cognitive satisfaction			0.094	0.189
Affective satisfaction			0.377	0.000

Tab. 2: Research Results in the case of the H2 Hypothesis (first part)

In the last part of Table 2 are shown the statistical coefficient that characterized the relations between the different dimensions of workplace satisfaction and the performance related to educational activities design; two of the three relations are statistically significant (p = 0.000). Both connections are positive (***β = 0.319, β = 0.377 respectively***).

The H2 hypothesis testing continues with the analysis of the relation between the three dimensions of satisfaction and the performance related to activities development (Table 3). Research results have shown that all relations are statistically significant (significance level values are below 0.05). Regarding the nature of the links, two of them are positive and one is negative. Therefore, an increase in satisfaction with job characteristics, namely an increase in affective satisfaction will increase the performance indicator level for activities development (β = 0.414, β = 0.435, respectively), while increasing cognitive satisfaction leads to a decrease in the performance indicator level for activities development (β = -0.155).

Dependent variable	Performance of activities development				Performance related to pupils achievements evaluation			
Independent variable	R	R^2	b	p	R	R^2	b	p
Satisfaction - workplace characteristics	0.661	0.437	0.414	0.000	0.581	0.338	0.151	0.058
Cognitive satisfaction			- 0.155	0.026			- 0.112	0.137
Affective satisfaction			0.435	0.000			0.534	0.000
Dependent variable	Performance of classroom management				Performance in professional development and leadership			
Independent variable	R	R^2	b	p	R	R^2	b	p
Satisfaction - workplace characteristics	0.552	0.305	0.339	0.000	0.513	0.263	0.333	0.000
Cognitive satisfaction			0.021	0.785			0.039	0.622
Affective satisfaction			0.303	0.000			0.249	0.002

Dependent variable	Performance in school development and promotion			
Independent variable	R	R^2	b	p
Satisfaction - workplace characteristics	0.460	0.212	0.215	0.014
Cognitive satisfaction			0.054	0.512
Affective satisfaction			0.297	0.000

Tab. 3: The Results in the case of the H2 Hypothesis (second part)

Foreword, there have been analyzed the relations between the three dimensions of satisfaction and performance related to the evaluation of pupils' achievements. The statistical coefficient calculations (Table 3) have shown that the only statistically significant relation is between the affective satisfaction and performance related to pupils' achievements evaluation ($p = 0.000$); the relationship between the two variables is positive ($\beta = 0.534$). In the case of the relations between the three dimensions of satisfaction and performance related to the classroom management, there have been observed that two of the three investigated dependencies are statistically significant ($p = 0.000$ for the satisfaction with workplace characteristics and classroom management and between affective satisfaction and classroom management); both relations are positive ($\beta = 0.339$, $\beta = 0.303$, respectively).

The characterization of the dependencies between satisfaction dimensions and the performance variable related to professional development and leadership were studied (Table 3). Only two of the three investigated links are statistically significant, namely that between satisfaction - workplace characteristics and performance related to professional development and leadership ($p = 0.000$) and between affective satisfaction and performance related to professional development and leadership ($p = 0.002$). Both relations are positive ($\beta = 0.333$, $\beta = 0.249$, respectively). The last dependencies that were analyzed were between the satisfaction dimensions and the performance variable related to school development and promotion. The statistical coefficients presented in Table 3 have shown that only two of the three investigated dependencies are statistically significant, namely that between satisfaction with job characteristics and the performance related to the school development and promotion ($p = 0.014$) and between affective satisfaction and performance related to the school development and promotion ($p = 0.000$). Both relations are positive ($\beta = 0.215$, $\beta = 0.297$, respectively).

Conclusion

The analysis performed allows the answer and debates to the question: *What kind of motivation has a greater influence on affective satisfaction?* Thus, the link between motivations and affective satisfaction is positive which means that an increase in intrinsic motivation will increase the level of affective satisfaction. Regarding the nature of the relationship between extrinsic motivations and affective satisfaction, it is a negative one, because affective satisfaction is affected negatively by increasing extrinsic motivations. The results can be explained by the fact that such extrinsic motivation requires tangible or verbal rewards nature and therefore not of itself, but rather is activated by these rewards. As opposed to this, intrinsic motivation does not need any incentive to behave.

In conclusion, we believe that in the case of the secondary educational system in Romania, the variables forming extrinsic motivation (elements of the remuneration system) can

be less influenced and so, they do not have influence in gaining work satisfaction. In addition, we can say that being a teacher is passion, due to the existence of a sense of self-fulfillment and not for material rewards type or due to constraints. Moreover, increasing teachers concerns on the remuneration system and working conditions has as affect the reduce level of affective satisfaction, and the diminishing of the work passion, interest, and pleasure felt because of the teaching work. The research results are important for researchers, schools managers/leaders, and schools inspectorates that should focus on their quest to increase performance and decrease teacher intention to change their jobs. One of the most important results of the research is that the existence of a high level of satisfaction of teachers towards work has two key consequences: increase the level of work performance and reduce their intention to change jobs.

One of the main limitations of this research is related to the sampling techniques used in the research (convenience sampling and sampling type "snowball") are part of non-probability sampling techniques. In addition, another limitation of this research is the small sample size used to test the validity of the proposed conceptual model (157 respondents). Therefore, future research that will address the subject of work performance of teachers must find financial resources and time to use probability-sampling techniques and to provide a large enough sample size so, that the results obtained can be generalized to the entire population statistics investigated.

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VARIATIONS AND FREQUENCY IN LEARNING STYLES IN BACHELOR´S ENGLISH LANGUAGE COURSE

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Abstract

Learning styles are being progressively more incorporated into technology-enhanced learning, and consequently a great deal of contemporary research work is occurring in this field. As more information and details about learning styles becomes available, the model of learning styles can be better applied and integrated into all aspects of educational technology and process. The aim of this paper is to analyse data about learning style variations and frequency of a group of bachelor students of Management disciplines with respect to the Felder-Silverman learning style model (FSLSM).

The analyses show the most frequent preferences of individual learning style dimensions as well as how the frequency of individual learning style preferences is represented, including the strengths of a particular preference. This information is especially important when learning styles are incorporated in technology-enhanced learning, e.g. e-courses, on-line courses.

Keywords

Learning styles (LS), Felder-Silverman learning style model (FSLSM), frequency in LS preferences, Index of learning styles (ILS), strength of preferences (strong, moderate, and balanced)

Introduction

In recent years, educational researchers have focused more and more on various aspects of learning styles and how they can be considered in educational technology. (Hubalovsky, 2013) In this context, several adaptive systems were developed that aim at integrating learning styles with the ultimate objective being the creation of a 'perfect' online lesson for every learner. Examples of such systems include WHURLE (Brown & Brailsford, 2004; Moore et al, 2001), CS383 (Carver et al, 1999) and ILASH (Bajraktarevic et al, 2003) all implement different aspects of the Felder-Soloman ILS (Index of Learning Styles) (Felder & Soloman, 2004). Others such as INSPIRE (Grigoriadou et al, 2001) uses Kolb's theory of experiential learning (Kolb, 1984); or the Dunn and Dunn model (Dunn & Dunn, 1978) as used in iWeaver (Wolf, 2002).(see Tab.1)

Here at the University of Hradec Kralove we use a variety of software products to suit the needs of students and teachers. Our teaching process is supported by large software packages developed by teams of professionals. However, we also incorporate smaller programmes tailored to a course´s specific requirements, as defined by a teacher's strategy, where appropriate. (Milkova 2012; Petranek,Janecka,Milkova 2013)

AEH system	Learning style model
AES-CS (Adaptive Educational System based on Cognitive Styles) (Triantafillou, 2002)	Witkin's field dependence/independence (Witkin & Goodenough, 1981)
iWeaver (Wolf, 2002)	Dunn and Dunn's learning style model (Dunn & Dunn, 1978)
INSPIRE(Intelligent System for Personalized Instruction in a Remote Environment) (Grigoriadou et al, 2001) **MOT** (My Online Teacher),2004) (Stash et al, 2004)	Kolb's theory of experiential learning (Kolb, 1984)
AHA! (Adaptive Hypermedia Architecture) (De Bra et al, 2003; Stash et al2004)	Honey and Mumford's Learning Styles Questionnaire (Honey and Mumford, 1992)
CS383 (**Computer Systems)** (Carver et al, 1999)	Felder-Soloman Inventory of Learning Styles (Felder & Soloman, 2004)
ILASH(Incorporating Learning Strategies in Hypermedia) (Bajraktarevic, 2003)	
TANGOW (Task-based Adaptive learNer Guidance On the WWW) - extended version (Paredes & Rodriguez, 2003)	
WHURLE(Web-based Hierarchal Universal Reactive Learning Environment) (Brown & Brailsford, 2004)	

Tab. 1: Overview of learning style models in extant AEH systems (Adaptive Educational Hypermedia)

The research into learning styles and the development of adaptive systems are motivated by learning style models which claim that learners have different ways in which they preferentially focus on different types of information, tend to operate on perceived information, and achieve understanding. Integrating learning styles into the teaching process can make learning easier and thus results in higher achievement. Felder, for example, pointed out that learners with a strong preference for a specific learning style may have difficulties if the teaching style does not match their preferred learning styles (Felder & Silverman, 1988).

In this paper, we focus on the Felder-Silverman learning style model (FSLSM) (Felder & Silverman, 1988), which is often used in technology-enhanced learning and is designed for traditional learning. Most other learning style models classify learners into a few groups, whereas Felder and Silverman describe the learning style of a learner in more detail, distinguishing between preferences on four dichotomous LS dimensions.

Each of the dimensions (active or reflective, sensing or intuitive, visual or verbal, sequential or global) has parallels in other learning style models. The combinations, however, are unique to Felder's model. The first dimension – active/reflective – is a component of Kolb's learning style, the second dimension – sensing/intuitive – is one of the four dimensions of Jung's theory of psychological types, the third dimension – visual/verbal – is analogous to the visual-auditory-kinaesthetic formulation of modality theory and is rooted in cognitive studies of information processing. The fourth dimension – sequential/global – has numerous references. (Felder, R.M., & Spurlin, J., 2005). (see Fig.1)

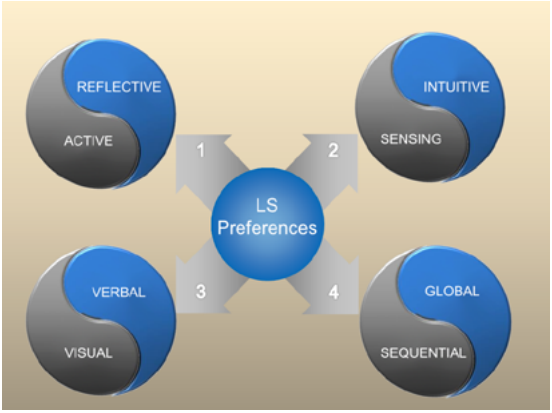

Fig. 1: Dichotomous dimensions of LS preferences

To demonstrate the characteristics of the above mentioned four dichotomous dimensions of LS preferences, we provide a brief summary from Felder and Silverman's (1988) article Learning and Teaching Styles in Engineering Education, p. 676.

There are four dimensions in FSLSM. Each learner is characterized by a specific preference for each of these dimensions. The ***first dimension*** distinguishes between an ***active*** and a ***reflective*** way of processing information. Active learners learn best by working actively with the learning material, by applying the material, and by trying things out. Furthermore, they tend to be more interested in communication with others and prefer to learn by working in groups where they can discuss the learned material. In contrast, reflective learners prefer to think about and reflect on the material. Regarding communication, they prefer to work alone or maybe in a small group together with one good friend.

The ***second dimension*** covers ***sensing*** versus ***intuitive*** learning. Learners who prefer a sensing learning style like to learn facts and concrete learning material. They like to solve problems with standard approaches and also tend to be more patient with details. Furthermore, sensing learners are considered to be more realistic and sensible; they tend to be more practical than intuitive learners and like to relate the learned material to the real world. In contrast, intuitive learners prefer to learn abstract learning material, such as theories and their underlying meanings. They are more able to discover possibilities and relationships, and tend to be more innovative and creative than sensing learners.

The ***third***, ***visual-verbal*** dimension differentiates learners who remember best and therefore prefer to learn from what they have seen (e.g., pictures, diagrams and flow-charts), and learners who get more out of textual representations, regardless of whether they are written or spoken.

In the ***fourth*** dimension, the learners are characterized according to their understanding. ***Sequential*** learners learn in small incremental steps and therefore have a linear learning progress. They tend to follow logical stepwise paths in finding solutions. In contrast, ***global*** learners use a holistic thinking process and learn in large leaps. They tend to absorb learning material almost randomly without seeing connections, but after they have learned enough material they suddenly get the whole picture. Then they are able to solve complex problems, find connections between different areas, and put things together in novel ways

but they have difficulties in explaining how they did it. Because the whole picture is important for global learners, they tend to be more interested in overviews and in broad knowledge whereas sequential learners are more interested in details.
In short, we can say, that the learning style model is closely connected with the information processing style which can be sub-divided into three sections: holist/analytic; verbaliser/imager and sensing/intuitive. These in turn relate to specific dimensions of learning styles. (Brown et al, 2005). (see Fig.2)

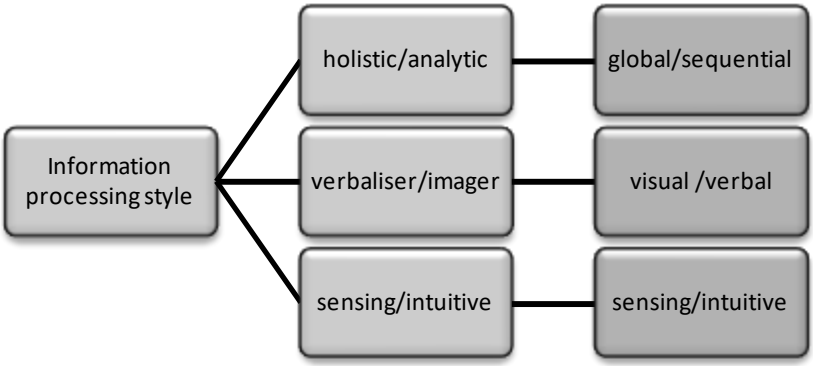

Fig. 2: Information processing style and Felder-Solomon LS preferences

Based on the FSLSM introduction above, we can state that the objective of this paper is twofold: first, to analyse data based on FSLSM to provide a more detailed description of LS preferences of bachelor students of Management disciplines at Faculty of Informatics and Management, and second, to introduce the frequency of individual learning style preferences, including the strengths of a particular preference.

Materials and Methods

In this part of the paper we focus on describing the Index of Learning Styles (ILS) questionnaire (Felder & Soloman, 2012), which was used for data collection, and discuss the results of the conducted frequencies analyses in an attempt to reveal the most commonly repeated patterns of our students' preferences.
The instrument used in this study to assess learners' learning style preferences, which was the first research objective, was the Index of Learning Styles questionnaire. The Index of Learning Styles is an on-line instrument used to assess preferences on four dimensions (active/reflective, sensing/intuitive, visual/verbal, and sequential/global) of the learning style model formulated by Richard M. Felder and Linda K. Silverman. The ILS is targeted at 11 forced-choice items for each of the four dimensions (for a total of 44 questions). Each item has a possible **a** or **b** response that corresponds to either one of the categories related to the dimension - for example - the active or reflective dimension. The **b** responses are subtracted from the **a** responses to obtain a score that is an odd number between -11 to +11 (Felder & Spurlin, 2005, p.104).
Felder (1993) points out that each of the learning style dimensions are continua and not either/or categories. Therefore, an individual's preference on a given scale (e.g. for sequential or global tendencies) may be strong, moderate, or almost non-existent; may change with time; and may vary from one subject or learning environment to another (Litzinger et al, 2007).

The 44-item questionnaire can be submitted and automatically scored on the Web. After taking the survey on-line, students receive instant results in the form of a profile of their dominant learning styles. (see Fig.3)

We can imagine the ILS result as the four scales of the ILS, with two opposite (dichotomous) categories of each scale. If you score 1 or 3 on both sides (see Fig.3), it means you have a mild or balanced preference for one of the particular LS, if you score 5 or 7 on both sides you have a moderate preference and if your score is 9 or 11 you have a strong preference .

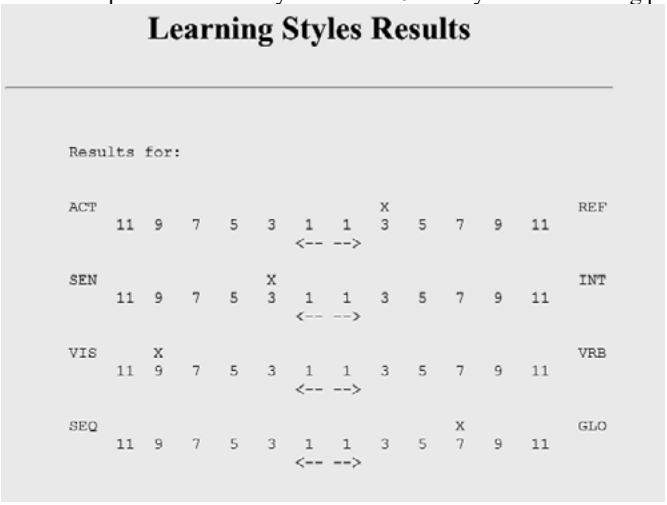

Fig. 3: ILS result - example

In relation to our second research objective we used **A** to identify **the minus** (-5 or-7= moderate preference,- 9 to -11= strong preference) **side of the scale**, representing active, sensing, visual and sequential preferences; **B** to identify **the middle** (-3 or -1 = mild or balanced preference for active, sensing, visual or sequential mode; +1 or +3 mild or balanced preference for reflective, intuitive, verbal or global preference) **part of the scale** representing both modes of the dichotomous LS preferences; and **C** to identify **the plus side** of the scale (+5 or +7 = moderate preference, +9 or +11= strong preference) representing reflective, intuitive, verbal or global mode. This division was used to identify the frequencies as part of the second objective of this paper. (see Fig.4)

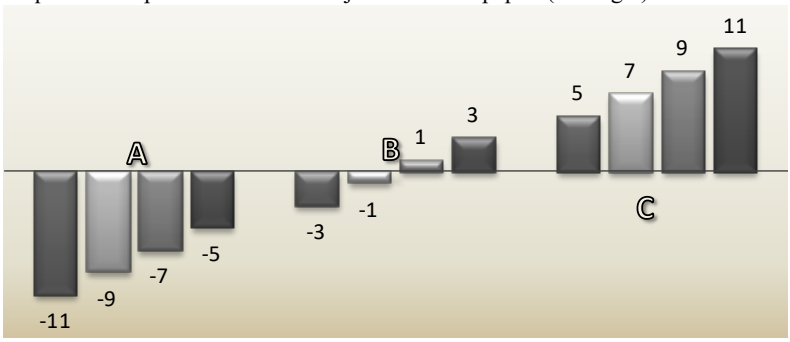

Fig. 4: ILS scale

Results and Discussion

The participants in this study were 223 first and third-year college students who majored in two disciplines including Management of Tourism (n=172), and Applied Informatics (n=51).Among the participants, 83 were males and 140 were females. The study was conducted during the first semester of the 2013/14 academic year.

Students who participated in professional English language courses were asked to take part in the survey and fill out the Index of Learning Styles questionnaire which was uploaded to the on-line English language course in Blackboard LMS. It took the participants an average of 50 minutes to complete the questionnaire.

Figure 5 shows the percentages of participants displaying their preference to Active-Reflective, Sensing-Intuitive, Visual-Verbal, and Global-Sequential dichotomous learning style dimensions. A large number of students share preference to Sensing (185 students – 83%) and Visual (172 students – 80%) dimensions of learning style. There are, however, considerably large groups of students displaying preference to Sequential (131 students – 59%) and Active (125 students – 56%) dimensions of learning style (LS). Another relatively large group is the one containing students with Reflective (98 – 44%) and Global (92 – 41%) preferences. Verbal (44 - 20%) and Intuitive (38 – 17%) students belong to a minority.

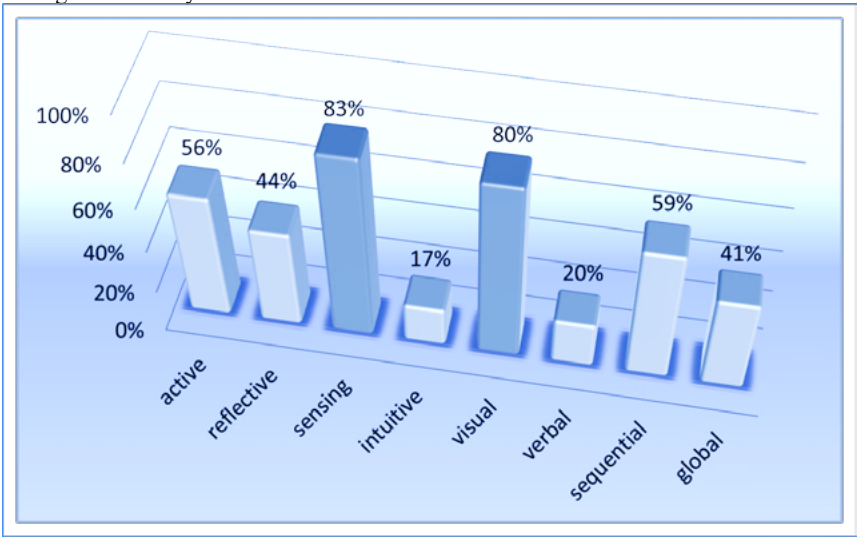

Fig. 5: General overview of LS preferences in %

The findings in the above graph indicate that the participants vary in their preferences for particular learning styles; this affects their learning behavior in the way they perceive, interact, and respond to the learning environment. It is important for teachers to examine the variations in their students with regard to their learning styles, because the information about a learner's preference can help teachers become more sensitive to the differences different students bring to the classroom (Felder & Spurlin, 2005).

In an attempt to reveal the most commonly repeated patterns (frequencies) of our students' preferences we used the ILS scale (see Figure 4). The results clearly proved that the majority of students belong to a BBAB or BBBB pattern, which means that a large

number of students (86%) displayed mild or balanced preferences for the left and right sides of the LS Results scale (there were 84 frequencies which involved variations of the B and A sides of the scale). Only 24% of the students were identified as having moderate or strong preference for the right side of the LS Result scale, representing reflective, intuitive, verbal or global preference mode. (see Fig.6 and Fig.7.)

1	2	3	4	frequencies
B	A	B	B	15
B	B	B	B	12
B	B	A	B	11
B	A	A	B	10
B	A	A	A	7
B	A	B	A	7
A	B	B	B	5
A	A	B	B	4
A	B	A	A	4
B	B	B	A	4
C	A	A	B	4
A	B	A	B	3
B	A	B	C	3
B	C	B	B	3
C	A	B	A	3
C	A	B	B	3
C	B	B	B	3
A	A	A	B	2
A	A	C	B	2
A	B	A	C	2
B	A	C	B	2
B	B	B	C	2
B	C	A	B	2
C	C	A	B	2
A	A	A	A	1
A	A	C	A	1
A	B	B	A	1
A	B	C	B	1
A	C	A	B	1
B	A	A	C	1
B	B	A	A	1
B	B	A	C	1

A – moderate / strong preference
B – mild / balanced preference
C – moderate / strong preference

1 active / reflective
2 sensing / intuitive
3 visual / verbal
4 sequential / global

B	B	C	B	1
B	C	A	C	1
C	A	A	C	1
C	A	C	A	1
C	B	A	A	1
C	B	B	C	1
C	C	A	C	1

Fig. 6: LS Results preference frequencies

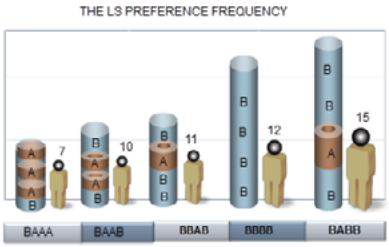

Fig. 7: LS frequencies variations

In other words, only 24% of the students show a clear preference for only one learning style pole of a reflective, intuitive, verbal or global dimension and could achieve optimal learning results if only the opposite learning environment were provided.

Conclusion

The author concludes with recommendations for further research. The figures given above prove that a mild preference to the four dimensions of learning styles is representative of the majority of bachelor English language course students (86%). This indicates that they cannot be strictly classified as having preference for a single learning style, since they share a great variety of learning style preferences and are well balanced in the environment featuring both styles of a particular dimension. On the other hand, there is a small group of students (24%) who are moderately or strongly limited to one of the right side preferences of the LS scale, which can affect their flexibility in the learning environment. Further research, within the Specific Research Project in the summer and winter terms of 2014, in the area of evaluation of learning styles will continue as there are some more questions to be answered. First, we need to understand why so few students belong to the reflective, intuitive, verbal or global modes, which belong to the C side of the scale. We then need to establish the extent to which this information can be applied to innovative teaching processes and learning environments. Second, we must address the question of how to create synergy between effective teaching strategies and brain learning rules, which are closely connected with the learning style models. The author is convinced that continuous research in the area of LS and preferences is worthy as new technology and corresponding teaching styles will consequently result in a higher standard of teaching and learning. Helping students to identify the ways they learn best and providing them with opportunities to use all their senses and different intelligences is one of key challenges in the teaching process.

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TRAINING EFFICIENCY MEASUREMENT AND EVALUATION

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Abstract

The paper focuses on the approach to evaluation of training efficiency in organisations in the Czech Republic. The main objective is to evaluate the use of training measurement and evaluation methods and related aspects in organisations in the Czech Republic in the period from 10/2012 to 06/2013 and to compare the results obtained with the results from the previous period. A partial objective is to test dependencies between selected qualitative features in order to verify the conclusions made. The results revealed that only 44.4% of respondent organisations systematically evaluate training efficiency. The year-on-year increase in the number of organisations systematically evaluating employee training was 5.9%. The survey results also confirmed that important factors determining the evaluation of training efficiency in organisations continue to include an organisation´s size, existence of a HR department and a developed HR strategy. Nevertheless the strength of dependencies is, compared to the previous period 2011/2012, weak.

Keywords

Efficiency, employee training, evaluation, human resources, organisation, survey

Introduction

At the present time, which is characterised by dynamic development and changes, employees are an important source of competitive advantage. Therefore human resource management in organisations gains a strategic orientation (Richard and Johnson 2001; Kiessling a Harvey, 2005; Way and Johnson 2005; Zupan and Kaše 2005; Lengnick-Hall, Beck and Lengnick-Hall, 2011). 'Strategic human resource management effectiveness significantly reduces employee turnover and increases overall market performance assessment' (Richard and Johnson, 2001: 299). It confirm also Buller and McEvoy (2012), according them there are important links between the organisation's strategy, its human resources, and performance outcomes. Training research and practice have considerably advanced during the last 30 years (Salas et al, 2012). Evaluation of training efficiency is an important task which is widely discussed by many researchers (Jablonský, 2011). According to Staňková and Drdla (2012), the most important requirements for an efficient training system involve the conformity with the needs and goals of the organisation, linking with the performance system and accord with the needs of an individual. Understanding how best to use training helps an organisation establish a skilled and competitive workforce (Salas et al, 2012). Vnoučková (2013) adds that the efficiency of human resources is the primary goal of all organisations to keep their competitiveness. Therefore organisations need to encourage the continued training and development of their employees in order to stay on top in their field (Salas et al, 2012). Despite the fact that effective human resource training and development are important factors for organizations success, most

organizations fail to evaluate the impact and return on training investments that they could and should (Brinkerhoff, 2005).

The paper focuses on the approach to evaluation of training efficiency in organisations in the Czech Republic. The main objective of the paper is to evaluate the use of training measurement and evaluating methods and related aspects in organisations in the Czech Republic in the period from 10/2012 to 06/2013 and to compare the results obtained with the results from the previous period (10/2011 to 06/2012). A partial objective is to test dependencies between selected qualitative features in order to verify the conclusions made.

Materials and Methods

In the period from 10/2012 to 06/2013 a questionnaire survey was conducted focusing on the training of employees in organisations in the Czech Republic. 364 organisations from both the private and public sectors took part in the questionnaire survey. 37.1% of the organisations surveyed have less than 50 employees, 27.5% of these organisations have 50 to 249 employees and 35.4% of these organisations employ more than 250 people. The results obtained were compared with the results from 10/2011 to 06/2012 (Königová and Fejfar, 2013). 109 organisations from both the private and public sectors took part in the questionnaire survey. 48.6% of the organisations surveyed have less than 50 employees, 29.4% of these organisations have 50 to 249 employees and 22% of these organisations employ more than 250 people.

To enhance the quality of the questionnaire survey it was required for the questionnaire to be completed by a specialist from the HR department or an owner of the given organisation. The data have been processed by means of descriptive statistics using the Microsoft Excel 2013 program and the IBM SPSS Statistics 21. Testing was done by Pearson´s Chi-Square Test in contingency tables. To interpret the strength of relationship coefficients a scale according to de Vaus (2002) was used.

Results and Discussion

The results of the survey revealed that 78% of the responding organisations train their employees. 22% of organisations do not pay attention to employee training. It is quite surprising that in the survey these were primarily (65%) mid-sized businesses (from 50 to 249 employees) although the general assumption is that it is in particular small businesses that still underestimate the importance of human resources. The latest findings of the Czech Statistical Office (2012) in the area of employee training show a positive trend, i.e. the number of organisations that provide their employees with further education is growing. According to the latest investigation of the Czech Statistical Office (2012) for the year 2010, 72.2% of organisations offered qualified training to their employees as compared to 69.9% five years before that. It is possible to anticipate, and the results of the survey conducted confirm, that in the future the number of organisations providing employees with further education will continue to grow since current developments in the business world bring a number of changes to which organisations have to respond. In order to stay competitive, organisations need to ensure that the level and quality of human resources correspond to their real needs. According to the Czech Statistical Office (2012), the Czech Republic holds, compared to other member states of the European Union (EA-17), a very good position. The share of organisations providing training ranges from 23% to 87% and in more than half of the countries (including the Czech Republic) the figure is more than 70%. Another interesting finding is the average time spent at courses, where

roughly half of the countries showed a range of 9 to 12 hours (9 hours in the Czech Republic) (Czech Statistical Office, 2012).

The survey also revealed that despite the fact that 78% of organisations train their employees, only 44.4% of these organisations systematically evaluate its efficiency. In absolute figures, this means 126 organisations of the selected sample. In the previous monitored period (2011/2012), it was 38.5% of organisations. The year-on-year increase in the number of organisations systematically evaluating employee training was 5.9%. To evaluate training efficiency, these organisations most frequently evaluate the following: assessment of development plan goals fulfilment (61.1%), employee´s reactions immediately after training (58.7%), informal feedback from direct superiors and employees involved in the training process (55.6%), records of the overall number of days of training per employee (39.7%), observation during work (27%) measuring work performance before and after training (immediate performance or their performance after a lapse of time) (19%).

The year-on-year increase in the number of organisations evaluating training efficiency was seen for the majority of methods mentioned: evaluation according to the assessment of development plan goals fulfilment (+ 18.2%), evaluation of employee´s reactions immediately after training (+ 3.9%), informal feedback (+ 12.7%), records of the overall number of days of training (+ 2.2%), and measuring work performance before and after training (+ 9.5%). A decrease was seen only for evaluation by observation during work (- 13.5%). The year-on-year comparison of training measurement and evaluation methods is displayed in Table 1.

Training measurement and evaluation methods	Monitored period	
	2011/2012	2012/2013
Assessment of development plan goals fulfilment	42.9%	61.1%
Employee´s reactions immediately after training	54.8%	58.7%
Informal feedback from direct superiors and employees involved in the training process	42.9%	55.6%
Records of the overall number of days of training per employee	37.5%	39.7%
Observation during work	40.5%	27%
Measuring work performance before and after training	9.5%	19%

Tab. 1: Training measurement and evaluation methods in year-on-year comparison

In the present situation, which is characterised by dynamic changes, the basic prerequisite of success of each organisation is the ability to quickly adapt to changes in the external and internal environments. After the global financial crisis employees realise the need for training more than ever before as training and development increase their chances to succeed in the labour market. In terms of employees´ will and initiative to learn, employees are willing to be trained in 57.7% of responding organisations, however, the course needs to be selected by the employer. In 32.7% of organisations it is the employees who select courses and in 8.5% of organisations employees are not willing to learn – they only participate in courses recommended by the employer. And finally, in 1.1% of organisations employees try to avoid courses. With respect to the above, it may be said that despite the fact that training is currently a necessity, in 9.6% of responding organisations employees are not willing to undergo any training. The year-on-year comparison is shown in Table 2.

Will and initiative to learn	Monitored period	
	2011/2012	2012/2013
Employees are willing to be trained bud the course needs to be selected by the employer	53.7%	57.7%
Employees select courses	33.3%	32.7%
Employees are not willing to learn – they only participate in courses recommended by the employer	11.1%	8.5%
Employees try to avoid courses	1.9%	1.1%

Tab. 2: Employees´ will and initiative to learn in year-on-year comparison

In terms of the year-on-year comparison, there was an increase in employees who were willing to learn of 4%, which corresponds to the trend in the labour market. It has been proven that the support of employee training and development brings a competitive advantage to organisations. In order to achieve this, training and development in organisations need to be based on a clear conception reflecting expected future changes. Responding organisations realise this as well. 66.5% of organisations determine areas in which employees need to be trained based on trend monitoring, 22.9% of organisations do this intuitively and 10.6% of organisations do not focus on these issues at all. A positive development may be seen in the year-on-year decrease in the application of intuition (- 6.5%) in favour of trend monitoring (+ 4.1%). The year-on-year comparison of methods for the determination of education areas in organisations is shown in Table 3.

Determining of training areas	Monitored period	
	2011/2012	2012/2013
Based on trend monitoring	62.4%	66.5%
Intuitively	29.4%	22.9%
Organisations do not focus on these issues	8.2%	10.6%

Tab. 3: Training areas determining methods in year-on-year comparison

For training to be efficient, it needs to be connected with other HR activities in the organisation, such as employee development, employee appraisal, remuneration, career management and talent management. 'The employee appraisal is an important factor for employee development and employee performance improvement because the outcomes of the evaluation represent input values for follow-up HR activities' (Königová and Fejfar, 2013: 286). The survey revealed that 57.1% of organisations have a formal system of employee performance appraisal (56% of organisations in 2011/2012, + 1.1%), out of which 81.7% of organisations utilise information obtained through employee performance appraisal for the purposes of their remuneration, 57.7% of organisations for career management, 56.7% of organisations use it for the training and development of employees and 38.9% of organisations for HR planning. The year-on-year comparison showed an increase in the use of outcomes of employee appraisal in the majority of monitored HR activities (career management: + 22.8%, training and development: + 18.2%, HR planning: + 14.1%) (see Table 4). It follows from the above said that more and more organisations realise that efficient training needs to be connected with other HR activities in the organisation

HR activities	Monitored period	
	2011/2012	2012/2013
Remuneration	82.6%	81.7%
Career management	34.9%	57.7%
Training and development	38.5%	56.7%
HR planning	24.8%	38.9%

Tab. 4: Connection of employee performance appraisal with follow-up HR activities

For reasons of comparison of results of tested dependencies between qualitative features in the period 2011/2012 (Königová and Fejfar, 2013) and 2012/2013 and verification of the conclusions made, the testing of dependencies of qualitative features was repeated. The results are shown in Table 5.

No.	Null hypothesis	Asymp. Sig.	Decision	Value of Cramer´s V	Strength of the relationship
1	A systematic evaluation of training efficiency is not dependent on the size of organisation.	0.000	Reject the null hypothesis	0.248	Low
2	A systematic evaluation of training efficiency is not dependent on the existence of an HR department.	0.000	Reject the null hypothesis	0.234	Low
3	A systematic evaluation of training efficiency is not dependent on the existence of a HR strategy.	0.000	Reject the null hypothesis	0.211	Low

Tab. 5: The results of the qualitative characteristics test for null hypotheses no. 1, 2 and 3

The results in Table 5 reveal that all three accepted alternative hypotheses were correct. Repeated testing of dependencies between qualitative features confirmed that:

1. A systematic evaluation of training efficiency is dependent on the size of organisation.
2. A systematic evaluation of training efficiency is dependent on the existence of an HR department.
3. A systematic evaluation of training efficiency is dependent on the existence of a HR strategy.

The dependencies are, compared to the previous period of 2011/2012, weak. In 2011/2012 significant factors that influenced the evaluation of training efficiency in organisations included the existence of an HR department (Asymp. Sig. = 0.000, Cramer´s V = 0.529), the HR strategy defined (Asymp. Sig. = 0.000, Cramer´s V = 0.377) and the size of an organisation (Asymp. Sig. = 0.000, Cramer´s V = 0.537). The dependencies were substantial (null hypotheses no. 1 and 2) and moderate (null hypothesis no. 3) (Königová and Fejfar, 2013).

Conclusion

On the basis of the evaluation of results of the survey it is possible to state that 78% of responding organisations train their employees and 44.4% of them systematically evaluate the efficiency of training. The number of organisations systematically evaluating

the efficiency of employee training saw a year-on-year increase of 5.9%. In the future further growth in the number of organisations ensuring training for their employees may be expected. This is confirmed by the conclusions of the Czech Statistical Office (2012) as well as preliminary results of the follow-up survey conducted in the period 2012/2013 (n = 182), according to which 80.8% of organisations train their employees and 51.7% of them systematically evaluate the efficiency of training. The survey results also repeatedly confirmed that important factors determining the evaluation of training efficiency in organisations continue to include the following: an organisation´s size, existence of a HR department and a developed HR strategy. Nevertheless the strength of dependencies is, compared to the previous period 2011/2012, weak.

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EFFICIENCY OF COALITION STRUCTURE FORMATION

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Abstract

There are a number of real problems in which it is necessary to create different coalitions to negotiate a successful solution. Effective teaching of coalition structure formation can be carried out using laboratory experiments. This paper presents results of repeated economic laboratory experiments with information asymmetry. On the assumption of complete knowledge of the information is possible to determine the first-best solution. Experimental results by information asymmetry can be compared with the first best solution. This paper shows the results of the negotiations based on real situations and discusses the results achieved by the efficiency of the established structures. Students played the role of managers of polluting entities seeking to gain support in the auction when bidding pollution reductions Negotiations take place under pressure when conditions regulate behavior of participants in the negotiations.

Keywords

Coalition structures, combinatorial auction, economic laboratory experiments, environmental support, negotiation principles

Introduction

Effective teaching of coalition structure formation can be carried out using laboratory experiments. This paper presents results of repeated economic laboratory experiments with information asymmetry. Frequently used means of achieving consensus in group decision making are negotiation processes (Raiffa, 1985). For the participants a negotiation position is not so important itself, but how the position meets their interests. Some participants' interests may be common and some contradictory. The point is to capture the common interests and the promotion of conflicting interests through mutual concessions to reach a decision acceptable to all participants in decision-making.

Auctions are popular market mechanisms. Different types of auctions were tested in laboratory experiments (Davis and Holt, 1993). In this paper combinatorial auctions are used for laboratory experiments. Combinatorial auctions are those auctions in which bidders can place bids on combinations of items which are usable in various application areas (see Cramton, Shoham and Steinberg, 2006). Combinatorial auctions were first proposed by Rassenti, Smith, and Bulfin (1982), for the allocation of airport landing slots. Their paper introduced many key ideas on combinatorial auctions, including the use of techniques from experimental economics for testing combinatorial auctions. Since then, a number of contributions deal with testing of combinatorial auctions using laboratory experiments, including comparative work (Brunner et al., 2010). The paper reports laboratory experiments that evaluate the performance of a flexible package bidding format developed by the Federal Communications Commission for the sale of spectrum rights, in comparison with other combinatorial formats that have been proposed in the recent

literature. They find stark differences in terms of efficiencies and revenues, sometimes caused by seemingly minor design details. The reverse combinatorial auction model was proposed for a case of public supports granted to individual and coalition projects reducing environmental pollution (Fiala and Šauer, 2011).

This paper is a follow-up of papers (Fiala, 2012) and (Fiala, 2013), which presented the use of laboratory experiments. The paper (Fiala, 2012) dealt with using of combinatorial auctions by solving pollution reduction problem through coalition projects. The paper (Fiala, 2013) analyzed the negotiation process under pressure between individual students. Both approaches are illustrated on simple artificial examples. This new paper is a combination of auction and negotiation processes on the real task with a greater number of participants and with a greater number of possible larger coalitions. These new conditions affect efficiency of coalition structure formation.

The paper is organized as follows. Next session summarizes the methods used in the paper: laboratory experiments, combinatorial auctions, and negotiation principles. Session 3 presents experiment design based on a real-life situation. Students played the role of managers of polluting entities seeking to gain support in the auction when bidding pollution reductions. Results and discussion are presented in session 4. On the assumption of complete knowledge of the information is possible to determine the first-best solution. Experimental results by information asymmetry can be compared with the first best solution. Negotiations take place under pressure when conditions regulate behavior of participants in the negotiations. The last section summarizes parameters of laboratory experiments that affect efficiency of coalition structure formation.

Methods

Laboratory experiments have been used to evaluate performance in a wide variety of institutions (Davis and Holt, 1993). Coalition structure formation was tested by laboratory experiments. For verifying the efficiency of coalition formation has been used a combination of tools such as combinatorial auctions (Fiala, 2012) and negotiation concepts (Fiala, 2013).

Laboratory experiments

Economic theories are devised to explain market activity. Economists have developed an impressive a technically sophisticated models, but the capacity to evaluate their predictive content has lagged. Traditionally, economic theories have been evaluated with statistical data from existing natural markets. Predictions are often based on very subtle behavioral assumptions for which it is difficult to obtain evidence from naturally occurring markets. Experiments provide an inexpensive way to examine various economic policy proposals. The main advantages offered by laboratory methods are replicability and control. Replicability refers to the possibility to reproduce the experiment by other researchers, and thereby verify the findings independently. Control is the possibility to manipulate laboratory conditions so that observed behavior can be used to evaluate alternative theories and policies. Laboratory auctions are reasonably used in experimental analysis to test the predictions of negotiation results. Standard assumptions and methods are used in our experiments. Real money is used to increasing interest in the results.

Combinatorial auctions

Auctions are important market mechanisms for the allocation of goods and services. Auctions have emerged as a particularly interesting tool for negotiations. An auction provides a mechanism for negotiation between buyers and sellers. Combinatorial auctions

(see Cramton, Shoham and Steinberg, 2006) are those auctions in which bidders can place bids on combinations of items, so called bundles. The advantage of combinatorial auctions is that the bidder can more fully express his preferences. This is particular important when items are complements. The auction designer also derives value from combinatorial auctions. Allowing bidders more fully to express preferences often leads to improved economic efficiency and greater auction revenues.

We use a reverse auction of indivisible items with one buyer and several sellers. This type of auction is important for supplier selection problem. Let us suppose that m potential sellers $S_1, S_2, ..., S_m$ offer a set R of r items, $j = 1, 2, \ldots, r$, to one buyer B.

A bid made by seller S_h, $h = 1, 2, \ldots, m$, is defined as $b_h = \{C, c_h(C)\}$, where

$C \subseteq R$, is a combination of items,

$c_h(C)$ is the offered price by seller S_h for the combination of items C.

The objective is to minimize the cost of the buyer given the bids made by sellers. Constraints establish that the procurement provides at least set of all items.

Bivalent variables are introduced for model formulation:

$y_h(C)$ is a bivalent variable specifying if the combination C is bought from seller S_h ($y_h(C) = 1$).

The reverse combinatorial auction can be formulated as follows (see Cramton, Shoham and Steinberg, 2006)

$$\sum_{h=1}^{m} \sum_{C \subseteq R} c_h(C) y_h(C) \rightarrow \min$$

subject to

$$\sum_{h=1}^{m} \sum_{C \subseteq R} y_h(C) \geq 1, \forall j \in R, \tag{1}$$

$$y_h(C) \in \{0, 1\}, \forall\ C\ \subseteq\ R, \forall\ h, h = 1, 2, \ldots, m.$$

The objective function expresses the cost. The constraints ensure that the procurement provides at least set of all items.

The CRAB (CombinatoRial Auction Body) software system was proposed (Fiala, Kalčevová and Vraný, 2010). The CRAB is a non-commercial software system for generating, solving, and testing of combinatorial auction problems. The system solves problems by Balas' method or by the primal-dual algorithm.

Negotiation concepts

Negotiation problems are studied using a number of theoretical approaches and findings of the application areas of negotiations. Among the most important areas of application include negotiating economic area and the area of diplomatic negotiations. The theoretical approaches used in modeling the negotiation process include utility theory, aspiration theory, game theory, and recently multi-criteria optimization and artificial intelligence. There are some concepts for modeling the negotiation process with multiple criteria that correspond to different types of behavior of the participants in the negotiations. Negotiation models are quite complex and difficult to understand. To increase the efficiency in education is suitable to explain the negotiation principles on the examples and use laboratory experiments.

The pressure negotiation concept is based on the assumption that each participant decides

under pressure of objective context, subject to a variety of internal and external pressures (Kersten, Szapiro, 1986). Participant is under pressure, for example, if he wants to reach a consensus, he is aware of prices for delayed decisions; other participants influence their behavior, etc. Pressure is a term that includes internal values and external influences and determines the decision making process. Assume that the pressure does not affect the selection of decisions directly, but through a set of conditions that have to be satisfied.

Experiment design

The experiments were designed based on real-life situations. Projects to reduce pollution should be implemented in Vrchlice basin. Municipalities can implement individual projects or coalition ones. Map of the region is on Figure 1 (darker dots characterize municipalities for potential coalition projects).

Fig. 1: Vrchlice basin

List of municipalities with the potential of coalitions:

A-Černíny, B-Červené Janovice, C-Chlístovice, D-Choustkov, E-Korotice, F-Kralice,

G-Krasoňovice, H-Malešov, I-Opatovice, J-Předbořice, K-Roztěž, L-Štipoklasy, M-Vidice.

It is theoretically possible to create $2^n - 1$ coalition, which for our case n = 13 polluters meant 8191 coalitions. It would mean a high computing, evaluation, strategic and communication complexity. In practice, however, does not make sense to pursue projects that are obviously economically inefficient due to high cost projects and negotiations. For the experiment, 13 individual projects were worked out (A, B, C, D, E, F, G, H, I, J, K, L, M) and 49 potential coalition projects (15 two-coalitions, 15 three-coalitions, 14 four-coalitions, one six-coalition, 2 seven-coalitions, one eight-coalition, one nine-coalition), total of 62 projects. For each of the projects have been set following parameters:

- Total costs of projects.
- Maximal own funding that municipalities can invest in the project.

Students negotiate support under pressure. Support gets only 50 percent of the proposed applications (only the top half of the proposed coalition structures). This condition pushes the search for the best structure and minimizes the required total support. Individual municipalities, however, try to obtain the highest possible support to save their own funds for other activities. Students are trying to reduce their own funding under the specified maximum. Students are financially evaluated according to this condition. If student's project does not get support, his/her reward will be only 70 CZK. If he/she gets the support and will save a portion of the funds of the municipality, he/she will get 100 CZK + premium 10 CZK for every saved 15 % of maximal own funding.

Results and Discussion

The first-best solution was calculated by assumption of knowledge of information about projects' costs. This solution takes into account the total social costs, which consist of equity financing municipalities and support provided by the environmental authority. The solution is calculated by the solving reverse combinatorial auction model (1) considering all possible potential coalitions of municipalities.

The optimal coalition structure:

Three- coalition: BIL (Červené Janovice, Opatovice, Štipoklasy).

Two-coalition: CG (Chlístkovice, Krasoňovice).

Individual projects: A, D, E, F, H, J, K, M (Černíny, Chroustkov, Koratice, Malešov, Předbořice, Rozteč, Vidice).

Total costs: 153800.

The total cost for the coalition structure of individual projects together: 176100

Laboratory experiments were conducted with different groups of 13 students of the University of Economics in Prague. We will present results of 4 groups. Tables (Tab. 1, Tab. 2, Tab. 3, Tab. 4)

Coalition structure – own funding						Costs	Support
H - 11500	K -800	M-1000				58900	45600
A-2200	B-7100	E-1600	G-300	I-1900	L-1900	83000	68000
J-1050						3500	2450
C-4500	D-500	F-1650				34600	27950
Total						180000	144000

Tab. 1: Results of Experiment 1

Coalition structure – own funding						Costs	Support
A-2400	B-10400	J-1050	L-2400			66740	50490
H – 11500	K -1200	M-1300				60000	45000
C-5400	D-75	F-1650				34600	27475
I-2100						7000	4900
E-1000						6000	5000
G-480						1600	1120
						175940	133985

Tab. 2: Results of Experiment 2

Coalition structure – own funding						Costs	Support
H - 10000	K -1100	M-1400				58900	46400
C-4500	D-750	F-1950				34600	27400
A-2100	L-2100					19000	14800
G-480						1600	1120
J-1050						3500	2450
I-2100						7000	4900
E-1800						6000	4200
B-10800						36000	25200
Total						166600	126470

Tab. 3: Results of Experiment 3

Coalition structure – own funding						Costs	Support
M-1500						5000	3500
L-2400						8000	5600
K-1200						4000	2800
I-1900	J-700	G-400				24000	21000
H-13200						44000	30800
F-1950						6500	4550
E-1800						6000	4200
D-750						2500	1750
C-5000						18000	13000
A-2000						8000	6000
B-10800						36000	25200
Total						162000	118400

Tab. 4: Results of Experiment 4

Experimental results raise discussions about the efficiency of coalition formation. Efficiency is affected by the conditions of auctions and negotiations. Reverse combinatorial auction is an appropriate model but can be improved by multi-round or multi-criteria models. Negotiation in this case is based on a combination of cooperative and non-cooperative approaches. These conflicting pressure conditions complicate negotiations. Finding the optimal coalition structure is sufficient space for determining the required support to ensure that support is obtained and also saves their own funds (benefit for students). Experiments did not reach the optimal structure. Experiments 3 and 4 are the top half of the proposed coalition structures in total costs (166600, 162000) and required supports also (126470, 118400). These structures get supports. Students from these coalition structures get money where amount is based on differences between maximal own funding and real own funding (surplus). The question is whether the amount of remuneration is sufficient to motivate student behavior. Study evaluation may be more important.

Problem size and complexity of coalitions is next important parameter. In this case (13 participants, 62 potential projects, nine-coalition), no experiment gives optimal coalition structure in comparisons with simple artificial examples (Fiala, 2012, 2013). The question is where is the boundary of the range of problems for negotiations and the search for the optimal coalition structure by laboratory experiments without computers.

Negotiations for establishing a coalition project are the most time-consuming activities. It is necessary to provide sufficient time to find coalition partners by information asymmetry. Computer network could streamline this process.
Suitability of the problem explanation is a necessary condition for the successful realization of experiments. The effort to create coalitions at any cost can lead to surprising results. It is interesting that the total costs in Experiment 1 (180000) are greater than the sum of the total costs of individual projects (176100). Our results show that lower the total cost also mean less support. In general, it might not. The question is how to evaluate such coalition structures.

Conclusion

Experiments have shown a very good usability of reverse combinatorial auction model for the preparation of economic laboratory experiments. Negotiation process by coalition projects formation based on pressure concept corresponds to a combination of cooperative and non-cooperative behavior of participants. The coalition negotiation process is carried out under economic information asymmetry between subjects. Both approaches are good theoretical basis for laboratory experiments.
The results of the laboratory experiments by coalition structure formation are affected by:

- condition specifications,
- problem size and complexity
- time for negotiations,
- suitability of the problem explanation.

The results are very sensitive to the setting of these parameters for future experiments.

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PATH TO THE LABOUR MARKET: CZECH STUDENTS' STUDY WORKLOAD AND WORK EXPERIENCES

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Abstract

The aim of this paper is to examine the impact of the study workload and work experiences on the student's expectation of their future labour market chances. For the future formal evaluation of the Czech students' workload, it is necessary to take into account if the students' jobs are closely connected to their field of study, which makes the important part of their education. We used the unique dataset based on the survey EUROSTUDENT V to test this challenging question. We have found that Czech full-time students spent in the workweek almost one full-time employment studying at working. It was proven, that students who study very hard as well as students with in-branch experiences are optimistic about their future labour prospects. Especially business-minded students prefer working hours to studying at school or at home. Finally, we have found considerable differences between men and women work experience during their studies.

Keywords

Cluster analysis, EUROSTUDENT V, ECTS, job-participation, study workload

Introduction

One of the most crucial questions of recent tertiary education in the Czech Republic is the balance between traditional formal education at universities and students' working activities during the term. Employers seek graduates with substantial job-experience (Čermáková et al., 2013). Meanwhile, the importance of employees' lifelong learning is growing rapidly (Mazouch, Suchánková, 2013), which highlights the leading role of formal education for working life and careers.

Dadgar (2012) maintains that according to the classical Becker's Human Capital Theory, it is optimal for individuals to get a job after completing formal education to make the investment into individual human capital fully beneficial. Scott-Clayton (2012), on the contrary, stresses the concavity of human capital productivity which leads to marginal returns on the work experience. From this point of view, a student's job during the term can improve their soft skills, career network and secure references (ibidem).

In short, the study-work rate challenges economic theory: if Human Capital Theory connected with Garry Becker's research (Becker, 1962) proves to be right, then a student's study workload should be very high and their work experience should create just a marginal part of their university years. Nevertheless, if higher education was just a necessary, but not sufficient condition in terms of job market signalling (Spence, 1973), then we should call for the higher working participation of Czech students.

The aim of this paper is to examine the impact of the study workload and work experiences on the student's expectation of their future labour market chances using data from the survey EUROSTUDENT V[1]. The rest of the paper is organized as follows. We introduce the data and the statistical methods we used. We then present the results of our analysis. Firstly, the study workload from the perspective of study field, enrolment status, market chances and work experiences is discussed. Secondly, we analyse the relationship between study field and current job in terms of gender, chances on the labour market and wages. Finally, the experience and family background of business-oriented students is researched.

Materials and Methods

Our research is based on high quality and unique data from the survey EUROSTUDENT V, which was conducted in 2013 over all Czech public and 29 private universities. The questionnaire was sent to 95 177 undergraduate full-time and part-time students, with the response rate below 7%, and after removal of uncompleted or insufficient questionnaires, our dataset consists of 4 664 respondents (Fischer and Vltavská, 2013).

For the purpose of our analysis the optimal week study workload was computed. The Bologna Declaration of 1999 (Ministry of Education, Youth and Sports, 1999) supports the European Credit Transfer and Accumulation System (ECTS). It is suggested that one term should consist of 30 ECTS on average, with 1 ECTS being from 25 to 30 lessons (1 lesson = 45 minutes). Based on the schedules of 11 Czech universities[2], the 20 week term[3] is standard. One ECTS is considered to be 26 lessons (e.g. Mazouch and Fischer, 2011). The average weekly study workload in hour is computed as

$$study\ workload = \frac{lessons \times TOTAL\ ECTS \times \frac{45}{60}}{weeks} = \frac{26 \times 30 \times \frac{45}{60}}{20} = 29.25 \sim 29\ hours.$$

Study workload was then divided into 5 categories. The first category covers the workload that is lower than half of the optimal week study workload, the second one stays for more than half of the optimal hours, in the third category there are students whose studies during the workweek are exactly the optimal workload, the forth category includes students who study longer than 29.5 hours but less than 40 hours and the last category contains students whose study workweek is longer than the standard Czech labour workweek.

study workload [hours]	intensity
(0, 14.5>	very low
(14.5, 29>	low
(29, 29.5>	enough
(29.5, 40>	high
(40, 146>	very high

Tab. 1: The study workload intensity in five categories

[1] This survey was lead in the Czech Republic within the project IPn KREDO CZ.1.07/4.1.00/33.0005.

[2] Charles University in Prague; University of J. E. Purkyně, Ústí nad Labem; Prague University of Economics, Prague; Czech Technical University in Prague; Masaryk University; Czech University of Life Sciences; University of South Bohemia in České Budějovice; University of West Bohemia in Plzeň; Institut of Chemical Technology in Prague and Technical University in Liberec. These schools create 77% of our dataset.

[3] Including the examination period.

Variable *wage*, as a proxy for wages which can be expected by students of different programmes on the Czech labour market, was taken from the report based on the REFLEX 2010 survey (Koucký and Bartušek, 2012). As the dataset for the recent labour market situation was not available at the time of writing, the *wage* variable from 2010 was considered mainly as the relative one. Using the average wage on the Czech labour market in the 4th quarter 2010 (25 803 CZK, CZSO, 2011), we create the new dummy variable acquiring a value of 1 for the above-average wage and value of 0 for the below-average wage.

We have used statistical software STATISTICA 12 to perform standard statistical tests as the analysis of variance and -test (Budíková et al., 2010). For the nominal and ordinal data, correspondence analysis was used (Řezanková et al., 2009).

Results and Discussion

Study workload

Part-time students should be able to study approximately 11 hours more than full-time students during weekends to fulfil the optimal study workload of 29 hours per week. Full time students spent 37 hours during the workweek studying and working in paid jobs, part-time students study and work during workweek in total 49 hours. T-test for independent samples confirms that a significant difference between the study intensity of full-time students and part-time students exists. If we consider the standard full-time employment in the Czech Republic as 40 hours, than full-time students study and work during the workweek is almost at the full-time level.

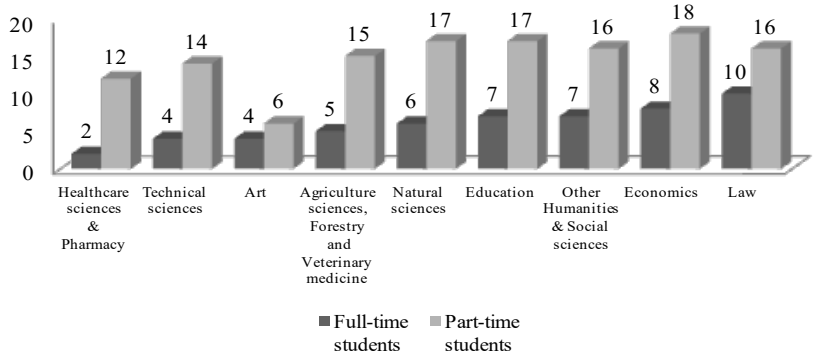

Fig. 1: How many hours should full-time and part-time students study during weekends to fulfil the optimal 29-hours-quota? Categorisation according to the field of study.

Figure 1 clearly shows that the full-time students of Healthcare sciences and Pharmacy accomplish nearly whole optimal workload during the workweek; on the other hand students of Law and Economics should spend approximately 8 – 10 hours studying during weekends. The narrowest difference between the weekend overload of full-time and part-time students is in Art, and the deepest one in Natural sciences.

The correspondence map (fig. 2) visualizes he relationship between study workload during the workweek and the field of study (because the 2nd dimension explains 90% of the whole inertia, we can focus just on the horizontal relationship). While the highest workload is connected with the full-time Healthcare and Pharmacy study programmes

(more than 40 hours per week), students of Law, Economics, other Humanities and Social sciences spend less than 14.5 hours studying during the workweek. This is in line with the greater number of compulsory lectures in Healthcare and Pharmacy in comparison to Law or Economics.

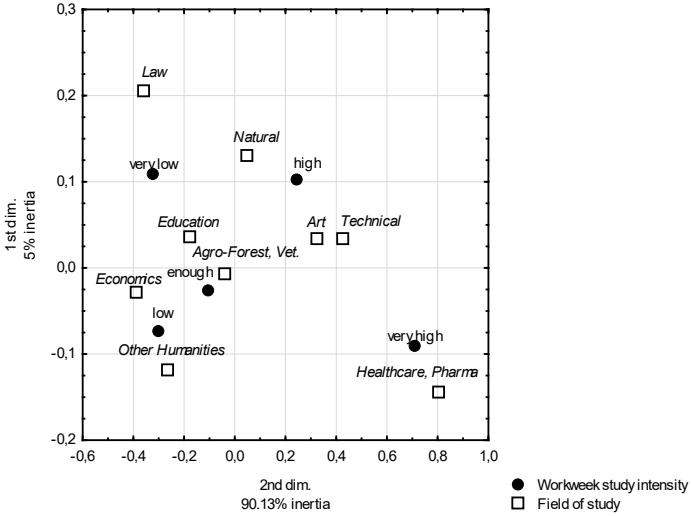

Fig. 2: Association between the workweek study intensity and field of study

Full-time students who are studying hard during the workweek consider their chances on the Czech labour market as very good, students who studied exactly the optimal 29-29.5 hours consider their chances being fair (fig. 3).

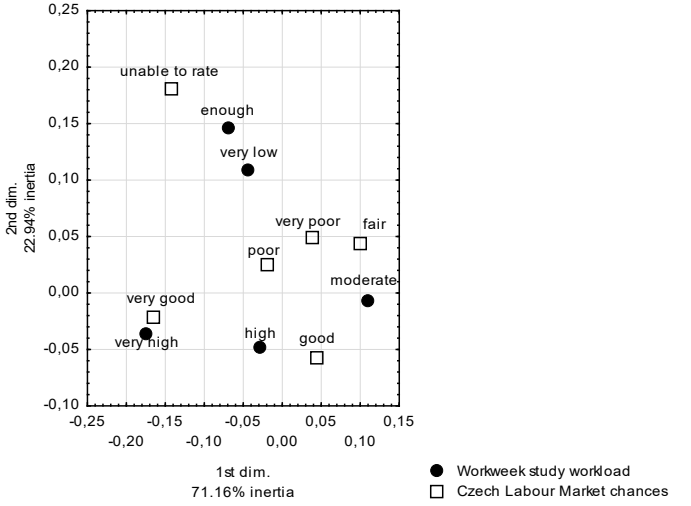

Fig. 3: Association between the workweek study workload and evaluation of the chances on the Czech labour market

Students, whose job is very closely connected to their field of study, spend in the workweek just a little time studying. On the other hand, if the intensity of studying is very high (more than 40 hours workweek), there is not a close relationship between their job and field of study. In this case, the term job is a clear substitute for formal education.

Field of study and the labour market

There exists a moderate relationship between the wage level typical for the study programme and the chances students consider to have on the Czech labour market (Cramer V =0.20). Students of programmes with significantly higher wages evaluate their chances on the Czech labour market as very good or good. Students who evaluate their labour-market chances as fair or poor can expect lower wages. However, there is not a statistically significant difference between the expected wages of full-time students who consider their chances on the Czech labour market as very poor and those who are unable to rate their chances (fig. 3).

Full-time students who do not have a paid job during semester study during workweek significantly more intensively (31.5 hours) than students who work (25.5 hours).

Full-time students are more confident in terms of getting a job at the national labour market if their recent work is related to the content of their study programme (fig. 5). Students, whose job is not closely related to their study, evaluate their labour market chances as fair or poor or they are unable to rate them at all.

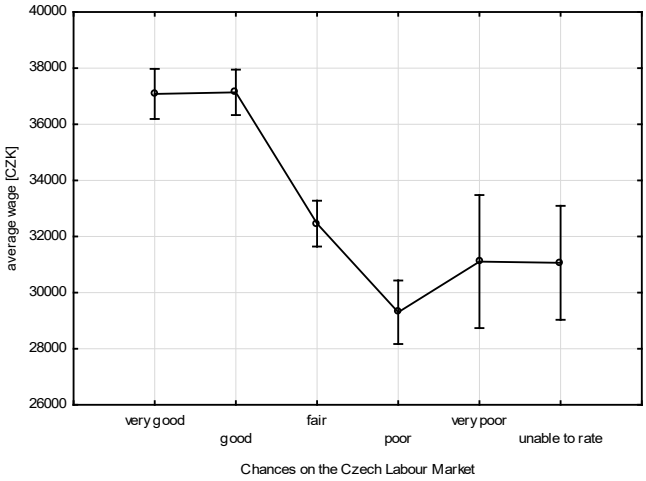

Fig. 4: Students evaluation of the Czech labour market chances and the average wage they can expected

There exists a significant relationship between the sex of students and relationship of their job to the content of their study programme. Male students tend to work during their studies more often in the field of their study than women (Cramer V = 0.19). While 44% of working male students work in a job very closely or closely related to their study, 40% of female-students work in a branch that has nothing in common with their study field. This could be a latent factor that models the wage differences among men and women. Moreover, female students study more often programs in which graduates have significantly lower wages. While, in our dataset, the typical female branch is Education

(the field with the highest rate of below-average wages), females create only 28% of law students (with law being one of the best-paid fields). This is in line with Chalupová and Borůvková (2012) who remark that for Czech male students career security, prestige and profitability are key factors in choosing their profession. In total, 67% of female students study in a programme in which graduates have a below-average wage. On the contrary, 59% of male students major in a field with an above-average wage.

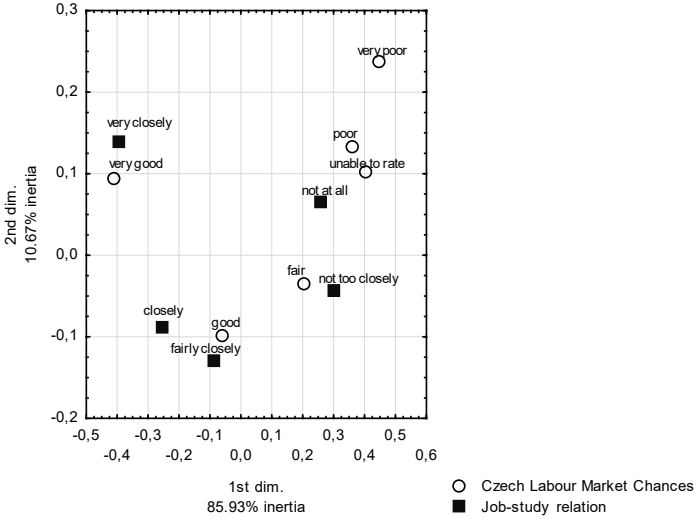

Fig. 5: Labour market chances in light of the job-study relation

Conclusion

In this paper the measurement of students' workweek workload is based on the optimal quota of 29 hours which students should spent studying at school and at home. There are great differences in the amount of study among the fields covered. The number of study hours depends also on the student's participation in the labour market.

We have discovered that wage differences during the working career might have their roots in undergraduates' activities. Women tend to enrol in study programs for which below-average wages are typical; furthermore, they lose the opportunity to enhance their working experience when they work on jobs that have nothing in common with their field of study.

For the future of the Czech national economy, it is threatening that, according to the survey, business-minded students count for just a small part of Czech undergraduates. One of likely explanations for this might be that this survey data is biased, as the business-minded students are perhaps not motivated enough to fulfil a survey questionnaire. On the other hand, it is obvious that students who want to run their own business find the marginal revenue from the one additional lesson of study lower than from one additional hour of paid work. This is in line with Scott-Clayton's suggestion (2012).

This paper is a further contribution to the discussion on the need for closer link between formal education and work experience. It is obvious that students who work in the field of

their study consider one hour of work being the substitute for one hour of formal studying, and are more optimistic in terms of their future career. It provides the decision makers with the sufficient data analysis, that should be taken into account when computing the compulsory ECTS for the Czech universities.

Acknowledgements

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IS PARETO'S 80-20 RULE APPLICABLE IN RESEARCH? A CASE OF CULS PRAGUE

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Abstract

This contribution testifies if Pareto's 80-20 rule is applicable on research results of PhD students. The authors analyse 809 PhD students (436 males and 373 females) enrolled at Czech University of Life Sciences Prague in the year 2011. For this purpose, the authors set three working hypotheses that concern on the whole university, and also on differences between genders and faculties. The authors use a test of compliance to testify if the research results have the 80-20 distribution. Results show that the 80-20 rule does not work, except of a few cases. Moreover, the results show that a huge portion of PhD students have zero research results.

Keywords

Analysis, chi-square, goodness-of fit test, Pareto's 80-20 rule, PhD student, RIV points

Introduction

Academic staffs, as well as PhD students, both face a constant pressure to increase a quality of their research results. Along with this pressure for a higher quality, number of their research results should also increase. Many higher education institutions (HEIs) in the Czech Republic launched motivation programmes to stimulate research results of their academics and PhD students. However, who had had research results before, have had results after as well. The focus of all HEIs should rather focus on those who have been publishing neither any points nor very small number of research results. If any HEI would like to increase the quality of research, the first step should focus on PhD students. Pareto's principle (also known as the 80-20 rule) states that roughly 80% of some effects come from 20% of the causes. This rule is named after Italian economist Vilfredo Pareto who observed in 1906 that 80% of country's wealth was controlled by 20% of its population. The 80-20 rule has been used in many areas (for example Lorenco et al., 2013; Sousa et al., 2013; Svenssson and Wood, 2006). The authors of this contribution would like to testify if this rule is also applicable on research results. Thus, the 80-20 rule can be modified for the research purpose as follows: *20% of academics make 80% of research results*. This contribution focuses on PhD students' performance at the Czech University of Life Sciences Prague (CULS Prague). Therefore, the authors operate with following working hypotheses (WH):

WH_1: 20% of PhD students make 80% of RIV points of the whole CULS Prague.

WH_2: Considering the 80-20 rule, there are not significant differences between male and female PhD students at CULS Prague.

WH_3: Considering the 80-20 rule, there are not significant differences among faculties of CULS Prague.

Doctoral study programmes are the third level studies at the all faculties of CULS Prague, i.e. Faculty of Economics and Management (FEM), Faculty of Agrobiology, Food and

Natural Resources (FAFNR), Faculty of Engineering (FE), Faculty of Environmental Sciences (FES), Faculty of Forestry and Wood Sciences (FFWS), and Faculty of Tropical AgriSciences (FTAS). Deans or vice-deans of each faculty are responsible for the organization, administration and control of the studies (CULS, 2012).

Studies in the Doctoral Study Programme (DSP) are intended for university graduates who completed their studies with a required state examination in a field ensued by the DSP or in a field closely related. The basic aim of the DSP is to obtain and demonstrate the ability of independent research work in a particular scientific field by carrying out and defending doctoral dissertation, publications and other forms of presenting own scientific-research activities, including completing all required exams and the State doctoral exam. The DSP graduates receive an academic-scientific title "Doctor" (abbreviated as PhD behind the name). Students are enrolled into the studies on the basis of a positive result of entrance examination.

The objective of the contribution is to analyse RIV results of PhD students at CULS Prague and find out, if the 80-20 rule is applicable on these results. The next parts of the contribution are divided as follows: the following part specifies the dataset and describes all statistical methods used for the analysis. The methodology of RIV evaluation is also described in this part. The main part of the contribution is devoted to the results and ends with some concluding remarks.

Material and Methods

Data specification

Czech University of Life Sciences Prague provided 18 doctoral study programmes in 29 PhD specializations in the year 2011 (CULS, 2011). In these study programmes, in total 1093 PhD students were enrolled. Nevertheless, PhD students from the first years are excluded from the data set. The reason for this exclusion is justifiable, because if we consider in average more than a year to publish a research result, a huge majority of PhD students from the first years have zero research results. Thus, the first year PhD students could negatively influence the analysis. Moreover, study specialization Sustainable Rural Development at FTAS is also excluded from the analysis due to its recent establishment in 2010. So the analysis consists of 809 PhD students (436 males and 373 females) enrolled at CULS Prague in the year 2011.

The analysis is based on the RIV results published in February 2013. These data includes research outputs published by all PhD students from CULS Prague between years 2007 and 2011. In total, all PhD students made 7137.8 RIV points. Table 1 summarizes the numbers of PhD students and number of RIV points across all faculties at CULS Prague.

Faculty	No. of PhD	No. of male PhD	No. of female PhD	Sum of R&D pts	Sum of male R&D pts	Sum of female R&D pts
FAFNR	182	72	110	1285.876	482.562	803.315
FE	97	83	14	868.592	841.521	27.071
FEM	173	90	83	1061.936	533.127	528.809
FES	142	72	70	2126.893	1145.655	981.28
FFWS	147	90	57	1582.341	744.660	837.680
FTAS	68	29	39	212.169	94.672	117.497
CULS	809	436	373	7137.807	3842.197	3295.611

Table 1: Number of PhD students and RIV points at CULS Prague, 2011

Evaluation of the R&D results

The source of the RIV results is Rejstřík informací o výsledcích/Information Register of R&D results (RIV), which is the key database for the evaluation of scientific work in the Czech Republic. The evaluation is carried out by the Rada pro výzkum, vývoj a inovace/ Research, Development and Innovation Council (RVVI). All the results are evaluated by the Metodika hodnocení výsledků výzkumných organizací/Methods for evaluating R&D results (RVVI, 2010), which are focused on research results that were made by each research organisation in the last five years. The model is based on the data files that refer to RIV results published between years 2007 and 2011. Data from the period 2008-2012 has not been published yet.

The official evaluation process is based on formalised procedures. Method distinguishes between two categories of results: results of the basic research (books, papers in scientific journals, conference proceedings) and results of applied research (patents, prototypes, industrial designs, maps, certified methods, and software). Each of these RIV results is ascribed a score (RIV points). The evaluation is carried out for each organisation (such as a university), whereby the organisation gains the relative share equal to the share of the authors who created the outcome and are affiliated to the given organisation (RVVI, 2010).

Statistics

The authors use non-parametric testing approaches for analysing the working hypotheses HW_1 - HW_3. The non-parametric approaches do not require distributional assumptions such as normality (Hindels et al., 2007). The authors use test of compliance, which enable us to test if the analysed variable has specified probability of distribution. In general, the non-parametric approaches are used for testing of coincidence frequency. Chi-square test belongs to a goodness of fit test, which is used to compare observed and expected frequencies in each category (SPSS, 2014).

Working hypotheses testing is based on the 80-20 distribution. Nevertheless, the test of coincidence frequency works with intervals around the proposed distribution. These intervals depend on frequencies (number of PhD students) in each observation. From the reason of different frequencies, all intervals are different.

Results and Discussion

This section is divided into three main parts due to the defined working hypotheses. Each hypothesis is tested and discussed and the results are followed by a critical discussion on the PhD students' research results.

HW_1: 20% of PhD students make 80% of RIV points of the whole CULS Prague

The first working hypothesis works with H_0 that says: *RIV points of PhD students at CULS Prague are distributed according to the Pareto's 80-20 rule*. Table 2 contains of the statistical evaluation of this hypothesis. In this case H_0 is rejected (p=0.000), i.e. is lover than 0.05), therefore, the distribution of RIV points at CULS Prague is not according to the 80-20. In the year 2011, 95 PhD students out of 809 made 80.08% of the RIV points. However, to fulfil the 80-20 rule, 162 PhD students should have made around 80% of the RIV points.

Thus, we can conclude that the situation at CULS Prague is even worse and only 11.74% PhD students made 80%. Moreover, if we look closer on the RIV results we find out that 464 out of 809 PhD students (57.35%), who were studying at CULS Prague in the year 2011, did not make any RIV points. If we consider that the data includes 5 years, then it is

a huge portion of PhD students. We can also observe huge differences of number of RIV points among the PhD students ($\chi^2 = 34.473$).

	Observed N	Expected N	Residual		
80-20 students	95	161.8	-66.8	Chi-Square	34.473
Rest of students	714	647.2	66.8	p-value	.000
Total	809				

Table 2: 80-20 rule and results of WH_1

HW_2: Considering 80-20 rule, there are not significant differences between male and female PhD students at CULS Prague

The first working hypothesis focused on the whole CULS Prague evaluating male and female PhD students together. Nevertheless, it can be useful to analyse differences between male and female PhD student. From this reason, the HW_2 analyses the 80-20 rule for male PhD students and female PhD student separately. Thus, H_0 for male PhD students says: *RIV points of male PhD students at CULS Prague are distributed according to the 80-20 rule*.

In this case the H_0 is rejected ($p = 0.000$) so the distribution of RIV points of male PhD students at CULS Prague is not according to the 80-20 rule (Table 3). In the year 2011, only 13.07% of male PhD students made 79.85% RIV points at CULS Prague. To fulfil the 80-20 rule approximately 87 male PhD student should had made 80% of RIV results, i.e. 29 male PhD students more. Moreover, 235 out of 436 male PhD students (it represents 53.9%), did not make any RIV points during the assessed period.

	Observed N	Expected N	Residual		
80-20 students	58	87.2	-29.2	Chi-Square	12.222
Rest of students	378	348.8	29.2	p-value	.000
Total	436				

Table 3: 80-20 rule and results of WH_2 - males

Similarly is defined H_0 for female PhD students. Hence H_0 says: RIV points of female PhD students at CULS Prague are distributed according to the 80-20 rule. H_0 is also rejected ($p = 0.000$) and the distribution is not according to the 80-20 rule (Table 4). Only 10.19% of female PhD students at CULS Prague made 80.14% of all RIV points. Moreover, 229 out of 373 female PhD students (61.39% of all female PhD students) made zero RIV points between 2007 and 2011.

	Observed N	Expected N	Residual		
80-20 students	38	74.6	-36.6	Chi-Square	22.446
Rest of students	335	298.4	36.6	p-value	.000
Total	373				

Table 4: 80-20 rule and results of WH_2 - females

If we consider both male and female PhD students, we cannot observe significant differences between these two groups. In both cases the 80-20 rule was rejected because significantly less PhD students made around 80% of the RIV results. The distribution is worse in case of female PhD students (comparing the chi-squares and residuals).

HW_3: Considering the 80-20 rule, there are not significant differences among faculties of CULS Prague

Both of the previous working hypotheses analysed the 80-20 rule according to the whole CULS Prague. Firstly, male and female PhD students were analysed together. Secondly, the 80-20 rule was analysed separately for both groups of PhD students. Analysis shows that the 80-20 rule is not applicable on the RIV results. However, it is also important to analyse differences among the faculties of CULS Prague. Therefore, the third working hypothesis works with H_0: RIV points of PhD students at each faculty of CULS Prague are distributed according to the Pareto's 80-20 rule.

Table 5 summarises these results for each faculty. The 80-20 rule is applicable at some faculties and at some of them not. For example, H_0 is not rejected at FAFNR ($p = 0.911$), thus, the distribution of RIV points is according to the 80-20. In the year 2011, 37 PhD students (20.33%) made 80.22% of the RIV points. However, still 90 PhD students out of 182 (49.45%) made zero RIV results. The 80-20 rule is also applicable at FE ($p = 0.509$) where 22 PhD students (22.68%) made 80.32% of RIV points. The number of PhD students with zero RIV results is 41.24% (40 PhD students).

On the other hand, H_0 is rejected in case of FFWS ($p = 0.000$), FEM ($p = 0.002$), FTAS ($p = 0.021$), and FES ($p = 0.049$). In all these cases the distribution of RIV results is worse than the 80-20 rule. At FFWS 4.76% of PhD students made 80.3% RIV results, at FEM 10.41% of PhD students made 80.59% of RIV results, at FTAS 8.82% of PhD students made 80.41% of RIV results, and, finally, at FES 13.38% of PhD students made 79.59% of RIV points. The p-value for FES lies very close to the acceptance level (Table 5). The main problem of all these faculties is the huge number of PhD students with zero results. At FFWS 70%! of PhD students (104 PhD students) had zero results, at FEM 65.9% (114), at FTAS 63.24% (43), and at FES 51.41% (73).

		Observed N	Expected N	Residual		
FAFNR	80-20 students	37	36.4	.6	Chi-Square	.012
	Rest of students	145	145.6	-.6	p-value.	.911
	Total	182				
FE	80-20 students	22	19.4	2.6	Chi-Square	.436
	Rest of students	75	77.6	-2.6	p-value.	.509
	Total	97				
FEM	80-20 students	18	34.6	-16.6	Chi-Square	9.955
	Rest of students	155	138.4	16.6	p-value.	.002
	Total	173				
FES	80-20 students	19	28.4	-9.4	Chi-Square	3.889
	Rest of students	123	113.6	9.4	p-value.	.049
	Total	142				
FFWS	80-20 students	7	29.4	-22.4	Chi-Square	21.333
	Rest of students	140	117.6	22.4	p-value.	.000
	Total	147				
FTAS	80-20 students	6	13.6	-7.6	Chi-Square	5.309
	Rest of students	62	54.4	7.6	p-value.	.021
	Total	68				

Table 5: 80-20 rule and results of WH_3 - faculties

The results show that the 80-20 rule is mainly not applicable on the RIV results of PhD students at CULS Prague. In all cases, H0 is rejected due to the even worse percentages of PhD students who made approximately 80% of the RIV results. These results mainly depend on zero RIV results of a huge portion of PhD students. In some cases more than 60% of PhD students belong to this portion. Moreover, we cannot observe any dependence in these portions of PhD students, i.e. it is influenced neither by the gender nor by year of study.

Nowadays, a high emphases on improving research quality at the Czech higher education institutions exists, CULS Prague is not an exception. As Malčík and Seberová (2011) pointed out, school quality improvements cannot be done only by implementing certain strategies. Improvements should be done by understanding the school environment, along by thinking what could be done better. If we consider the results of this contribution, the solution lies in the zero results of a huge portion of PhD students across the faculties at CULS Prague. Thus, the improvement of the research quality should focus on facilitating these PhD students to avoid zero RIV results. The research result of CULS Prague would increase by 13% if each of the PhD students with zero RIV results will make only around 2 RIV points.

An influence of PhD supervisors plays important role in research results of PhD students (Barnes and Austin, 2009). Pinheiro, Melkers and Youtie (2014) observed that co-authoring with a supervisor is a significant source of publications. Moreover, this co-authoring and mentoring have positive impacts for future research performance. Thus, not inappropriate supervising could partly cause the huge portion of zero results. Therefore, CULS should focus on improvement of PhD student-supervisor mentoring.

This improvement must go along with a proper PhD students' education. As Lee and Kamler (2008) pointed out, learning how to write and speak in discipline-specific way, how to frame research questions, and how to effectively collaborate are important in science fields. This learning should be provided on a faculty or department bases. For example, FEM CULS launched in 2012 a programme for innovation doctoral studies that would increase a research performance (Flégl et al., 2013). The programme includes eight PhD workshops (statistics, academic writing, etc.) for developing students' skills and also workshops for PhD supervisors. This paper assesses RIV results between 2007 and 2011; so, before the innovation programme started. The impact of the innovative programme can be evaluated in a future research.

The 80-20 analysis can be followed by a performance analysis among PhD students that would give us information about ways of potential improvements. Flégl et al. (2013) used Data envelopment analysis for evaluating research performance among the PhD specialisations at CULS Prague. Their results correspond with the results of 80-20 rule analysis of this contribution. In that paper the PhD specialisations at FAFNR also achieved the best results.

Conclusion

The objective of this contribution was to analyse a possibility to apply the Pareto's 80-20 rule on the RIV results of PhD students at CULS Prague. Results show that in most cases the 80-20 rule is not applicable. In the case of CULS Prague significantly less PhD students made around 80% of RIV results. These results mainly depend on huge portions of PhD students who made zero RIV results in the year 2011. In some cases these portions come up to 60% and more. Moreover, no difference was observed between male and female PhD students. On the other hand, some differences were observed among faculties

of CULS Prague. This analysis can be used in various ways considering the improvement of CULS Prague research performance.

Acknowledgements

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TRADITIONAL VERSUS ONLINE TEACHING AND LEARNING

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Abstract

Online teaching and learning is increasingly common nowadays at many types of higher education institutions, ranging from hybrid/blended courses that offer a combination of face-to-face and online instruction, to fully online experiences and distance learning. The purpose of this article is to outline the main benefits of online teaching and learning; survey which of the forms of instruction prevails at the institutions of tertiary education, in this case at the Faculty of Informatics and Management in Hradec Kralove; and to what extent students' learning preferences correspond to the selected form of instruction, particularly in the teaching of a foreign language.

Keywords

Online learning, traditional teaching, blended learning, learning preferences, survey

Introduction

Online teaching and learning is increasingly common nowadays at many types of higher education institutions, ranging from hybrid/blended courses that offer a combination of in-person and online instruction, to fully online experiences and distance learning (cf. CRLT, 2013). The main reasons why online learning environment is widely used are as follows:

- it contributes to pedagogy because it supports more interactive strategies, not only face-to-face teaching (Graham et al, 2003; Popelkova and Kovarova, 2013);
- it thus encourages collaborative learning; students or educators can work together on some projects from anywhere and at any time (Bruffee, 1993; Cerna and Svobodova, 2013);
- it deepens intercultural awareness since it puts together researchers, educators, and students from anywhere in the world;
- it reduces costs of teaching and learning since students do not have to undertake so many frequent travels to complete their education (Graham et al., 2003); and
- it might match students' learning style although there is no clear consensus on this issue (Coffield, 2004; Gregorc, 1979; Hubackova and Semradova, 2013; Poulova and Simonova, 2012; Simonova, 2013; or Simonova and Bilek, 2010).

Also in the Czech Republic tertiary education is partly run online (cf. Frydrychova Klimova and Poulova, 2012; Kucirkova, Kucera and Vostra Vydrova, 2012; Simonova, 2010). For example, the Faculty of Informatics and Management (FIM) of the University of Hradec Kralove, Czech Republic, runs more than 230 e-courses which are exploited in different ways. They are run purely as online courses or they are led as blended courses (see Frydrychova Klimova, 2009 for their definition) or they serve as an additional support for students after their regular, face-to-face classes so that students can read once again the information already obtained during the lecture. Several surveys and research

performed at the faculty confirmed that students welcomed the possibility to exploit online courses but mainly as blended learning courses (see, for example, Frydrychova Klimova, Hubackova and Semradova, 2011; Frydrychova Klimova and Poulova, 2013a). Therefore the aim of this article is to survey which of the forms of instruction in fact prevails at FIM and to what extent students' learning preferences correspond to the selected form of instruction, particularly in the teaching of a foreign language.

Material and Methods

In January of 2014, 42 part-time students of Management of Tourism at FIM were given a questionnaire in order to discover whether their attitude towards online teaching has altered or not and to what extent their learning preferences correspond to the selected form of instruction. The research tools used were as follows:

- pen and paper questionnaires consisting of multiple choice questions;
- descriptive statistical methods of processing the results of the survey;
- a comparison method of descriptive measures in analyzing the results of the survey; and
- observations.

The level of students' English was in most cases B2 according to the Common European Framework of Reference for languages (CEFR).

All students submitted the questionnaires. 35 (83%) of them were females and 7 (17%) were males (Fig. 1). The biggest groups of the students were between 20-24 years old (31%) and between 25-29 years old (31%), while 19% of the respondents were between 30-34 years old. 12% were aged between 35-39 years. See Fig. 2 below for further description.

Fig. 1: Respondents' sex

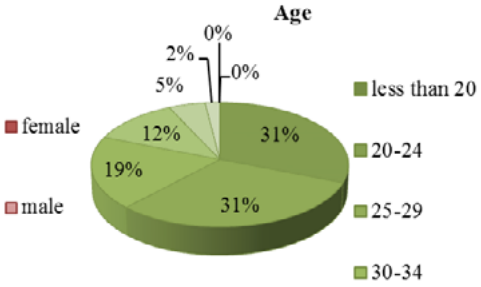

Fig. 2: Respondents' age

Results of the survey

Within another larger survey focused on the development of students' productive language skills, students were asked two core questions which are a subject of this article and they are as follows**:**

Which form of instruction would you prefer in the teaching of English? Please tick one option only.

a) traditional, face-to-face;
b) online/eLearning; or
c) blended (a combination of traditional and online teaching).

What are your learning preferences while learning a foreign language? Please tick one

option only.

- ***visual*** *(seeing);*
- ***auditory*** *(hearing);*
- ***kinaesthetic*** *(moving); or*
- ***tactile*** *(touching).*[1]

Question 1: As for the form of instruction, 21 students (50%) prefer a combination of online and traditional teaching; 16 respondents (38%) would rather be exposed to face-to-face teaching and only five students (12%) would favour pure online teaching. See Fig. 3 below.

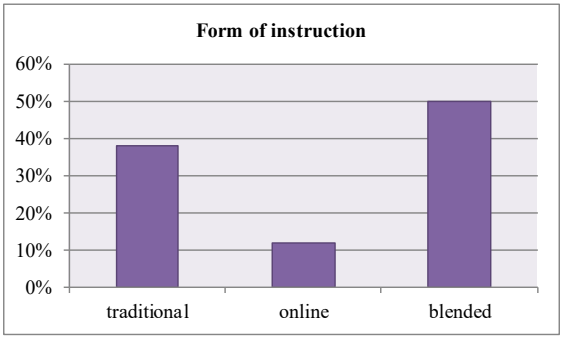

Fig. 3: Form of instruction

Question 2: As far as the students' learning preferences are concerned, the numerical proportions of the options were quite balanced. In most cases students, however, preferred a *kinaesthetic learning style* (13 students/ 31%); 10 students (24%) favoured an auditory learning style and the same number of respondents (10/ 24%) preferred a visual learning style, while nine students (21%) preferred a tactile learning style. See Fig. 4 below.

[1] Visual learning style students:
- look at the teacher's face intently;
- like looking at wall displays, books, pictures;
- often recognize words by sight;
- use lists to organize their thoughts; and
- recall information by remembering how it was set out on a page.

Auditory learning style students:
- like the teacher to provide verbal instructions;
- like dialogues, discussions and plays;
- solve problems by talking about them; and
- use rhythm and sound as memory aids.

Kinaesthetic learning style students:
- learn best when they are involved or active;
- find it difficult to sit still for long periods; and
- use movement as a memory aid.

Tactile students:
- use writing and drawing as memory aids; and
- learn well in hands-on activities like projects and demonstrations.

Compare to Dunn and Dunn (1993).

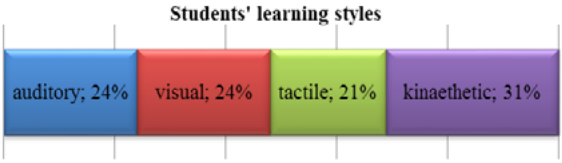

Fig. 4: Students' learning styles

In addition, the author of this article analysed the learning preferences with respect to the form of instruction since she was interested to discover whether there was any connection between the form of instruction and the relevant student's learning style which justified the selected form of instruction. The survey findings showed that the students who favoured the traditional form of instruction preferred mostly an auditory learning style (eight students/ 19%); five students who liked better online learning had kinaesthetic (two respondents/ 4%) and visual (two respondents/ 4%) learning preferences; and the students who fancied a combined form of study favoured mostly a kinaesthetic learning style (eight students/ 19%), followed by a tactile learning style (six students/ 14%) and visual learning style (five students/ 12%). See fig. 5, 6 and 7 below for further descriptions.

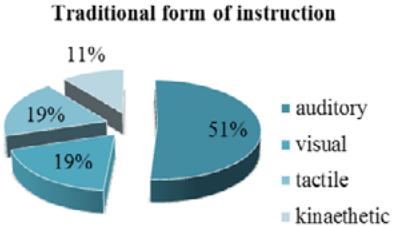

Fig. 5: Traditional form of instruction and students' learning preferences

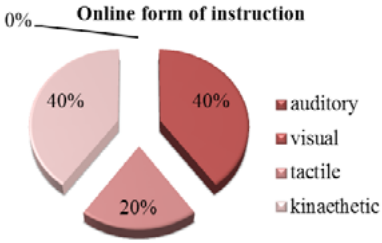

Fig. 6: Online form of instruction and students' learning preferences

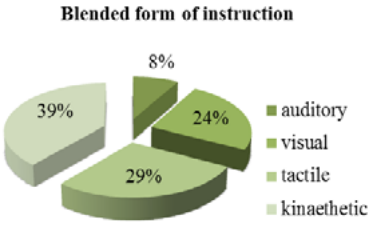

Fig. 7: Blended form of instruction and students' learning preferences

Discussion

Although the representativeness of the survey sample was quite small if compared with the total number of students at FIM (over 2,000 students), its findings from Question 1 in fact indicate similar results from the previous, large-scale sample research and surveys (e.g. Frydrychova Klimova and Poulova, 2013a, b, c; Hubackova and Semradova, 2013) carried out across the disciplines taught at the faculty. Thus, from the above described results of the survey, it is clear that students welcome an opportunity to work online although, predominantly, in the so-called combined/blended/hybrid form of learning. This form of instruction is nowadays one of the methods in the teaching of English enhanced by ICT (cf. Sorden, 2012).

Moreover, students can complete their knowledge and thus finish their learning process, which they did not manage to do during the face-to-face classes. They are not forced to do it immediately at school or in the library because they can access the online course from the cosiness of their homes any time they feel like that. In addition, if they did not understand anything during the lecture, they can contact their teacher online and ask him/her.

The findings of the analysis of students' learning preferences were quite surprising and might indicate some general conclusions, which are as follows: students who prefer the traditional, face-to-face teaching, favour mostly an auditory learning style, which might mean that they want to be exposed to spoken English as much as possible. This in fact confirms Krashen's theory of the acquisition of a foreign language (Krashen, 1981). However, due to a small sample of the respondents, this would, of course, need to be verified by conducting focus interviews with the respondents. Similarly, the students who prefer a blended form of instruction prefer kinaesthetic learning style since this form of instruction might offer more interactive ways of learning. Thus, the teachers of foreign languages should bear in mind not only the preferred students' learning styles but at the same time (re)consider the teaching methods and techniques in the second language acquisition which would match these preferred students' learning styles.

Conclusion

The blended form of instruction thus seems to be a solution to the acquisition and learning of a foreign language because it can take into account the key factors which make foreign language learning successful – and those include: continuity, sufficient input, frequent use, motivation and proper learning materials (Lightbown and Spada, 2006, as cited in Ishihara and Ham, 2012).

In this form of instruction the teacher/tutor is the key figure in the process of making students' learning successful; s/he has to take on several roles (pedagogical, organisational/managerial, social and technical) and balance them according to his/her current students' needs (cf. Frydrychova Klimova and Poulova, 2011).

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CASE STUDIES OF THE IMPLEMENTATION OF ICT AND IT COMPETENCIES DEVELOPMENT IN PRIMARY AND LOWER-SECONDARY SCHOOLS

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Abstract

The paper explores the concept and results of case studies of the implementation of information technologies and the development of information technology competencies into pupils' and teachers' educational activities and into the school educational environment, which were realized in 2013 as part of extensive research focused on the field of information technology education in primary and lower-secondary schools in the Czech Republic. The main research method was a questionnaire for teachers, by means of which relevant data from more than 1000 primary and lower-secondary schools were obtained. In the second phase of research, all together six case studies were conducted in selected schools. The purpose of case studies was to supplement other applied methods by an observation, a discussion and an interview right in the school environment and to partly complement the findings of the research.

Keywords

Case studies, education, primary and lower-secondary school, ICT implementation, ICT competencies

Introduction

When ensuring information technology education and targeted development of information technology competencies seen as specific cognitive and operational skills and attitudes, a primary and lower-secondary school plays a significant role regardless of the increasing importance of informal education based on the experience with using ICT in society (Straka, 2009). The concept of current information technology education is based on the competence approach leading to building information technology literacy through the development of particular information technology competencies within the system of key competencies of elementary education (Eurydice, 2002).

The concept of contemporary information technology education must support the development of abilities, or competencies enhancing pupils' adaptability, knowledge and skill transfer into new contexts and the ability to learn in a rapidly changing environment. It must develop pupil's critical thinking, their ability to decide and argue reasonably, develop informatics and algorithmically thinking and problem-solving; it must develop pupils' creative thinking and encourage their creativity (Ala-Mutka, 2011). However, the approaches to the development of pupils' information technology competencies are not uniform and we may see the differences in the organisation, extent, as well as in the form of educational activities in individual school systems (Eurydice, 2011).

The research project, which seeks to examine the current state and concept of pupil's information technology competencies development in primary and lower-secondary schools, within which case studies, the subject of this paper, were realized, was based on the notion of the significance of information technology education as part of the primary

and lower-secondary school curriculum and possible differences in approaches to pupils' information technology education.

The "Children's Information Technology Competencies and their Development in Primary and Lower-secondary Schools" research project was realized in 2012 and 2013. 1183 primary and lower-secondary schools joined the project through their teachers and pupils from all regions of the Czech Republic. The primary objective of the research was to identify the current state, structure and orientation from the viewpoint of curricular, process and organisational aspects of the development of pupils' information technology competencies in terms of building a particular level of their broadly understood information, or information technology literacy. Information technology education, or the area of relevant educational activities realized in primary and lower-secondary schools towards the development of pupils' information technology competencies, became hence the research field of the project. The research subject was divided into five issue areas focusing on 1) the characteristics of informatics educational activities, 2) the content of informatics educational activities, 3) the development of pupils' information technology competencies, 4) the structure of teachers' information technology competencies, and 5) the implementation of the development of information technology competencies into educational activities and school environment (Rambousek et al, 2013).

In addition to explorative methods, other methods were used within the project such as case studies of the implementation of information technologies and the development of information technology competencies into pupils' and teachers' educational activities and into the school educational environment. The scenario of case studies consisted of four blocks: school tours, classroom observations, discussions with pupils, and an interview with teachers. The paper seeks to describe the concept and course of case studies and results of the methods above.

Materials and Methods

The research, on which this paper draws, was divided into two main phases. Within the first phase, the following were realized: the identification and modification of basic information, methodology, organisation and material conditions for the realization of the survey and the pilot administration of a questionnaire for teachers, which was the primary research method in the research (Rambousek, Štípek and Wildová, 2012). The questionnaire for teachers was modified and finalised following the results of the pilot version and it was administered to more than 3500 randomly selected schools. 1183 respondents (33.8%), teachers of informatics orientated subjects, provided research data (Štípek, Rambousek and Procházka, 2013).

The questionnaire for teachers also included an invitation to participate in the second phase of the research consisting of the administration of the survey for teachers, a questionnaire for pupils and case studies. 167 teachers accepted the invitation to cooperate. In September 2013, six primary and lower-secondary schools were randomly selected from the registered schools interested in the cooperation. They were asked to consent to carry out the case studies. In October and November 2013, six case studies were realized, two of which in schools in Prague, and one in each of the following regions: Plzeň, Ústí nad Labem, Olomouc, and Moravia-Silesia. Pupils from both primary and lower-secondary schools took part in the research (ISCED 1 and ISCED 2).

The method of case studies of ICT implementation and the development of information technology competencies into educational activities and a school educational environment was used as a supplementary method in the second stage of the research in six schools.

The research took place in one class in Year 3, Year 5 and Year 6 and then three classes in Year 9. The purpose of the case studies was to supplement other applied method by an observation, a discussion and an interview directly in the school environment and partly complement the research findings. The case studies were hence based on the same theoretical foundations and approaches as the whole project. The scenario of the case studies consisted of four blocks: school tours, classroom observations, and discussions with pupils and an interview with a teacher. Each case study block was realized and technically documented by a researcher accompanied by, or helped by a teacher of informatics subjects, or a representative of the school leadership.

From the methodology perspective, the methods of an observation, discussion and interview were primarily used within the qualitative empirical research in schools. Familiarisation with the school environment was characterized by an open observation (the teacher knew the role and intention of the researcher) and a participative observation (the researcher got involved in the tour with the aim to get familiar with the school environment as best as possible). The classroom observation was realized as covert in relation to pupils (the researcher pretended to be a newly qualified teacher from a different school), non-participative, structured and in a natural context. The discussion was conducted as a group interview and usually with the same pupils as the previous observation in the lesson with a teacher present. The researcher introduced the issue to the pupils and he or she encouraged them to participate in the discussion following the pupils' spontaneous interest. The interview with a teacher was conducted as semi-structured. The beginning was unstructured; gradually it focused on in advance prepared topics. The end of the interview was usually informal. From the viewpoint of typology, descriptive case studies of the organisations and institutions were included with the aim to provide a description of the given phenomenon. The intention of the research was a description of a particular phenomenon in education reality.

1. School tour
    - Familiarisation with the school environment
    - Familiarisation with the school technical equipment

The first block of the case study consisted of a school tour, during which the researcher got familiar with the school environment, or the environment of common areas, classrooms and special classrooms and school technical equipment. In terms of the technical equipment, the following were of special interest: the current state and solution of computer networks and access to the Internet and the devices connected to the networks, and projection and interactive technologies. The first block was hence directly related to the fifth area of the research exploration in terms of identifying the ways and directions of the implementation of ICT into the school educational environment.

2. Classroom observation
    - The application of the observation scheme

The second block of the case study comprised a classroom observation of a compulsory informatics subject, which usually included one or two lessons based on the current timetable of the visited schools. During these lessons, regular teaching was going on. The selection of the classes was random and followed the teacher's schedule on the day of the researcher's visit. In advance prepared observation scheme was used to capture the content of the lessons. The organisation of teaching and applied methods, pupil's activity and overall atmosphere were monitored. The second block of the case study was hence directly linked to the third area of exploration in terms of the way of monitoring, or the teaching methods and organisation, by means of which the pupils' information

technology competencies are developed. It was also implicitly linked to the all other areas of exploration.

1. Discussions with pupils
   - What does it mean to you to be able to work with a computer?
   - Do you think you can already work with a computer? Is it sufficient?
   - Do you enjoy informatics at school?
   - Why do you like it, what's good about it?
   - Why don't you like it, what's bad about it?
   - What have you missed in the subject so far?
   - Should informatics be taught in schools at all?

The third block of the case study consisted of discussions with pupils, within which the pupils' opinions on the lessons of the informatics subject were found out and they were also asked how they would evaluate their lessons. More specifically, the discussion was conducted by means of targeted questions from the researcher. The discussions took approximately thirty minutes. Printed cards with fourteen thematic units were especially helpful to younger pupils in the discussions concerning mainly the learning content. The third block of the case study was related to the first area of exploration considering the completion of the characteristics of informatics subjects, and also to the second area of exploration in terms of the content of informatics subjects. Directly, it was related to the third area of exploration focusing on the concept of the process and evaluation of the results of the information technology competencies development of the pupils in primary and lower-secondary schools.

2. Interview with a teacher
   - Information technology education in SEP (School Educational Programmes)
   - Implementation of ICT into school educational activities
   - Methodology approaches to the development of information technology competencies
   - Level and directions of teachers' development in the area of using ICT in teaching
   - School ICT infrastructure and future plans

The fourth block of the study comprised an interview with a teacher of informatics subjects concerning the issues of the school approach to using technologies and their implementation within SEP, availability and ICT use in the learning process, pupils' and teachers' information technology competencies and the ICT level of school infrastructure. The conduction of the interview was based on in advance prepared topics. During the interview, which took one to two hours, the emphasis was put on the prepared topics but also on the observed events in the course of the whole school visit and on the questions, for which there was not sufficient time during the school tour.

Results and Discussion

The case studies were coded and divided into the blocks according to the structure of the school description based on its tour, description of the equipment (information from the first and fourth study), classroom observation, discussions with pupils and an interview with a teacher. Within individual blocks of the study, the obtained data were analyzed through the cluster analysis method, during which the participants' statements and observation outcomes were grouped based on their similarity. In the individual blocks, dominant clusters covering observed facts were thus identified. The findings obtained through the case study method are as follows:

Teachers consider the current concept of FEP EE (Framework Educational Programme for Elementary Education) in the field of Information and Communication Technology as outdated, lacking a clear concept, not reflecting the development in the field and new requirements for the development of pupils' information technology competencies. They lean toward the considerable revision of its content and time allocation of the subject, or explicit integration of ICT and development of the competencies into other subjects.

Some teachers try to innovate the SEPs and adapt them to current trends. Another approach is to leave the SEPs in their original form and focus on the development of their own teaching materials and contents because there is a permanent shortage of up-to-date and high-quality materials for teaching ICT.

Better technology equipment in the classrooms and for teachers helps ICT to enter gradually into other subject as well. Educational applications are used less than before (they remain popular mainly in primary schools and in foreign language teaching). Real environment of the Internet using modern web browsers with HTML 5 support and other technologies connecting web environment to the usual workstation environment is becoming a didactical means increasingly. The gap between the online applications built on the Web 2.0 concept and the applications installed on workstations is narrowing.

Primary and lower-secondary school teachers use increasingly interactive technologies, most often financed from the European funds whereas they gradually turn away from the concept of using interactive whiteboards together with a digital projector. The increased use of LCD displays or other, cheaper, touchscreen technology for any surface based on eBeam technology is a general trend. Teachers use their technical equipment to prepare their own teaching contents. They share their successful contents and they work on their improvement along with other teachers within or outside the school, or they publish them on the Internet. Pupils also start getting involved increasingly well in the development of the materials.

Resources from projects and grants go also into the support of school ICT infrastructure. Schools manage workstations based on Windows and Linux operational systems as a full solution not only for school work. On some workstations, pupils can choose the operating system during the startup process without influencing the lesson objectives. In terms of servers, the installations of Linux system prevail, most frequently Debian distribution, or schools are switching to full cloud solutions based on Google Apps for education.

It goes without saying that a local network distribution and a high-quality Internet connection can be nowadays used by both pupils and teachers in the learning process. The connection is usually ensured by local providers. Pupils can use computer labs also for other study, work or entertainment purposes. School wi-fi networks available also for pupils make it easier for pupils to use their own smart phones or tablets. The rules for using school networks are usually based on mutual trust, filters and other third party solutions are not often reliable and they are not fit for purpose. Mostly, school staff participates in the administration of ICT; external staff provides only occasional technical support for school infrastructure or server administration.

Websites are a usual part of school presentation, the content of which is no longer limited only to providing information. Websites are becoming part of school life, its culture and they help to illustrate its overall atmosphere. On the websites, photographs and videos from school events but also common everyday activities are published; teachers establish their own subject websites and blogs with study materials and tasks. Classes also establish their own websites. Both pupils and teachers are involved in creating their content. Parents start contributing as well. Easily accessible CMS tools, often integrated directly within the

web administration, are used to publish information. External subjects participate in web development only exceptionally.

Mutual communication with parents within and outside school is done mostly by e-mail. Attempts to transfer this communication into the environment of closed groups in social networks are not isolated. There are no formal rules for the communication between a teacher and parent in schools. The originally widespread application Bachelors for school administration is replaced by modern online systems, among which School Online or iSchool.cz belong, which are commonly used for the school register administration, preparation of the school report, but also as a substitute for pupil's Record Book. Schools consider an electronic class registers as well.

ICT is becoming a tool for Czech and international projects in schools. Technologies are used for mutual communication of the participants and international cooperation. eTwinning is a fairly widespread activity, boarder schools use actively a cooperation with foreign language subjects. E-learning in the school environment has not proved very successful in relation to a pupil; nevertheless it is used for teachers' formal and informal education, which the schools often prepare by themselves. For these purposes, Moodle is used as a platform. The use of e-portfolio is starting to be discussed in schools. Schools are aware of its significance in terms of longitudinal evaluation and pupil's self-reflection and they consider various ways of its implementation (Fuglík and Černochová, 2012).

For each case study, there was allocated one day with a regular programme and teaching. Within the school visit, a detailed record of all that was found out was processed. The obtained data were processed by the same researcher, who carried out the research in school as well, with an ongoing supervision from other project researchers. The selection of the schools included in the list of candidates for the case study was based on ICT teachers' voluntary consent and we may thus suppose that case studies were realized in the schools, in which the issue of ICT receives special attention.

Ethical aspects of case studies were consulted with the school headmasters. The monitoring of the learning process was carried out by means of an observation and pupils were not in advance prepared for the observer's visit. In contrast, they were informed about the discussion, which was conducted during the lesson with the teacher present. It was realized with the aim to capture pupils' sensory perception and volitional processes. The questions were structured so that they would not make pupils shy and they would not be afraid to answer them truthfully.

The above described results of case studies are difficult to compare with the results of similar research activities since there has not been similarly focused research in the given context of methods conducted in Czech primary and lower-secondary schools yet. Similarly focused case studies were conducted e.g. in 2006 within the SITES international project (Law, Pelgrum and Plomp, 2008; Pelgrum, 2001). The findings of the international study called ICILS (International Computer and Information Literacy Study) may provide some comparison (Fraillon, Schulz, Ainley, 2013). This research sought to describe the current state of computer literacy in 19 countries including the Czech Republic and it also provided mutual comparison. Another comparison could be provided by the findings of the TALIS, the Teaching and Learning International Survey in the field of learning environment (Luyten et al, 2010; Scheerens, 2011; ČSI, 2013). The results of the conducted case studies are in the context with the findings of the surveys above and they show an increasing importance of informatics education in primary and lower-secondary schools. However, they also reveal problems with curricular provision of informatics instruction.

Conclusion

Overall, based on the findings of the case studies realized within the „Children's Information Technology Competencies and Their Development in Primary and Lower-secondary Schools" research project, in relation to the monitored curricular, process and organisation aspects of information technology education in primary and lower-secondary schools in the Czech Republic, and taking into account the above mentioned restriction concerning the representativeness of the sample, we may conclude that the development of pupils' information technology competencies is not ensured only through compulsory informatics subjects in schools, though their role is dominant in this direction. The content of FEP EE in the educational field of Information and Communication Technologies is considered as extremely general and it is criticised primarily for the lack of up-to-date content. In the first place, the document should be modified in terms of the increase of time allocation, better specification of the content and in terms of its extension and innovation. Following these directions, schools try to modify and extend the concept of FEP EE in their school educational programmes as well.

Although a platform and application approach prevail in school practice, a lot of teachers' find it important to work in various environments so that pupils' competencies development will not be dependent on a specific platform and application since easy adaptation to new technologies is possible only when pupils' understanding is based on invariable hyper platform and beyond application approaches. The implementation of digital technologies and activities supporting pupils' information technology competencies development into school life and educational environment thrives primarily in the fields that do not place extra time or qualification demands on teachers. Besides the content orientation of informatics subjects, appropriate technological equipment, and teachers' qualification and expertise level, it is also broad implementation of digital technologies and activities supporting pupils' information technology competencies development into various subjects, educational environment and school life that is seen as a condition for effective pupils' information technology competencies development.

Acknowledgements

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INNOVATIONS IN OPTICS AND PHOTONICS FOR HIGHER EDUCATION

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Abstract

The innovations proposed in this article deal with Optics & Photonics teaching, from a collaborative prospective. Several simulations of optics phenomena are presented, to support the teaching in the classroom. Originally developed in MATLAB, the simulations are being migrated to JAVA and compiled on a website, which will allow the student to run the simulations from anywhere using an internet connection. As a first step in building the website, a survey has been conducted among students from different universities (Saint Louis University – Madrid Campus, University of Alcalá in Spain, and Charles University in Prague), to collect their needs and expectations to properly design the website. Results from this survey show the expectations and needs detected among the students.

Keywords

Online teaching, optics, simulation, virtual laboratories, collaborative learning

Introduction

One of the main objectives of the Bologna Process started in 1999 was to settle the European Higher Education Area (EHEA), aiming to ensure more comparable, compatible and coherent systems of higher education in Europe (The Bologna Process, 2014). The rapidly-changing global market demands professionals able to solve completely new issues, in many cases autonomously. To this end, one of the core goals of the EHEA is to promote the students' individual and collective homework outside the classroom.

Engineering and scientific studies are very good candidates to implement such learning innovations. Such students are very familiar with new technologies, and autonomous, on-line learning methodologies can be smoothly introduced. On the other hand, many of the subjects in technical studies require practical laboratory tests. In this context, great progress is being made in recent years on **v**irtual **r**emote **l**aboratories (VRL). VRLs aim to use ICT to perform simulated experiments, but also to manage physical experiments remotely (Nandana, de Mel and Priyankara, 2012); (Chaos et al., 2013). VRLs have several advantages, including:

- Access from multiple geographic locations (e.g. students from different cities, countries, etc.).
- Efficient sharing of resources between schools, resulting in economies of scale.
- Improved quality through specialization (e.g. each center may focus on developing one / several practices, rather than undertake the development of all corresponding to the same subject well).
- Experiments can be done with no risk to the students, in case of failure.

Today there are several resources which allow to performing virtual simulations on optical experiments from a computer connected to the internet. These web-based tools, usually developed in JAVA (Oracle, 2014), are suitable to get a first introduction to the

physical phenomenon. In some cases, these resources allow interaction with real, on-going experimentation in the laboratory (Chang et al., 2005). On the other hand, websites with videos of real experiments in Optics are also common (Carreño, 2007) but usually they do not allow users to share their experiences (via the forum, for example). In addition, scripts practices are usually static, not providing multimedia capabilities offered by video tutorials, or on- line assessment of the contents.

The proposal presented in this paper describes a set of simulations of various optical phenomena, allowing students to complement their practical training performed in the laboratory classroom. The student is offered the opportunity to study a priori the scientific basis that explains each experiment, prior to performing the virtual experiment step inside the portal. The ultimate goal is to upload all these simulations on a website platform, providing additional functionalities to registered users, based on the needs expressed on a survey run among students from different universities.

Materials and Methods

Virtual simulations

A set of software tools has been developed, allowing virtual and physical laboratory testing of different optical phenomena through the same software platform (Gamo, 2011). Developed in MATLAB (Mathworks, 2014), the tools cover different topics in Optics, including Diffraction, Radiometry and Photometry, Acousto-Optics interaction, Moiré phenomenon, and Computer-Generated Holograms (CGHs). The tools can be run on any PC equipped with a run-time version of MATLAB software. All these tools were part several Master Thesis projects developed during the last few years at University of Alcalá. The tools were conceived, designed and supervised by the main author of this paper (Gamo, 2011).

Fig. 1 shows the main window of the Diffraction tool. When clicking on the corresponding icon, the software launches the application for that aperture. Classical apertures, as well as pre-stored images provided by the user can be simulated using this tool.

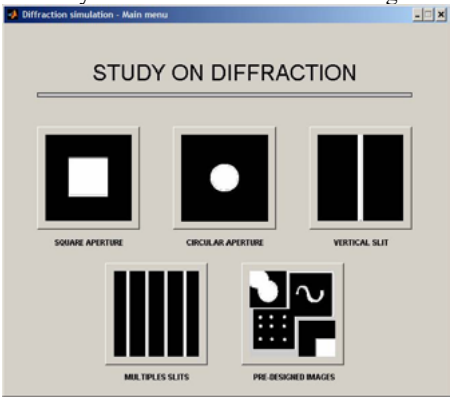


Fig. 1: Diffraction tool: main screen

All the applications were developed under the following structure:

- Theoretical module
- Simulation module
- Laboratory experimentation module

The **theoretical background** module introduces the student to the corresponding optical phenomenon throughout a multi-page environment. Fig. 2 shows the theory module for the diffraction tool. The **simulation module** allows the user to carry out simulations of the optical phenomenon using the power and flexibility of MATLAB. Fig. 3 shows the simulation module of the Diffraction tool.

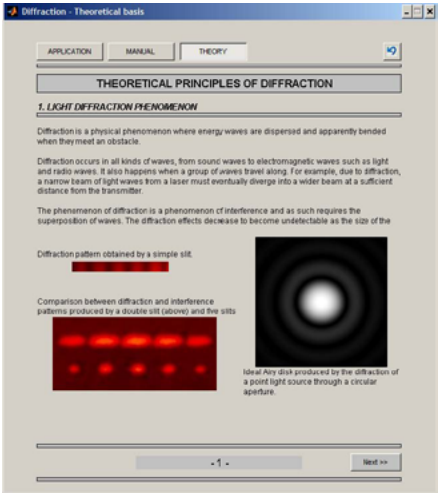
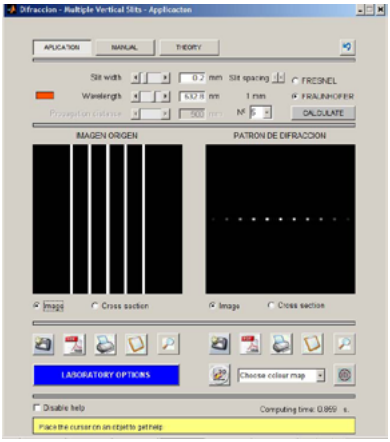


Fig. 2: Theoretical module of the Diffraction tool



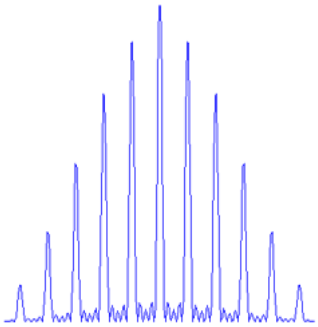


Fig. 3: Application module of the Diffraction tool (left) Computed Fraunhofer (far-field) pattern for 5 vertical slits illuminated with red light (right) Cross-section of the computed diffraction pattern

One interesting feature is the possibility to compare simulations with real experiments. Fig. 4 shows the basic laboratory setup (left) and real experimental implementation (right).

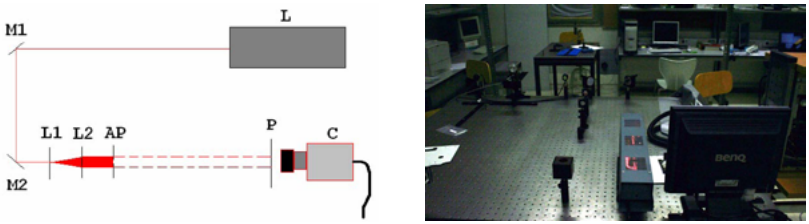


Fig. 4: Layout (left) and experimental setup (right) for the Laboratory Options in the Application module of the Diffraction tool

The comparison between real and virtual experimentation is done by the **laboratory experimentation module**. Fig. 5 shows the main application of this module on the Diffraction tool. The computed diffraction pattern can be compared to the real pattern captured using the experimental layout shown in Fig. 4. A cross-correlation between the two patterns gives the degree of similarity between simulated and real experimentation.

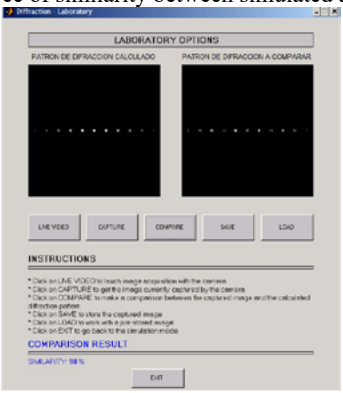


Fig. 5: Laboratory experimentation module of the Diffraction tool

Innovative pedagogical model

An on-going project is being carried out to implement these applications on a website platform. To do this, the Model of School Improvement (Medina, 2009), is being adapted to this scenario. Fig. 6 summarises the innovative model, from the pedagogical standpoint.

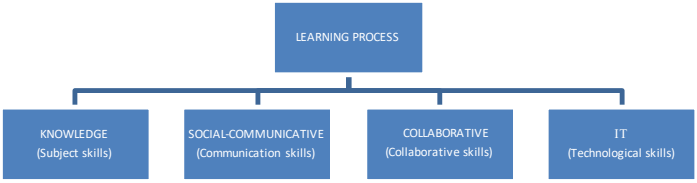


Fig. 6: Outline of proposed innovative model

To ensure the success of the proposed innovation model, a joint effort and commitment of all actors involved (teachers and students) is mandatory to successfully implement the proposed innovations (Medina, 2009). This is especially critical in the pilot implementation, therefore it is worth to design incentive mechanisms for the voluntary

participation of students and teachers in these pilots experiences. As outlined in Fig. 6, the innovation model proposed is highly collaborative. To this end, a preliminary Innovation Survey has been developed, as described in Fig. 7. The survey seeks to test the students' willingness to make use of virtual content that will be part of the subjects. Up to 95 students participated on the above mentioned survey so far. Participants are taking different technical degrees at the Division of Science and Engineering, Saint Louis University – Madrid Campus (12 students), the Department of Electronics, University of Alcalá (51 students) and IT & Technical Education Department, Faculty of Education, Charles University in Prague (32 students). The outcome of this survey is described in the Results and Discussion section below.

INNOVATION SURVEY

This questionnaire is anonymous so we expect you to answer honestly.

1. Have you ever taken a course using a virtual teaching platform? (YES / NO)

2. Would you be in favour of using a remote data acquisition platform, in support of classroom teaching in the laboratory? (YES / NO)

3. Do you have internet connection at home? (YES / NO)

4. If so, what type of connection do you have?

- *ADSL 20 MB*
- *ADSL 10 MB*
- *ADSL 6 MB*
- *ADSL < 4MB*
- *Do not know*

5. How much time per week devoted to remotely connect to the platform?

- *Less than 1 hour*
- *1 to 3 hours*
- *3 to 6 hours*
- *More than 6 hours.*

6. Rate the preferred time slot to connect to the platform (1 = „strongly disagree" and 5 = „strongly agree")

- From 8.00h to 14.00
- From 14.00 to 20.00h
- After 20.00h

7. From which location will you preferably connect to the platform? (1 = „strongly disagree" and 5 = „strongly agree")

- From home
- From University facilities
- From work

8. Rate what you consider most useful tools (1 = „strongly disagree" and 5 = „strongly agree")

- E-mail with Professor and other students
- Open forums to raise doubts
- Chat sessions with Professor
- Tutorials and examples

9. Additional comments / suggestions

Fig. 7: Innovation survey for students

Results and Discussion

The results are summarized graphically in subsequent charts, as shown in Fig. 8. No big differences to this survey were found between the responses coming from these universities.

Even with the high level of IT deployment in today's universities, 28% of the students never took a virtual teaching course (72% did take a virtual course). E-learning courses seem to be more common in professional, specific teaching rather than in university education. On the other hand, a vast majority of the students (88%) would be in favour of using a remote learning platform. All but one students interviewed reported that they have internet connection at home. Many of them (30%) have large, wideband connection (20 Mbit or higher). This paves the way to include heavy-traffic applications and services (e.g. complex numerical simulations, video-taped real experiments, video-chat, etc.). Most surprisingly, 35% of the interviewed does not know which type of connection they have, probably because they still live in their parents' house and/or shared apartments where internet connection is already provided.

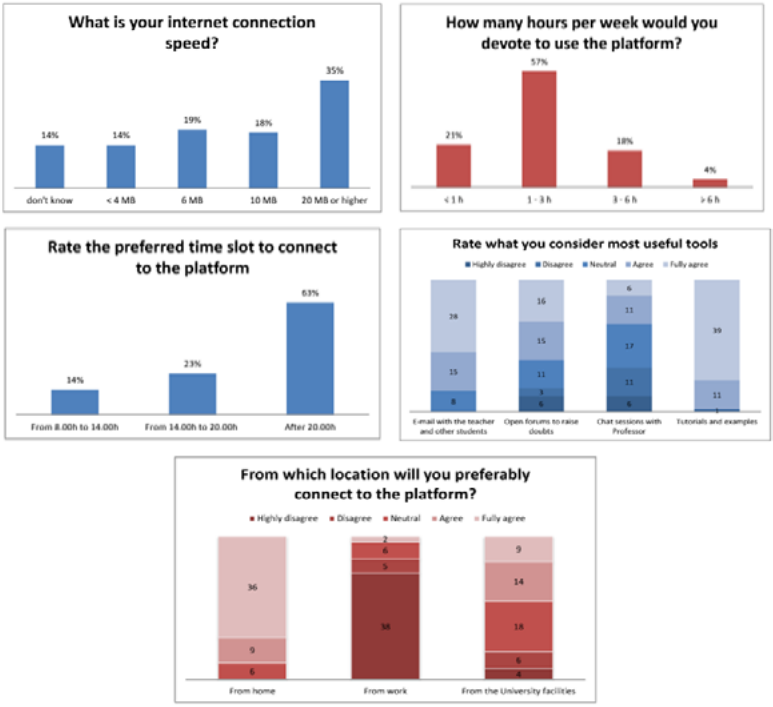


Fig. 8: Results on the innovation survey

There is a strong preference in using the platform from home (63%), on late evenings (67%), and for 1 to 3 hours per week (58%). This has to be taken into account when designing the platform architecture, since concurrent accesses are likely to happen. Tutorials and examples are the most appreciated services demanded by the students (71%). This indicates some preferences for autonomous working. Email with teacher and other students is the second most-demanded service (60%).

One of the key aspects in distance learning is the possibility of making self-evaluation tests. Fig. 9 shows the self-evaluation test module developed for the Radiometry and Photometry application. Similar self-evaluation tests are being built for the rest of the applications. The student would choose the number of questions, and enable/disable the

Suggestions area to make it more realistic. Some statistics would be generated, including the point average and the time employed to complete the test.

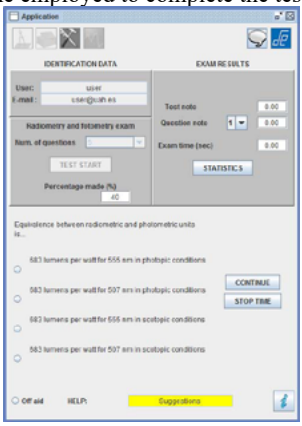


Fig. 9: Self-evaluation test module for the Radiometry and Photometry application

Conclusion

For the authors it is clear that the collaborative methodology fits well to the virtual remote laboratory paradigm, and will undoubtedly pave the way to new teaching practices. Participants should also play a key role in the successful design of the practices. Besides, the survey also shows that both remote and on-site teaching systems must coexist, since a pure, virtual environment does not seem to be enough. The future website will allow the students to consolidate the technical knowledge before facing the final exam. We also believe that teachers from other subjects can find some inspiration in this work for their own courses.

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COMPETENCES IN MATHEMATICS: INVOLVING LEARNING OUTCOMES INTO TEACHING/LEARNING

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Abstract

The contribution presents the experience core and ideas accumulated during the managing of the project named REFIMAT on University in Hradec Králové, Czech Republic. Its key activities consisted in defining and implementation of learning outcomes (LO) into teaching/learning of subjects with mathematical content (12 subjects as calculus, linear algebra, discrete mathematics, operational research up to statistics). It turned out that the project knowledge as its inner output has to be shared by teachers and developed for the next studies purpose; the whole work, finalized with its output products due to the project goals, denies a deeper immersion into teaching/learning of mathematics on university level. This is important especially in the existing frame of a rapidly declining knowledge and skills in mathematics in nowadays student generation. Touching LO, special remarks deal with assessment methods in mathematics, with a reflection on recommendations of recognized education authorities.

Keywords

Assessment, competences, constructive alignment, knowledge, learning outcomes, skills

Introduction

The working question posed at 14th MWG SEFI seminar
„What are the major problem facing engineering maths education in Europe?“
has been answered as a strong agreement (Alpers, 2008):
„The lack of basic skills of university freshmen is well-known and seems to be Europe-wide.“
ESF project CZ.1.07/2.2.00/15.0016 *“Innovation of Teaching Mathematics in Technical and Economic Education with the Aim of Study Failure Reduction”* (*REFIMAT)* has been managed on UHK, Faculty of Informatics and Management (FIM UHK) during 2010 – 2013. The project task required to develop education innovations - in the frame of existing syllabi – with the aim to help in coping mathematics, as one of the key knowledge tools at the faculty with programmes in informatics, economics and management. These concerned in total of 12 subjects with mathematical content as calculus, linear algebra, discrete mathematics, operational research up to statistics, and more than 5700 students have been involved into the project, having at least one of those subjects inscribed into his/her study programme. The substantial design of innovations involved in the project consisted in the core concept *Learning Outcomes.* The aim of the paper is to present a knowledge base of the concept and related methods used in the project, together with their specific backgrounds; next, to provide experience resulted from the implementation of learning outcomes into teaching/learning in mathematical subjects, and also to show that the innovation task means a more complex problem: the approach of all actors towards teaching/learning requires substantial changes.

The concept of *Learning Outcomes (LO*) in teaching/learning turns the education strategy out from a teacher to a learner, and tends the orientation of education on its (measurable) outputs as the education purpose (Biggs and Tang, 2011, Kennedy, Hyland and Ryan, 2007, Adam, 2009, also Gosling and Moon, 2001): *Learning Outcomes means statements of what a learner knows, understands and is able to do on completion of a learning process and are defined in terms of knowledge, skills and competence.*
In details, LO (Adam, 2009, „Prague lecture"): *knowledge, skills and competences* mean*:*

- knowledge is the ability to acquire, to process and to use information, and it is the outcome of the assimilation of information through learning; it consists of facts, principles, theories and practices that are related to a study branche/subject;
- skill means the ability to apply the acquired knowledge and perform it, using appropriate tools, in an appropriate way for solving appropriate problems;
- competence means the ability to use knowledge and skills; such ability has to be proven.

The start of the project required the crucial agreement made by the solvers team: *LO enable to make a shift from the surface approach to the learning to the deep approach,* that is, from

- *surface level learning*: fact memorisation to
- *deep level learning*: understanding underpinning theory and concepts

(Marton and Säljö, 1984). Craik and Lockhart (1972) have shown that information processed to a 'deep' level will be better remembered than that one only to a surface level. Studies more recently have shown that deeper approaches to learning are related to higher quality LO (Prosser and Millar, 1989, Ramsden, 1992, Trigwell and Prosser, 1999). *Surface level learners are known as* 'strategic' learners; the strategy is useful and acceptable in certain circumstances when the learner selects and prioritises what he/she need to learn. Examples of surface level learning characteristics are (Gibbs, 1992, Biggs, 1993): the learner is more or less forced to adopt a rote learning strategy; a concentration is on routine fact memorisation which can give the impression that understanding has occurred; finding the 'right' answers etc. *Deep level learners* attempt to relate ideas together to understand underpinning theory and concepts, and to make meaning out of material under consideration (Fry, Ketteridge and Marshall, 2009). It is also associated with those learners who are able to understand authors' and/or lecturers' words enough to give a meaning using their own words (Marton and Säljö, 1984). Examples of deep level learning characteristics (Gibbs, 1992) are: *gaining a full understanding of a concept; an overview of a topic; grasping the main idea in a chapter; distinguishing principles from examples; questioning the conclusions; recognising the key ideas in a lecture.*
Surveys documented the importance of the key step in involving LO which consists in the implementation of LO into assessment – checking whether LO have been achieved. Well managed assessment should motivate, guide and encourage learner's approach to learning in general; the formative, ungraded assessment means serves him/her as a support before or during learning to provide him feedback about learning progress/offers; then the summative, graded assessment documents his/her final result. Thus, assessment approach, its methods and alignment with education and learning are steps of the key importance. The problem sounds: how to organize assessments forcing *a shift from the surface approach to the learning to the deep one?* There are systemized approaches to assessments and their methods; the starting point, anyway, means to possess first a collection of information about the nature and extent of LO and any procedure used to estimate learners learning.

In our project, the following principles listed in James, McInnis and Devlin (2002), were of the special importance:

- Variety in types of assessment allows a range of different LO to be assessed. It also keeps students interested.
- Students need to understand clearly what is expected of them in assessed tasks.
- Criteria for assessment should be detailed, transparent and justifiable.
- Group assessment needs to be carefully planned and structured.
- Systematic analysis of students' performance on assessed tasks can help identify areas of the curriculum which need improvement.

There is also an extra added value of assessment (James, McInnis and Devlin, 2002): for academic staff, the assessment is often a final consideration in their planning of the curriculum. In contrast, students often work 'backwards' through the curriculum, focusing first and foremost on how they will be assessed and what they will be required to demonstrate they have learned. The concept of *the aligned curriculum* is required: an effective assessment task is one which assesses students' attainment of LO, and these are represented in the form of assessment tasks, together with the defined pre-differentiation of performance levels. The *aligned curriculum* means that (Biggs and Tang, 2010, 2011)

- LO are clear and formulated first,
- learning experiences are designed to assist student achievement of those LO; what the teacher does and the learners do are aimed at achieving LO by meeting the assessment criteria, and
- carefully designed assessment tasks allow students to demonstrate achievement of those LO.

The chapter showed the range of the problem in general. It proves also that the primary task of the project solvers' team was to become acquainted with the knowledge base on LO presented here, followed by directed changes in personal attitudes of teachers to teaching in a substantial way, with its orientation on a learner instead on a content itself.

Materials and Methods

At any work level, it is necessary to start from *learning objectives: knowledge of the subject matter, terminology, techniques and conventions covered in the subject, as well as understanding of the underlying principles, plus the ability to solve problems involving then understanding of the concepts.* There exists a description of learning objectives in mathematics, commonly shared (SEFI, 2013); they served well for the project. Thus, LO in mathematics, as knowledge (*what does it mean*), skills (*how does it work*), competence *(the purpose and how to apply it for the purpose),* independently on a programme/subject/module, mean: *upon completion of the programme/subject/module students should be able:*

- to acquire knowledge on mathematical concepts, on their substance, structure, properties and importance; to gain knowledge on applicable methods, and on specific theories;
- to demonstrate an appropriate level of problem-solving skills using analytical reasoning; to manipulate with concepts/objects in an effective and consistent way, applying corresponding formal mathematical procedures, including technological or software means – to demonstrate proficiency with various technological tools; he/she is able to justify the procedure due to its mathematical substance, and to recognize the correct/incorrect steps; he/she recognizes the range of applicability of the procedure used;

- to express a simple problem in the form of a mathematical model, with symbols for concepts, objects, relations and operations – to provide a transition from concrete to abstract thinking; he/she is able to decide on the use appropriate mathematical tools for solving the problem and apply them; using logical argumentation, he/she is able to interpret its solution, or to provide reasons for the non-existence of a solution; he/she is able to use a formal language for formulating the statements.

Coming out of the argumentation base, in the project, LO were defined first in 12 subjects with mathematical content, then up to their moduls, with all details. Next, LO have been implemented into teaching/learning and assessments, and also into study supports (printed books, or electronic internal "unit" study materials as multipurposed e-courses, elaborated in LMS system BlackboardLearn 9.1; as a complete and dynamic subject package, any unit was tightly related to the corresponding subject). These units are endowed with full teaching support including lectures and tests, also other references to learning; they serve as a channel for any necessary information and communication connected with the study. Implementation has been substantially supported by activities, followed also from Bologna process in EHEA, and a large experience base enabled the work (Biggs, 2003, Biggs and Tang, 2010 and 2011, Adam, 2009, Ramsden, 1992; also Kennedy, Hyland and Ryan, 2007, Gehmlich, 2010); in mathematics, as a challenge support serves Kahn and Kyle, 2002.

Our project experience on LO are as follows:

- LO in module/subject/programme should be written by its own teacher(s), based on syllabi.
- Teaching/learning must be done in the strong and explicit correspondence with LO.
- The learner's role is to facilitate ways how to acquire LO.
- Knowledge, skills, competences, and their goals must be explicitly presented in teaching by the learner himself/herself (on a principle „explain – show – use").
- In this way, a learner is involved into LO: but more: act as a teacher so that he/she should *accept them,* and *will identify with learning methods* – this is a precondition of success.
- In the study and its supports as well: it is necessary to declare which knowledge, skills, competences are actually developing, to decide which skills require a deeper approach, and to define the range of the knowledge; it is evitable to provide materials of different level for the work with, and containing also showcases/showsteps leading to knowledge, skills.
- The teacher will induce LO into formative tests (under time and technological conditions).
- Summative tests must be prepared in a parallel way; their structured form should contain a subject/programme „overview" at a level in question; technological, pedagogical conditions must be previewed, so invent and arrange „tests management" for proving LO are achieved.
- The previous aspects mean also that a learner is oriented in conditions on his/her success in learning, but also in possibilities of improving the failure (if even possible); access to study regulations or to ethics code available and known to him/her.

The immediate success with LO involved is hardly to be pressumed; as a rule, a new and new modified variants will follow. The accommodation of the whole institution environment to this teaching/learning style is required (compare also with *ECTS Study Guide*), with

- study supports (classical or e-supports) available and accessible, fully covering syllabi;
- effective IS, study administration, IT equipment for teaching and self-study;
- mutual communication and social contacts available, study guidance (a body like a „jury of appeal“ as well), tutors as persons or e-tutors (acting online?);
- „smart“ exams system, transparent and functional, ethic principles known and respected.

Concerning assessments, typical requirements on a learner assessed in mathematics are

- to demonstrate an appropriate level of problem-solving skills, using analytical reasoning;
- to do so on the base of adequate concepts, methods, theories and application of the appropriate and required technological tools.

Some groups of teachers are convinced on usefulness of multiple choice quizzes, those are often denoted as a tool for lower order/surface learning only; in mathematics, they serve also as an appropriate teaching and assessment tool. They can provide a rapid feedback on their learning (the need of could be included); they indicate whether students understand the foundation concepts or procedures. In the project, it was proven that these are often the first, encouraging source how to approach to a problem.

Due to concepts in the project REFIMAT, assessments were formulated mostly in written form (in alignment with LO, they should be redefined so that demonstrate the achieved knowledge and skills), followed by oral form (assessing the depth of understanding and knowledge checking); PC allowed; formulations requiring argumentation and time schedule did not allow only to guess solutions. Searching for achievement of LO, this concerns even their formal wording as well (it turned out that some partial or doubled themes have been omitted in tests). The final assessment is based on a cummulative principle, middle-semester tests included and counted. Due to education experience in mathematics, written form of tests is highly preferred. In teaching/learning scheme, the whole operational procedure has to be assessed; especially in formative part, it is important to endowe students with “step-by-step analysis”, helping them to improve in future. A rather simple quantitative approach to assigning marks was used, based on the numerical scale 1 – 4. The advantage is that marks 1(task or element done), 3 (task or element done, but clearly incorrect) and 4 (task or element not done) could be easily identified; anything else is classified as 2. Unsatisfactory performance means usually under the 50% of requirements.

Results and Discussions

The experience of team work with LO contributes to project results; LO are a support tool for success, and preceding chapters describe the complexity of the task. Analyzing the project impact, several surveys have been provided on changes motivation to the learning, on approach of learners to the study and to LO, on preferred learning styles, on student’s prerequisites to studies, and also on approach of teachers promoting LO in teaching. In the final project phase, surveys reflect innovations effect in 7 subjects. We put here some results after reduced analysis: we have been mostly interested in the first two levels of agreement followed from Likert’s 5 valued scale (273 respondents, 147 responses of total 6006 disrated):

- Assessment fully proved the level of LO achievement, followed by credits award: mean 2,307, agreement nearly 65 %.
- My abilities to understand a scientific lecture/text with mathematical content

increased: mean 2,247, agreement more than 60 %.

- My knowledge of principles, concepts, methods have increased: mean 2,247, agreement nearly 75 %.
- My practical and computational skills how to solve a problem have increased: mean 2,289 agreement nearly 70 %.
- My abilities to communicate on how to solve mathematical problems increased: mean 2,523 agreement 56 %.
- I have been led to organize my worktime and to its effective use: mean 2,625, agreement more than 51 %.
- My competences how to organize the work/the study increased: mean 2,667, agreement nearly 50 % (however, the response *I strongly agree only* 10%).
- I got a deeper insight into roles and methods of mathematics: mean 2,603, agreement more than 50 % (however, one third of responses were *neither agree nor disagree*).
- I gained the positive attitude to the study of mathematics: mean 3,165, agreement 33 % nearly. However, *disagreement or strong disagreement* have been expressed in 40%, neutral responses at rather high level of 28%.

Other project surveys documented that

- there is a lack of basic mathematical skills for HE studies; its perception proceeds often as vague feeling only,
- learners are confused: even with the existing belief of their inner motivation, they are not able to achieve an improvement in the study.

As innovation have been addressed mainly to learners in first study years, later on it may appear, under the systematic approach of the institution as an education unit (so, „success not yet, but possibly as postponed only"). A wider attachment to LO may tend to a successful absolvent. The change of students's approach requires the changes of teachers' attitude to education first.

Conclusion

As documented in chapters, the project outputs and results concern the concept of LO, the defining of LO in given subjects with mathematical content, their implementation into teaching/learning, into study supports and into assessments. These enable a discussion on the mathematical education in a more general way. Surveys showed the change in life approach of generations (Generation X, Y, Z etc.) in connection with teaching/learning (not only in mathematics). In spite of the lack of the initial knowledge and skills, our freshmen declared to be motivated and prepared to study – still the unsuccessfulness percentage is (and remains) high. Let us provide the main project conclusions; several are out of mathematical education:

- do not lose learners: identify learners level of pre-knowledge and pre-skills as soon as possible *(„Teach the Students You Have"* – Krantz, 1999);
- provide them an information on their „input" level; often they only *feel* the lack, but a great part is unable to identify their level problem precisely, and to solve it in the proper steps;
- search for learning styles; they might be very different, depending on the faculty;
- as teachers, include LO in the teaching, demonstrate this inclusion; diverse them in teaching applying the scheme knowledge – skills – competences, use appropriate terms and language;
- include the formative assessment into learning *as an obvious, standard part of the learning, enabling a stress-free feedback,* and also as a way how to prepare for the

summative assessment; include a great number of tools, based on diversed study approaches, enabling formative self-assessment;
- relate assessments to LO: also formally, verbally, in a tight relation with credits or grades.

New approaches, partly based also on technologies, enable to attrack learners to the study – using specific individual projects, making use of their personal interests, working with a specific (mathematical) software. So a task is to provide a non-trivial and motivated work (or a game?), showing also teacher‘s own activities outside the class, or a description of the personalized history producing a recognized (small or great, not important) success in society.

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NONVERBAL ELEMENTS AND TRANSFER OF KNOWLEDGE IN MATHEMATICS TEACHING

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Abstract

The non-verbal element, as an independent means of communication, plays an important role in mathematics. We use it in two ways - either to mediate curriculum content, or for expressing content using non-verbal elements. Visualization using non-verbal elements helps to achieve a better understanding of mathematical problems. Geometry practically cannot be presented without visualization. The research on non-verbal elements and their interaction with human perception, comes under an extensive research area called research on pictures. In this article, we report on research about non-verbal elements in terms of their function as a visual representation, in which we examined the extent to which students are able to work with these visual representations when they have to apply learned knowledge. Research is aimed at secondary school students working on the topic of quadrangles. In this article, we try to answer the question of whether visual representations help students with the transfer of the learned geometric matter.

Keywords

Nonverbal elements, visualization, visualization representation, transfer of knowledge

Introduction

Currently, there are many different views and much research on the interaction between nonverbal element and its readers. All of it belongs to an extensive research area called the research on picture (see, for example, Anglin, Vaez, & Cunningham, 2004; Anglin, Towers, & Levie, 1996, Levie, 1987, 1984, Brody, 1981 ff.). We can distinguish four main research areas according to their focus on nonverbal elements. According to Janko (2012), these areas focus on: (1) the process of picture interpretation, (2) the factors influencing remembering a picture and creating mental representations of nonverbal elements (3) nonverbal elements in terms of education and (4) the description of aesthetic reactions and emotions associated with nonverbal elements.

Nonverbal elements are understood as visual representations in this article. The visual representation allows us to display difficult mathematical phenomena even if we show only the significant features without breaking their complex structure. In the field of education, the visual representation plays an important role in creating pupils' concept of a mathematical phenomenon (Janko, 2012). First, the curriculum is presented to pupils by using external representations that focus on a specific learning objective (Schnotz, 2002). Pupils create an internal mental representation in their minds during mathematics lessons. If the pupils understand a given subject matter, they create the correct internal representation. Whether the external and internal representations actually correspond to each other is, to a large extent, determined by the method of teaching. The choice of a suitable of the external representation is crucial. Issues such as mental representations are closer dealt with in (Opwis and Luer, 1996).

All our communication on-line and in the real world is full of projections. We perceive the world through our expectations, needs, interests, fantasies and feelings, and we design other people and the world accordingly (Pavličíková, 2010). Using nonverbal elements, like visual representations, helps us to display some mathematical information. It is thus also a means of communication which is full of pupil's projections, expectations and needs. These problems in communications can cause difficulties when creating correct internal mental representations in pupil's mind.

One of the great dangers when teaching geometry is formalism (Hejný and Kuřina, 2001). There are several methods of preventing uncritical acceptance of mathematical knowledge without deeper understanding, which is the characterization of formalism. These methods, called the evocative techniques, are based on geometric interpretations of visual reception; work with nonverbal elements – visual representations (Roubíček, 2004).

In this article, we deal with representations of school curriculum using nonverbal elements and their application when transferring the learned subject matter. This transfer is an ability to transfer knowledge into different educational situations. Our research concentrates on two of such educational situations. The first one is the visual representation in a form of a drawn construction, where we investigate to which extent pupils are capable of the transfer of knowledge, thus if they are able to read this visual representation correctly and to either re-interpret it by re-drawing it or by confirming or disproving a certain given feature.

The second educational situation lies at the opposite direction. This situation employs the ability of the transfer of knowledge by drawing a described figure using given pieces of information on the properties of a given geometric model. Using the suggested criteria, we then evaluate final works of pupils to find out to what extent the visual representations help them with the transfer.

Materials and Methods

Pilot data collection took place in December 2013. Respondents of our research were Grade 8 pupils in one elementary school in České Budějovice. We tested two groups of pupils who achieve comparable average results. There were 39 pupils altogether.

The aim of this pilot research was to verify if the pupils understand all of the assigned instructions when working with questionnaires and tests, if the pupils understand the questions they are asked, and to find out the attitude of the respondents to our research and to the methods themselves – which means to find out whether the pupils are willing to take part in our research at all. During the verification of the pre-research, we eliminated questions that were too easy or too difficult to prevent the erasing of conclusive differences between the tested groups. The performed pre-research accomplished the planned objectives and confirmed the functionality and validity of our research tools.

The consequent research was based on didactical tests. The tests consisted of 5 geometry task and the pupils were given 18 minutes to solve them. The tests were evaluated using descriptive statistics (frequency distribution tables). The research hypotheses were formulated as follows: On the grounds of perception of nonverbal element pupils are able to correctly describe this element and determine its properties. Pupils are able to transform a verbal statement into a graphic form. The topic of quadrangles, which is crucial in our research, is, according to the lesson plan of this school, a part of the curriculum of Grade 7. It is important to mention that this topic had already been introduced to the pupils, even though it is not a commonly taught.

The first task contained the visual representation of the construction of a geometric object and the pupils' task was to read this visual representation correctly and re-interpret it by executing the construction with a ruler and a pair of compasses. It was the construction of a balloon consisting of three circle sectors. In this task, the pupils transferred knowledge from one educational situation, in which the pupils were to recognize from the visual representation basic geometrical features and relationships between the given objects, and apply this structure into a different educational situation, which was a construction of a balloon.

Task 1

Construct the baloon as shown below. Lengths are given in centimeters

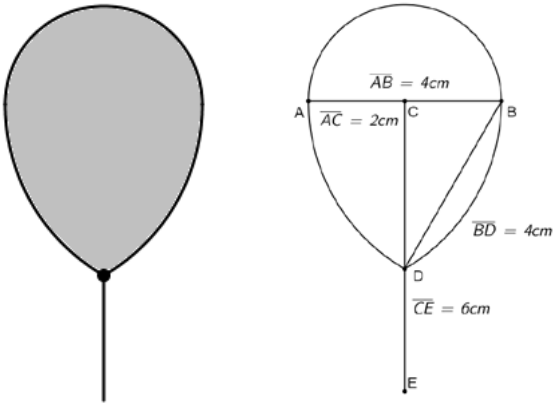


Fig 1: Task 1

In **the second** task, the pupils were given a list of geometrical properties and they were supposed to sketch a geometric model in accordance with the given characteristics. The pupils used basic properties of a quadrangle concerning its inner angles, diagonals and opposite sides. In this case of the transfer of knowledge, the pupils should create a correct mental representation of a geometrical object they had in mind and then express it visually. The correct solution was a sketch of a rhombus or a rhomboid.

Task 2

Draw and name a geometric shape with the properties that are given below:

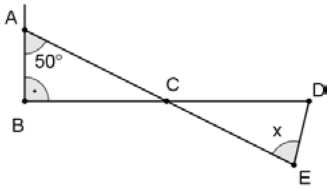
It is a geometric shape, whose opposite sides are parallel and congruent. Consecutive angles are different, but they are supplementary. Opposite angles are congruent. The diagonals of this shape bisect each other.

Fig 2: Task 2

The third task was taken from the TIMSS research (Trends in International Mathematics and Science Study, https://nces.ed.gov/TIMSS/). It focused on the mental representation from a visual representation. The pupils had to use nonverbal data to determine some data that followed from the presented geometric relationships. Using transfer of knowledge,

they had to successively apply three pieces of knowledge of sum of the inner angles of a triangle, the size of vertex angles and the size of the inner angles of an isosceles triangle. The correct solution is D, which is $x=70°$.
This task was intentionally chosen to allow us to compare the solutions of the observed pupils to the results of all pupils in Czech schools in TIMSS research.

Task 3



There are $|CD| = |CE|$ on the picture.
How many degrees is *x?*

A) 40 B) 50 C) 60 D) 70

Fig 3: Task 3

In **the fourth** task, the pupils were intentionally given a visual representation of a non-existent geometric figure. Their task was to make a decision based of the presented properties whether the presented figure was a rhomboid. The pupils were to apply the basic knowledge of the diagonals and the lengths of a rhomboid's sides. Using the transfer of knowledge based on the already created mental representation and considering what the pupils had already known, the pupils should analyse the presented nonverbal elements and discover the reasons why the presented object does not exist. The correct answer was the discovery that if the diagonals bisected each other at the right angle, the figure could not be a rhomboid.

Task 4

Decide if the geometric shape, which is shown below, is a rhomboid. Explain your answer.

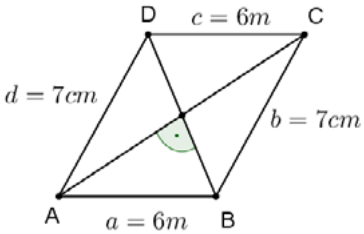


Fig 4: Task 4

The fifth task presented two visual representations of a quadrangle. The pupils should

decide what kinds of quadrangles were in the picture. The presented visual representations were a rhomboid and a trapezium whose shapes seemed to be more a rectangle and a square. The pupils should consider all the important properties of these visual representations and compare them to their created mental representations of a rectangle and a square. This is when the incorrect mental representations based only on the shapes of the given geometrical objects and not on characteristic properties (such as the sizes of the inner angles, the diagonals bisecting each other, the opposite sides being perpendicular) could become evident.

Task 5

Decide and write down what kind of geometric object is on the picture below.
(square, triangle, rhombus, rhomboid, rectangle, tetrahedron, parallelogram, trapezium)

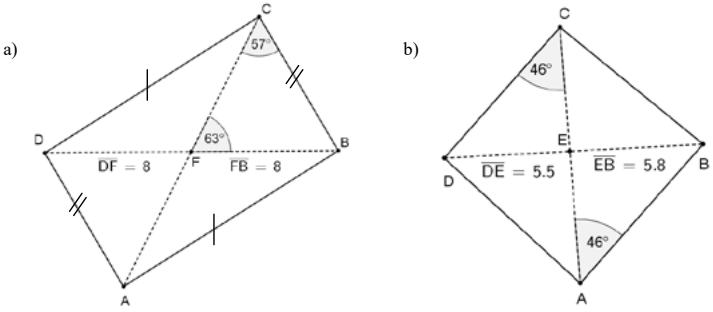


Fig. 5: Task 5

Results and Discussion

The results of the tests are summarized in the following graph. For each task, we present a percentage of pupils who answered correctly, incorrectly or did not answer at all.

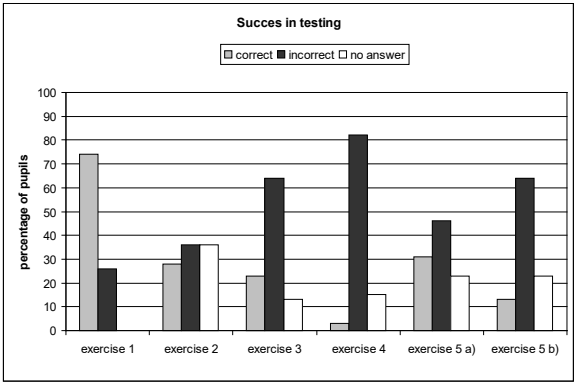


Fig. 6: evaluation of research

According to Stylianidou (2002), the interaction with nonverbal items is not a simple matter for pupils. Pupils learn to understand nonverbal items gradually. The results of

the tests are highly surprising in the number of incorrect answers. The results imply that the pupils from this research sample had problems with the most of these tasks and their answers pointed to many deficiencies in the correct concepts, mental representations of geometric shapes with all their properties. Because the pupils could not use a given algorithm to solve this task, it emerged that even the transfer of knowledge into different educational situations caused great problems to the pupils.

There may appear some distortions during the cognitional reception of a visual representation, because of pupils' poor knowledge of the given problems. It may be caused by diffusion of previous experiences as well, or because of wrong perceptions (Mareš, 2001), (Ainsworth, 2006), (Levin and Mayer, 1993). In this article, we concentrated on the way of perceiving the nonverbal elements as visual representations and on the way the pupils work with these elements when they transfer knowledge. The first type of the tasks concentrated on the correct understanding of a visual element and on the use of the transfer of knowledge based on already created mental representation to decide about a certain property (Tasks 3, 4 and 5). In these exercises the pupils found it difficult to carry out the transfer of knowledge especially because of incorrect mental representations created on basis of only vague concepts of individual types of quadrangles. According to Hejný and Kuřina (2001), there are many pupils who have poor or deformed ideas about geometric objects at elementary school. They usually know only typical geometry objects as a square, a rectangle etc. with horizontal and vertical route. Most of pupils cannot work with less known geometrical models.

Another problem was a formal attitude of the pupils. In case of Task 4, where the task intentionally contained a mistake, over 80% of pupils did not doubt validity of all presented pieces of information in a visual representation. For younger pupils it could be more difficult to focus on important feature of a nonverbal item (Peeck, 1993). The research of Levie and Lentz (1982) shows, that pupils hardly obtain the right information from nonverbal items, because they use variety of cognitive strategies to "read" nonverbal items (Strnad, Uždil and Švec, 1954).

The second type of the tasks was course of actions, where the pupils should create a mental representation and use the transfer of knowledge to create a visual representation (Tasks 1 and 2). The point of the first task was to understand the visual representation and to grasp it to use it as an instruction for construction. In this case the pupils did not have to think about validity of a particular statement or use mathematical knowledge to determine a missing piece of information; they only had to grasp a visual representation and its reinterpretation, which did not prove to be difficult for 74% of the observed pupils. Task 2 was more difficult, because it did not contain a visual representation in a form of a picture, but they had to understand the text correctly, and, based on that text, the pupils had to create a correct concept and to use transfer of knowledge to match it to appropriate mental representation corresponding to quadrangle. Less than 30% of pupils accomplished this task by drawing a correct sketch or by naming the quadrangle.

The research was influenced by many factors. The conclusions that we make here are therefore arguable. Our aim is not a generalization of the test results. In a detailed analysis of the possible causes of the pupils' failure and their mistakes, it is a subject of a further investigation within the consequent wider research we are planning. At this point, we present the first results that turned out to be surprising.

Conclusion

The results of the research showed that working with nonverbal elements like visual representation often causes problems to these children and their mental representations are burdened with many deficiencies including formalism. The transfer of knowledge when working with visual representations is a bigger problem than we expected. Further research could concentrate partially on the deeper causes of these deficiencies and partly on further testing of a bigger sample for a longer period of time and with more diverse exercises with the transfer of knowledge.

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TECHNICAL EFFICIENCY ESTIMATION OF BACHELOR STUDY

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Abstract

The paper deals with the technical efficiency evaluation of the Bachelor study on the Faculty of Economics, VŠB – Technical University of Ostrava. For the efficiency estimation purposes there were used two approaches – optimization modelling of the data envelopment (DEA output-oriented model with variable return to scale) and econometric estimation of the deterministic frontier (DF) function using the corrected ordinary least squares (COLS) method. The data sample included 433 bachelor grade students. Technical efficiency is studied and compared for groups divided by sex and type of the high school from which students come. Results show that the average technical efficiency was higher for DEA models in comparison with the estimation using COLS method. Male bachelor grade students are less efficient in comparison with female students. Secondary grammar school studies allow for gaining slightly higher efficiency in comparison with specialized high schools.

Keywords

Technical efficiency, data envelopment analysis, output-oriented model, corrected ordinary least squares model, deterministic frontier function, Bachelor studies

Introduction

Competitive market environment of universities presumes that their management pursues not only productivity of the academic staff but also productivity of their students in their institutions. According to Vltavska and Fischer (2013) the teaching and research productivity is distinguished for the teacher and these aspects complement each other (one of the study programme accreditation conditions is the support of teaching activities with research activities in the related field). Confirmation of positive influence of ICT on the labour productivity and the total factor productivity in Czech Republic is documented in the publication of Fischer, Vltavska, Doucek and Hanclova (2013).

On the other side there is also an evaluation of students' study efficiency performed which is conditional to exam results in each subject. It is also related with successfulness of gaining adequate job in the relevant field. Strang (2013) focused on the evaluation of a pedagogical method to help students improve exam scores. A number of bachelor grade students have trouble with passing exams in Mathematics and Operations research subjects. Majovská (2013) deals with possibilities of using software support in the teaching process of the mathematics subject. Her conclusions confirm that integration of the ICT in the teaching process of mathematical subject adds to a better understanding and practice of acquired knowledge and skills. Also authors Hanclova, Banarova and Nemec (2013) document efficiency of the e-testing in the Operations research subject. The authors point out several possibilities of improving quality of solved tasks database according to acquired exam results. It is clear that knowledge is an important resource for

a successful passing of study courses but also for the usefulness of students in the practice. Klimešová and Brožová (2009) deal with modelling of the knowledge acquisition process and methods of their representation including ICT support. An important influence of ICT related knowledge and skills of university graduates on their usefulness in the practice is confirmed by Maryska, Novotny and Doucek (2010).

The aim of this paper is to contribute to methods of university studies efficiency evaluation in relation with high school studies results. Also a distinction of separate study years on the university plays important role in the analysis. The basic concept of the model is depicted in the figure 1. In general sense, the **efficiency** can be achieved under conditions of maximizing results of an action in relation to resources used and it is calculated by comparing effects obtained in their efforts (Stanickova and Melecky, 2013). In our case we strive to get best outcomes of Bachelor grade studies (i.e. lowest average grade from the defence of the final thesis and from main subjects on the final state exam). This fact is analysed in contrast with input sources – average grade from the high school in each year of the Bachelor studies.

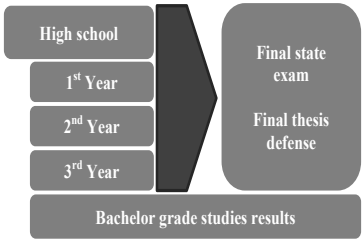

Fig. 1: Concept of the Bachelor studies efficiency evaluation model

Fig. 1: Concept of the Bachelor studies efficiency evaluation model

First section of this paper dealt with possibilities of students' and teachers' outputs improvements in the competitive market environment of universities. Second section deals with selection and specification of methods and models for the efficiency measurement. Next section deals with empirical evaluation of Bachelor studies efficiency. The last section sums up main conclusions and possibilities of the usage of introduced approaches.

Material and Methods

Analysis of efficiency measurement can be done using a group of non-parametric methods represented mainly by optimization models of **Data Envelopment Analysis (DEA).** The other group contains parametric methods that specify the **deterministic frontier function (DF)** or the stochastic frontier function (SF) based on an econometric approach of production, cost of profit models estimation (see Coelli et al., 2005). Application of various DEA models in the university efficiency evaluation is very popular. Flegl and Vltavska (2013) compare two different approaches – DEA analysis and index approach to estimate efficiencies at economics faculties in the Czech Republic. In this paper there will be *output-oriented DEA optimization model* with *variable return to scale* (VRS) used for the Bachelor studies efficiency evaluation and the *deterministic frontier function* will be estimated using the *Corrected Ordinary Least Squares (COLS)* method. The VRS model was chosen due to the non-linear nature of the production function (the students tend to resign on getting better final study results if they are getting worse grades during their studies).

Output-oriented **technical efficiency (TE)** measures keep input constant and explore the proportional expansion in output quantities that are possible. TE is computed by solving the following fractional linear programme for each student (i.e. decision making unit DMU_r, $r=1,...,R$):

$$\max \frac{\sum_{n=1}^{N} u_n y_{nr}}{\sum_{m=1}^{M} v_m x_{mr}} \quad \text{subject to: } \frac{\sum_{n=1}^{N} u_n y_{nr}}{\sum_{m=1}^{M} v_m x_{mr}} \le 1, \quad r = 1,...,R, \quad u_n \ge 0, \ \forall n = 1,...,N; \quad v_m \ge 0, \ \forall m = 1,...,M \tag{1}$$

where y_{nr} is a quantity of the output n for DMU_r; u_n is a weight attached to the output n, x_{mr} is a quantity of the input m for DMU_r and v_m is a weight attached to the input m. This mathematical programme seeks out for DMU_r a set of outputs and inputs weights that maximizes the technical efficiency of a DMU (subject to important constraints). Output-oriented model in the equation (1) can be formulated as an **additive output-oriented model with variable returns to scale** in the equation (6) (Cooper et al., 2007). This model will be applied in this research under the abbreviation **DEA model:**

$$\max g = \phi + \varepsilon \left(\sum_{m=1}^{M} s_m^- + \sum_{n=1}^{N} s_n^+ \right) \tag{2}$$

$$\text{subject to } \sum_{r=1}^{R} \lambda_r x_{mr} + s_m^- = x_{m0}, \, m = 1,...,M \tag{3}$$

$$\sum_{r=1}^{R} \lambda_r y_{nr} - s_n^+ = \phi y_{n0}, \, n = 1,...,N \tag{4}$$

$$\lambda_r \ge 0, \quad s_m^- \ge 0, \quad s_n^+ \ge 0, \quad r = 1,...,R; \ m = 1,...,M; \ n = 1,...,N \tag{5}$$

$$\sum_{r=1}^{R} \lambda_r = 1 \tag{6}$$

where s_r^- and s_r^+ are surplus variables in constraints for inputs and outputs, λ_r is a weight for the DMU_r. Variable ϕ can be interpreted as a demand rate of output increase to achieve effective frontier and its value is from the interval <0; 1>. Econometric approaches to measuring efficiency stem from a statistical process specified in a model $y_r = f(\boldsymbol{x}_r, \boldsymbol{\beta}) \cdot TE_r$, where technical efficiency DMU_r is $0 < TE(y_r, \boldsymbol{x}_r) \le 1$, $\boldsymbol{\beta}$ is the vector of parameters of the production function to be estimated. One output y is considered for each production unit. When using a log-linear Cobb-Douglas production function we can state:

$$\ln y_r = \alpha + \sum_{m=1}^{M} \beta_m \ln x_m + \varepsilon_r = \alpha + \sum_{m=1}^{M} \beta_m \ln x_m - u_r, \quad (7)$$

where $u_r \geq 0$ is a measure of technical inefficiency since $\varepsilon_r = \ln TE_r$ and $u_r = -\ln TE_r \approx 1 - TE_r$ and $TE_r = \exp(-u_r)$. The non-stochastic part of the right hand side in the equation (8) is labeled *deterministic frontier function.* Aigner and Chu (1968) suggested two methods of computing parameters that would constrain residuals u_r to be non-negative. Both are based on the fact that the ordinary least squares (OLS) estimator of the slope parameters $\beta_m (m = 1,...,M)$ is consistent and unbiased. One simple remedy is to shift the estimated production function upward until all residuals except one are negative (the one on which we hang the function). The intercept is shifted to obtain the

Corrected Ordinary Least Squares (COLS) constant as $\hat{\alpha}_{COLS} = \hat{\alpha}^* + \max_r \hat{\varepsilon}_r$ from a model:

$$\ln y_r = (\alpha + E[\varepsilon_r]) + \sum_{m=1}^{M} \beta_m \ln x_m + (\varepsilon_r - E[\varepsilon_r]) = \alpha^* + \sum_{m=1}^{M} \beta_m \ln x_m + \varepsilon_r^* \quad (8)$$

where residuals $\hat{\varepsilon}_{r,COLS} = \hat{\varepsilon}_r - \max \hat{\varepsilon}_r$ satisfy the theoretical restriction. In this study there will be the COLS method used for the estimation of the deterministic production frontier and technical efficiency and these models will be marked as **DF.**

The sample we used included 433 Bachelor programme students that study on the Faculty of Economics, VŠB – Technical university of Ostrava and that started their Bachelor studies in the academic year 2010/2011. These students also attended final state exam after 3 years of studying their chosen Bachelor study programme. The model omits students that did not fulfil their study duties and were forced to repeat the study year, interrupted their studies or ended the studies prematurely. The source of the data is the EDISON university information system.

The input to the Bachelor studies is the results from the high school (Z_SS) with values from the interval <1, 4> and running results from during the Bachelor studies (Z_1, Z_2 Z_3). It is an average grade gained in between the 1st and the 3rd study year with value from the interval <1, 4>. **The output** of the Bachelor studies is the average grade from the defense of the final thesis with valuation 1, 2, 3 or 4 (Z_ZP) and passing of the final exam from main subjects with valuation on the same scale (Z_SZZ). For the defined technical efficiency production function in the equation (1) we will adapt results of the *r*-th student's results (RAZ_SZZ_r where *r=1, 2, ..., R)* according to the equation (9) as a maximization of the output, i.e. gaining the best grade in the final exam:

$$RAZ\_SZZ_r = 5 - \frac{Z\_ZP_r + Z\_SZZ_r}{2} = 5 - AZ\_SZZ_r. \quad (9)$$

Descriptive statistics of study results in the table 1 document that the higher the study year is the better the students are on average (1st year 2.26, 2nd year 2.04 a 3rd year 2.00) but the higher is also their variability measured with std. deviation – sequentially 0.34, 0.38 and 0.42. A group of students can be classified also by *sex* or by *the type of the high school* which they come from. Statistics of the sample in the table 2 confirm that on the Faculty of Economics there were mostly 68% of female bachelor students and only 45

% of male bachelor students that came to the faculty from a secondary grammar school (G = "gymnázium"); other were from specialized high schools (SOS = "střední odborná škola").

Variable	Mean	Std. Dev.	Minimum	Maximum	Cases	Missing
Z_SS	1.776	0.431	1.0	3.1	433	0
Z_1	2.264	0.344	1.0	3.0	433	0
Z_2	2.042	0.378	1.0	2.9	433	0
Z_3	2.001	0.414	1.0	2.8	433	0
AZ_SZZ	1.806	0.763	1.0	4.0	433	0

Tab. 1: Descriptive statistics for input and output variables

Sex		Study program		High school	
Female	296 (68 %)	EPA	166 (38 %)	specialized high schools	237 (55 %)
Male	137 (32 %)	EM	242 (56 %)	secondary grammar school	195 (45 %)
		SEI	25 (6 %)		

Tab. 2: Frequency distribution of specific student subgroups

Results and Discussion

In the first part of the **efficiency evaluation** we focus on the evaluation of the technical efficiency for the whole sample (ALL) and also for the group of women (W) and men (M) and for the type of the high school (SOS, G). Results we got are compared using a kernel density estimation of the assessed technical efficiency. We will use logarithms of study results as input and output variables and this transformation will be marked in the name of the variable as L, e.g. LZ_1 = log(Z_1).

	DF_ALL	DF_W	DF_M	DF_SOS	DF_G
constant	2.019*** (0.063)	2.029*** (0.066)	2.171*** (0.156)	2.056*** (0.093)	1.923*** (0.089)
LZ_SS	0.029 (0.063)	0.157** (0.074)	-0.264** (0.133)	0.075 (0.085)	-0.055 (0.097)
LZ_1	-0.156 (0.106)	-0.264** (0.096)	-0.042 (0.226)	-0.141 (0.152)	-0.134 (0.155)
LZ_2	-0.176* (0.091)	-0.208** (0.098)	-0.104 (0.215)	-0.242* (0.124)	-0.080 (0.136)
LZ_3	-0.371*** (0.077)	-0.319*** (0.081)	-0.651*** (0.198)	-0.413*** (0.101)	-0.333*** (0.124)
R2	0.184	0.206	0.201	0.217	0.145
CHI2	150.567	63.363	49.976	66.453	90.609

Tab. 3: COLS Deterministic Frontier estimation

Results of the deterministic frontier function (DF) estimation are summed up in the table 3 – for all student group types and besides estimated parameters there are standard deviation values in parentheses. First column is devoted to the whole sample and documents that

results of the final bachelor study exam are getting better by 0.37 % due to the lower average grade in the 3rd study year by 1 %. The value of the determination coefficient is in the interval <0.15, 0.22> in all assessed groups. It points to the fact that results of the final bachelor state exam are determined also by other factors that are not encompassed in the model. The last row CHI2 includes the chi squared Wald test. It tests the null hypothesis of no systematic inefficiency in the distribution (which is rejected) at the 0.05 level of significance with 1 degree of freedom (critical value is 3.84).

average	_ALL	_W	_M	_SOS	_G
DEA_TE	0.831	0.831	0.833	0.838	0.830
(std. dev.)	(0.176)	(0.181)	(0.167)	(0.176)	(0.177)
DF_TE	0.682	0.679	0.655	0.760	0.721
(std. dev.)	(0.152)	(0.145)	(0.160)	(0.153)	(0.155)

Tab. 4: Average of DEA and DF technical efficiency

Graphical representation of the kernel density comparison for the technical efficiency of the DEA_ALL and the DF_ALL model is depicted in the figure 2. Descriptive statistics are compared in the table 4 in the first column.

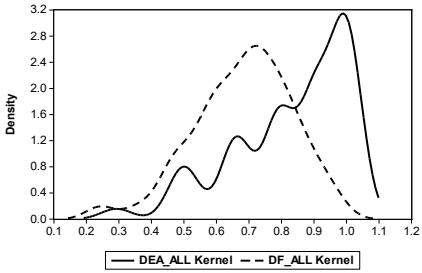

Fig. 2: Estimated technical efficiency based on DEA_ALL and DF_ALL models

Average technical efficiency in the table 4 was higher for the DEA_ALL model (0.83) in comparison with the DF_ALL model (0.68) but with higher value of standard deviation. Results of the study efficiency for male and female subgroups tell that the efficiency of the Bachelor studies is slightly lower for male students. It is shown in the figure 3 as a shift of the kernel density for male subgroup to the left and with lower peak. It is also evident from the table 3 that final results of the Bachelor studies are statistically significantly and positively influenced by grades from the 1st, 2nd but mainly 3rd Bachelor study year. Negative influence is evident for study results from the high school vice versa. In the male group we can see that with better grades from the high school and with better grades mainly from the 3rd year of Bachelor studies we can expect also more successes on the final state exam. Differences between male and female student subgroups usually lie in a more precise nature of female students' preparation during self-study and continuous fulfillment of study duties. On the other side, male students are willing to quickly understand the context, if it comes to results. Male students also tend to have increasing interest in getting better final study results if they study more specialized mandatory and optional subjects in the 3rd year of their Bachelor studies (see estimated statistically significant parameter -0.651 in the table 3.

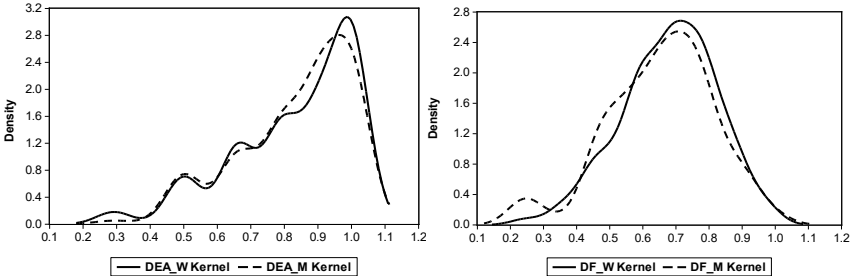

Fig. 3: Estimated technical efficiency by the students' sex

We got interesting results for groups of students defined according to the type of the high school. According to the figure 4 the DEA approach which is data-driven shows almost the same efficiency of Bachelor studies for students from both types of the high school. DF_SOS and DF_G approaches which are guided by economic theory shift the kernel density to the right for students from the secondary grammar school. They are therefore achieving higher efficiency in the Bachelor studies. The table 3 complements these findings with lowest total factor productivity (1.92) – mainly successes in the last year of the Bachelor studies are deemed as main determinants of results in the final state exams. The addition of high school results as inputs into the model is of course disputable, however authors feel that it belongs there. It's due to the information on the initial state of students' knowledge and skills which will be further developed during the Bachelor studies. The problem lies in the comparability of evaluation of these results between high schools and national comparative trials help to solve this problem. Each university however tries to educate quality Bachelors so it picks new students on the basis of results of an admission procedure (like SCIO tests). Unfortunately this information was not available for our research. Teaching experiences on the faculty, however, confirms that students coming from secondary grammar schools are better prepared and tend not to end the studies on the Faculty of Economics prematurely. Empirical results for male and female student subgroups statistically significantly confirmed legitimacy of usage of this input factor.

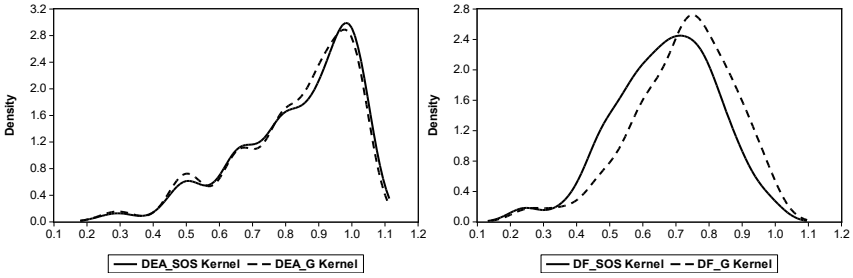

Fig. 4: Estimated technical efficiency by the type of the high school

Conclusion

The paper dealt with Bachelor studies efficiency evaluation using non-parametric DEA optimization approach and parametric methods of deterministic frontier function estimation using the COLS method.

The results document that average technical efficiency of DEA models was higher (<0.83, 0.84>) in comparison with DF models (<0.66, 0.76>) but encompassed higher variability. Male students of the Bachelor studies are slightly less efficient in the studies in comparison with female students. Main factors of their success in the final bachelor state exam are results from the high school and results in the last year of the Bachelor studies. The study efficiency of female students is influenced by results during the whole length of studies. In the comparison of groups determined by high school type, it was proven that students who came from secondary grammar schools (G) achieved higher study efficiency with lower total factor productivity; the average efficiency is, however, higher for the specialized high school group (SOS).

Acknowledgements

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INTELLIGENT M-LEARNING APPLICATION FOR PLANT LEAF RECOGNITION

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Abstract

This article introduces the importance of plant recognition, identifies the perks of this process, and describes some of the recent approaches to solve this task. Based on the analysis of the mentioned approaches, we propose a scenario for leaf identification, which reduces the visual complexity of the input image, pre-processes it into multiple input channels, and enables us to classify it as a corresponding species with an artificial neural network. Using this procedure, we present a state of art m-learning application utilizing the intelligent web service for recognizing the plant leaves. This application is further extended with a herbarium, which enables users to manually verify provided results.

Keywords

Image Recognition, Plant Leaf Recognition, E-Learning, Artificial Intelligence

Introduction

Identifying the plants by their visual characteristics is a skill that must be learned in various domains of human activities. The students of medicine and pharmacology should learn to identify medicinal herbs and their possible application, aspiring agronomists and horticulturists should be capable of differentiating weeds from cultivated plants to apply an appropriate herbicide or employ a method of mechanical removal. In the experiential learning stage, students often find themselves unable to identify the less common of these subjects, especially in the early stages of their growth. The common way to solve this issue is to consult a domain expert, or try to match the plant against a herbarium. Both of these approaches have a key flank – they are not readily available. Experts capable of reliable classification are also scarce and their advice can thus be expensive, while herbariums often only contain a visualisation of a "model individual" followed by a general description, which can lead to ambiguous conclusions. The ongoing advances in the object identification, especially notable in the face recognition systems, however, lead the authors to consider another approach – an intelligent system capable of recognizing the plant from a photograph.

The modern smart-phones appear to be an ideal tool for such a task, thanks to the variety of sensors and input modules, such as a camera, as well as access to a fast internet connection. These features make them a robust, yet highly portable tool for outdoor, on-site visual plant recognition, which can be especially helpful in experiential learning. Several authors discussed the benefits and merits of using mobile applications (Hui et al, 2011) and interactive materials (Magdin et al, 2013) in e-learning to reinforce the conventional classroom materials; other researchers study how the students and educators perceive the use of such technology (Abachi, 2014). All of them generally agree that such materials impact students' knowledge in a positive way. (Popelková et al, 2013) have, however, pointed out the danger that additional materials in e-learning may not always be

the source of statistically significant improvements in performance of involved students. It is therefore important to carefully consider the ratio of merits and the investment costs of such a solution, and analyse its further use cases.
This paper will present the architecture of a m-learning application capable of recognizing the plant leaves using methods of artificial intelligence, as well as presenting the students with ready to use visual herbarium. It describes the steps we followed in designing the internal logic of this state of art application, including the noise reducing image acquisition technique, the multi-channel image pre-processing, and classification of these resulting images with the artificial neural network.

Materials and Methods

For actual design of an intelligent agent capable of human-like object recognition, we need to analyse the way a human visually identifies a flower in an image. It relies on multiple individual perceptions – the look of the stem, leaves, blossom, fruit - they are all combined into a single arbitrarily certain result. The same way, an intelligent agent can be taught to extract various features of the plant, recognize them, and eventually combine the individual arguments into one valid conclusion. Reliable plant recognition system is thus logically highly complex. Let us now limit our discussion to the leaf recognition to identify the crucial problem areas.
Pairing a leaf with the name of the plant is challenging from various points of view. First of all, their shape is highly irregular, so any kind of spatial rotation can affect the way the solution classifies the image. Even within a single species, the leaf shapes can be largely variable, which can be further emphasized by different climatic and soil conditions. Leaves are also subject of fast temporal changes, as represented by their growth, damage, aging, and consequent degeneration. Several approaches have been designed to overcome these issues: Wu et al. (2007) proposed a feature extracting algorithm, which describe the shape of the leaf with several shapes-derived measures, Wang et al. used a moving median centre (MMC) hypersphere classifier, Fu and Chi (2006) focus on leaf vein pattern extraction, Parekh and Chaki (2011) utilize the centroid-radii (C-R) approach in shape representations, other authors try to mathematically describe the perimeter of individual species. The possible ways of describing a leaf seem to be countless. The majority of these solutions requires human interaction in data processing.
The identification is, however, a relevant issue only after a leave is successfully detected on a photograph. This is probably the greatest problem up to date, because the plants, and leaves in particular, can be vastly overlapping, tangled within each other, and thus highly difficult to differentiate. Moreover, the texture of the photographed leaf (object of interest) is often highly similar to the one of the backgrounds. For creating a working e-learning solution, it is thus desirable to reduce the dimensionality of the input space.
Several issues associated with the leaf segmentation, recognition, and identification has been outlined. To mitigate some of these problems, we decided to formalize simplifying schema in the process of image acquiring. These steps ensure the intelligent agent is confronted with the quality data set, containing as little noise and distortion as possible. To accomplish this, the photographs should be taken with a monochromatic background, and the leaves on them positioned in a way, which reduces their spatial distribution. The procedure we designed goes like this:

1. Place a leaf on a white piece of paper
2. Try to flatten the leaf as much as possible to reduce angular variance
3. Centre the leaf in the photograph view

4. Position the leaf in a way that the top of the leaf blade points to the top of the view, while the petiole (by which the blade is attached to the stem) faces the bottom
5. Take the photograph to include the whole leaf, and as little paper as possible

The photographs acquired following this process are further pre-processed and analysed to eliminate the noise caused by the variable illumination and camera sensor noise. Two basic scenarios, each leading to the creation of an information channel, have been employed. The first procedure relies purely on the leaf shape, and represents it in the form of binary image, while the second represents the leave as an RGB image, thus utilizing also the information included in the colour channels

The shape extraction sequence this project follows is separated into three steps. The image is converted into greyscale, and smoothen with the Kuwahara filter 5x5 (Kuwahara et al, 1976) to emphasize the edges, and subjected to binary segmentation and Canny edge-detection algorithm (Canny, 1986). The result of this procedure is the outer shape of the leaf, its contours. The whole process is demonstrated in the figure 1.

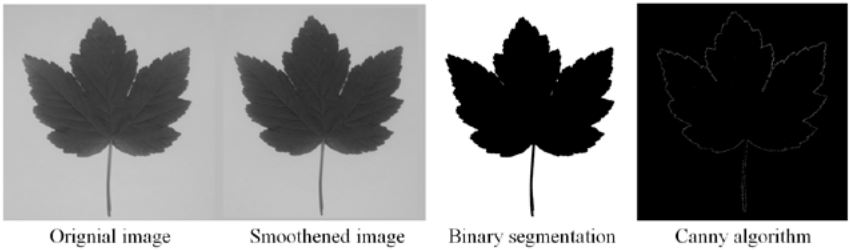

Fig. 1: The leaf edge preprocessing sequence (Acer pseudoplatanus)

In processing the RGB channel, the preprocessing procedure is much simpler. The only important task is to clear the background and reduce the noise in the photography by performing the Gaussian smoothing.

So far, the input images considered could have been of varying resolution, depending on the camera. For presenting them to an intelligent agent, we however need to stabilize their size. To do this, we employ a simple algorithm, which scales down the image respecting its ratio in a way that the larger of the image dimensions fits the pre-set input matrix dimensions. The input image is consequently centred, and the unoccupied space filled with a constant colour corresponding to the background. The optimal AI input size is yet to be empirically determined, our solution is currently yielding satisfying results using the 150x150 px input image.

To classify the pre-processed images to a corresponding category, the multi-level perceptron (MLP) network with one hidden layer is used. For each channel generated from the input image, a corresponding network has been trained. The “Edge” classifying neural network produces results from the binary input image. The “RGB” network is 3 times as large and thus slower in processing, because each pixel in the input image is described with three corresponding values – red, green, and blue. The online back propagation algorithm has been used for training of each of the networks. As an output, both of the networks produce a vector of values of equal size. Each value corresponds to one leaf specie, and takes a value of a real number from zero to one. By combining the results from both networks, and confronting them with a threshold, we limit the collection of results presented to the final user.

The complete recognition procedure is summarized in the figure 2, following the BORM methodology.

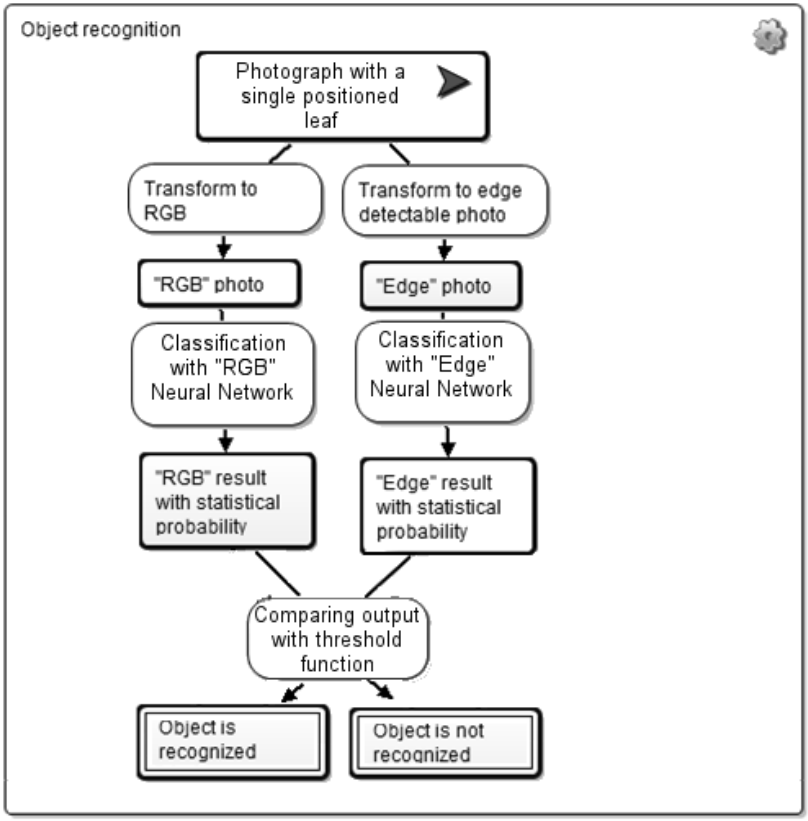

Fig. 2: The leaf recognition procedure

Results and Discussion

The previously described methods of image acquisition and processing combined with the classification using an artificial neural network have yielded experimental results robust enough to encourage us into designing a piece of working software. While the use of such limiting factors is not robust enough for autonomous machinery in industrial applications, we realized the potential of the current development stage in e-learning and m-learning applications and decided to create an intelligent mobile application capable of recognizing the plant, based on the image of a leaf. The application uses the mobile GUI in combination with plant recognition module of the "Athena" multi-purpose artificial intelligence, running as a web service. The server-side part performs the actual image preprocessing, and recognition. The architecture of the proposed solution is visually depicted in the figure 3.

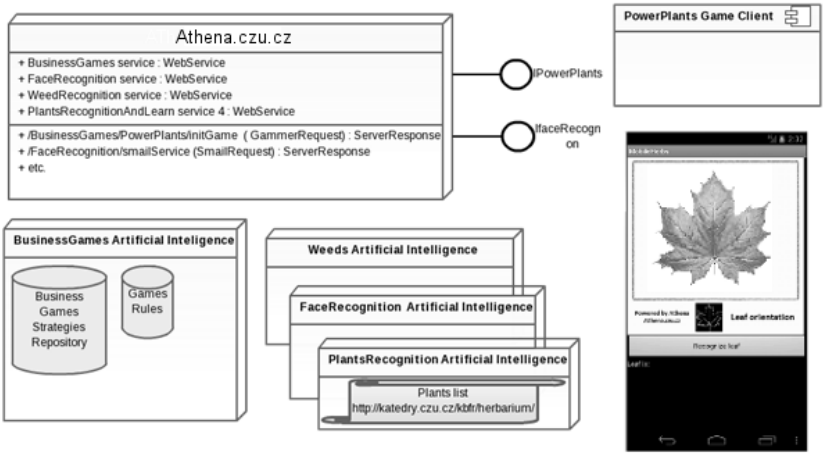

Fig. 3: The Athena multi-purpose artificial intelligence architecture with mobile phone application GUI

The image-taking procedure used so far, has one significant drawback - taking the photograph of individual leaf on the white background often requires plugging that one of the maternal plant. If applied to the full variety of individuals, this can severely damage a plant population, and lead to irreversible damage. We are aware of these ethical implications, and decided to limit the scope of our interest domain to the trees.

For being able to successfully identify most of the Czech trees, the user must only follow the 5 simple rules for taking a photograph, as has already been presented in the previous chapter. After taking the photograph, the user can submit a request for identification to the web server, together with the image. The intelligent agent then processes the image, classifies it, and presents the user with a single result, the most likely plant depicted in the photograph taken. For validating the generated result, the corresponding chapter in the in-build herbarium containing a thorough description of the candidate plant with several illustrative images of the most distinct features, is displayed. When confronting the actual leaf with the herbarium entry, and finding out the suggested plant name is likely to be wrong, the user can mark the answer as faulty. This will both upload an error report to the server, and present a user with a result that has been identified as the next most likely. The application should thus offer a reliable source of domain knowledge, responsive to the further specification from the user, and also provide a method for presenting the most distinctive features of the plant to the student, and thus support learning.

Several authors have directed their work efforts in designing a solution capable of the intelligent plant classification. The cited authors, including Fu and Hi (2006), Chaki and Parekh (2011) or Wu et al. (2007) however study primarily the methodologies, that can yield satisfactory classification results, without further considering an application framework. On the other hand, Husin et al. have created a portable solution based on the classification of preprocessed images with artificial neural network. (Husin et al, 2012). By introducing a set of the limiting conditions, they reach the overall recognition rate of 98.9%. We extend their methodical framework by adding the RGB channel, and

thus composing the classification based on multiple information. We also add the mobile application architecture, and graphical interface. For supporting the e-learning aspects, we also embedded a herbarium of local species.

Abachi and Muhammad (2014) and Pereira and Rodrigues (2013) respectively, have proven the usefulness of m-learning, and mobile applications by evaluating the correlation between the use of this technology, and student's knowledge. In comparison with the deterministic solutions observed in these studies, the intelligent solution could achieve much more significant results. We're currently conducting a quantitative research to prove the relationship between the use of our application, and improvement in students' knowledge, following the methodology Teri et al (2014) have used for studying the relationship between the voluntary use of additional m-learning materials and improvement in examination results.

Further development stages of this project should be capable to detect a leaf in its natural environment. Such an application could also be useful in monitoring the localities of species photographed in nature. When the identified plant is connected with the GPS coordinates recorded at the moment of taking the picture, a very useful source of information about the geographical dissemination of a species can be established. As a part of their terrain exercises, students can thus not only learn from experience, but also help in describing the environment.

Conclusion

This paper introduces the mobile phone application utilizing the web service based on the artificial neural networks for plant leaf recognition. It also includes a herbarium containing selected images used for the training of the artificial intelligence, together with the characteristics of the plants described. This application is so far capable to recognize the Czech trees and selected indoor plants. We have, however, avoided the problem of detecting the leaf of interest in the "raw" photograph from the nature by introducing a set of simplifying conditions, which reduce the information contained in the image. These steps must be followed by the application users, in order to achieve successful plant identification. This application can prove very useful in the educational efforts by providing the students of the Czech University of Life Sciences with the portable solution, which can help them to learn to classify plants in an entertaining experiential way. Another merit of such an application is the feedback link between the authors and users. The submitted photographs can be used to further extend the training set of our AI, and help us improve the future classification results.

Acknowledgements

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EFFECTIVE METHODS OF TEACHING FINANCIAL ISSUES

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Abstract

The paper deals with an original collection of educational means developed by the authors. Their aim is to support the financial education of future teachers within the subject *An Introduction to Finance* at the Faculty of Education at the University of South Bohemia. The paper mainly refers to research, the objective of which was to gather data that would allow the adjustment of the subject's content to meet current demands. Findings of the research also motivated specific recommendations for the teaching of mathematics.

Keywords

Computer aided teaching, financial literacy, teacher education, mathematics teaching

Introduction

One of the key tasks of an education system is to ensure the financial literacy of citizens. Scarcely any topic of the school curricula is undergoing such rapid and frequent changes as the topic of financial issues. Therefore its teaching requires new approaches that would dynamically respond to the current situation.

The paper deals with an original collection of educational methods developed by the authors to support the financial education of future teachers within the subject *An Introduction to Finance* at the Faculty of Education at the University of South Bohemia. A significant part of the paper refers to research, the objective of which was to gather data that would allow the content of the subject to adapt to current needs. This collection integrates various kinds of digital learning environments, each of them having a significant position in the process of exploring the financial world.

As Binterová and Tlustý (2013) pointed out, only the right use of ICT may significantly influence the results of the educational process. Therefore since the establishment of the above mentioned subject we have continuously done research to test the effectiveness and actuality of the presented methods. This paper focuses on the results of the last research, which was aimed at the financial literacy of newcomers to the faculty. The research data was obtained by means of a questionnaire survey, the reliability of which was verified by the use of the Kuder-Richardson formula according to Chráska (2011, p. 199). Some specific recommendations for the teaching of mathematics based on the research results are expressed.

From the data presented on the portal *International Network for Financial Education* by OECD (2012) it follows that the financial literacy standards based on the recommendations taken from OECD (2005) are fully implemented into the main curriculum documents of primary and secondary education in the majority of countries. The Czech Republic is no exception. The national strategy of financial education formulated in MŠMT ČR (2010, actualized version of the 2007 edition) was followed by the statement of particular standards of financial literacy in MF, MPO and MŠMT ČR (2007).These standards have

been implemented into curricular documents of the Czech educational system, called *Framework Educational Programmes* (FEPs) for the particular type and education level of school. The age limit for compulsory financial education was lowered from 15 to 6 years from September 2013. For example the issue of the age limit for financial education is discussed in Petrášková and Hošpesová (2013).

In compliance with the above measures the Faculty of Education of the University of South Bohemia included the subject *An Introduction to Finance* in the fields of study concerning the teaching of mathematics. The other faculties of education in the Czech Republic responded similarly. The common goal of the newly established subjects around the faculties was to provide future teachers with competent orientation in the field of money and price issue.

Materials and Methods

Means of financial education

Due to the frequent changes in the offers of financial products and the often unclear, insincere and confusing statements of commercial advertisements it is not easy to get a real grasp of the basic terms, their interrelations and functions in the field of finance. To keep pace with the dynamic changes in financial issues the authors decided to support the teaching of the subject by means that would be open to change. They took advantage of the qualities of selected software and developed a series of educational materials to help students of mathematics teaching to improve their grasp of the actual financial issues.

In addition to the usual computer means of financial computation such as spreadsheet and online calculators the authors discovered the utilization of the computer algebra system Maple to be beneficial, namely its interactive so called *smart documents*, combined with the randomly generated online tests targeted at financial issues actually being taught.

A key means for the effective teaching and learning of financial issues in the subject *An Introduction to Finance* is a series of educational materials based on the computer algebra system (CAS) Maple by Maplesoft (2014). Each of these Maple-based materials, so called *smart documents*, is related to the solution of an example – a real life problem that covers an up-to-date financial product. The *smart document*, also called an *interactive document*, represents a unique environment enabling the user to combine the text, formulae for symbolic and numerical computations entered in the Maple code, graphs and tools for control of input parameters such as e.g. input and output fields, scroll bars or radio buttons. After opening a *smart document* it seems to be a text document presenting a solution to a specific task with mathematical formulae integrated into the text, as shown in Fig. 1. However, with the possibility of a change in input values and subsequent conversion through the Maple function 'Execute the entire worksheet' it has a major advantage over text documents. In smart documents the user gets a powerful tool for experimentation and examination of the dependence of a solution upon input values. An advantage of this educational aid is the possibility of continuous updating according to the current condition of the financial products market. Compared to online calculators, which are no doubt one of the basic tools for every-day financial computation, smart documents reveal all relations and formulae that are behind the computation and may represent more than one task at a time.

The efficiency of smart documents as a means of teaching and learning financial issues for future teachers of mathematics was verified by means of the research carried out on the students of the Faculty of Education in 2010 as stated in Hašek and Petrášková (2010).

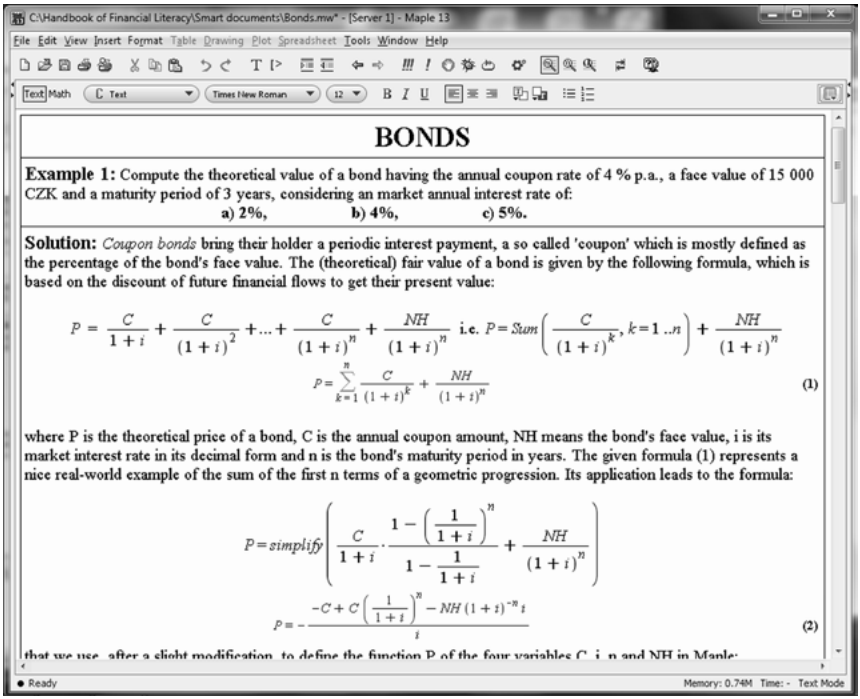

Fig. 1: The beginning of the smart document "BONDS"

A spreadsheet is no doubt a key means of software support for every-day financial computation. It provides the users with an ideal feature to solve their common financial issues. Students of *An Introduction to Finance* use a spreadsheet as a basic means to solve common practical financial tasks. For example they utilize it to create a personal or family budget or to examine different variants of considered financial services and thus eliminate the risk of incorrect decisions.

Along with the spreadsheet online calculators are the necessary means to deal successfully with every-day financial issues. To know reliable sources of actual online calculators on the Internet should be a necessary part of financial education. A typical situation in which we can make good use of online calculators is the refinancing of a mortgage credit.

Issues of the effects of the above mentioned means are based on the concept of some authors (Atkinson et al, 2006) that combine the term financial literacy with the term financial ability, expressing the capabilities of a proper application of financial literacy. The research on the impact of the above mentioned tools in the improvement of the financial literacy and ability of future teachers, which is minutely presented in Hašek and Petrášková (2010), revealed that the most difficult tasks appeared to be those dealing with consumer credit, mortgage credit and inflation. Students often did not even try to solve these actual real-life problems. The results of research also highlighted the fact that students can seldom resist the usual marketing strategy of banks' commercials based on the fact that a monthly interest rate looks visually better than an annual interest rate. To enable students to gain more experience in dealing with these common financial tasks

the authors decided to add online tests with randomly generated questions targeting the problematic situations to the above-mentioned collection of educational materials. These tests, created by the second author (in alphabetic order) and available at the address http://jcu.inqool.cz/index.php/2-uncategorised/89-pf-06, became very popular and sought out resources with students.

Research

The effectiveness of the subject *An Introduction to Finance* is decisively influenced by its topicality as well as how it harmonizes with the level and structure of students' knowledge. The content and quality of the financial literacy of high school graduates has changed in recent years in accordance with the gradual implementation of financial issues into the school curricula as prescribed by MŠMT ČR (2010). Students who started attending the University last year are the first generation that is fully trained in accordance with this national strategy. Therefore the authors decided to conduct a pilot survey aimed at mapping the level and structure of the financial literacy of students in the first year of university study at the Faculty of Education of the University of South Bohemia in České Budějovice.

The survey was conducted by means of a questionnaire. It consisted of twenty closed-ended questions always with four choices, only one of them being correct. Reliability of the questionnaire was verified by the application of the Kuder-Richardson formula (Chráska, 2007, p. 199). The relevant coefficient of reliability was 0.802, i.e. the test could be considered as reliable, because the permissible value of the coefficient of reliability is from 0.8 to 1.

The questionnaire questions were evenly related to five topics (four questions to each topic): investment, credit, family budget, money and insurance. These areas cover the standards of financial literacy that were determined in MF, MPO and MŠMT ČR (2007).

The data collection was conducted at the beginning of the winter semester of the academic year 2013/2014. The pilot survey was carried out on 43 students from the 1st year of study in the programme *Specialization in Pedagogy* (the bachelor's degree program, which is the first stage of university teacher training) at the Faculty of Education. The number of students involved was in accordance with the recommended minimum number of 30 respondents for pilot research that is presented in Chráska (2011, p. 175). Their ages were between 19 and 21. Students participating in the survey were introduced, as the forerunners, to financial issues according to the full demands of the Czech curricular documents at their schools. The question of the structure of secondary schools from which students came (24 students came from high schools, 8 from secondary pedagogical schools and the remaining 11 came from various secondary vocational schools) was not the subject of a pilot research. This issue will be considered in the forthcoming full survey that will be carried out on about 300 respondents.

The research study was of a quantitative nature. The data was processed by the software STATISTICA 10. The analysis was processed by means of the following steps:

1. The null hypothesis statement:
   H_0: "There is no (significant) difference between the results in individual areas."
   against
   H_1: $\neg H_0$
2. The Friedman test.
3. Post-hoc analysis of the Friedman's test results.

Results and Discussion

To verify the null-hypothesis the Friedman test was used according to the methodology described in Mrkvička and Petrášková (2006). The results are given in Tab. 1. Because the p–value is 0.00766, i.e. it is less than 0.05, we rejected the null-hypothesis at the 0.05 significance level. Therefore the differences between the results in individual areas (investment, credit, family budget, money and insurance) were proved. In addition, in Tab. 1 we can see the value 0.08075 of Kendall's correlation coefficient that also indicates the variances between the results in individual areas.

Variable	Friedman ANOVA and Kendall Coeff. of Concordance ANOVA chi-sq. (N=43, sv = 4) = 13.88841 p = 0.00766 Coeff. of Concordance = 0.08075			
	Average rank	Sum of ranks	Mean	Std. Dev.
Invest	2.604651	112.0000	1.511628	1.099179
Loan	2.686047	115.5000	1.488372	1.032152
Budget	3.616279	155.5000	2.162791	0.814460
Money	3.139535	135.0000	1.860465	1.036969

Tab.1: Results of the Friedman test

We were then interested in which pair showed a difference in results in the areas of investment, credit, family budget, money and insurance. For this purpose we decided to use the post-hoc analysis of the Friedman's test results, which is not implemented in the software STATISTICA 10. We used the results from Tab. 1, particularly the data from the column "Sum of order". The test statistics of the post-hoc analysis works with differences of orders $|R_{.j} - R_{.m}|$. Table 2 includes these differences and the statistically significant differences are starred **. We see it as statistically significant that from the results given in Tab. 2 differences in 2 pairs of areas were identified: the difference between loan and household budget and the difference between investment and household budget. These differences are also proved by the box plot in Fig. 2.

$\lvert R_{.j} - R_{.m} \rvert$					
	Investment	Loan	Household budget	Money	Insurance
Investment	-	3	43**	23	15
Loan		-	40**	20	12
Household budget			-	20	28
Money				-	8
Insurance					-

Tab.2: Post-hoc analysis for the Friedman test

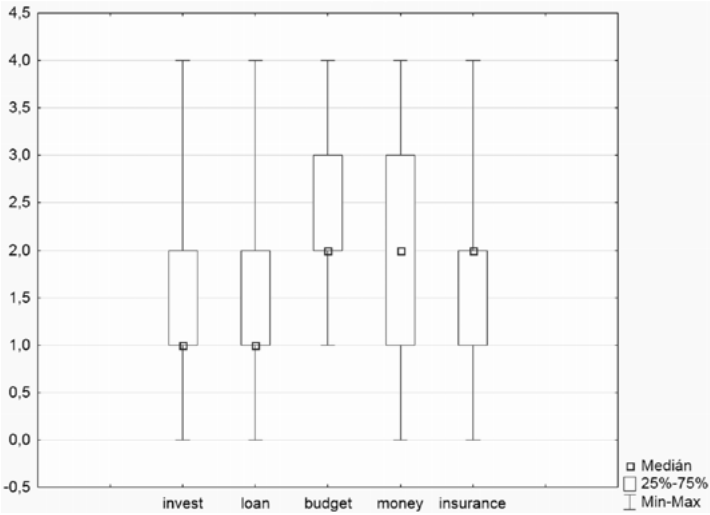

Fig. 2: Box plot of data from the pilot research – distribution of correct answers for each of the five areas (invest, loan, budget, money and insurance)

Conclusion

A pilot survey showed that respondents have the least favourable results in the areas of investment and loans and that they were surprisingly good in the field of insurance. This area included the pension reform (especially the third pillar dealing with additional pension insurance), all types of life insurance (risk, capital, pension and investment insurance) and non-life insurance (e.g. home and travel). In accordance with this finding is the fact that, as follows from STEM MARK (2010), Czech households have shown a significant lack of financial planning (no matter if short-term, medium or long term financial planning), the integral part of which are issues of investment and loans.

As a conclusion of their research the authors adjusted the content and composition of tasks solved in smart documents and affected by the online tests to increase the emphasis on issues of investment and loan. Smart documents and online tests, thanks to their easy adaptability proved to be suitable tools in financial education which allow a user to create a set of model situations and to compare different products from these two key areas.

In the authors opinion analogous adjustment should be implemented within the secondary schools curriculum. The findings of the research, in the authors' opinion, pointed out the essential role of mathematics education in the formation process of the financial literacy of secondary school students. The authors recommend taking advantage of the topics *Working with data* and *Arithmetical and geometrical progression* in secondary school mathematics to solve every-day financial problems.

The presented research was primarily aimed at improving the financial education of future teachers at the Faculty of Education. Its results obviously cannot be generalized to other faculties. Therefore, the authors are currently preparing more general research that will be carried out on several hundred respondents from different faculties.

Acknowledgements

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EFFECTIVENESS OF ENTREPRENEURSHIP EDUCATION – COMPARISON OF CZECH AND IRISH GRADUATES

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Abstract

The comparative study draws a comparison between Czech and Irish students as regards their motivation and ability to become a self-employed entrepreneur. The carried out statistical survey compares the population of 233 Czech and the population of 248 Irish graduates. The paper presents some selected results from an extensive research at the Czech University of Life Sciences Prague. Statistical evaluation of questioning demonstrates weak and moderate differences between both groups in the majority of items being subject to the research. Comparison of self-assessment regarding skills and competencies related to starting up an enterprise discovered that Czech students seem to be less self-confident and the evaluation of their abilities. In terms of practical skills, Czech university seems to provide students with similarly good background as universities in Ireland. But the idea of becoming a self-employed entrepreneur is three times higher in the sample of Irish students than with the sample of Czech students. The study analyses the causes of this situation and formulates recommendations intended for authorities in the area of higher education.

Keywords

Entrepreneurship based education, comparison Czech and Irish students, self-employed entrepreneur, motivation to self-employment

Introduction

Many countries around the globe face the problems of economic and financial recovery. Entrepreneurship and small businesses become increasingly keys to an economic prosperity and regeneration and support of local and regional, as well as national, economies.
Entrepreneurship is taught as a key competence necessary to develop a modern society. Many studies demonstrate the close relationship between GDP and its growth. The research in this paper undertakes an statistical analysis of the students' acquired business skills and various environmental factors such are intention to build own business, risk acceptance, small business success patterns, personal motivation, self-confidence and self-assessment in the higher education institution by using a mix of quantitative and qualitative research. The study deals with the relationship of students enrolled in a study programme "Entrepreneurship and Administration" at the University of Life Sciences Prague, Czech Republic to independent entrepreneurial activities and evaluations of curriculum contents from the point of view of motivation and mediation of entrepreneurial skills as necessary prerequisites when considering a career of a self-employed entrepreneur. The immediate impetus for the elaboration of a vast statistical survey and the subsequent analysis in this area came out from the work Naomi Birdthistle from the Centre for Entrepreneurial Studies, University of Limerick (Birdthistle, 2007). The results show data and information revealing the interest of Irish students to pursue

independent entrepreneurship and the identification of factors having impact on students´ decision not to "apply for a job" but to follow the path of "being on one´s own", i.e. not to be afraid of independent entrepreneurship and start up their own business. Research at the Czech university made use of the well-proven methodology of Dr. Birdthistle and an analogous statistical survey covering relevant population sample of Czech students was carried out.

The article focuses on two selected *working hypotheses* submitted within the framework of an extensive research, namely: "Among a group of Czech and Irish students there are not significant differences a) in the decision of students to establish own business after graduation, b) in practice-oriented teaching that supports student decision to establish own business.

The *objectives of the research* are: a) provide us with data enabling the comparison of both groups of students – Czech and Irish – and allowing for the evaluation determining whether entrepreneurial environment specific for both young generation of students in the respective countries differ or not, b) investigate the sources of gaps between the entrepreneurial knowledge given on lectures and students' acquired competencies and give a few recommendations for facilitating collaboration among stakeholders in the higher entrepreneurship education.

There are three good reasons for which the comparative study drawing comparison regarding the intentions of and the abilities to pursue independent entrepreneurship with a population sample of Irish and Czech students:

1) Twenty years ago and shortly after the Velvet revolution, the Czech University of Life Sciences Prague re-established a close cooperation with experts from the University College Cork. These experts were one of the first helping during the first years of transformation affecting Czech economy and educational system to create new study programmes at the University, among others the programme Entrepreneurship and Administration whose content is very close to similar study programmes available at Irish universities.

2) Similarly as the Irish economy and the potential for entrepreneurship in Ireland seem to be to a large extent influenced by its strong economic neighbouring country, Great Britain, Czech Republic also has an economically powerful neighbour – Germany. The proximity of strong economies and entrepreneurial and trade opportunities in the close vicinity of both small states means strong as well as weak points which are inevitably reflected in the opinions of university graduates as regards independent entrepreneurship and their plans to pursue independent entrepreneurial activities.

3) Educational objectives and the content of educational programmes have been evaluated according to competences and skills supposedly acquired by the graduates of the given study programme. Although teachers appear to have grasped the concepts of competencies and skills properly a closer look reveals that in different countries, these concepts may assume different contents. The differences related to the way competencies are conceived in Anglo-Saxon, French and German educational systems are for instance dealt by Brockmann, Clarke and Winch (Brockmann, 2008). In the course of transformation in the past 20 years the Czech educational system has been transformed and adapted to the Anglo-Saxon model oriented more likely to the development of graduate employability (strongly employer-led development on functional skills). As far as the conceptions of competence and skills are concerned, Irish and Czech educational systems share similar characteristics.

Materials and Methods

A practically-oriented university curriculum must encourage original thinking and creativity of students. The ability to think in a creative way is one of qualities without which any artist or entrepreneur can do. Innate abilities of creative conduct can be developed and supported in the course of studies thanks to a practically-oriented tuition. Tynjälä (Tynjälä, 2008) argues that the worlds of education and work are moving closer each other and stresses the role of informal education in building competences for entrepreneurship of graduates. Informal education may be involved into curriculum directly by business practices. There are also other ways how to integrate informal knowledge in the curriculum: games, multimedia, well-made cases, lectures of practitioners (Havlicek and Kvasnicka, 2012). The natural talent of the student is of great importance when training the entrepreneurship (Konigová and Urbancová, 2012); especially if it is supported by practices (Margarisová, Šťastná and Kvasničková, 2011) and with knowledge based study texts (Rauchová and Houška, 2013). Karlsson and Moberg (Karlsson, 2013) evaluated the impact of an university entrepreneurship program on entrepreneurial self-efficacy, attitudes to entrepreneurship and whether or not the students had started a company during their education. The result indicates that the entrepreneurship program was effective in enhancing students' attitudes to entrepreneurship. On the contrary, Henry, Hill and Leitch (Henry, 2005) analyse the idea if entrepreneurship can really be taught at the university. Other research sources stresses the necessity of practical training both direct in companies and indirect by multimedia (Hynes, Costin and Birdhistle, 2011; Cheng, Chan and Mahmood, 2009; Matlay, 2008).

Large number of students enrolled in the first year of a study cycle makes it almost impossible to ensure a quality specialized practical training within a standard university course for all of them. Universities do not happen to have a problem related to the conclusion of an agreement with a big production enterprise regarding the completion of a traineeship and working stays of its students. A big and a rich enterprise is able to provide for both practical training and traineeships, and possibly co-finance these activities but the result is that students going through such practical traineeships in enterprises become adapted for their prospective entry into employment relationship instead of being motivated to set up their own business. Differently put: a student succeeding in completing such a traineeship can become "a good employee working under a good boss" but definitely not "a boss of his/her own".

Practical education developing and encouraging the ability of independent entrepreneurship pursued by a future graduate student must be concentrated primarily on the development of student's creativity and encourage their motivation enticing them to set up their own business. The way entrepreneurship education can influence intentions to become an entrepreneur has been dealt with in many studies. For example the paper by Graevenitz, Harhoff and Weber (Graevenitz, 2010) provides a model of learning in which entrepreneurship education generates signals to students. The research identifies significant effects on students´ self-assessed entrepreneurial skills and supports the idea that students may receive through educational process primarily informative signals and learn about their entrepreneurial aptitude.

Organization of the comparative survey

Questionnaires were presented to students in the last year of their master´s study of "Business Administration and Regional Development" and "Economics and Management" study programmes. In the population sample of students both men and women had an equal representation. Majority of students (85%) were full-time students and the rest accounted for part-time students. The fields of study ranged from business to business administration, marketing and economics.

Students were explained the objective of the statistical survey and they were promised to be subsequently acquainted with its results. The questionnaire was presented on anonymous basis but students had the opportunity to state their name and contact details. The total number of 233 questionnaires out of 450 was used. These stand for properly filled in questionnaires that we got back. It is interesting that 195 students stated their name and email contact though it was not obligatory. It was important since it enabled us to contact those students after the conduct of the statistical survey and discuss the results together.

Since it is expected that both features being subject to comparison are independent due to different conditions of Irish and Czech educational as well as entrepreneurial environment, the division regarding frequency in the contingency table makes possible to conduct the testing of features supposedly homogeneous in relation to Irish data and of the frequency expected among Czech population sample. Standard Pearson´s chi-square statistics was employed as a test criterion. For statistical calculations the SPSS statistical software version 20 was used. Testing of statistical hypotheses was based on the significance level of $\alpha = 0.05$.

Results and Discussion

In the first stage of the comparative study, features describing (1) a student´s decision "to become an independent entrepreneur" and (2) the way universities stimulate and encourage this decision were examined. The results are demonstrated in the Table 1 and Table 2.

Have you ever concretely thought about founding an enterprise?	Irish students		Czech students	
	Frequency	Valid Percent	Frequency	Valid Percent
No, never	45	18.1	119	51.1
Yes, sketchily	83	33.5	24	10.3
Yes, rather concretely	32	12.9	18	7.7
Yes but I turned away from it	16	6.5	16	6.9
Yes, I am bound and determined to be self-employed	50	20.2	15	6.4
Yes, I already started with the realisation	14	5.6	13	5.6
Yes, I am already self-employed	3	1.2	17	7.3
Yes, I was self-employed but no longer am I	5	2.0	11	4.7
Total	248	100	233	100

Tab. 1: Have you ever concretely thought about founding an enterprise?

It is obvious already at first sight from the Table 1 that there are differences in data recorded with Irish and Czech students. The values of χ^2 ($p = 0.000$) and the coefficient $C_p = 0.416$ were calculated whereas they indicate the statistically significant difference between both data sets; it concerns the dependence of medium significance. There is a greater number of persons already pursuing some entrepreneurial activity with Czech students (7.3% Czech students, 1.2% Irish students). In case of Czech population sample, it most commonly concerned students coming from families operating small and medium-sized business as well as students who pursued their entrepreneurial activities in close link with those of their family or relatives.

Students expressing their positive intention to set up their own business or those already pursuing some entrepreneurial activity were asked to describe practical steps and measures taken in order to meet their objective. The answers obtained allow us to examine to what extent they succeeded in putting their decision to become a self-employed entrepreneur in practice as well as knowledge they acquire regarding planning and organization during their university studies. Data are demonstrated in Table 2. Statistically significant difference was identified with answers related to the last four questions ($p \leq 0.05$). It was the group of Czech students which seems more active since 28.1% of students participated in events intended for new entrepreneurs (8.6% with Irish students). A high percentage of Czech students consulted the possibilities of financial aid with respect to their business with potential investors (39.5%). Interviews with respondents showed that they visited various authorities offering support to entrepreneurial projects ("spin-off" for young entrepreneurs, grant agencies, regional initiatives for the submission of entrepreneurial projects related to regional development etc.) and consulted their ideas concerning starting up their own business with them.

There were 14.0% out of 21.9% of registered young entrepreneurs (and simultaneously students) having 1 employee whereas the rest employed 2 or more persons. Furthermore, 18.5% out of 27.2% of existing prototype products accounted for software products or services whereas the rest was represented by agricultural or food products and trade-related services.

Following the comparison of results in Table 1 and Table 2 it can be deduced that Czech students show much lower interest in starting up their own business than with their Irish counterparts. However, a small group of Czech students interested in operating their own business (only one fifth) is more active and manages to choose practical techniques necessary for their prospective entrepreneurial activities.

Conclusions

The hypothesis that "Among a group of Czech and Irish students there are not significant differences in the decision of students to establish own business after graduation" was not accepted. The decision of becoming a self-employed entrepreneur is *three times higher* in the population sample of Irish students than with the population sample of Czech students (Table 1).

On the other hand, the second hypothesis "Among a group of Czech and Irish students there are not significant differences in practice-oriented teaching that supports student decision to establish own business can be accepted. Table 2 demonstrates that even Czech students wishing to start up their own enterprise are able to work up and cultivate their entrepreneurial plans. Majority of questions were responded by both groups in a similar way and statistically significant differences found out in the last 4 items of Table 2 may be influenced by specific administrative as well as political measures taken in the respective

countries. The results show that students acquired important practical skills during their studies as far as the starting up of an enterprise is concerned: evaluation and precision of a business plan, formulation of a marketing plan, gathering and processing of essential preliminary information. In terms of practical skills, Czech university seems to provide students with similarly good background as universities in Ireland (Table 2).

Steps Taken in Starting a Business	Irish students who expressed a positive interest in self-employment		Czech students who expressed a positive interest in self-employment		Statistical significance	
	Frequency YES	Valid Percent	Frequency YES	Valid Percent	p-value	Coefficient of contingency
No step taken	81	41.1	62	54.4	0.147	
Thinking through first business idea(s)	83	42.1	59	60.5	0.050	
Writing down first business idea(s)	47	23.9	37	32.5	0.375	
Developing a business plan	29	14.7	39	34.2	0.113	
Gathering start-up specific information	32	16.2	28	24.6	0.769	
Visiting start-up specific events	17	8.6	32	28.1	0.013	0.113
Talking to potential sources of financing	15	7.6	45	39.5	0.000	0.197
Determining a date of foundation	8	4.1	25	21.9	0.000	0.147
A prototype of the product exists	8	4.1	31	27.2	0.000	0.181

Tab. 2: Steps Taken in Starting a Business

Considering the fact that both groups – Irish as well as Czech students – went through university admission exams and passed successfully a lot of exams, their intellectual capacities and skills may be regarded homogeneous and equal. It is therefore assumed that differences identified in the comparative study occur due to external factors. Universities should in their profiles describing graduate students put more emphasis on students´ ability to develop and carry out entrepreneurial ideas. The objective of "education enabling the mastery of skills essential for entrepreneurship" should be given much higher priority than the objectives of "education preparing students for taking up a job" or "education for better employability". It can be achieved by means of a careful arrangement of sample case studies, business simulations, assignment of semestral projects and themes of bachelor and master´s theses, inclusion of discussions with successful entrepreneurs – graduate students in the tuition etc. The network of active contacts of the university and chosen small entrepreneurs is essential and it is necessary to keep this network updated on a continuous basis and cultivate it as well as ensure its funding.

The results of the comparative study conducted at the given Czech university may be interesting and inspiring not only for other universities in the Central European region

but also for other European universities encouraging the development of entrepreneurial skills in the profiles of their graduate students and monitoring their success in the labour market.

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STUDENTS´ VALUE ATTITUDES BASED ON THE METHOD OF SEMANTIC DIFFERENTIAL

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Abstract

The paper presents value attitudes of students studying at Grammar School with Polish language of instruction in Český Těšín related to the concept of ideal teacher and real teacher. The school provides education for Polish minority in the region of Těšín Silesia and their students are educated in specific conditions of bilingualism and biculturalism. The analysis of their value attitudes reflect the fact that the students grow up in a different socio-cultural environment emphasizing the region, its historic specifics, and they mostly have parents who also used to attend the same school in the past. The main part of the paper focuses on the analysis and evaluation of the questionnaire survey based on the method of the Semantic Differential distributed to the Polish students. The authors expect that there will be numerous differences between Polish and Czech students related to value attitudes, and also in the area of thinking critically.

Keywords

Ideal teacher, minority education, real teacher, Semantic Differential, value attitudes

Introduction

The Těšín Silesia Region is an example of an area where numerous ethnic groups have lived and still live communicating with more than one language. The region can be characterized by a coexistence of the Czechs and Poles using two languages and a dialect for everyday communication. According to some opinions, the described situation is related to bilingualism and biculturalism related to special value attitudes acquired in complicated historic development of the region. The authors expect that the members of Polish minority share certain culture values that are placed according to the Hofstede´s Three Levels of Human Mental Programming in the part related to the collective programming. This level is common for people belonging to a certain group or category and involves the language, relationship building, perceiving human activities surrounding them, etc.. (Hofstede, 2001). The feeling of cohesiveness of the Polish minority is very strong and it is also reflected in young generation´s attitudes.

The article presents value attitudes of students studying at Grammar School with Polish language of instruction in Český Těšín in the Těšín Silesia Region related to the concept of *ideal teacher* and *real teacher* as well as recommendations to the headmaster of the mentioned school. The authors presumed that bilingual individuals have better conditions for developing creative and critical thinking than monolingual ones.

The concepts of ideal and real teacher has been a frequent topic of collecting data from the perspective of secondary school and university students using the method of the semantic differential to assess opinions, attitudes and values on a scale related to the semantics or meaning of words, particularly adjectives, and their referent concepts. They focus on the ideas pursued by different groups of students and the fact how they evaluate

their current teachers in the educational context, considering especially the role of the teacher, desirable qualities of the teacher, their professional preparation, etc. Some studies also attempt to provide a view related to measuring pupils' attitudes toward various school subjects (Pavelková, Škaloudová, 2008). In such studies, the respondents are asked to choose where their positions lie on a scale between two bipolar adjectives (for example: «Adequate-Inadequate», «Good-Evil» or «Valuable-Worthless»).

The current survey community was chosen deliberately as both authors had graduated from the mentioned school and as they share the opinion that Polish national minority including the only Polish grammar school shows absolutely unique characteristics both in terms of educational, sociological and psychological issues(Kostelecka, Jancarik, 2013). It has been proved that the parental level of education has a significant influence on the education level of their children. (Fischer and Lipovska, 2013). In the case of Polish grammar school, majority of students´ parents are graduates of the school themselves and attained the tertiary level of education.

The article deals with the specifics of communication surroundings in school taking into consideration its culture and sociological aspects, and using the method of the Semantic Differential investigates the scale of the span between the concepts of ideal and real teacher in terms of his/her knowledge, communication skills, and personality qualities. The paper involves the results of the first part of the questionnaire research, the other one – the questionnaire survey conducted in Czech secondary schools -will be the topic of another paper. The authors expect that there will be numerous differences between Polish and Czech students related to value attitudes, and also in the area of thinking critically and displaying it in changing social circumstances in terms of specifics of minority education system in Těšín Silesia (Weber, 1968).

Materials and Methods

The Semantic Differential measures people's reactions to stimulus words and concepts in terms of ratings on bipolar scales defined with contrasting adjectives at each end. The method belongs to psycho-semantic ones investigating individuals´ attitudes in the system of positive and negative evaluation. Each attitude involves cognitive, emotional and conative aspects.

The method originally developed by C. Osgood is based on locating a concept on a scale in the multidimensional semantic space. The poles of the scales are represented by pairs of adjectives with the opposite meaning. The Semantic Differential enables to measure connonative meanings of the concepts and to facilitate an insight into the individual´s inner world. Acquired data can be statistically processed using qualitative and quantitative approaches and classified in several ways – an analysis within an item, an analysis based on evaluation of global similarity, and an analysis related to specific dimensions. The risk of the method can be seen in the relevance of adjectives.

According to Heise (1970) the Semantic Differential D methodology involves several basic aspects:

- Bipolar adjective scales are a simple, economical means for obtaining data on people's reactions. It is possible to use them both with adults, children coming from any culture.
- Ratings on bipolar adjective scales tend to be correlated, and three basic dimensions of response have been found - Evaluation, Potency, and Activity (EPA).
- Some adjective scales are almost pure measures of the EPA dimensions; for example, good-bad for Evaluation, powerful-powerless for Potency, and fast-slow

for Activity. Using them, it is possible to get reliable measures of a person‘s overall response to something.

The most important general contribution of the Semantic Differential is the provision of a single attitude space for all stimuli. This permits analyses, comparisons, and insights that were impossible with traditional instruments (Heise,1970).

As Vašťatková and Chvál (2010) state that the method of the Semantic Differential in applicable is the measurement of pupils´ attitudes towards particular concepts of educational reality (Brožová, 2011). The comparison of the data obtained in the form of anonymous feedback is a valuable source of information for school self-evaluation.

The questionnaire based on the semantic differential was translated into the English language for the purpose of this article and was distributed to the students of the 1st and 3rd years at Polish Grammar School in Český Těšín in the school year 2012-2013. It comprised two versions – an ideal teacher and a real teacher, each of them consisting of a set of 18 items divided into the following three parts: the area of teachers´ facilitating knowledge and skills, their communication competence and their personality. There were two basic sets in the survey – the sample of the 1st year students with the size of 50 and the sample of the 3rd year students with the size of 100. These samples were compared in terms of the students´ attitudes to the concepts of ideal and real teacher.

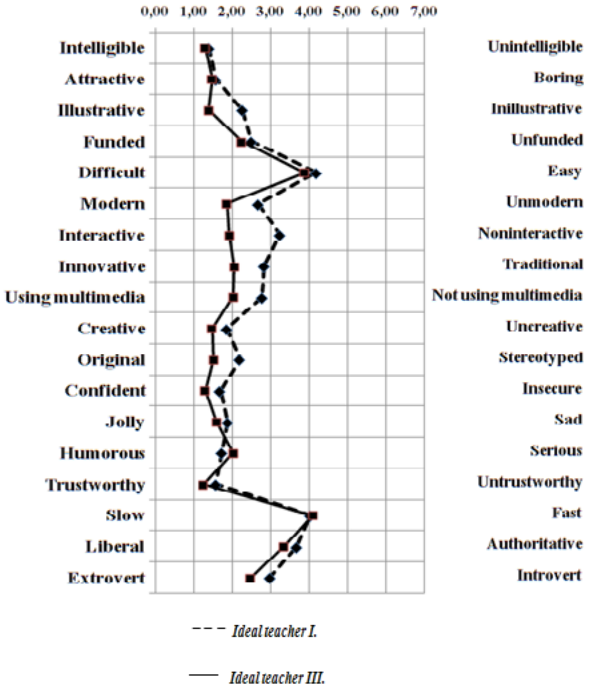
Results and Discussion

The results of the survey and their description is limited only to the most interesting charts related to the set of the 1st and 3rd year students at the mentioned above Polish grammar school and differences in their expectations in the case of ideal teacher and real existing teacher. In the future, the survey should be extended to the second grammar school existing in the town of Č.Těšín – to Czech grammar school. It is possible to estimate that the students´ attitudes towards the concept of ideal and real teacher might be different.

The first graph presents results related to the concept of the *ideal teacher* from the point of view of 2 groups of students attending the1st and the 3rd year. It is possible to state that there are significant differences in the value attitudes of the mentioned groups. The 3rd year students emphasized illustrativeness, which is probably connected with the need to focus on the specialization related to the future study or profession. The value linked to the dimension of *modern-unmodern* is higher due to the opportunities of comparison with other educational programmes, for example within the European programme Comenius enabling students to travel abroad.

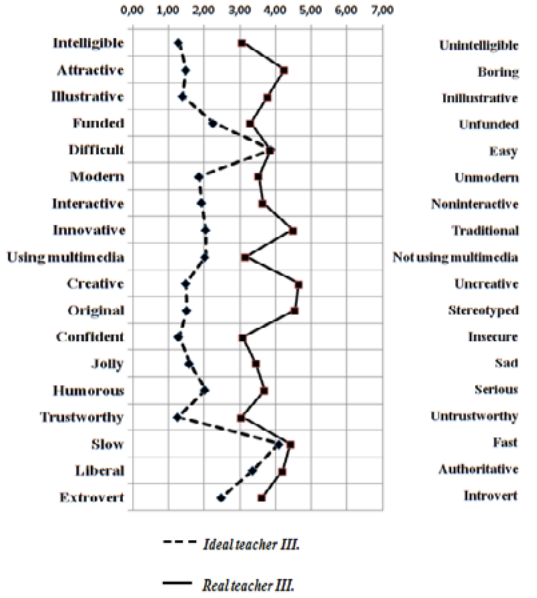
In the area of communication skills, the 1st year students appreciate values related to the dimensions of *interactive, innovative, using multimedia, original,* which is apparently connected with the idea of primary school pupils that education in secondary schools should be on a higher level.

In the area of personality qualities, the mentioned two groups´ values were similar to each other. Both of them prefer the dimensions of *trustworthy* and *extrovert.* The question is whether these qualities are generally accepted ones or required in the society. The dimensions of *liberal* and *authoritative,* as well as *slow* and *fast* are balanced, which is probably connected with students´ capacity to study.



Tab.1: Graph related to survey results - ideal teacher I and III

The following graph shows interesting findings comparing the value attitudes in the group of the 3rd year students comparing the concepts of *ideal* and *real* teacher.
It indicates that the two curves, in most points very similar to each other, meet each other only in two dimensions – the first one related to the concept of *difficult - easy* and the other one about the dimension connected with *slow - fast,* which means that in these dimensions students´ expectations in case of ideal and real teacher are very close to each other. However, huge differences are visible in the dimensions of *attractive - boring*, *interactive – non-interactive*, *innovative - traditional, creative - uncreative,* and *original - stereotyped.* Presumably, the notified discrepancies show that in the real-life situations teachers tend to be boring and non-illustrative, non-interactive and traditional rather than innovative, and uncreative and stereotyped. These findings seem to be significant for the quality of education. It is also necessary to point out that most of the mentioned dimensions belong to the second part of the questionnaire related to teachers´ communication competences.



Tab2: Graph related to survey results – ideal and real teacher I and III

Conclusion

The article presents value attitudes of students studying at Grammar School with Polish language of instruction in Český Těšín, related to the concept of *ideal teacher* and *real teacher.* The authors presumed that bilingual individuals have better conditions for developing creative and critical thinking than monolingual ones. The next step of the research will focus on Czech secondary schools with the following comparison of collected data. The recommendation to the headmaster and teachers of the school would be focusing on an analysis related to the dimensions where the curves were the most remote from each other, i.e. the area of communication competences. The authors´ recommendation also includes implementing Semantic Differential method in other surveys related to students´ value attitudes. The authors expect that there will be numerous differences between Polish and Czech students related to value attitudes, and also in the area of thinking critically and displaying it in changing social circumstances.

Acknowledgments

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LANGUAGE COMPETENCE AS ONE OF THE KEY COMPETENCES IN THE EU

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Abstract

In the current globalized society languages and multilingualism play a major role not only in communication with people, mutual understanding, mobility, etc. but also in economy and its development. The long-term objective of the strategy of the EU is that every citizen is able to communicate at least two languages in addition to his/her mother tongue. Language competence belongs to priorities of educational establishments in EU countries. The article aims at analysing selected statistical data obtained from Special Eurobarometer 386, containing the most comprehensive accessible material on language competency within the European Union, and at comparing the findings with an additional survey undertaken in the group of undergraduates of Silesian University in Opava, School of Business Administration in Karvina.

Keywords

European educational policy, foreign languages instruction, language competence, multilingualism

Introduction

The growth of unemployment and difficult employability of graduates of secondary and tertiary educational grade are leading to creation of new European strategic vision in education. Beside European benchmarks focused on lifelong learning and tertiary education, the European policy is being developed in the framework of mobility, employability, and foreign language competencies. In our paper we will deal with competencies in foreign languages (further FL) in European context. It can be assumed that in relation to the sharp development in all the branches, the knowledge and skills gained at school will not be so important, but the emphasis will be put rather on the ability to learn new things quickly, on language skills, computer literacy and wider general basis (Lepič, Koucký, 2012). The importance of increasing language skills and provision of opportunities to gain and develop key competencies for all EU citizens are as well emphasized within the second pillar involving improvement of the quality and efficiency of education and vocational education and training (*Czech Priorities for Europe*, 2010). In priorities for the period of 2009 – 2011, beside others, FL study is mentioned with emphasis on the goal that all citizens of the Czech Republic (further CR) were able to speak two FLs (p. 8). It should be also added that the inadequate level of graduates' language abilities was criticised (*National Institute of Technical and Vocational Education*, 2004).

In European education system the attention is paid to competencies. They are often connected with attributes of key, professional or specific competencies. Their formation overlaps the present and future European educational systems as they will play a crucial role in formation of an individual adaptation to changing life and professional situations. Belz and Siegrist (2001) classify key competencies according to the approach to them.

It is possible to take a cognitive approach, or consider activities which are connected to competencies or aspect oriented to the society. The starting point for clarification of the notion of competence should be notions of cognition and cognitivity. Cognition poses an aggregate of operations and processes by means of which a man realizes the world and oneself, and learns about them. Cognitivity means recognizing, comprehension, reasoning and level of knowledge. According to Skrabankova (2009) it involves a sequence of *comprehension - judgement - conclusion - ability to solve problems - ability to criticise - reflexivity*. The author Skrabankova regards Hegel as a predecessor of such comprehended behaviour, namely in his cognitively theoretical presumptions of behaviour.

The meaning of the concept of competence is mostly defined as being able to perform effectively. Mulder (2011: 3) defines competence widely as 'the set of integrated capabilities which consist of content related clusters of knowledge, skills, and attitudes, which are conditional for sustainable effective performance (including problem solving, realizing innovation, and creating transformation) in a certain context, profession, organisation, job, role and situation'. As for language competence, in the Free dictionary it is understood as 'knowledge of a language that a speaker possesses and which enables him/her to produce and understand the language' (2014). The distinction of competence and performance was also tackled by a linguist Chomsky (1965) as a basic methodological tool for linguistic research. According to the author everyone has an innate property to master any grammar of any language – which relates to competence – it is unlimited possibility of creating new sentences of a given language, i.e. ability to use a language, mental knowledge of language itself. On the other hand, performance is a summary of real particular sentences of a speaker. The theory reminds the Saussure´s distinction langue/parole (Černý, 1996). However, linguistic performance does not simply reflect the intrinsic sound-meaning connections established by the system of linguistic rules. It involves many other factors, such as extra-linguistic beliefs concerning the speaker and the situation.

Recently competence is also dealt with in the Czech curriculum in introducing general educational programmes; see e.g. Lokajíčková (2013).

It is generally agreed that within language instruction a holistic approach should be applied, i.e. it should not include only language development in sense of the four language skills, reading, writing, speaking and listening (in whatever order) considering also lexis and grammar structures all of which could be included into language competence. Developing communicative competence is connected with more other skills concerning areas such as identifying one's own goals and plans, organising learning, finding one's resources, developing decision making skills and creative thinking, problem solving, critical evaluation, intercultural awareness, empathy, understanding different cultures and value diversity, global problems, etc. It may be said that all these, and many more should enable holistic personality development of the learner. It is possible to characterise the communication competences within: linguistic competence (comprising grammatical competence, semantic competence, phonological competence, lexical competence, orthoepic competence, orthographic competence); sociolinguistic competence (including linguistic markers of social relations, politeness, conventions, expressions of folk-wisdom, register differences, and dialect and accent); and pragmatic competence (concerning knowledge of the principles according to which messages are organised, structured and arranged, then used to perform communicative functions and sequenced according to interactional and transactional schemes, discourse competence, functional competence, design competence). It should be stated that to a certain extent, all of these contribute

to meeting the goals of the language instruction, and subsequently the professional competence.

The current language situation in Europe with regards to competencies is outlined based on official data from the Report mentioned above in which the matters of multilingualism in current Europe, language use, attitudes towards language use, learning and improving language skills, effective and efficient learning methods, EU citizens' attitudes to multilingualism have been analysed. Currently, 23 official languages are recognized in the EU, beside these other 60 regional and minority languages are also spoken there. The policies adopted by the EU towards languages concern especially raising their importance and standards, their further dissemination, developing interest in FLs, and also ensuring that Europeans are provided with information in their own language.

The findings of the research conducted in EU (2012) show that as for mother tongues in Europe, they are in agreement with population, e.g. 16% of citizens use German, which is the most widely spoken mother tongue, after come English and Italian with 13% each, followed by French with 12%, and Spanish and Polish with 8% each. It has been also found out that for the majority of European citizens their mother tongue belongs to official languages of the country they live in. 54% of respondents are able to communicate in at least one other language, a quarter (25%) can speak at least two other languages, and 10% can use at least three languages. According to the findings, to the countries whose biggest proportion of inhabitants speaks one FL at least belong Luxembourg (98%), Latvia (95%), the Netherlands (94%), Malta (93%), Slovenia and Lithuania (92%), and Sweden (91%). On the other hand, less than a half of citizens are not able to communicate in a FL at all, to the countries belongs the Czech Republic (51%), Romania (52%), Bulgaria (52%), Spain (54%), Ireland (60%), Great Britain (61%), Portugal (61%), Italy (62%), and Hungary (65%). As can be seen, the poorest language competencies appear especially in the countries which were part of Eastern bloc or belong to the countries where a world language is spoken so they do not feel a need to learn a FL. In CR studying FLs except Russian was not desirable and so older generation did not develop language skills at the required level. The research shows that in CR English is spoken by 27% respondents, then Slovak by 16% and German by 15%. Concluding, it may be stated that the Czech results are very poor and not satisfying the requirements of the EU policy – every citizen should speak two FLs at least. However, in this respect only 8 countries meet the long-term objective, i.e. Luxembourg (84%), the Netherlands (77%), Slovenia (67%), Malta (59%), Denmark (58%), Latvia (54%), and Lithuania with Estonia (53%).

It seems that only a few European countries have adopted systems of language education that promote proficiency in many languages. The situation indicates that the role of educational policies at national levels remain crucial in language education.

The article aims at analysing selected statistical data obtained from Special Eurobarometer 386, containing the most comprehensive accessible material on language competency within the European Union, and at comparing the findings with an additional survey undertaken in the group of undergraduates of Silesian University in Opava, School of Business Administration in Karvina. Concerning the analysis method, at first selected data from the EU level, focusing in particular on the frequency of FL use, opportunities in which a FL is used and barriers to learning are presented, after the aspects under discussion are analysed from the point of individual countries and compared to the findings about SUO respondents. For pragmatic purposes, only 3 the most illustrative tables are included in the article.

As far as assumptions, it is believed that the findings will show that young generation

(SUO students) will cite more frequent FL use, in more opportunities and recognise the benefits of FL competence to a larger extent. As well it is expected that in the given student group, English will dominate among other FLs.

Materials and Methods

The paper aims at analysing selected statistical data obtained from Special Eurobarometer 386, which deals with language strategies of the European Union, focusing at first on the specifications of some of the former countries of the Eastern part, namely the Czech Republic, Poland and Slovakia, neighbouring countries with similar recent FL history, and also on comparing the findings with an additional survey undertaken in the group of undergraduates of Silesian University in Opava (further SUO). The former EU survey was carried out in 2012 when 26,751 EU respondents from different social and demographic groups were interviewed. It belongs to one of the most extensive research which has been done. It contains the most comprehensive accessible material, which can be a starting point for comparative studies as it comprises data acquired from 29 European countries. According to the Report about Europeans and their languages (2012), this survey has been carried out to map and assess FL situation in EU, tackling the overall European citizens' language experiences and perceptions of multilingualism. As well as spoken ability, the study examines the level of understanding and use of other languages, learning behaviour, attitudes towards learning or improving language skills, perceptions of the most useful languages, views on EU policy in relation to language use and the role that translation has. The primary research was conducted in groups of 648 students, aged 19-23 years, attending language courses in the SUO, School of Business Administration in Karvina. All the first and second year students were delivered adapted questionnaires in Czech, based on the questionnaire from Special Eurobarometer 386. The obtained results are compared with those which are mentioned in the Report of Special Eurobarometer 386. It should be noted that the SUO respondents study various programmes focusing on enterprising: Economic Policy and Administration, Economics and Management, Hotel Management and Tourism, System Engineering and Informatics. Thus, a FL does not belong to students´ field of study; however, they are aware of the importance of a FL competence especially in terms of a mobile workforce which is the key to the competitiveness of the EU enterprises, their future potential employers.

The language input is at the level A2 even if the students have been doing the language for about 10 years and more on average. The output should reach B2 (for detail see Hejtmánková, 2011). One FL, which is taught for four semesters in the first, second and third years, is compulsory for all undergraduates. The department offers two languages, i.e. Professional English 1,2,3,4, which is chosen by the majority of students, and Professional German 1,2,3,4. In some specialisations, e.g. Hotel Management and Tourism, two languages are compulsory.

Results and Discussion

In the following part the attention is drawn to the research results illustrating especially FL use frequency, opportunities for use and barriers to learning a FL. The overall results concerning EU citizens, then in the individual countries, i.e. CR, Slovakia and Poland, and university respondents' findings are discussed. From the overall findings it follows that 25% of European inhabitants use a FL every day or almost every day, 30% of respondents often communicate in a FL, 69% of respondents use a language occasionally, 2% of respondents do not know or give an answer. Countries in which people speak a FL daily

or almost daily are the following: Luxembourg (67%), Malta (49%), Lithuania (44%) and Spain (44%). Further we will concentrate on how often people use a FL in CR, Slovakia and Poland in comparison with SUO students. From Table 1 below, it follows that FL use in the given countries is deeply below average. At the same time it is interesting that inhabitants in CR use a FL less than those in Slovakia. Similar results have been achieved in CR and Poland; 10% of Czech and 11% of Polish use a FL daily or almost daily. The same results (29%) can be seen in the answer often, but not every day in CR and Slovakia, on the other hand, it is only 24% in Poland. As for using a FL occasionally, the results have been 60% for Czechs, similarly 59% for Polish and a little less 51% for Slovaks. If we take into consideration university respondents, we can see that daily use is the lowest 8%, however, only by 2% lower than results in CR, and the same difference 2% is true for often use, and occasional use is balanced to a certain extent.

Country	Daily	Often	Occasionally	I don`t know
CR	10%	29%	60%	1%
Slovakia	18%	29%	51%	2%
Poland	11%	24%	59%	6%
SUO	8%	27%	59%	6%
EU	24%	23%	50%	0%

Tab. 1: How often do you use a FL?

From the table above it follows that use of FLs of SUO students is the lowest in daily and often use, on the other hand it is similar to occasional use.

Observing the EU inhabitants speaking a FL and disregarding the frequency, it can be stated that the majority uses English (47%), followed by German (37%) and Spanish (also 37%). French is spoken occasionally by 22% of respondents, and 22% of respondents use Russian more than occasionally. According to Eurobarometer the most used FL is English, after German, Spain, French, and Russian out of these mostly French and Russian are used occasionally. Similar results are achieved by the Czechs and SUO students´ in terms of the FL sequence; however, the numbers are quite different. The findings of SUO students show surprisingly that they speak English the most often (92%) compared to 27% stated by the Czechs. The second most widely known language is German in both the groups, with 15% result given from the Czechs but surprisingly only 6% given by students although more than one half (62%) have studied German during their school attendance. English is also reported by 83% of the students to be the most useful language for EU citizens, followed by German (12%). Other languages are spoken very rarely by the students. Among languages SUO students have ever learned, English is mentioned by 96%, after comes German (62%), and Russian (16%) with French (14%). Concluding the issue, the findings prove domination of English in all the groups in question.

Further, let us look at opportunities in which a FL is used. One third of European citizens use a FL regularly when watching films on TV or listen to the radio (34%), on the Internet (34%) and communication with friends (31%). One quarter uses a FL at workplace (25%), 24% of respondents read books, newspapers, and magazines in a FL. However, FL use on holiday has reached the highest number (46%). The next results for the groups under discussion are illustrated in Table 2.

Opportunity	Country/university				
	CR	SUO	Slovakia	Poland	EU
Holiday abroad	56%	63%	37%	32%	45%
Watching films /TV, listening to the radio	37%	72%	58%	24%	34%
On the Internet	31%	70%	31%	28%	34%
Communicating with friends	35%	26%	39%	21%	31%
Communicating at workplace/school	23%	14%/63%	19%	16%	25%
Reading books/ newspapers/ magazines	22%	22%	40%	10%	24%
Communicating with family members	10%	10%	14%	5%	16%
While learning foreign languages	21%	69%	17%	19%	12%
On business trip	12%	1%	11%	12%	10%
While learning something else	7%	49%	8%	4%	9%
Other opportunity	3%	2%	2%	3%	4%
I don`t know	0%	0%	1%	6%	1%

Tab. 2: When do you regularly use the first FL?

Comparing the results with those of our groups, it can be seen that the Czechs use a FL on holiday abroad in 56%, and SUO students reach above-average result 63%, i.e. by 7% higher than Czech respondents which could also mean that the students in general travel more often. However, the highest number by the SUO undergraduates is achieved in watching films /TV and listening to the radio (72%), after using the Internet (70%), and naturally, learning foreign languages (69%) while citizens of CR, Slovakia and Poland reported average or quite poor results, e.g. from the lowest 24% in Poland to 58% in Slovakia. We can see that the Czech respondents results are different from SUO students´ ones especially in the opportunity of learning foreign languages by 48%, learning something else by 43%, working on the Internet by 39% and watching films / TV, listening to the radio by 35%. The results show quite a big difference by almost 40% between SUO and other respondents, which apparently arises from the students' role. Similarly, the difference in use in business trips about 10% follows from the same issue. The same results by both the Czech groups are obtained in opportunities of reading books/ newspapers/ magazines (22%) and communicating with family members 10%.

Summarizing the point, it should be taken into account that excluding 63% use on holidays, the students use a FL passively, e.g. watching films /TV, listening to the radio or using the Internet. However, the findings are quite satisfactory, and indicate the necessity that language teachers should concentrate on skills development which leads to active FL use. In the question concerning a barrier to learning another language, all the Europeans mention a lack of motivation (34%), around a quarter (28%) mentions lack of time, and 25% cite that it is too expensive. The other results outlined in Table 3 point to the fact that Polish have quite lot opportunities, only 10% of respondents cite lack of opportunities; on the other hand, SUO respondents miss opportunities surprisingly in 41%. Lack of motivation is reported as the highest in Slovakia 58%, whereas in Poland the number is the lowest (31%). The big difference between the two Czech groups can be seen in inappropriate methods (35%) and the lack of opportunities (21%). It is clear from the answers that SUO students and also Czech respondents might be the least self-confident

in foreign languages as one third of them think that they do not have talent in languages, whereas only 17% of Polish think that they are not talented. As for lack of time, only 10% of the SUO students report it as a barrier, other findings are balanced. Relating to price, there are not big differences (from 27% in CR to 38% in Poland). It has also been found out that SUO students are the most critical as methods are concerned, 38% of them think that used methods are poor.

Barrier	Country				
	CR	SUO	Slovakia	Poland	EU
Lack of opportunities	20%	41%	19%	10%	16%
Lack of motivation	41%	38%	58%	31%	34%
Lack of language talent	33%	34%	29%	17%	19%
Lack of time	22%	10%	23%	20%	28%
Price	27%	34%	29%	38%	25%
Inappropriate methods	3%	38%	11%	5%	8%
Idleness	-	63%	-	-	

Tab. 3: What may discourage from learning a FL?

In our research, only SUO students were provided with the last option if idleness may be discouraging from learning a FL. On the one hand, the high number (63%) implies how they are critical of their performances, on the other it may be considered as a positive point as we can be optimistic about the future after students change their attitudes to FLs, their language competence will develop.

Conclusion

The paper focused on exploration of European attitudes and behaviour in relation to key language competencies providing an analysis of selected data from the survey carried out by European Commission, and of findings obtained in a survey conducted in Silesian University in Opava. It may be stated that Europeans have positive attitudes towards multilingualism; however, language competencies still need to be developed. The findings clearly show that English dominates among other languages in Europe. In terms of opportunities where respondents can use FLs, it has been found out that they are used especially abroad on holiday, but also when watching films/television or listening to the radio, using the Internet, communication with friends, and learning a FL. The findings show that SUO students utilize the opportunities of FL use much more than average Europeans, in particular when watching films/television or listening to the radio, using the Internet.

The findings imply that the majority can use a FL, however, mostly in its passive form. As for the barriers to learning another language, a lack of motivation was mentioned by a third, around a quarter mentions lack of time, and cites that it is too expensive, for SUO students, inappropriate methods, lack of opportunities and talent as well as idleness are discouraging from developing language competencies. On the one hand, particularly the high number (63%) mentioned in the item of idleness implies how they are critical of their performances, on the other it may be considered as a positive point. Thus, we can be optimistic that in future after students change their attitudes to FLs and are more motivated

when creating their career, they might satisfy the demands put by the EU Commission to be able to speak at least two foreign languages in CR. In spite of the fact that educational establishments are short of money, the authors are convinced that it is necessary to include FL instruction in the university graduate profile as compulsory subjects. Without any doubts, nowadays, in the international background, business students will probably need two FLs at least in their professions. The analysis has confirmed that undergraduates are aware of the needs and demands for language competencies which may be the first vital step for FL learning. In future it is intended to carry out a survey which will explore language competencies of SUO students in comparison with their attitudes to multilingualism.

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EVALUATION OF STUDY SUPPORTS USED IN TEACHING FINANCIAL ACCOUNTING

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Abstract

Teaching financial accounting at universities can not do without teaching aids, or more precisely study supports. This paper aims first to characterize the teaching aids used in teaching financial accounting at the FEK UWB Pilsen in the Czech Republic, then to define which of them fulfil the criteria of study supports, present the results of research focusing on the evaluation of these supports, and finally to inform about innovations being prepared in the supports at FEK UWB in Pilsen. The paper presents partial results of the research conducted in the 2012 - 2013 years through a questionnaire survey. This survey pointed to the fact that students prefer professional books to e-learning, it also defined the advantages and disadvantages of the two study supports and characterized ways in which students solve a situation when their study aids fail to provide them with complete or adequate information necessary for understanding the issues.

Keywords

Accounting, e-learning, questionnaire, teaching, textbook

Introduction

Education is realized with the help of different and varied means acting both intentionally (directly, deliberately) and functionally (indirectly, inadvertently on the educated individual). Educational means are understood as one of the factors of the educational process, mediating the interaction between the educator and the educated individuals (Stojan, 2003). Study supports are currently becoming a specific form of educational means. These are support study texts, intended not only for the distant form of learning, which contain information arranged in a logical and clear structure.

Texts of study supports are didactically designed to facilitate learning to the maximum degree possible. This means that the curriculum is presented evenly and after each part there are feedback elements checking the students´ understanding of the topic and also their skill to process it actively. The text itself is amply graphically structured and includes problem assignments and questions (Nezvalová, 2007). Nezvalová (2007) lists the main differences between traditional textbooks and study supports, see Table 1:

Features	Traditional textbooks	Study supports
Function	To complement the full-time study	To complement the module presentation and allow self-study
Goal of the text	Only for the author, as a rule it is not stated	Both for the author and readers
Flow of the text	Often uninterrupted	Short paragraphs, division of the text
Language of the text	Complex language, foreign words are used	Clear language, short sentences, activation
Graphics	Illustrative, complementary	It guides the reader and plays a key role
Activity	Only reading, passive reception of information	Reading, active learning, task solving
Fixation	Low, rarely there are questions at the end	Higher – leads to revision, questions are in the text, feedback
Motivation	It is presumed	It tries to arouse students´ interest

Tab. 1: Characteristic features of texts of study supports

A properly prepared study support contains text that is interlaced with pedagogical tools in such a way that students would not be tired of one predominant activity. (Danihelková, 2013). Study supports can take various forms: electronic (usually this is e-learning) or written (book, paperback).

Numerous authors are currently dealing with the issues of study supports. Especially e-learning is a current topic and it represents an individual conference section at educational conferences. Such an example might be Popelková (2013), who deals with evaluating the impact of e-learning on students´ study results. The negative aspects of e-learning in tertiary education are published by Jabor at al (2013), who addresses himself to obstacles to the application of e-learning (e.g. due to the resistance of teachers to the implementation of e-learning).

However, this paper has been inspired by Kuncová (2013), who evaluated the e-learning system at the College of Polytechnics Jihlava, or Jindrová at al (2013), whose paper assessed the e-learning at the Faculty of Economics and Management of the Czech University of Life Sciences in Prague using a questionnaire survey. The last-mentioned paper states: "The analysis of the survey generally shows that the students commonly have a positive attitude to the e-learning support of the classical courses. The e-support is mostly taken as a source of information, a container of texts, pictures and videos. It also serves as a direction sign for the self study. It enables the student to understand better the content of the subject, continuities and relations."(Jindrová, 2013) This statement gave us an idea to examine whether in the financial accounting courses at the Faculty of Economics, University of West Bohemia in Pilsen (FEK UWB in Pilsen) students also manifest a positive relation to e-learning, or more precisely whether they prefer e-learning to other teaching aids.

The aim of this paper is first to characterize the teaching aids used in teaching financial accounting at the FEK UWB in Pilsen, then to define which of these aids fulfil the criteria for study supports, to present the partial results of the research focusing on the evaluation of benefits of these study supports and finally to inform about innovations that are prepared in the study supports at FEK UWB in Pilsen.

As part of the research, whose results will be presented in the paper, the following hypotheses were defined:

1. The applied professional books including solutions to the examples and case studies will come first in the hierarchy of teaching aids within the framework of financial accounting, as they contain both theoretical instruction and practical skills training and students evaluate them positively over a long period.
2. Students will be able to determine the pros and cons of each study support.
3. In case where the study support fails to provide students with complete or adequate information necessary for understanding the issues, students will primarily use consultation of the teacher.

The confirmation or refutation of these hypotheses will contribute to the efficiency of financial accounting education.

Materials and Methods

In order to accomplish the goal set above, it will be necessary first to define teaching aids used in teaching different financial accounting courses at the FEK UWB in Pilsen by the description method. The following can be regarded as such teaching aids:

a) accounting software – for practical application of accounting using computer technology, both the accounting software designed for financial reporting of small and medium-sized enterprises is employed and since 2013 a course specializing in financial reporting of large companies trading on stock exchanges has been taught; in this course students learn how to use accounting modules of SAP.

b) university textbooks, professional books and monographs containing or summarizing the issues of lectures - in addition to lecture textbooks, a number of monographic publications of the members of the Department of Finance and Accounting of the FEK UWB, which were published in the publishing houses with the scientific editorial board, can be assigned by their content to individual courses. These publications are used to get a broader view on the topics covered in the syllabus of accounting courses.

c) Applied professional books - a publication that always follows the syllabus of the given course is available for each course taught by our Department. Each chapter comprises the theoretical and applied parts along with solutions to the examples and case studies, which are given especially for students of the combined form of study. The most extensive applied professional books are written for the courses Accounting I (Hinke and Bárková, 2011) and Accounting II (Hinke and Bárková, 2010), as these are compulsory courses for all students of the bachelor study programmes.

d) E-learning courses - e-learning is used for most courses of the full-time study programmes as well as the combined form of study at the FEK UWB in Pilsen. All students have access to the e-learning applications of courses for which they have registered in the given academic year.

e) Informative portal “Courseware” – To support teaching at the university, the informative portal Courseware has been introduced. It is a portal where, for example, general information about courses, updates, schedules of lectures and exercises, assignments of individual works, information on credit and exam tests including illustrative tests, a list of basic and recommended literature and information for students of the combined form of study are published in the system of bookmarks for individual courses. This portal also includes an option of discussion in the form of chat between students and teachers. The basic information published on the Courseware is updated and innovated by the

respective guarantors before the start of the academic year; however, the updates may be published, specified and changed at any time. The portal aims to reduce the number of organizational questions asked by students; it is used to store complementary teaching materials, to facilitate communication between teachers and students and, above all, to provide the full-time students and especially students of the combined form of study with the comprehensive information about their courses. However, the information on courses is not fully accessible to all those interested. Without login the system, only general data on courses and study materials can be obtained. Similarly, when entering materials by teachers, they can select whether the materials will be available to all the logged students, or only to those logged and registered for the course. The time period of publishing the document or message can also be set.

f) Assignment of consistent examples and seminar papers and their elaboration model - in all courses in financial accounting students are required to work out a separate example (individually or in a group). A consistent accounting example is elaborated individually in the course Basics of Accounting, which means that students draw up a balance sheet on the basis of the given balance sheet items and then they choose at will any five economic operations that they enter in accounts, prepare final accounts and draw up financial statements. Students work out the most extensive individual paper in the course Accounting for Entrepreneurs (UC1), where based on specified accounting documents of a limited liability company students draw up a journal, nominal ledger and subsidiary ledgers (as needed), process payroll of employees, take an inventory, close accounting books, draw up a financial statement and fill in a corporation income tax return. An individual work in the course Advanced Accounting (UC2) reflects the opposite direction of teaching. Students´ task is to present a financial statement of a selected company, i.e. they must prove that they are knowledgeable in the already-compiled financial statements of the chosen accounting entity. As for the course Accounting Using Computer Technology (UC3), students´ individual work is to draw up documents (both external and internal) which serve as materials for working with the accounting program in classes. Topics of individual works are assigned operatively in the courses Accounting 4 (UC4) and Accounting under IAS/IFRS (UC5) so as to respond to topical issues in the area of Czech legal regulations, the IAS/IFRS, US GAAP, the convergence process, etc. This method of assigning tasks ensures the students´ insight into current events.

The comparative method was used to compare the specified teaching aids with the characteristic features of study supports mentioned in Table No. 1. It resulted in the finding that only two aids, e-learning courses and theoretical-applied professional books fulfil the criteria for study supports. For this reason, these aids constitute the core study supports for students, especially of the combined form of study.

In order to achieve the aim of this paper, the results of the research focusing on the evaluation of the benefits of study supports and also the innovations which are being prepared in the study supports at the FEK UWB in Pilsen are presented below.

The paper presents the results of the research which was conducted through a questionnaire survey. The basic sample of respondents consisted of 140 students enrolled in the full-time and part-time master´s studies at the Faculty of Economics UWB in Pilsen. The total number of returned questionnaires was 133. A high rate of questionnaire return amounting to 95% was attained thanks to the guarantor´s appeal (in the course Accounting UC5) to

the students´ participation in the research. The questionnaire survey was conducted in the full-time form of study in the 2012 – 2013 period. The answers to the questions were anonymous. The questionnaire was composed of a total of 15 mostly semi-open questions divided into three parts. The sequence of questions was determined. The first part of questions resulted in the identification of the respondent (whether he/she was a man/woman, whether they graduated from a secondary school specializing in economics or not). The second part of the questionnaire was focused on teaching aids. As for the second part, the popularity hierarchy of all available teaching aids and the identified positives and negatives of the two study supports mentioned above are presented. The questions of the third part dealt with the issues of self-study. With respect to the stated hypotheses, only the evaluation of the question finding out how students solve a situation when the study supports fail to provide them with complete or adequate information necessary for understanding the issues was chosen from the third part of the questionnaire.

Results and Discussion

To determine the popularity of all the above-defined teaching aids in the courses of financial accounting among students, the respondents had to define a study aid that they would prefer in their study and then they had to enumerate other aids provided that the above-mentioned was not available. The popularity of aids was scored and on the basis of the total score the following order was determined:

1. theoretical-applied professional books containing solutions of examples and case studies,
2. case studies (including solutions),
3. theoretical textbooks of accounting (lecture textbooks),
4. e-learning supports,
5. the others (In this question the students were required to suggest other possible study aids. They proposed the following: joint discussions and workbooks without the key to exercises; Courseware is not perceived as an individual study aid).

It is evident that as for the teaching aids for accounting the students most prefer professional books including examples and case studies along with their solutions. A considerable proportion of respondents would also welcome separate case studies. The e-learning comes third in the popularity hierarchy and particularly workbooks without solutions come last. The respondents further state that they would appreciate more detailed studies based on the analysis of legal regulations.

Within the open-ended questions in the questionnaire survey also the pluses and minuses of both defined study supports were determined.

a) The pluses of professional books: their use is not limited by time, place of study or the internet connection; the book is, at least partly, also used in direct tuition to verify communicated theses; students are accustomed to studying from books; book is readily available also for the short-term study or immediate verification of knowledge.

b) The minuses of professional books: if the professional book is not updated every year, i.e. it is not reissued, it is, due to turbulent changes in accounting and taxes, highly likely that it will contain outdated information. Another disadvantage is the acquisition cost of the book.

c) The pluses of the e-learning study support: an unlimited possibility to change the content of this study support should ensure higher currentness of information; e-learning courses are free of charge; as for the technical side, the e-support can

ensure proper procedure in study (the necessity to study from the first chapter and to complete all control tasks, etc.) and it may also provide links to other literary sources, etc.

d) The minuses of the e-learning study support: the study is limited by the internet connection; it is not promptly available for the short-term study or immediate verification of knowledge; teachers usually do not use it in their lecture, which constitutes a possible independent relation between the e-learning course and the topic dealt with in direct tuition.

In connection with the evaluation of study supports it is necessary to mention the fact that an essential element in their study is a way of solving problems with the study text. Therefore, the questionnaire survey subsequently examined the ways in which students solve a situation when their study aids do not provide them with complete or adequate information necessary for understanding the issues. The results of this survey are shown in the following chart:

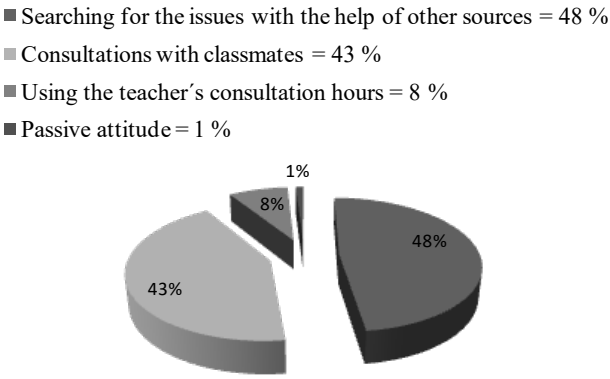

Fig. 1: Ways of solving problems with the studied topic by the students of FEK

The chart above shows that the most common way of learning the given issues is to search for them in other sources (e.g. in other monographic publications and on the Internet). Discussions with classmates are also used very often. However, even after such discussions sometimes the students do completely not understand the issues. At this point, it seems suitable to visit the consultation hours of the teacher or guarantor of the course. However, only 8% of respondents normally use the consultation hours. The students have stated that they first attempt to resolve the problem by themselves, or with their classmates, and even if it does not lead to the clarification of the given subject matter, they first evaluate the importance of the aspect and only very rarely attend the consultation hours of the academic employee that is involved in teaching the respective course. This raises the question of whether students (in various stages of their study of the given issues) are able to assess the significance of the issues which they have mastered poorly (and because of considering them insignificant they give up consultations). Course teachers may contribute to the solution to this problem by reminding students very often the opportunity to consult their difficulties (either in person or via Skype, e-mail, etc.) with discussed topics in direct tuition.

In 2014 partial innovations are being prepared in both of the above-mentioned study supports. Chapters dealing with new problematic topics related to the content of courses are added in the e-learning. As for the course Accounting for Entrepreneurs (UC1), a database of training test questions has been put into this learning system. Preliminary credit tests are generated from this database so that students can try them and check their knowledge. According to the success rate in these tests students may judge whether they have sufficient knowledge to pass the credit tests. An electronic way of tuition is used in the course Advanced Accounting (UC2), which is completed with an examination, and students also take the written part of the exam in the e-learning. The greatest advantage of electronic testing is the fact that it saves your valuable time spent on correcting the written works.

Other regularly performed activities are as follows: innovations of theoretical-applied professional books, especially for the compulsory optional subjects of financial accounting, and creating a new instructional handbook for the course Accounting Using the SAP Program.

As for the other teaching aids, new consistent accounting examples are being created, new and interesting conference articles and papers are presented to students on the Courseware and new accounting software programmes will be implemented.

Conclusion

Education is an essential part of life, whether of children, youth or adults. The aim of this paper was to characterize the teaching aids used in teaching financial accounting at the Faculty of Economics, University of West Bohemia in Pilsen, to define which of these aids meet the criteria for study supports and also to present the results of the research focusing on the evaluation of benefits of these study supports.

The results of the questionnaire survey have shown the preference for theoretical-applied professional books including solutions to examples and case studies. An interesting finding seems to be the fact that most students do not like attending consultation hours of the course guarantor or teacher in case of the insufficient understanding of the discussed subject matter, or more precisely that consultations are the ultimate solution to the situation provided that the student could not find solutions in other sources or with classmates and also found the uncomprehended issues to be sufficiently significant.

Therefore, as for the stated hypotheses, Hypotheses 1 and 2 have been confirmed, while Hypothesis 3 has been refuted.

It is evident that teaching accounting at universities is not an unchanging matter and requires incessant and systematic activity of the whole team comprised of the course guarantor and all teachers. They must respond not only to changes in expertise but, above all, to current trends in education, within which it is appropriate to identify the popularity of individual study supports, their pros and cons.

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EFFICIENCY OF TEACHING CONCEPTS FOR ENVIRONMENTAL EDUCATION

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Abstract

Currently, it is possible to combine many different pedagogical tools and resources to set up innovative teaching portfolios and concepts. In this work we analyse the information and attitudes provided by pupils on a particular topic of environmental education (fair trade) in order to develop original teaching concepts. The core of the work lies on the comparison of learning outcomes among individual concepts to evaluate the efficiency of knowledge transfer reached through the concepts. Using the methods of statistical analysis we proved statistically significant differences among the concepts measured by the results of didactic test after the topic has been taught.

Keywords

Environmental education, teaching concepts, fair trade, didactic test, learning outcomes

Introduction

The opportunity of getting real-time information about a great variety of events eminently rose within the last years. Consequently, the teachers lost their status of prominent knowledge depository, despite the fact that the knowledge and information overlapping is only partial. According to Stan, Suditu, and Safta (2011), the contemporary world is overwhelmed with information and there is not so many people implementing the selection criteria. Recognition of mass media as a standard criterion is often satisfactory for the relevancy consideration on the cognitive level. This means the information is considered as relevant if they appear in newspapers (earlier) or in TV (nowadays). Strategy changes used in education are influenced by turns in recent years, which often reflect in the economic, politic and social standards of people (Mircea, Iuliana, and Paul, 2013). According to (Anghelache and Benţea, 2012), it is necessary not only to change the didactic tools in accordance with contemporary demands, but also to prepare teachers and adjust their attitude to changes in education.

There are many authors dealing with different types of teaching resources used for environmental education. Ruchter, Klar and Geiger (2010) deal with modern computing, mobile technologies and application. Brenner, Shacham and Cutlip (2005) examined the use of mathematical simulation for the pollution of water used in environmental education. Fleming and Easton (2010) deal with the evaluation of online educational program, Luppi (2011) evaluated the effectiveness of e-learning activities in the field of sustainable development, also Ors (2012) focuses the role of the media in environmental education. Kirac, Yildiz and Cobanoglu (2012) critically evaluate the influence of newspapers on environmental ethics. Srbinovski, Erdogan and Ismail (2010) analysed how the curriculum of Turkish and Macedonian literature corresponds with environmental issues. Pedro and Pedro (2010) create teaching strategies that lead to considerate behaviour of high school students to nature and the environment. Macris and Georgakellos (2006) use a knowledge

map based on ontology as a teaching tool for environmental education. On the other hand, other researchers such as Abdullah and Halim (2010) deal with the knowledge levels of teachers themselves, especially in the area of environmental education.
The objective of this work is to evaluate pedagogical efficiency of different teaching concepts for transferring knowledge in environmental education. For this purpose we design a pedagogical experiment to determining the concepts, evaluating the learning outcomes of pupils involved in the experiment. The aim of this paper is to use statistical methods for comparing the outcomes among the concepts.

Materials and Methods

Design of the pedagogical experiment

To achieve the objective above, it was necessary to proceed according to the following six steps, which correspond to the methodology of pedagogical experiment (Chráska, 2011):
Step 1: Selection of problem domain
The aim is to specify the appropriate area for the transfer of knowledge in the environmental education. The area of fair trade was chosen as the problem domain, which extends not only to the environmental field, but also social, economic and others.
Step 2: Experiment 1 and the evaluation of results
Activity used to determine what the pupils' awareness of fair trade and the environment, nature and popular tool for teaching students. The experiment was conducted by stylistic composition (up to 1 standard), when students via the text should focus on selected topics. Evaluation of results: activity, which led to word processing documents (stylistic compositions) text mining methods, i.e. the evaluation of the frequency matrix most commonly used words and statistical evaluation of the knowledge selected problem domain, i.e. fair trade and teaching resources that students like to use for studying.
Step 3: Making teaching aids for environmental education
Making teaching aids: activity, within which were created four teaching concepts (A, B, C and D). Each teaching concept was based on methods that experiment in high school No. 1 came as most popular teaching resources.
Step 4: Experiment 2
Activity at High School, within which the authors visit a secondary school. Students were divided into 4 groups. Each group worked with a different concept (A, B, C and D). Each concept was dealing with fair trade issues.
Step 5: Didactic test and evaluation results
Didactic test: activity that is related to the creation of didactic test, which is used to determine the transfer of knowledge from the field of fair trade. Didactic test was given to students one week after the second hour devoted to the issue of fair trade. Evaluation of results: activity that led to the evaluation of educational tests.
Step 6: Statistical analysis
Activity related to statistical data processing, i.e. sorting, calculation of basic descriptive statistics and the use of parametric statistical tests for testing hypotheses and to derive results on the chosen level of significance.

Methods of Statistical Analysis

In order to establish the basic idea about acquired data, indicators of descriptive statistics are used, especially the measure of central tendency and the measure of variance of acquired data (see e.g. Lindsey, 2009). Furthermore, the testing of the assumption of

normal distribution of data using the distribution test (Shapiro-Wilk test) (e.g. Gravetter and Wallnau, 2009). The method of single-factor analysis of variance (ANOVA) is used to determine the statistical differentness of averages for more groups. ANOVA is one of the most commonly used statistical techniques. It is a summary name for a group of very efficient methods with the common idea of dividing the total variability into components that can be assigned to each reason of variability. The aim is to compare the level of studied quantitative variable in several groups in which the basic set is divided. The sorting criterion for dividing the basic set into groups was one or more variables of the nominal type (Bassett, Bremner and Morgan, 2000). For one-dimensional analysis of variance, the influence of one factor on a certain dependent variable is observed (Lindsey, 2009).

Description of the Experiment 1

The first experiment was conducted in 2013 in high school (Grammar school in Teplice, CZ). The sample of participants was about 74 students of fifth grade. The essence of the experiment was to obtain information on whether high school students are familiar with the concept of fair trade that was chosen as the problem domain of environmental education, and what they perceive as an effective didactic tool. The experiment was conducted by stylistic composition (reflection) of the Code Range 1-2 standard pages. The compositions were checked in the electronic version in MS Office Word. Evaluation of stylistic compositions were gathered using methods of text mining, which aims to acquire, index, and analyze useful information in texts. We use basic text mining methods, the texts were divided into so-called tokens (words) using a frequency matrix were found most frequently occurring words in context above two topics. For further processing, it was necessary to represent the information obtained through statistical methods. Text mining and statistical analyzes were performed using Statistica software from StatSoft.

Description of the Experiment 2

In high school (Grammar school in Teplice, CZ, the same school as in the first experiment) the second experiment was conducted. The second experiment tested the effectiveness of each proposed concepts consisting of teaching resources that students in the experiment no. 1 reported as the most popular and effective. Students of 5th grade were randomly divided into 4 groups. Each group worked with a different concept (A, B, C or D). In each group there were 20 people. Individual learning concepts (A, B, C and D) were taught in agreement with the teachers during the two weeks.

Results and Discussion

On the basis of the results from the experiment, we designed environmental education teaching resources for knowledge transfer in the field of fair trade. Analysis of text documents showed that the majority of students (with ration 0.77), i.e. 57 student knows the concept of fair trade and not know what the term means, 17 students said that the concept knows or has heard him, or has an idea what the term means.

Texts were analyzed in terms of the context of popular teaching resources and frequently occurring words (tokens) were: searching the Internet and computing skills, educational games, educational video and film, visual aids and interpretation and explanation. Taking the concept of the Internet search and work with PC occurred in 57 documents, in 33 documents educational games, video tutorials and films were occurred in 17 documents, visual aids were mentioned in 14 documents and the notion of interpretation was mentioned in 5 documents, other documents contained additional terms such as excursions, trips, discussion with experts, project, reading books etc. Some students used

more words, others only one or two, so frequency matrix contained a document and record multiple concepts simultaneously (this implies that the number of tokens found in the area of teaching resources is greater than the number of documents analyzed).

Creating teaching concepts for environmental education

Based on the results of Experiment 1, we designed four different concepts (A, B, C, D) teaching double lesson (about 90 minutes, or 2 x 45 minutes in total), which differed in the combination of teaching resources used to introduce a topic in fair trade.

Concept A

Concept is based on classic traditional teaching resources. Its main part is based (40 minutes) to interpretation, which is complemented by writing notes on the board and their transcription into notebooks (20 minutes). After students receive information themed posters in A4 size (one identical in size A2 poster will hang in the classroom). In addition, students will receive themed bookmarks (the tabs are useful information to the issue). Information on posters and bookmarks, students read and ask questions the teacher (15 minutes). Students can take home the bookmark and posters. In conclusion, students receive "puzzles" in which they try to find terms that were presented during the lesson (10 minutes). During final 5 minutes, the teacher resumes lesson contents and emphasizes the essential knowledge that pupils should remember.

Concept B

Concept B is based on linking traditional and modern means of instruction. The first part is based on the initial interpretation on the issue (15 minutes) and the second part is the creative activity of students (45 minutes). The students' task is to prepare a presentation in MS Office Powerpoint presentations with a clearly defined structure that is precisely the area, which must relate, students work in teams and have a clear division of roles (creative officer, retrieval, search files, organizer, assembling presenting, etc.). All students seeking information on the Internet, each student has their own computer, tablet or notebook. The teacher supervises the performance of activities and outputs. If students have some question, a techer has a consultative role. At the end of the concept by those present their outputs in front of each other (25 minutes), evaluate each other, the end of the lesson the teacher will recapitulate the contents of hours and emphasizes the essential knowledge that pupils should remember (5 minutes).

Concept C

The concept is based on the interpretation (35 minutes) and work with worksheets in with prepared questions to which the student finds answers. As a source of information, they use the Internet, while the worksheets contain specific website where answers can be found. Each student has their own computer, tablet or notebook. The teacher supervises the ongoing performance of activities and in case of questions students have a consultative role (40 minutes). After the time for processing the answers to the worksheet teachers with the students go through each question and answer to the correct answer (10 minutes). In conclusion, the concept of the teacher will summarize the issues being discussed and emphasizes the essential knowledge that pupils should remember (5 minutes).

Concept D

The concept is based on modern teaching aids. In the introduction, the teacher gives a commentary on the issue (15 minutes), then the students watch a short video (film), for example, freely available on the internet (10 minutes). Students view demonstrations of fair trade products with which they may encounter in the Czech Republic (5 minutes). After the teacher divided students into pairs for playing "themed memory game", i.e.

each pair receives 64 cards, which together belongs to the classical pairs differ by 2 related cards are not identical but complementary, contain information that is complementary to, the accuracy of their students assignments are recognized by the corner of cards that are complementary with identical cards (35 minutes). The last activity is an activity "banana card," the teacher hands out a card with pictures of students and allowed the banana is schematically divided into six parts, the first two bananas in proportion as they think the individual links in the chain (grower - the owner of the plantation - the transporter - importer - supplier - retailer) receive money from the sale of a banana. Then show them how it manifests in fact a classic fair trade (10 minutes). The teacher provides students with the prepared remarks of teaching. The pupils read the remarks (10 minutes). At the end of the concept teacher will summarize the issues being discussed and emphasizes the essential knowledge that pupils should remember (5 minutes).
Tab. 1 shows that the didactic resources were used during the various concepts (gray box means which tool was used, the symbol x stands for the approximate time required for work with tools, x = 5 minutes).

Concept	Internet, PC	Playing games	Video, film	Visual aids	Interpretation, explanation	Other
A		xx		xxx	xxxxxxxx	xxxxx
B	xxxxxxxxx				xxx	xxxxxx
C	xxxxxxxx				xxxxxxx	xxx
D		xxxxxxx	xx	x	xxx	xxx

Tab. 1: Assignment and time range of tools in the concepts

Didactic test and evaluation results

Didactic test serve as a tool for measuring learning outcomes. After completing the teaching according to one of the four concepts (A, B, C or D), the didactic test objective tool for finding knowledge transfer in the field of fair trade. Didactic test was identical for all participants of concepts. The multiple choice test included 20 questions. Each task contained five possible responses, with just one answer correct. The *m* maximum number of points (score) is 20 points, one point for each correct answer. Wrong answers were not penalised. Didactic test was given to students one week after the second hour of the selected concept dealing with the issue of fair trade.

Statistical analysis and deriving results

First, we evaluated the basic descriptive statistics of the test results after the individual concepts have been applied in education. Maximum number of points obtained in the test after completing the training program was for concepts A and C 20 points, with concepts B and D 18 points. Lowest minimum number of points achieved was 6 points, for undergoing the test by teaching the concept B. The highest average test score gain didactic teaching undergoing testing by the concept C (15.65 points).
Furthermore, graphically frequency distribution of individual characteristics and using the Shapiro-Wilk test was tested the normality of different concepts. The null hypothesis says that the data come from a normal distribution, alternative claims to the contrary. For all the variables (concepts) is p value greater than the selected significance level α =

0.05, therefore, null hypothesis remains valid in all cases. *P* value for the concept A is p = 0.47809, p = 0.52072 for B, p = 0.34204 for C and p = 0.88947 for D.
Since all data (for concepts A, B, C and D) come to the chosen level of significance from the file with the normal distribution, the prerequisites for the use of parametric tests, i.e., analysis of variance. Using analysis of variance, we examined whether the type of teaching concept of working with different types of media affects the transfer of knowledge from the field of fair trade. The null hypothesis says that the files have identical diameters, alternative claim that there is at least one file that has a different diameter from the other groups.
P value of the F test, p = 0.00008, which is less than the chosen significance level α = 0.05, therefore there is at least one concept that is different from your average other.
In next step we used a more detailed evaluation- post-hoc analysis (Tukey test), it proved the statistically significant difference between the concepts A and B (p = 0.000751), the concepts B and C (p = 0.022417) and between the concepts C and D (p = 0.022417), which is visible in Fig. 1.

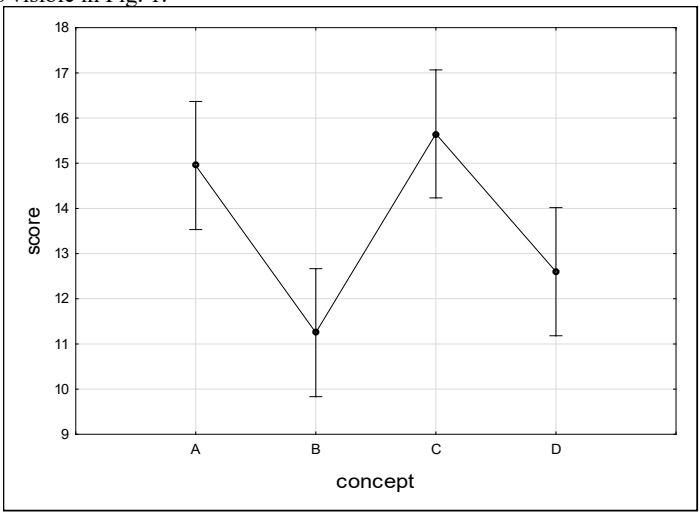

Fig. 1: Comparison of learning outcomes (didactic test results) among the concepts

As well as in our work, the influence of teaching concepts on learning outcomes in environmental education has been confirmed by other authors. Jančaříková (2012) showed how narrative method dramatically improved the value of the lessons perceived by the student. This is in line with our results, where the concepts A and C are classified as the most efficient – the ones based on narrative method (interpretation, explanation supported by other minor tools). On the other hand, PC-based concept B with relatively more time spent with individual work could be sometimes of a problematic effectiveness (Houška and Beránková, 2010). Even probably the most innovative concept D, where games and videos play very important role, did not provide expected results. But as Bártová and Frolková (2012) mentioned, many factors such as level of education, students and their personal characteristics, personality of the teacher, etc. always matter, when a teaching concept is set up and planned for particular subject and topic. And here, obviously, the specific implementation of the concept D did not meet the requirements and characteristics

of the target group of the students.

Conclusion

In this paper we present an innovative way to determine teaching concepts for a specific subject and evaluate their impact on learning outcomes provided by the students. Of course, it would be incorrect to make generalization that this approach always generates the teaching concept of the optimal efficiency. Even in this case study we did not know (and we were not able to anticipate) the best teaching concept before applied. In future research we will concentrate to determining the factors influencing the efficiency of the concepts and improving the text mining techniques used in Experiment 1 to receive information of higher quality to set up different teaching concepts.

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SHADOWING IN THE RESEARCH OF DEPUTY HEAD TEACHER´S ROLES

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Abstract

The article deals with the issue of managing and leading Czech schools as specific and autonomous units. It points out on the deputy head teacher´s roles also because it currently stays an under-researched phenomena in the Czech educational research.
The qualitative research strategy is described with the focus on presentation the shadowing method. The selection criteria of deputy head teachers are mentioned. The circumstances of first phase of shadowing, the intensive and unstructured observation is introduced in a more detailed way. The concluding part of the paper presents and discuss the preliminary results of the analysis of field notes by means of open and axial coding.

Keywords

Deputy head teacher, shadowing, czech school, preliminary findings

Introduction

School education is playing very important role in a society (Pont et al, 2008). Czech schools have undergone many changes in recent years. They have gained greater level of autonomy, which brings consequences for the school work. The primary responsibility for school educational quality lies with the Czech headmaster as each school has freedom to formulate and conduct its own (curricular) policy. The school management is thus expected to apply more participatory approaches from school improvement perspective and to balance them with activities supporting school accountability (Pol, 2007; Vanhoof, Petegem, 2007). The responsibility for quality assurance in the school is thus spread across various actors, deputy head teachers having a notable share in it. In this respect, foreign research deals mainly with head teachers, for instance with actual and ideal responsibility from their point of view (Kwan and Walker, 2010; Norton and Kriekard, 1987) or with the relationship between head teacher and his/her deputy (Marshall 1993; Harvey 1994; Michel 1996). Out of a few specifically focused researches, Harvey (1994) offers particularly critical view on deputy head teachers. He claims that his/her main duty is administrative work for the purpose of maintaining organisational stability, this work being defined chiefly by needs of other school staff. It is also interesting to conclude that deputy head teachers are to certain degree said to be “forgotten actors” or “ignored“ in research studies (Hartzell, 1993). This holds very much true for the Czech research that has focused mainly on career, competence, working activity, and professional growth of head teachers (e.g. grants such as Research Centre on Schooling, LC 06046; School: Research of Internal Processes and External Conditions of its Functioning, GD 406/09/H040; Czech School Head Teachers and their Personal and Professional Path Development, GAČR 406/07/0845; Pol, 2007; Sedláček, 2008; Pol et al., 2009, 2010; McKinsey&Company, 2010; Prášilová, 2011). That is why the aim of this paper is to explore the deputy head

teacher´s roles in school management, leadership and governance. The article is based on preliminary data collected via shadowing (observation) of deputy head teachers.

Materials and Methods

The following section briefly introduces the preliminary findings from the first phase of shadowing of deputy head teachers. Shadowing has been chosen as a method for gaining valuable information about the unexplored and complex phenomena of deputy head teachers´ work in Czech schools. Generally speaking, shadowing is used for different purposes: when mentoring head teachers of schools (OECD, 2003), training future head teachers (Slavíková, 2000; Slavíková, Karabec, 2002)… Nonetheless, it stays an under-researched aspect of leadership development (Simkins et al, 2009). Shadowing is also a research method or a process through which information about activities of an individual in natural settings is gathered in order to be analysed and interpreted. It is based on a long-term unstructured observation of the professional day-to-day work of the person during which the researcher takes field notes. To explore the meaning of the observed issue, the interview is also an essential part of shadowing. The relation between observation and interview can according to Simkins et al (2009) take four different forms. As MacBeath (2011) puts forward, in the school environment the shadowing provides the longitudinal view of the school functioning since the formulas of interactions are to be deduced from a longitudinal observations not just from "one-shot" scene.

Based on interpretative paradigm, the „shadowing plus in-depth discussion" (Simkins et al, 2009: 245) has been chosen to answer the following research question: What are the roles of head teacher in a Czech school? To be more specific, particular research questions can be stated as follows: How does the daily work of the Czech deputy look like, why do these activities happen, how do the Czech deputies perceive them? How do these role relate to the deputy head teacher´s teaching profession? The first question forms the baseline for the observation, the others for the following interviews so that the complex view of the role, its contextual logic, explicit and implicit rules that operate in this area can be explored. This paper presents the data gained during three-month observation of deputy head teachers in two Czech schools. Criteria for selection of the deputy head teachers have been set as follows:

1. The expertise, it means the deputy head teacher acting in his or her position for a longer time (having gone through the adaptation phase in the position), at least three years of being in the position of deputy head teacher.
2. The type of school so that deputy head teacher works at a school providing compulsory school only (ISCED 1 and 2). This in Czech reality means that for instance pre-primary education is not provided at this school/legal entity.
3. The agreement of stakeholders, i.e. not only of the deputy head teacher but also of his/her head teacher. This criterion is rather specific as for shadowing usually only the agreement of a person, people being directly observed is needed, in the case of staff working schools the consent of the school head is essential, too
4. Last but not least, it is the geographic proximity to schools that lowers time and financial costs of the research to a certain extent.

Using the above listed criteria, several schools were asked (by e-mail, telephone and later by personal contacts) to participate in the research. In the case of two deputies from different schools the research could start. Based on the experience from previous shadowing (Vašťatková, 2005), during the first meeting the ethical rules of shadowing were agreed on and the informed consent was gained both form the head teacher and the

deputy. For scheduling the shadowing, the clear distinction between moments when he/she acts as a teacher and when as a head teacher was necessary. For the purpose of this study, only the activities relevant for the position of a deputy head teacher were observed. The research design is based on the grounded theory that aims at creation of a scheme, a figure involving relations among different concepts (Šeďová, 2007: 86-87). The procedure of grounded theory consists of the following stages: data collection, analysis of the collected data, data coding and designing the theory. The phases of data collection and analysis overlap. The data coding is based on the use of different coding. Open coding starts the whole process of data analysis and leads to the conceptualisation of key events. Axial coding, according to Strauss and Corbinová (1999: 84) is a process of introducing codes, subcategories to a particular category and creates thus a link between the subcategories.

Results and Discussion

The trust between researchers and deputy head teachers was gradually growing and it was possible to observe natural course of activities. During the three months unstructured observation, a lot of field notes were taken. They were analysed firstly by two researchers independently, later trying to make an agreement. Using the grounded theory, open coding was performed to explore the content of the deputy head teacher´s work. To identify the relations among the open codes, axial coding was used in the second stage of data analysis. The gained codes and categories briefly presents the following table.

Categories	Codes	Examples of observed activities
The roots	Keeping the old arrangement Care for the school culture	Working with the school time schedules, organising the school ball
We	Distributed leadership His/her learning Support for the development of others	Meetings with teachers aiming at taking decisions; participation in an ICT course; conducting interview with a teacher aimed at determining her educational needs
They	Accountability	Preparing materials for the annual school report
The community (We + They)	Networking Care for the instructional quality	Communication with other school to organise peer visit; managing the school self-evaluation process
The lost way	Chaos Redundancy	Searching for documentation, meetings with traders

Tab. 1: Coding of the data

The relationships among the codes are presented in the following figure. It shows that the deputy head teacher´ roles are framed by the «roots of the school» that he/she subsequently affects. In this way Koru´s (1993) finding that the main deputy head teacher´s duty is to maintain the status quo and the organisational culture of the school has been confirmed

but extended at the same time. The deputy head teacher performs activities connected with distributed leadership and professional development of all staff including himself/herself (WE) but also accountability activities. These two branches unite in activities focused on the support of all actors´ joint effort for the quality of school work (instructional quality in particular). The very specific category is made up by activities not directly relevant for school life.

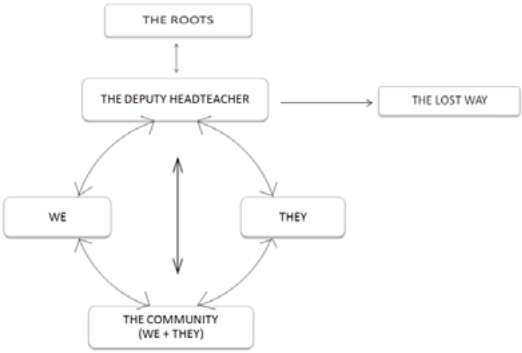

Fig. 1: The relations of the categories

When interpreting the gained data, the possible limitation of the chosen research design has to be taken into consideration. The challenge of any observation in shadowing is the constant presence of a researcher, of a "foreign person" which can lead to discomfort and partially to disruption of the "normal setting". The implementation of this method is very demanding: time, methodically (keeping and processing of all field notes) etc. which can cause some misinterpretation, too. Therefore it is essential to complete the existing database with the data of the in-depth interviews. The codes and categories presented in this paper will be used as the guidelines for conducting the in-depth interviews with deputy head teachers in the nearest future.

Conclusion

The article has characterized the preliminary findings of exploring the important and sensitive issue represented by the deputy head teacher´s roles in Czech autonomous schools. The strategy of shadowing has been described. The preliminary findings from an intensive observation of the deputy head teachers´ activities in natural interactions show the mutual relation between his/her activities and the school community (framed by the «school roots»). The concept of deputy head teacher´s purely administrative role is thus extended. Nevertheless, the data form the in-depth interviews will supply the complexity and causality of deputy head teachers´ roles in the nearest future.

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SUPPORTING ELEMENTS FOR REQUIRED SCIENTIFIC OUTCOMES AT A UNIVERSITY DEPARTMENT

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Abstract

The quality of scientific outcomes of a university department play an important role not only during the process of accreditation of study programmes but also in building required competences of department's academic staff. The paper deals with a suggested set of the key precautions and tools which, from the author's point of view, could form the necessary basis for the successful work at this field. The author offers to discuss so-called supporting elements which can, according to their description, help significantly for required scientific outcomes at the department level. The goal of the paper is also to formalize the appropriate author's vision.

Keywords

Academic staff, department environment, motivation, scientific outcomes, university department

Introduction

Three types of universities can be found in the Czech Republic. These are public, private and state universities. Their environment, especially their funding, can differ significantly. On the other hand, regardless of the university type above, academic staff has always two main activities – participation in teaching and research processes. Their labour productivity consists of two parts – teaching productivity and the research productivity (Vltavská and Fischer, 2013).

The fact that publication is the primary measure of professionalism (Light, 1974), is still valid. The contemporary networked environment influences the research process and the required outcomes significantly. Firstly, Hughes (1998) was interested in gaining better understanding of the factors that support faculty in their efforts to perform and publish research. Then, Hughes (1999) explored personal and institutional factors that support productivity. She focused on the role of the campus telecommunications environment. The interesting contribution to the problem of the faculty publishing productivity was done by Budd (2006). Bertot and McClure (2003) focused on outcomes assessment in the networked environment. The issue of effective project and data management and collaboration tools to manage research projects is described in (Holewa, 2013).

Current research is closely connected with the digital libraries. Xie (2006) identified user's criteria and applies them to the evaluation of existing digital libraries. Kaufman (2007) described how individual, environmental, career and work factors influence the publishing and other scholarly productivity of faculty members in Physical Therapy (PT) education programs in the United States. Research provided by Chylova, Natovova and Michalek (2013) among students could be applied also on academic staff.

The paper deals with searching suitable approaches and tools which can support creation of required scientific outcomes at a university department level. The importance of

scientific outcomes is also visible in the accreditation of study programmes processes. The scientific outcomes also make easier way to getting funds for the research activities in the future. Without scientific outcomes the access to funds for projects is impossible.

Materials and Methods

The author of the article works at the ICT focused department of the Czech state university. This department played a key role in development of the so-called 'Information portal for research, development and innovation' (IPRDI). This information system has been developed from the scratch by a few members of the university academic staff. It is operated independently on the commercial sphere and the functionality of the system is under permanent improvement. Nowadays the university uses the IPRDI as a key supporting element for the processes connected with the scientific projects.

From the department point of view the most important attributes of the IPRDI are as follows:

- Openness;
- Transparency.

The IPRDI is open to the next development and the stored data can be used by all members of the academic staff. Each member of the team can compare his/her own outcomes with the others. The open evidence of all requirements to purchase and business trips leads to the transparency of the processes. The evaluation of the efficiency of deposited funds is possible and can be used in the interest of better functionality of the contemporary procedures and approaches.

The positive influence of the IPRDI on the research is evident. The most important characteristics offered by IPRDI are the list of all solved projects, their funding, state of materials, equipment and services ordered by academic staff and the records of all outcomes of research activities. The relevant objective characteristics from IPRDI serve for decision making process of research teams.

Results and Discussion

The gained experience leads to the formulation of a few useful facts which seem to be a basis for the improvement of approaches and procedures in the field of scientific work outcomes. The author is focused on a department level. From the author's point of view supporting elements for required scientific outcomes at a university department could be formulated as follows:

Department structure (DS)

With regard to the department structure the so-called 'three generation' structure seems to be the optimal solution. The approximate age ratio 1 : 1 : 1 among young researchers, middle age researchers and older experienced researchers can fulfil the long-term expectations best.

Proper work conditions (PWC)

Good communication inside the department, to be informed in time and relevantly, keeping of a dynamic balance between freedom and mandatory duties, 'at least' a small competition and appropriate support can lead to the satisfied academic staff and the whole department to better results. The department culture and its internal environment should be permanently cultivated.

Role distribution (RD)

Department politics should include suitable approaches for selecting and improving key roles in a research team such as ideas generators, advisers, creators, publishers, correctors, presenters, managers. The open minded and strong individuals capable to cooperate and communicate effectively can achieve required synergistic effects. The dynamic responsibility division can make a condition for an economical behaviour of the member of a team.

Co-operation links (CL)

Interdisciplinary tasks need various forms of co-operation links. It is not possible to omit co-operation at a faculty level and a university level. The co-operation links should be established with other universities and commercial firms at home and also abroad. A mutual benefit should be searched and found.

The academic staff of the department should be focused on:

- Building and improving professional contacts;
- Organizing a suitable department conference;
- Presentations of research outcomes.

Motivation (M)

A proper motivation should be based on the knowledge of competences and personal goals of department's academic staff. Centrally organized publishing support can be useful, especially in the terms of foreign language corrections of the scientific articles. Target remunerations can play a decisive role especially in demanding but strongly required publishing activities, e.g. publishing in journals with impact factors. If possible, department managers should specify target remunerations similar to Tab. 1. The term RIV point stands for a unit used in current assessment of scientific outcomes in the Czech Republic. The concrete values in CZK used in the next tables serve only for a demonstration of author's thoughts.

Category of scientific output	Target remuneration per RIV point
Journal with impact factor	CZK 3,000.00
Journal accepted in Scopus	CZK 1,500.00
Conference proceedings accepted in Web of Science	CZK 1,000.00

Tab. 1: Possible form of target remuneration for key scientific outcomes

The economical behaviour of the academic staff could be supported by the appropriate evidence according to Tab. 2.

Type of scientific output	Costs of realization	Benefits (RIV points)
Article in a journal with impact factor	CZK 10,000.00	20
Article in a journal accepted in Scopus	CZK 3,000.00	10
Article in conference proceedings accepted in Web of Science	CZK 15,000.00	8

Tab. 2: Possible form of key scientific outcomes evidence – department level

Finally, the concrete financial reward for the publishing authors could be evaluated according to Tab. 3.

Category of scientific output	Citation record (CR)	Author (A)	Financial reward
Journal with impact factor	CR1	A1 – Jan Black (60 %)	CZK 30,000.00
Journal with impact factor	CR1	A2 – Paul Brown (40 %)	CZK 20,000.00
Journal accepted in Scopus	CR2	A1– Paul Brown (100 %)	CZK 12,000.00
Conference proceedings accepted in Web of Science	CR3	A1 – Jan Black (100 %)	CZK -7,000.00

Tab. 3: Possible form of financial rewards for academic staff

The author keeps in mind that concrete numbers will always be dependent on the budget of the concrete university. He thinks that the approach demonstrated above can be implemented with the respect to the specific environment and in compliance with the current law measures. The final success and a positive influence will also depend on a suitable balance among the university, faculty and department level of competences. The department should have free hands in some aspects, e.g. how to support co-operation with selected key partners, how to support publishing activities of the youngest academic staff members, etc.

Goals (G)

The department should have long-term and also mid-term goals. Long-term goals (e.g. 5-year period) could be modified annually. They should express a vision of the department managers for the next five years. Mid-term goals should be set for every year or two-year period. These goals should be discussed and they should support department's development by concrete activities.

Foreign language competences of the academic staff, as a key prerequisite for required outcomes, should be carefully improved. The vocational education without a foreign language competence is impossible to accept. At least one world foreign language is a necessity for the academic staff. Searching the suitable ways for increasing the level of competence in a preferred foreign language should be under permanent attention. The academic staff has to be responsible at this field. The academic staff at the author's department is asked to pass the language exams according to the NATO STANAG 6001 norm.

Funds distribution (FD)

The funds for the research at the faculty level could be distributed in compliance with the triple as follows:

- Qualification of the department's academic staff;
- RIV points gained by the department's academic staff;
- Foreign language competence of the department's academic staff.

Department performance (DP)

The DP indicator can stand for the total number of RIV points gained in five last years by the department's academic staff. The DP can generally be used as a tool for correct funds distribution.

Department's solved projects (DSP)

At the department's level can be distinguished these types of projects:

- Specific research projects focused on students' participation in research activities;

- Department development project focused on a few long-term goals in research activities of the department's academic staff;
- Czech Science Foundation projects;
- Technology Agency of the Czech Republic projects;
- EU projects.

The number and the structure of department's solved projects is an important indicator of department capabilities and its position in the research.

Competition indicators (CI)

The selection of possible ways for a competition keeping inside the department's academic staff can be also useful. What key indicators can be used?
Firstly, it can be Individual clear research performance (ICRP)

$$ICRP = IRP / FC \quad (1)$$

IRP (individual research performance) stands for the sum of RIV points gained by an individual researcher in a concrete period of time (last five years);
FC (funds consumption) stands for all business trips, conference fees, the total expenses of work power in a concrete period of time which are connected with IRP (last five years).
Secondly, Individual clear research performance can also be connected with the concrete research project P.

$$ICRP\ (P) = IRP\ (P) / FC\ (P) \quad (2)$$

IRP (P) (individual research performance in project P) stands for the sum of RIV points gained by an individual researcher in the research project P;
FC (P) (funds consumption in project P) stands for all business trips, conference fees, the total expenses of work power in the research project P which are connected with IRP(P).
Thirdly, Publishing productivity (PP) with inclusion of all publishing outputs can be defined, the contribution of high qualified persons at the department can be evaluated, economic behaviour of the academic staff in a research project can be explored, etc.

Conclusion

Searching suitable approaches and tools which can support required scientific outcomes at a university department, cannot be underestimated. The author of the article tries to formalize his experience in this field and offers his conclusions for discussion. The indicators such as the ICRP and the ICRP (P) can play a key role in times of limited sources for the department's scientific activities.
The author assumes that the approach described in this article can contribute to the process of searching suitable solutions which are tailored to the various specific university environments. The final success will strongly depend on co-operation among university, faculty and department levels of management and also on justification and transparency of used rules. In the future it will be interesting to compare the results of at least two universities according to the described indicators.

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INTERNATIONAL BUSINESS WEEKS – IMPACT ON STUDENT MOBILITY

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Abstract

The article aims to describe the network of European business colleges/universities that created project activities called International Business Weeks (IBW) that were designed to encourage finance students to apply for international mobility. College of Polytechnics in Jihlava (CPJ) joined the network in 2008 and the goal of the paper is to present the first evaluation of the effect of IBW on Erasmus mobility. Analysis of the data from CPJ information system show that this impact has weakened gradually. The data also proved that the interest in IBW among CPJ students grows. One of the conclusions is that there is a need for further, preferably qualitative research of the students' motivations and obstacles of international mobility.

Keywords

International Business Week, network of universities/colleges, Erasmus mobility, internalization, College of Polytechnics Jihlava

Introduction

In the 21st century international activities of universities and colleges expanded dramatically in volume, scope, and complexity all over the world (Brooks, Walters, 2013; deWit, 2011; Pesik, Gounko, 2011). Tertiary institutions established various strategies of internationalisation (Maringe, Foskett, 2010; Knight, 2008): academic programmes (exchange programmes, cross-cultural training, joint/double degree programs, visiting lectures and other), research and scholarly collaboration (research projects and agreements, exchange programmes), extra-curricular, such as students associations and external relations (domestic and crossboarder). In the Czech context internationalisation is mainly understood as student and staff mobility and an aspect of quality enhancement (Janebová, 2009; Mertová, 2013). Student mobility remains the strategic goal of the Bologna Process: it aims primarily to increase inbound mobility for the whole degree programmes from other parts of the world, and temporary (between three months and a year) inbound and outbound mobility between the European countries (Brooks, Walters, 2013; Teichler, 2009). As it is stated in the Report on the Development of the European Higher Education Area, by 2020 at least 20 % of all graduates from the European Higher Education Area should have spent a period of time studying or training abroad (EACEA, 2012).

The last research among the Czech students (Fischer, Vltavská et al., 2013) showed, that out of the 4664 respondents almost 78 % of students (both bachelor and masters study programmes) are not interested in any international mobility. Almost one third of the respondents (31 %) that studied in the bachelor programmes planned to apply for international mobility, students from public universities/colleges showed higher interest in international experience. In general, motivations for mobility include commercial

advantage, knowledge and language acquisition, enhancement of the curriculum with international content, and many others (Altbach, Knight, 2007). Students in the Czech Republic see as the biggest obstacles in international mobility financial costs, fear of losing job and separation from a partner, children or friends. On the contrary the lowest barrier is the capacity of a mobility program or problems with the recognition of studies, which decreased significantly (Fischer, Vltavská et al., 2013).

College of Polytechnics Jihlava (CPJ) is a public college of a non-university type, offering bachelor study programmes. In the recent academic year 2013/2014 there are appr. 2500 students studying at CPJ. They chose from the study programme Economics and Management the course of Finance and Management or the course of Travel/Tourism, in the study programme Electrotechnics and Informatics the course of Computer Systems or Applied Informatics and the Health Service Studies and Social Works Studies. Students may choose study mobility from 29 partnering institutions in the Erasmus+ Programme. In 2008 CPJ joined the network of International Business Weeks (IBW), a network formed 16 years ago by Leuven University College and University Paris 13. Each IBW network member organizes a week of student activities, during which students work in international groups on an international business case, the central theme is international business. The main objective of IBW is to let students feel they can cooperate in English with fellow students on financial topics in an international context and in that way encourage them to apply for study programmes abroad.

The aim of this article is to analyse data about the CPJ students that attended IBW up till the present time (from February 2009 till April 2014) and of those who applied for Erasmus programme at the same time to prepare the first evaluation of the IBW project in terms of its influence on Erasmus mobility. A partial goal is to describe an IBW project.

The paper presents results of research that has quantitative design, analysing data from the CPJ information system. The next chapter presents IBW procedures and the background of the project that has grown in 16 years into vivid international cooperation of European universities and colleges also it describes methodology of the analysis of data. The chapter Results and Discussion summarizes results of the data analysis – specifically how interest in IBW developed over the time and what impact it had on students from different fields of study. In Conclusion authors express the need for more research on the topic and includes possible evolution of the IBW project at CPJ.

Materials and Methods

IBW is a network initiated and built by Leuven University College and University Paris 13.[1] Project reflected the situation in the late 90s: both partners tackled the problem of low interest of finance students in student mobility. These two universities partnered on the first IBW in Leuven in 1999, in the following years the number of universities/colleges in the network emerged (CPJ joined the network in 2008). In the first years all partners came to Leuven, the theme was accountancy, University Paris 13 prepared simulation game. In 2006 each partner accepted to organize IBW with its own business theme, at the present the network offers 15 IBWs each academic year (see Table 1).

[1] Description of the IBW history and procedures were consulted with Christianne Schueremans from University College Leuven in Belgium and are also based on her presentation at Businet Annual Conference in Malta in November 2013. Martina Chalupova minly drew from her own experience as the IBW co-ordinator.

Country	University/College	IBW Topic	Semester
Czech Republic, Jihlava	College of Polytechnics Jihlava	Financial and Management Case Study	Winter
Portugal, Setúbal	Polytechnic Institute of Setúbal	Entrepreneurship	Winter
France, Paris	University Paris 13 (IUT de Saint-Denis)	International Economical Simulation	Winter
Netherlands, Rotterdam	Rotterdam University of Applied Sciences	Risk Management	Winter
Belgium, Leuven	Leuven University College	Business Simulation	Winter
Denmark, Kolding	International Business Academy	Management Leadership in Finance Sector	Summer
Finland, Lahti	Lahti University of Applied Sciences	Financial and Management Case Study	Summer
Czech Republic, České Budějovice	Institute of Technology and Business in Č. Budějovice	Leasing	Summer
France, Paris	IUT de Saint-Denis (Université Paris 13)	Communiciation Case Study	Summer
Belgium, Leuven	Leuven University College	Banking Simulation	Summer
Latvia, Riga	Banku Augustskola	Financial Case Study	Summer
Poland, Wroclav	Wroclaw School of Banking	Project Management	Summer
Netherlands, Rotterdam	Rotterdam University of Applied Sciences	Financial Case Study	Summer
Germany, Zweibrücken	University of Applied Sciences Kaiserslautern	Business Simulation	Summer
Ukraine, Dnipropetrovsk	National Mining University	Business Simulation	Summer - postponed

Tab. 1: IBW Network Offer for Academic Year 2013/14

The exact dates of each International Business Week are discussed and announced before the start of the next academic year. Therefore, the official IBW representatives of every higher education institution have a meeting in spring to plan and discuss. The organizing university provides accommodation (4 nights), local transport and food (4 breakfasts, 4 lunches and 1 dinner) for each incoming student, and pays for any other costs directly related to the business week programme. The home university transfers a participation fee for each of the outgoing students to the organizing university (varies from 180 – 240 EUR per person).

Each IBW network member organizes a week of at least 5 working days (Monday till Friday). The topic, as it was mentioned before, must be related to international business. Students work in international groups on a business case. In order to get different nationalities together, universities/colleges can send no more than 5 students to every business week, if there are still places available (just before application deadline), higher student numbers can be discussed. IBW is meant for finance and/or business students, the sending university is responsible for the students' selection (by means of interviews, grades, motivation letters or CVs). It is recommended that students are accompanied by a lecturer of their

home university/college, preferably, the lecturer is integrated in the program as a coach. After meeting the IBW standards students receive a common validation paper with recognition of all partner universities involved in the network. Participation is validated by the sending university, students receive 2 credits.

Data about all students, who have attended IBW and Erasmus mobility, were extracted from CPJ's information system. It included information about the semester in which student attended IBW, student's study programme and whether he or she attended internal (in Jihlava) or international IBW (no information about specific university/college or country). The list was then compared with the list of Erasmus mobility participants, sorting data in 3 categories: students that attended only IBW, but did not apply for Erasmus mobility, students that went on Erasmus mobility after attending IBW, and students that attended IBW after their Erasmus mobility. Since academic year 2007/2008 up till the winter semester 2013/14 the total number of 271 CPJ students attended Erasmus Mobility Programme (only students from the fields of study: Finance and Management, Travel and Tourism and Applied Computer Science). First CPJ students attended IBW in the summer semester 2008/09, since then 229 of them took part in the project (data from the summer semester 2013/14 included), 228 of them were students of the study programme Economics and Management (163 studied Travel and Tourism and 65 Finance and Management) and 1 student of Applied Computer Science (he was excluded from the further analysis).

Data were analysed using contingency tables. According to the character of the data suitable tests of the independence were used, in the case of contingency table of the type (r is the number of rows, c is the number of columns) we usually use statistics (Hendl, 2006):

$$\chi^2 = \sum_i \sum_j \frac{\left(n_{ij} - e_{ij}\right)^2}{e_{ij}} \qquad (1)$$

If the p-value calculated by means of the χ^2test (Pearson Chi-square test) was lower than the selected level of significance $\alpha = 0{,}05$, null hypothesis was rejected. The analysis was carried out using SPPSS programmes.

Results and Discussion

Based on the data obtained in the CPJ information system it is possible to state that in the beginning IBW project affected Erasmus mobility significantly, nevertheless, in the last semesters its impact weakened. Results in Tab. 2 show that IBW fulfilled its purpose best in the summer semester 2009/10, when almost half of those who attended IBW decided to apply for Erasmus mobility. Since then the number of students that applied for Erasmus mobility after IBW, fell. P-value of the Chi-Square Test (0.012) proved dependency on IBW influence on Erasmus mobility and time.

		Semester											Total
		S 08/09	**W 09/10**	**S 09/10**	**W 10/11**	**S 10/11**	**W 11/12**	**S 11/12**	**W 12/13**	**S 12/13**	**W 13/14**	**S 13/14**	
No Erasm. IBW only	Freq.	18	5	7	9	8	8	13	10	34	28	33	173
	Rel. Column Freq.	72%	83%	50%	60%	57%	67%	76%	83%	72%	93%	92%	76%
Easm. **After** IBW	Freq.	7	0	6	4	3	3	2	0	7	1	0	33
	Rel. Column Freq.	28%	0%	43%	27%	21%	25%	12%	0%	15%	3%	0%	14%
Erasm. **Before** IBW	Freq.	0	1	1	2	3	1	2	2	6	1	3	22
	Rel. Column Freq.	0%	17%	7%	13%	21%	8%	12%	17%	13%	3%	8%	10%
Total	Freq.	25	6	14	15	14	12	17	12	47	30	36	228
	Rel. Column Freq.	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Chi-Square Test			
	Value	Df	p-value
Pearson Chi-Square	37.084	20	0.012

Tab. 2: IBW Effect on Erasmus Mobility of CPJ students

The positive fact is, that the number of students that are willing to have an experience with studying abroad, rises. The highest number of CPJ students that applied for IBW was so far in the summer semester 2012/13 (47). It was the first semester in which CPJ decided to cover the whole participation fee for the students (till then CPJ contributed 100 EUR to each student who enrolled for IBW), students have to pay their transportation costs in full. This may indicate that financial costs play the major role in decision making process of the CPJ students for international mobility. Also, current political situation in Ukraine affected the number of IBW participants in the summer semester in 2013/14, as the National Mining University in Dnipropetrovsk had to postpone its IBW and therefore 5 CPJ applicants did not leave for Ukrainian IBW.

Field of study (Travel and Tourism and Finance and Management) and decision to apply for IBW and Erasmus is not dependent (p-value of the Chi-Square Test is 0.84). Data in the Tab. 3 show that Travel and Tourism students decide to attend IBW more frequently (165 students in total), in comparison with 63 Finance and Management students.

		Fields of Study		Total
		Travel and Tourism	Finance and Management	
No Erasmus, IBW only	Frequency	125	48	173
	Rel. Column Freq.	76%	76%	76%
Erasmus **after** IBW	Frequency	23	10	33
	Rel. Column Freq.	14%	16%	14%
Erasmus **before** IBW	Frequency	17	5	22
	Rel. Column Freq.	10%	8%	10%
Total	Frequency	165	63	228
	Rel. Column Freq.	100%	100%	100%

Chi-Square Tests			
	Value	df	p-value
Pearson Chi-Square	0.386	2	0.824

Tab. 3 Different Field of Study Influence on IBW

Based on the above it can be concluded that in the beginning of the project CPJ students that decided to take part in IBW applied more for Erasmus mobility. Due to the lack of primary research it is impossible to state that the IBW actually motivated students to do so. The number of IBW applicants shows trend that there is a higher demand for IBW, but the number (and proportion) of students that decide to apply for Erasmus mobility is minimal.

Conclusion

Based on the results there can be summarized that IBW in the present does not influence students significantly in their decision to apply for Erasmus mobility. In the winter semester of 2013/14 only 1 student out of 30, who attended IBW, applied for Erasmus mobility. The project therefore currently does not fulfil its purpose. Nevertheless, it is possible to see the trend of higher interest in IBW. Also, the data analysis showed that students of the course Travel and Tourism apply almost three times more for IBW than those who study Finance Management (165:63). It is necessary to do the further research on the matter, preferably immediately when students return from IBW. The results should help to determine their motivation as well as obstacles of international mobility. One of the key elements would be, as the research of Fischer,Vltavská et al. (2013) showed, financial costs of mobility. Other important factor that should be tested is the level and quality of information that CPJ students receive about IBW and Erasmus mobility. The next research should have a qualitative design, preferably in-depth interviews.

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PSYCHOLOGICAL ADJUSTMENT OF FOREIGN STUDENTS AT FEM, CULS

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Abstract

An increasing amount of individuals is travelling between different cultures in today's global society. The high percentage of foreign students at our universities requires specific attention. This study is focused on the relationship between preferred type of adjustment - acculturation strategy and level of acculturation stress among foreign students at Faculty of Economics and Management of the Czech University of Life Sciences. The Spearman's rank correlation was computed to ascertain the hypothesis of relationship between variables. Significant positive correlation of the higher level of satisfaction with life and integrative acculturation strategy was discovered. The findings underline the importance of the type of acculturation strategy adoption to ensure satisfactory psychological functioning of foreign students.

Keywords

Acculturation strategies, foreign students, psychological adjustment, well-being

Introduction

In our time, there have been increasing numbers of individuals travelling from one culture to another, for various reasons. In recent decades, the debate on cultural diversity in Europe has been in the most prominent position. This discussion has been highly political, but it has also been the object of substantial psychological and social science research (Berry and Sam, 2013). Among those cultural travellers belong numerous groups of foreign students. According to the Czech Statistical Office (czso online, 2013), the percentage of foreign students at Czech universities was in the last academic year 10% of all the students. At Czech University of Life Sciences (CULS) were 1701 foreign students (7% of all the students were foreigners), while at Faculty of Management and Economics were 1061 foreign students (8% students) from 78 countries (Černý, 2013).

Adaptation to life in a foreign environment can perhaps best be conceptualized through the use of the term 'acculturation' (Pedersen et al, 2011). Acculturation is usually defined as: " a process, that entails contact between two cultural groups that results in numerous cultural changes in both parties" (Berry, 2004, p. 175). To refer to the individual level of acculturation and its various psychological changes, the term 'psychological acculturation' was coined (Berry, 2004). To what extent people wish to have contact with new culture and in the same time to what extent they wish to maintain the attributes of their own cultures is known as acculturation attitude. The most frequently used is Berry's model of acculturation, which proposes four acculturation attitudes that depend on two factors: the motivation to preserve one's own cultural values and the motivation to acquire the new society's cultural values. Accordingly, people can assimilate into the new culture, neglecting their home culture values; they may reject the new values, maintaining their original values and separating themselves from the new culture; or they can integrate the

two values systems or abandon both of them and become marginalized (Berry, 2005). The acculturation attitudes are in the centre of our interest, because Berry (1997) suggests that individuals with integration or assimilation attitudes are at the least risk for sociocultural and psychological adjustment difficulties during temporary residencies in foreign countries. This is the reason to pay a closer attention to their preferences.

Although research has not yet reached a consensus on a fixed set of criteria deemed appropriate for the assessment of intercultural adjustment, academic achievement and peer relationships have emerged as a commonly used indicator for students, while psychological adaptation is often operationalized via measures of mental health, life satisfaction and self-esteem (Frankenberg et al, 2013). This viewpoint is taken by authors of present study, life satisfaction, as an important component of psychological adaptation, will be therefore measured. The satisfactory level of academic achievement is apparently of the interest of academic stuff and the fast and successful adaptation of the students should therefore be supported by teachers and counsellors.

Classical theoretical approaches were encompassed by Ward, Bochner and Furnham's (2001) so called "ABCs of acculturation"– affective, behavioural and cognitive theories of acculturation. Affective components are highlighted in the stress and coping approach. With respect to the previous studies of authors of this paper, the stress and coping approach to acculturation is the one we will focus on more closely. The stress and coping perspective on cultural contact conceptualizes cross-cultural transitions as entailing series of stress provoking changes that tax individuals' adjustment resources and necessitate coping responses (Ward, 2004). Lazarus (1999, p. 102) defines coping as activities, which have "...to do with the way people manage life conditions that are stressful", among which undoubtedly belongs the adjustment to a new culture, stronger so to be it also academic achievement expecting environment. The process of cross-cultural adaptation is especially complex for freshmen at universities. They face multiple potential challenges associated not only with acculturation but also with the usual developmental tasks, such as achieving academic success, building social relationships, and forming an identity (Strohmeier and Schmitt-Rodermund, 2008). Stress related to the numerous demands of university students, which frequently leads to high discomfort and overall dissatisfaction was in focus of our previous studies (Chýlová, Natovová and Kolman, 2012; Chýlová and Natovová, 2013) as well as relationship between perceived self-efficacy, groups of coping strategies and specific behaviours that can contribute to higher vulnerability to stress (Natovová and Chýlová, 2014).

Psychological adjustment, based predominantly on affective components, refers to feelings of well-being or satisfaction during cross-cultural transition (Ward, 2004). As a follow up to the results of our previous studies, we focus on subjective well-being as a significant component and outcome of positive ways of coping. Diener (1994) defines subjective well-being as people's longer-term levels of pleasant affect, lack of unpleasant affect, and life satisfaction. Recently, Diener (2012) described newest findings on subjective well-being, namely benefits in health, longevity, and social relationships as a result of high subjective well-being.

Matschke and Sassenberg (2010) investigated the impact of group-related approach strategies on the psychological functioning of newcomers in the receiving society. The research has demonstrated that approach strategies have positive effects on people's well-being. Frankenberg and Bongard (2013) analysed which dimension of acculturation was more strongly related to positive outcomes in terms of academic success.

The aim of this study is to analyse some psychological aspects of adjustment among foreign students at CULS. Authors are especially concerned with the relationship between preferred acculturation strategy and the level of acculturation stress and in consequence level of satisfaction with life. We hypothesise that depending on the acculturation strategy we may detect different level of satisfaction with life. To reach this goal, the students were asked to fill in the Satisfaction with life scale (SWLS, Diener, 2010) accompanied with questions on preferred acculturation strategies. To ascertain the hypothesis of the relationship of the two variables, the correlation coefficient of the results will be computed.

Materials and Methods

Participants

The research was conducted during winter semester 2013/2014. Participants were students of English study programme Economics and Management at the Faculty of Economics and Management at the Czech University of Life Sciences (N=194). Most of the students were first year bachelor students (N=94), but there were students from other years as well. The average age of the respondents was 21.04 years (min. 19 years, max. 35 years). There were 82 men and 112 women. 164 students were foreign students (the different nationalities shows Table 1), 30 students were of the Czech origin. Respondents participated voluntarily, with no benefits except for the feedback on their satisfaction with life results.

	N	%
Former Soviet Union + Russia	44 + 48	26.4+29.3
European countries	30	18.1
Asia	25	15
America	7	4.2
Africa	7	4.2
Non-valid responses	3	1.83
Total	164	100

Tab. 1: Foreign students in a sample

Method

Standardized psychological questionnaire: The Satisfaction with Life Scale (SWLS), designed by Diener et al. (1985) was used for the data collection. It consists of 5 statements, with each of them participant agrees or disagrees by indicating the answer using a 7-point Likert type scale. Scale includes items e.g.: “In most ways my life is close to my ideal” or “So far I have gotten the important things I want in life”. The SWLS has high internal consistency and high test-retest reliability (0.82), Cronbach’s alpha is 0.87 Pavot and Diener, 2008). In order to determine the type of preferred acculturation strategy, the “four-statement measurement method” (Arends-Tóth and Van de Vijver, 2006, p. 15) was chosen. We used simultaneous measurement via four separate subscales, each referring to one of the four strategies (Berry, 1997), e.g.: “I find it important to have Czech friends and I also find it important to have friends of my own culture”. Agreement was indicated on 5-point Likert type scale. Next to the above described questions, respondents also provided the basic demographic data.

Statistical analysis

This study is focused on the relationship between the preferred acculturation strategy and the level of life satisfaction of the foreign students. First of all the descriptive statistics was performed, to describe the sample (results were described in respective paragraph). Consequently, the nature of distribution of each variable was explored. In all five cases the null hypothesis of normal distribution of the data was rejected; based on the output of general Kolmogorov-Smirnov and also on Shapiro-Wilk normality test, which is more powerful for smaller samples. The results of these tests are displayed in Table 2. We conclude that the data does not come from a normal distribution (the p-value is 0.000); therefore the Spearman's rank correlation coefficient was used in order to ascertain the hypothesis of the relationship between variables.

	Kolmogorov-Smirnova			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Integration	0.233	142	0.000	0.834	142	0.000
Separation	0.171	142	0.000	0.910	142	0.000
Assimilation	0.184	142	0.000	0.920	142	0.000
Marginalization	0.235	142	0.000	0.876	142	0.000
Satisfaction with Life Scale	0.108	142	0.000	0.907	142	0.000

a. Lilliefors Significance Correction

Tab. 2: Tests of normality

Results and Discussion

The mean value of Satisfaction with Life Scale (SWLS) of the sample was 21.78 points (results are shown in Tab. 3). Average value of SWLS index in common population is 19-24 points. Even though the value of our sample lies within the borders of the average value, it is still lower that the level of SWLS of Czech students computed in another study (Natovová and Chýlová, 2014) - 23.74 points. This could be a sign of acculturation stress at foreign students' sample, but deeper analysis of this assumption would require further research.

	N	Mean	Std. Deviation	Std. Error Mean
SWLS	162	21.78	6.874	0.540

Tab. 3: Descriptive statistics of Satisfaction with Life Scale

Preferred acculturation strategies' mean and median value demonstrate that in our sample is integration the most preferred strategy (Tab. 4); with more detailed look on distribution of the answers on integration strategy, 65.9% of respondents indicated it as the most preferred one. Also other studies on young migrants' acculturation paint a positive picture; according to Berry et al (2006) the acculturation strategy most highly represented among young migrants in Germany is integration - the acculturation strategy generally associated with the best psychological outcomes.

Acculturation strategies	mean	median
Integration	3.86	4 - agree
Separation	2.38	2 - disagree
Assimilation	2.55	2 - disagree
Marginalization	2.01	2 - disagree

Tab. 4: Descriptive statistics of preferred acculturation strategies

As it was already mentioned, this study is focused on a relationship between preferred acculturation strategy and satisfaction with life at foreign students at FEM CULS. The results of Spearman's correlation coefficient are displayed in Tab. 5.

			Integration	Separation	Assimilation	Marginalization	Satisfaction with Life Scale
Spearman's rho	Integration	Correlation Coefficient	1.000	-0.041	-0.080	-0.099	0.191*
		Sig. (2-tailed)	.	0.622	0.338	0.238	0.017
		N	157	147	146	144	155
	Separation	Correlation Coefficient	-0.041	1.000	0.222**	0.183*	0.120
		Sig. (2-tailed)	0.622	.	0.007	0.028	0.149
		N	147	148	146	144	146
	Assimilation	Correlation Coefficient	-0.080	0.222**	1.000	0.466**	-0.067
		Sig. (2-tailed)	0.338	0.007	.	0.000	0.428
		N	146	146	146	144	144
	Marginalization	Correlation Coefficient	-0.099	0.183*	0.466**	0.000	-0.027
		Sig. (2-tailed)	0.238	0.028	0.000	.	0.746
		N	144	144	144	145	143
	Satisfaction with Life Scale	Correlation Coefficient	0.191*	0.120	-0.067	-0.027	1.000
		Sig. (2-tailed)	0.017	0.149	0.428	0.746	.
		N	155	146	144	143	162

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Tab. 5: Spearman's correlation coefficient

Correlation coefficient of the Satisfaction with Life Scale and integration is statistically significant. The expected relationship between these two variables was therefore proven at our sample. Correlation with other acculturation strategies was not proven to be significant, even though there can be seen slight positive relationship with separation and slight negative one with marginalization and assimilation. As the length of this paper is limited, the non-significant results will not be discussed further. The result is promising namely in a way of expected better psychological adjustment (Berry and Sabatier, 2011) and thus supposedly also the respective academic achievement (Frankenberg et al, 2013), but will require further research to verify the assumption on larger samples, with more culturally unified composition.

Conclusion

This study was aimed at a potential connection between acculturation strategies and well-being of the foreign students, in order to find the ways in which it would be possible to ease or prevent difficulties connected with acculturation stress for newcomers at the universities. Authors tested the hypothesis of a relation between acculturation attitude and satisfaction with life among foreign students, as satisfaction with life is considered to be one of the indicators of psychological adjustment. The statistically significant positive correlation between integration and satisfaction with life was found. Other kinds of acculturation strategies did not have significant correlations to the SWLS scores.

Even though majority of the students of our sample preferred integration to other acculturation strategies, their overall score on Satisfaction with Life Scale was lower than the one of our Czech students (Natovová and Chýlová, 2014), yet still within the boundaries of normal level of satisfaction with life. The discrepancies in this result should be investigated in more detail in future research, focused on culturally less diverse sample, in order to diminish potential cultural bias of the responses. We should also consider the note made by Berry and Sabatier (2011), that even though the integration way of acculturating is usually associated with better psychological adaptation, due to the dual way of social support and dual competencies of the individual, the strength of the relationship frequently depended on the measurement method used.

The culture bias in responses was not considered within current results. As shown in Tab.1 the size of each culture group is way too small to be compared to others. The only exception is the group of students from Russia, which will be studied in detail in further intended research.

The findings underline the importance of early strategy adoption to ensure high-quality and valuable psychological functioning of the foreign students at the receiving universities. In order to enhance the positive outcomes of the acculturation process, our findings should be incorporated into a training programme for the newcomers (improve and revise the features, borrow good practices from other universities) as well as into a teaching curricula and counselling practice (e.g. development of cultural awareness of the staff).

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BIBLIOMETRIC INDICATORS AND THEIR COMPARISON ON THE SET OF CZECH SCIENTISTS

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Abstract

The article aims in analysis of selected bibliometric indicators on the set of 15 Czech scientists in the field of economics, econometrics and operations research. The data set is given from the Science Citation Index (SCI) and the Social Sciences Citation Index (SSCI) of the Web of Science. The performance of scientists with respect to their publication activities is usually measured using their citation indices. Most often used citation indicator is h-index (Hirsch-index) but many of its modification have been proposed in the past years. The paper informs about current indicators, analyses their relations and discusses their advantages and disadvantages. A discussion about using bibliometric indicators for evaluation of research performance of groups of scientists (departments, faculties, universities) completes the study.

Keywords

Bibliometrics; scientometrics; citation indicators; h-index; g-index

Introduction

Efficiency of higher educational units (departments, faculties, universities) is of a high attention of professional community and authorities that are responsible for allocation of funds among them. In the Czech Republic the problems connected with the efficiency evaluation in higher education was studied e.g. in (Jablonský, 2013) or (Flégl et al., 2012). The efficiency is significantly influenced by the performance of the units under evaluation. In higher education the overall performance of the educational units is given first of all by their teaching and research performance. Teaching performance depends on the number of students in particular study levels, number of graduated students, number of direct/indirect teaching hours, number of exams, etc. These quantitative characteristics as typical outputs of the educational process are compared with its inputs, e.g. the number of employees, operational expenses, qualification structure, etc. Research performance influences the overall performance of higher educational units in a similar way as the teaching performance and must be of a high attention of national, universities and faculties authorities as the indicator for evaluation of scientists and resource allocation.

The main aim of the paper is to discuss how to measure individual and institutional (group) research performance. This performance is not given only by the number of publications in various categories (journals, proceedings, books, etc.) but their quality must be considered. The quality of publications is measured by their national and international impact – using their citations. The common way how to analyse the citations of publications consists in comparison of bibliometric indicators (indices) of individual scientists but the paper discusses not only the research performance evaluation of individuals but suggests extension of current indices for institutional (group) evaluation.

In order to measure research and publication performance a simple index has been proposed in (Hirsch, 2005). This index, usually denoted as Hirsch- or simply *h*-index, became quite popular since its definition in 2005. *h*-index and its value depends on one hand on the quality of publication that is measured by the number of citations and on the other hand on the quantity of publication outputs of the particular scientist. Almost immediately after definition of *h*-index various its modifications have been proposed. This paper deals with their analysis and compares them with the original *h*-index on the set of real data.

Next section contains exact definition of *h*-index and several its modifications. Discusses using of given indices for performance evaluation of single scientists and their groups (departments, faculties, universities, etc.). Section 3 analyses all presented indices on the set of 15 Czech economic scientists. Final section contains discussion about appropriateness of all indices for research performance evaluation and discusses open problems connected with this evaluation.

Materials and Methods

Let us suppose that the scientist i has n_i papers indexed in the SSCI or the SCI of the ISI Web of Science (WoS) with the positive number of citations. Let c_j is the number of citations of the j-th publication of the i-th scientist and the publications are given in declining order of citations, i.e. $c_j \geq c_{j+1}, j = 1, 2,\ldots, n_i - 1$.

A scientist has the *h*-index of *h* if *h* is the highest number for which holds that he/she has *h* publications that are cited at least *h* times (Hirsch, 2005). The *h*-index is given by solving the following problem:

$$\max_h c_h \geq h\,. \tag{1}$$

The *h*-index is a natural number and it is not greater than the number of cited publications. The papers that define the *h*-index of a scientist are said to be in a *h*-core. The criticism of *h*-index definition contains mainly the following two points:

- It is a measure of lifetime achievements, i.e. scientists with a longer professional career have on average higher values of *h*-index.
- Definition of *h*-index ignores exceptional papers with a very high number of citations. Let us have two scientists both of them have 5 cited articles in the WoS with the following two vectors of citations: (94, 5, 3, 2, 1) and (5, 3, 3, 1, 1). It is clear that both have the identical *h*-index = 3 even the total number of citations is extremely different.

One of the first alternatives to *h*-index is *g*-index defined in (Egghe, 2006). It is the highest natural number *g* of papers that together received g^2 or more citations. This is equivalent to the highest number of papers that received *g* or more citations on average (here average means the arithmetic mean). The *g*-index is always lower than the total number of publications but it can be greater than the number of cited publications. It is always greater (or equal) than the *h*-index. The *g*-index solves the following:

$$\max_g \sum_{j=1}^{g} c_j \geq g^2. \tag{2}$$

f- and *t*-indices were introduced in (Tol, 2009). It is the number of papers that received at least *f* or *t* citations on average. Here average means the harmonic mean for the *f*-index and the geometric mean for the *t*-index. The problems can be expressed as follows:

$$\max_{f} \frac{1}{\frac{1}{f}\sum_{j=1}^{f} c_j} \geq f, \tag{3}$$

$$\max_{t} \left(\prod_{j=1}^{t} c_j \right)^{1/t} \geq t. \tag{4}$$

Both indices (3) and (4) are always greater than the *h*-index and lower than the total number of cited publications. Their advantage is that any additional citation of a paper in the *f*-core (*t*-core) influences the final index. It can be simply proved that among the mentioned indices the following relation holds: $h \leq f \leq t \leq g$.

The mentioned four indices are based on the same general principle – the number of papers exceeding arithmetic, harmonic, and geometric mean. Below are presented some other indices of a different nature.

The *A*-index was defined in (Jin, 2006). It is the average number of citation of the papers in the *h*-core.

The *e*-index is the square root of the total number of citations of the papers in the *h*-core reduced by h^2. It is the number of citations exceeding the theoretical minimum of citations for the given *h*-index. This index was introduced in (Zhang, 2009).

The h_w-index (Egghe and Rousseau, 2008) is given as the square root of the sum of highest w citations such that $\sum_{j=1}^{w} c_j / h \geq c_w$, where w is the highest index for which the relation holds.

The *m*-index (Bornmann et al., 2008) is the median number of citations given by the papers in the *h*-core.

The *R*-index, defined in (Jin et al., 2007), is the square root of the total number of citations of the papers in the *h*-core.

The *x*-index introduced in (Kosmulski, 2007) is the maximum of the product of the rank index and the number of citations.

	Number of citations of 20 most cited papers																				S
A	52	36	36	20	17	15	14	13	10	10	10	9	9	9	7	6	5	4	4	3	316
B	52	36	15	14	12	12	12	10	9	7	7	6	5	5	5	4	4	3	3	3	255
C	36	27	25	13	12	11	11	10	10	9	9	8	7	6	6	5	5	4	4	4	246
D	172	142	116	37	35	29	23	20	20	16	16	14	13	10	10	9	6	6	6	6	774
E	25	22	16	15	11	9	9	8	6	5	4	4	3	3	3	2	2	2	2	1	155
F	246	135	36	28	25	18	15	14	14	14	13	12	11	8	5	4	4	3	2	2	614
G	98	7	4	3	3	3	3	2	2	1	1	1	1	0	0	0	0	0	0	0	129
H	13	9	4	4	4	3	3	3	2	2	2	2	2	1	1	1	1	1	0	0	58
I	8	4	3	2	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	20
J	9	2	2	2	2	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	21
K	39	21	9	6	6	5	4	4	3	3	2	2	2	1	1	1	1	1	1	1	118
L	9	4	3	3	3	2	2	1	1	1	0	0	0	0	0	0	0	0	0	0	29
M	12	6	2	2	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	27
N	8	5	3	2	2	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	24
P	21	9	6	5	4	4	3	3	3	2	2	1	1	1	0	0	0	0	0	0	65

Tab. 1: Data set of 15 Czech economic scientists

The data set that was used for numerical experiments in the next section of the paper has a real background – it is set of 15 Czech of scientists in economics, econometrics and operations research. The data set contains high-cited authors with their *h*-index higher than 10 and the total number of citations in hundreds as well as scientists with several tens of citations only. All scientists have their professional career longer than 20 years. Table 1 contains for all scientists the number of citations of maximum 20 most cited papers and the total number of citations received from the WoS. The last column of the table is in genetal not the sum of 20 previous columns but the total number of citations in WoS.

Results and Discussion

Table 2 has in its first column the number of papers of particular scientists indexed in WoS. The remaining columns contain bibliometric indices according to their definitions described in the previous section of the paper. It is clear that all indices lead to similar rankings of scientists, e.g. the scientist "D" is always ranked as the best, "F" is second and "A" and "B" are with some exceptions on the third and fourth place. Only a little more significant difference in evaluation can be recognized for the scientist "G" – according to the *h*-index is this scientist one of the worse one (together with several others having this index 3) but according to the *A*-index reaches third position. It is given by high number of citations of his first paper (98), the remaining papers have significantly lower values. *A*-index, *e*-index and partly *x*-index takes into account the number of citations of highly cited papers and not only the number of papers.

	# of paps	h	A	e	f	g	hw	m	R	t	x
A	69	10	22.30	11.09	13	16	12.69	16	14.93	14	126
B	83	9	19.11	9.54	11	14	10.81	12	13.11	12	84
C	80	9	17.22	8.60	12	13	10.05	12	12.45	12	99
D	65	13	50.23	22.00	16	28	21.61	23	25.55	19	348
E	47	8	14.38	7.14	9	11	9.43	13	10.72	10	64
F	53	12	47.50	20.64	14	24	20.42	16.5	23.87	16	270
G	42	3	36.33	10.00	4	11	9.90	7	10.44	6	98
H	49	4	7.50	3.74	4	6	4.69	6.5	5.48	5	26
I	21	3	5.00	2.45	3	4	3.46	4	3.87	3	9
J	24	2	5.50	2.65	2	3	3.00	5.5	3.32	3	10
K	56	5	16.20	7.48	7	9	7.75	9	9.00	8	42
L	32	3	5.33	2.65	3	4	3.00	4	4.00	4	15
M	29	2	9.00	3.74	3	4	4.24	9	4.24	4	12
N	24	3	5.33	2.65	3	4	3.61	5	4.00	3	10
P	26	4	10.25	5.00	5	7	5.48	7.5	6.40	6	27

Tab. 2: 10 bibliometric indices of the set of 15 scientists

More detailed analysis of results shows that all indices are highly correlated – in almost all pairs of indices is the correlation coefficient greater than 0.9. Its lowest value is between *h*-index and *A*-index (0.74). Especially *h*-, *f*-, *t*- and *g*-indices are highly correlated but it is not surprising because their calculation is based on similar principles. It is clear that even the indices are correlated their calculation can bring a deeper sight on the performance comparison of the set of scientists.

The above analysis dealt with research performance of several selected individuals. The question is whether and how the discussed indices can be successfully used for analysis of research performance of the groups of scientists. Let us consider that the 15 scientists

are members of 3 departments and each department has identical number 5 scientists. The department D1 consists of scientists A, C, G, I and N, department D2 has scientists D, E, H, J and L, and the last department D3 the remaining ones, i.e. B, F, K, M and P.

Analysis of group research performance can be considered in two viewpoints. Using the discussed bibliometric indicators and their statistical aggregations for the group (e.g. simple arithmetic mean) is one of the possibilities. The second one can create a dummy scientist that is defined by publications of all scientist in the group. The experiments presented below show that the results of these two approaches can lead to quite different results. Table 3 presents all indicators as described above for the three departments D1, D2 and D3. The first group of indicators is given as the simple average of particular indices and the second group is calculated as indices for one aggregated dummy scientist for each department.

Analysis of results in Table 3 shows that, when applying evaluation using the dummy scientist, the department D1 is according to almost all indicators significantly worse than the remaining two departments that are more or less on the same level. This holds for all indices except *m*-index but its definition (median of citations in the *h*-core) is really questionable. In the contrary, when applying simple average of scientists' indices, the results are quite different. Except *x*-index the department D3 is better than the department D2 and the strength of the preference between them is not slight. Similarly, although the department D1 is usually the worse one, the level of preference of other two departments over D1 is not so significant. According to our opinion the evaluation of the dummy scientist correspond better to reality. It can be proved e.g. by the total number of citations of the department (see last column of Table 1) - for the department D1 it is 735 citations, and for the other two departments it is 1037 and 1079 citations, i.e. significantly higher values.

	D1	D2	D3	D1	D2	D3
	arithmetic mean			dummy scientist		
h-index	5.60	6.00	6.40	12	15	14
A-index	17.24	16.59	20.41	31.83	46.93	48.50
e-index	6.96	7.63	9.28	15.43	21.89	21.98
f-index	7.00	6.80	8.00	16	19	19
g-index	9.60	10.40	11.60	21	29	29
hw-index	7.94	8.35	9.74	16.88	22.41	21.73
m-index	8.80	10.40	10.80	26	23	23
R-index	9.14	9.81	11.33	19.54	26.53	26.06
t-index	7.60	8.20	9.20	18	22	22
x-index	68.40	92.60	87.00	216	348	270

Tab. 3: Group evaluation

Conclusions

Evaluation of research performance of scientists and/or the group of scientists is an important task because it is used for their personal evaluation and resource allocation among them or their groups. Commonly used indicator for this evaluation is *h*-index that was introduced in 2005. The problem is that this index is not an ideal characteristic. That is why various its modification have been proposed in the past years. The paper presents some of them and discusses their possible applications. The objections and open problems connected with applications of bibliometric indices can be summarized as follows:

1. This kind of evaluation is based on citations only, i.e. the quality of the research output is measured by the number of citations only. It is a life time characteristic and the comparison among younger and older scientists is questionable.
2. The citations are taken from one database (usually SCI or SSCI of the WoS) and all citations have the same importance (e.g. citation in A ranked impact journals and local conference proceedings indexed in WoS).
3. The problem is a certain number of self-citations that can be only hardly solved. It is not problem only in case of real self-citations but citations within the groups of colleagues, departments, faculties, etc.
4. Citations in case of co-authoring of publication items. The current practice does not consider this problem. Some attempts were published but the solution of this problem is not easy.
5. Quite high number of bibliometric indicators that have been defined during the last decade (more than 20). Are they all really helpful in analysis of research performance? Most of them lead to same or very similar results and although their extensions are theoretically possible it is difficult their real application due to problems with source data.

Even there are substantial objections against *h*-index it is still the most often or only generally used bibliometric indicator. The research in this field can generate interesting results but wider application of new defined indices depends on their inclusion in known world databases as it is now in the WoS with the *h*-index.

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THE EFFECT OF TYPES OF DIAGNOSTIC TEST ASSIGNMENTS ON STUDENT SCORES

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Abstract

The aim of this paper is to identify how the types of questions used in a diagnostic test of the language skills of immigrant students can affect the results of students in such tests as expressed as test scores. The authors show how in the case of closed questions student scores may increase when, after selecting the answers to the questions they know the correct answers to, they then guess the answers to the remaining questions, thus producing an inaccurate picture of their actual knowledge. Estimating formula scores is important in order to determine the threshold at which students demonstrate they have the required level of knowledge. The study was carried out as part of a project funded by the Czech Science Foundation focusing on the issue of diagnostic assessments of the language skills of immigrant students at Czech primary schools.

Keywords

Testing, random score, test results, matching type

Introduction

Although the Czech Republic has always had a positive net migration rate, post-war immigration figures were consistently very low and never amounted to more than 0.5% of the population. After the Czech Republic joined the European Union, the number of immigrants rose sharply. There are currently more than 400,000 foreign nationals residing in the Czech Republic, a figure equal to approximately 4% of the national population.[1] This new situation represents an enormous challenge for society, but also for the education system, which needs to be able to cope with the large influx of immigrant students into schools and to do everything possible to successfully integrate them.

Studies carried out at Czech schools in 2009, 2010, and 2011 (Kostelecká et al., 2013, Kostelecká and Jančařík, 2013, 2014) showed that the ability to communicate in Czech played an influential role in the integration of immigrant students. However, immigrant students' language skills are usually given just an intuitive assessment when they enrol at school on the basis of a conversation with a Czech-language teacher or with some other teacher at the school, with no experience teaching Czech or any other foreign language and no experience teaching immigrant children and/or testing language skills. There is no standard method used to assess immigrant students' language skills that would allow a more objective comparison of their progress over time or compared to other students. Developing a method of diagnostic assessment of Czech-language proficiency would significantly benefit not just students themselves and their educators, but also the academic community, because it could help to reveal the basic principles involved in the process of learning Czech as a second language over time in relation to a number of other factors

[1] According to the 2011 Housing and Population Census the total number of foreign nationals residing in the Czech Republic is 422,276.

(e.g. a child's sex, age, nationality, the linguistic distance between his/her mother tongue and Czech, the length of time a child has resided in the Czech Republic).

The authors of this paper are helping to develop a standardised diagnostic test *of the language skills of immigrant students at the primary school level. The test was designed in reference to the Common European Framework of Reference for Languages*[2] *and the European Language Portfolio,*[3] *and it is intended to measure four language-skill areas in Czech – reading and reading comprehension, listening and listening comprehension, writing, and speaking – from the level of no knowledge to the B1 level (in the case of older students).*[4] *The test shall be made up of three subtests that correspond to testing levels A1, A2 and B1 of the Common European Framework of Reference for Languages. The subtests will contain tasks that test all four language-skill areas. Students will be asked to perform three tasks in each skill area on each test level and each of the three tasks will contain five questions. The student will obtain one point for each correct answer, making it possible to obtain a total of 15 points in one skill area. Given that this is a diagnostic test*, students will only be required to obtain a minimum of 9 points in a tested skill area (a success rate of 60 %) in order to proceed to the next level.

The diagnostic test will employ different types of assignments and questions: multiple choice,[5] alternative response (binary multiple choice),[6] matching questions,[7] and open questions (written answers).[8] To test productive skills (writing and speaking) primary use will be made of open test questions; to test receptive skills (reading and reading comprehension, listening and listening comprehension*) primary use will be made of closed test questions. Individual test tasks will be designed as suited to the age and cognitive skills of the tested students. The test will make considerable use of visuals aids such as age-appropriate images to make the assignments easier to understand. Selecting suitable test tasks is crucial for the proper construction of the test. The diagnostic test employs various types of assignments and questions, both open* (written answer) and closed (multiple choice, alternative response, and matching questions), and the issue is to determine what kinds of closed test assignments and questions can most effectively test receptive skills.

A general objective of this paper is to examine how the choice of closed test assignments and questions may influence student test scores and from an analysis of data identify the types of test assignments most effective at accurately assessing proficiency.

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[2] Council of Europe (2001), Common European Framework of Reference for Languages: Learning, teaching, assessment, Cambridge: Cambridge University Press.

[3] European Language Portfolio for learners up to the age of 11 in the Czech Republic (Nováková et al., 2001), European Language Portfolio for learners aged 11 to 15 in the Czech Republic (Perclová and Marešová, 2001).

[4] Because younger pupils have less developed cognitive skills they are not able to cope with the requirements of a test at the B2 level.

[5] This is any kind of question that asks the respondent (test subject) to choose the best answer (or answers) from a selection of response options. Incorrect answers included among those options are called 'distractors'.

[6] This is a special kind of multiple-choice question (i.e. binary multiple choice), where the respondent (test subject) must choose between just two response options: true or false.

[7] This type of assignment asks respondents (test subjects) to pair items (questions and answers) that match. The number of question items respondents are asked to pair may vary, as may the number of response options they are offered to choose from.

[8] This allows respondents to answer a question in their own words and according to their own thoughts. A disadvantage is that it is more difficult to assess this type of response.

Materials and Methods

We will look at what scores students attain and the probability of their attaining them if they know the answers to a certain number of questions and guess the answers to the others (see Diamond and Evans, 1973, Ebel and Frisbie, 1986 and Albanese, 1986). We will compare the scores obtained for the three types of closed question – multiple choice, alternative response and matching questions – in the diagnostic test.

1. Basic information

To calculate the possible scores students can obtain and the probability of students obtaining those scores we used the traditional methods of probability and combinatorics (see Charter, 2000). Unlike the multiple choice test, the authors know of no other similar calculations or comparisons of the matching questions type of test in the literature.

We shall assume for all the calculations carried out in this chapter that the student knows the answers to a pre-determined number of questions and that he or she guesses the answers to the other questions by having to use each response option just once. In no case would the student select the same response option more than once to answer the questions (for an illustration of this, see Fig. 1).

The (proposed) test uses 'matching questions' (for an illustration, see Fig. 1), which produced very positive results in the pre-testing stage (the students enjoyed performing this type of task and intuitively understood what they were asked to do).

Fig. 1: Example of a 5-7 type of matching question

The most likely form of test question used in the case of matching questions are ones that ask students to match 5 lexical items with their meaning (for an illustration, see Fig. 1). However, the number of response options offered can range from 5 to 7. In this paper, we will analyse three variants of this kind of test question where students are asked to match five lexical items and can choose from:

- five response options (the 5-5 type),
- six response options (the 5-6 type) and
- seven response options (the 5-7 type).

The results compared below are the scores students would probably obtain using the above-mentioned types of test tasks with those they would obtain using multiple choice or alternative response tasks and questions.

We used rencontres numbers $F(k,n)$ to calculate the probability of students obtaining a certain score (see Arratia, and Tavare, 1992, Pitman, 1997), where $F(k,n)$ is the number of permutations of an n-element set that keeps k elements fixed.

$$F(n,k) = n! \sum_{j=k}^{n} \frac{-1^{j-k}}{(j-k)!\,k!} \quad (1)$$

2. 5-5 Type of matching question

In the case of the 5-5 type of matching-question assignment, the student is presented with five response options (without using distractors[9]) and has to correctly match them to five lexical items. Table 1 presents the calculated probabilities of a student obtaining each of the five scores that a student could get in such an assignment. The rows give the number of questions correctly answered by the student, and the columns give the probability of the given score being attained. We are interested in learning, for instance, what the probability is that a student who knows the answer to fewer than three questions will ultimately obtain three or more points on this type of assignment (and will thus complete the assignment successfully with a score of 60% or more). Table 1 indicates that the probability that students who know the answer to just two questions will get a score of three or more points is greater than 50% for this type of assignment (there is a 50% likelihood that the student will obtain 3 points, and a 17% likelihood that the student will get as many as 5 points for this type of assignment).

		Theoretically possible total score					
		0	1	2	3	4	5
No. of answers a student knows	0	37%	38%	17%	8%	0%	1%
	1		38%	33%	25%	0%	4%
	2			33%	50%	0%	17%
	3				50%	0%	50%
	4					0%	100%
	5						100%

Tab. 1: Probability (in %) of obtaining different total test scores in relation to the number of answers a student knows: 5-5 type of matching question

		Theoretically possible total score					
		0	1	2	3	4	5
No. of answers a student knows	0	24%	40%	26%	9%	1%	0,1%
	1		32%	42%	21%	5%	0,4%
	2			42%	42%	14%	2%
	3				56%	38%	6%
	4					75%	25%
	5						100%

Tab. 2: Probability (in %) of obtaining different total test scores in relation to the number of answers a student knows: 5 multiple-choice questions, each with 4 response options, 3 of which are distractors

We examined what the student scores would be like if instead of this type of matching question (the 5-5 type) we used a multiple-choice type of question. For a comparison, in

[9] An incorrect answer in a questionnaire with closed answers.

Table 2 we show the probability of students obtaining a certain score in a multiple-choice type of assignment (Abu-Sayf, 1979) when they are presented with five multiple-choice questions and have to choose from four possible response options for each such question (one correct answer and three distracters). The table indicates that an assignment with five multiple-choice questions, each with three distractors, provides slightly more information than matching questions do (the 5-5 type). The calculations clearly indicate that in this type of assignment students who know the answers to two questions are 42% likely to obtain the corresponding two points. Unfortunately, there is an equal probability that they will obtain an undeserved three points.

In Table 3 we compare the results we would obtain by using the alternative-response type of assignment, where students are given five questions and answer them by indicating either 'true' or 'false'. The results clearly show that there is little information value to this type of assignment. For example, the probability that students who know the answers to two questions will obtain the corresponding two points is just 13%. By contrast, the student with that amount of knowledge has a probability of almost 40% of obtaining three or even four points for this assignment.

		Theoretically possible total score					
		0	1	2	3	4	5
No. of answers a student knows	0	3%	16%	31%	31%	16%	3%
	1		6%	25%	38%	25%	6%
	2			13%	38%	38%	13%
	3				25%	50%	25%
	4					50%	50%
	5						100%

Tab. 3: Probability (in %) of obtaining different total test scores in relation to the number of answers a student knows: 5 true or false questions

The findings of this analysis indicate that, even without the use of distractors, there is more informational value in the matching type of assignment than the alternative-response (true/false) type of assignment. The (5-5 type of) matching assignment is less accurate than the multiple-choice assignment in which students are asked five questions and there are three distractors in each response, because, for example, it allows students who know the answers to two or fewer questions to obtain a score of three points. There is therefore less informational value in this type of assignment than the multiple-choice type of assignment.

3. 5-6 TYPE OF MATCHING QUESTION

Table 4 presents the scores and probability calculations for the type of matching question that uses one distractor (Type 5-6). This assignment is more informative than the multiple-choice assignment with three distractors. However, students who know the answer to just two questions still have more than a 50% chance of attaining the required score of three points and being assessed as having successfully completed this task.

		Theoretically possible total score					
		0	1	2	3	4	5
No. of answers a student knows	0	43%	37%	15%	4%	1%	0%
	1		44%	37%	15%	3%	1%
	2			46%	38%	13%	4%
	3				50%	33%	17%
	4					50%	50%
	5						100%

Tab. 4: Probability (in %) of obtaining different total test scores in relation to the number of answers a student knows: 5-6 type of matching question, 5 questions and 6 matching options (1 distractor)

4. 5-7 TYPE OF MATCHING QUESTION

Table 6 presents the probability of students obtaining different scores depending on the number of answers they truly know in the case of a matching assignment using two distractors (the 5-7 type). In this type of assignment, the probability that a student who knows two correct answers will obtain three points is less than 50%. This is therefore the best type of assignment among those studied here for testing the language skills of immigrant students in the prepared diagnostic test.

		Theoretically possible total score					
		0	1	2	3	4	5
No. of answers a student knows	0	48%	36%	13%	3%	0%	0%
	1		50%	36%	12%	2%	0%
	2			51%	38%	10%	2%
	3				58%	33%	8%
	4					67%	33%
	5						100%

Tab. 5: Probability (in %) of obtaining different total test scores in relation to the number of answers a student knows: 5-7 type of matching questions, 5 questions and 7 matching options (2 distractors)

RESULTS AND DISCUSSION

A comparison of the above-mentioned test assignments is presented in Tables 6 and 7. Table 6 calculates the average score of a student in individual tests in relation to the number of correct answers the student actually knows. The figures indicate that for the purpose of the diagnostic test the best type of assignment from those studied is the matching assignment using two distractors.

		Theoretically possible total score				
		T-F	M-C	5-5	5-6	5-7
No. of answers a student knows	0	2.5	1.25	1.0	0.8	0.7
	1	3.0	2.00	2.0	1.8	1.7
	2	3.5	2.75	3.0	2.8	2.6
	3	4.0	3.50	4.0	3.7	3.5
	4	4.5	4.25	5.0	4.5	4.3
	5	5.0	5.00	5.0	5.0	5.0

Tab. 6: Average scores for the different types of test assignment in relation to the number of answers a student knows

		Theoretically possible total score				
		T-F	M-C	5-5	5-6	5-7
No. of answers a student knows	0	50%	10%	9%	5%	3%
	1	69%	26%	29%	19%	14%
	2	88%	58%	67%	54%	49%

Tab. 7: The probability a student can successfully pass the assignment even if s/he has less than the required amount of knowledge to pass in relation to the number of answers a student knows

Table 7 shows the probability that a student who knows the correct answer to two or fewer questions will attain the required minimum of three points to pass the assignment. The results indicate that the alternative-response type of assignment (true/false) is not effective because it is not very informative about a student's true knowledge. The best and most informative type of assignment is the matching question with two distractors. Pre-testing has moreover shown that this type of test assignment appeals to students and is easy to understand.

The findings show (see Tab. 6) that, unlike multiple-choice testing, the scoring formula for the matching assignment is not a linear transformation (cf. Ridel, 2006). Therefore, this type of assignment produces better results for some outcomes than for others. Specifically, the matching assignment with two distractors is more accurate for identifying students whose actual knowledge would give them a score of 60 % or less than are the other types of questions examined in this study. Conversely, the multiple-choice question with three distractors provides more informative results for students with better skills. To determine which assignments are the most appropriate it is necessary to consider the objectives the test is designed to meet. In our case, we were testing whether students' skills were sufficient for them to attain the minimum score of 60% required to pass the test. This means that the matching assignment with two distractors is the best type of assignment that can be used among closed-question types of assignment.

Conclusion

The matching assignments described in this paper proved to be a useful tool for testing language skills. However, this assignment must be used with at least two distractors, in which case its informational value is greater than that of a multiple-choice type of

assignment with three distractors. The results currently indicate that matching questions are not useful if the objective is to rank students or to distinguish between very good students – and this holds even if two distractors are used. If these are the objectives it is better to use multiple choice assignments.

Because the scoring formula is not a linear transformation, future research will focus on assignments that contain more questions and combinations of different types of questions. The aim will be to propose suitable threshold levels as well as to find which types of questions should be used in tests designed to distinguish between students of different skill levels.

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ACADEMIC MISCONDUCT AMONG CZECH AND FOREIGN STUDENTS

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Abstract

The academic misconduct which includes various types of unethical behaviour of student is rising in many academic and professional contexts. More than 50% (and even more) of students have tried to get better grade without appropriate self-employed work. The goal of this study is verify whether the attitude towards the unethical behaviour differs between the Czech and foreign students of the University of Life Sciences in Prague. The statistical analysis indicates that there are significant differences between the ways of academic misconduct but not in the total frequency. The feeling that such behaviour is immoral is comparable.

Keywords

Academic misconduct, assignment cheating behaviour, exam cheating behaviours, unethical behaviour

Introduction

The unethical behaviour is in the contradiction with the academic integrity; the cheating and other types of academic misconduct violate the values as: honesty, trust, fairness, respect, and responsibility (Center for academic Integrity, 1999). Faucher and Caves (2009) classify the unethical behaviour in three primary domains: taking, giving, or receiving information from others, use of forbidden materials or information, and circumventing the process of assessment. The term 'cheating' is more often used in relation to examinations, and the other unethical behaviours are called 'academic misconduct'. (McCrink, 2010)

The research made by students´ information portal *Studenta media* among 2105 students of various universities in the Czech Republic stated that 71% have known the questions before the exam, 91% use the materials made by an other person, 57% share the materials with others, 50% feel guiltily, and they are quite aware of doing something improper (Koval, 2013).

Similar numbers came from other countries as well. The Centre for Academic Integrity (CAI), has found that more than 75 % of college students cheat at least once during their undergraduate careers (Center for academic Integrity, 1999). By Park, Park, and Jang (2013) 50% and 78% of the students were engaged in exam-cheating respectively in the assignment cheating behaviours.

The new communication techniques brought new possibilities for unethical behaviour. A huge amount of text can be found in the Internet and it is also possible to order and pay certain assessment (including bachelors or diploma thesis) custom made. When the examination questions are presented electronically, they can be stolen and the leaked questionnaire can not only help dishonest people cheating, but it also makes impossible to reuse the questions later (Keresztury and Cser, 2013).

The academic misconduct is harmful to a fundamental goal of education which is *to equip students with self regulatory capabilities that enable them to educate themselves* (Bandura, 1997 in Chýlová and Natovová, (2013). The students will not create proper learning manners which fact can negatively influence their future carrier and life satisfaction. People on higher posts tend to be focused on work, doing maximum so that things are done the best way possible while making use of all knowledge and skills acquired (Staňková, 2009).

It is necessary to point out this problem because various ways of academic misconduct do not represent neither ethical nor technical problem for many students.

This study is focused on the unethical behaviour of the students of the Czech University of Life Sciences in Prague. It is based on a survey which searched for the opinion of the students and for their attitudes to the unethical behaviour. The main goal was to find the differences between the Czech and foreign students. The partial goals were connected with analysis of particular questions from the survey.

In order to meet the goals following working hypotheses were formulated:

H1: The nationality has no influence on the students´ behaviour during writing tests.

H2: The nationality has no influence on the students´ behaviour during writing assessments.

H3: The nationality has no influence on the students´ attitude towards unethical behaviour and the moral judgement.

Materials and Methods

The survey was designed and managed by the authors including formulation of the questions. The responders of the survey were chosen from the students of the branches Business and Administration, Economics and Management, and Informatics (year 1-3, Faculty of Economics and Management, Czech University of Life Sciences in Prague). The collection of the filled-in questionnaires was carried out in the winter semester 2013. The question forms were distributed in the regular teaching lessons both in Czech and English language. The foreign students (studying in English) of all nationalities filled the question form in English.

The question form was divided into 3 parts: behaviour during writing tests, assessments, and the evaluation of the moral attitudes.

The statistical analysis was based on the tools of the single dimensional and multiple dimensional analyses of the categorical data. The basic analysis of the values of variables is presented in the frequency distribution and calculations of the descriptive characteristics. The dependencies of two variables were described by the contingency tables which contained frequencies for pairs of categories. One category of the pair is for the first variable and the second category is for the second variable. The tests of the dependencies and the calculations of the measures of the dependency intensity were based on the contingency tables. The chisquare test was applied for the test of independence of variables in the contingency tables.

The construction of the dependency intensity measures was based on the calculation of the Cramer's V which can have values from the interval <0;1> . The value 0 means statistical independence of variables, the value under 0.3 means weak dependence, 0.3-0.5 medium dependence, 0.5-0.7 high dependence, over 0.7 means very high dependence (Pecáková, 2008).

For the test of the statistical hypotheses and the following analysis the significance level $\alpha = 0.05$ was used. The practical calculations were made with MS Excel and the statistical software SPSS version 20.

Results and Discussion

There were all together 523 filled question forms, 14 of them were removed when coding and cleaning the data. The final data matrix applied for the data analysis contains 509 question forms. The reactions of responding students were positive and the students were interested in the result of the research.

427 responders were Czechs; the others (82 responders) were other than Czech nationality. There were more women (60.3%) what is in line with the percentage of female students at the university.

The analysis of particular question showed that the use of prohibited notes (69.4%), copying (66.8%), and prompting (60.9%) were the most frequently mentioned as exceptional but used behaviour. The use of some electronic devices (mobile phone, etc.) is not stated so frequently. 85.1% responders have never used any electronic device and only 5.3% admitted the frequent usage.

Many students probably tried what would be acceptable for concrete teacher, in concrete subject. Taking advantage of information from students who had already passed the test was very frequent (in 71.1% cases). But in this point, it is not quite clear what is and what is not the unethical behaviour.

The following analyses were focused on writing assessments, bachelors and diploma thesis. Copying other person's text was frequent for 2.8% responders, exceptional for 20.5%. The Internet was used for plagiarism exceptionally in 40.7% and frequently in 10.2% cases. The same texts in more than one subject submit exceptionally 19.2% of students.

The mentioned results indicate that the students´ attitude to the assessments is not responsible and not in line with the academic integrity. The students most often try to explain such behaviour by being overloaded with different tasks and the independent and responsible work on each of it is not manageable.

The last part of the survey dealt with the attitudes toward the unethical behaviour and to the threat of some disciplinary actions. 71.4% of responders thought that there are enough mechanisms which are able to prevent the unethical behaviour, 13.2% do not agree, and 15.4% do not know.

The results proved that student face quite often a moral dilemma. Two thirds (66.8%) of the responders stated that they feel pangs of conscience when they are cheating. It means that they are aware of certain moral rules but anyway at least sometimes behave unethically.

The main goal of this study was to confirm or refuse the hypotheses H1, H2, and H3, which are concerned with the differences in the students´ behaviour and the possible correlation with their nationality.

	p-value	Cramer's V
Do you use prohibited notes (cribs) or other aids?	0.000	0.249
Do you use (copy) other students' answers?	0.000	0.212
Do you communicate with other students (prompt)?	0.185	
Do you use electronic device (mobile phone)?	0.000	0.396
Do you use information from students who have passed the test?	0.000	0.332
Do you share information on the tests you have passed in the social networks (face book)?	0.010	0.135

Table 1: The dependency of nationality and the behaviour during writing tests

It follows from the Table 1 that there are statistically proved differences in answers of Czech and foreign students for all the questions connected with the behaviour in writing tests. The contingency tables analysis proved the medium dependency (Cramer's V over 0.3) for usage of electronic device: the Czech students use them often in 2.6%, exceptionally 6.1%, and never 91.3%. The foreign students use electronic device frequently in 19.5%, exceptionally 26.8%, and never 53.7%.

The foreign students are probably more familiar with the electronic devices and more used to count with the information from the Internet or from virtual communication.

The information from colleges use the Czech students often in 77.4% cases, exceptionally in 16.7%, and never in 6.0%; the foreign students often in 39.0%, exceptionally in 35.4%, and never in 25.6%.

It looks like the personal communication is still more reliable for Czech students. They may also know better each other in relatively steady study groups.

The working hypothesis H1: The nationality has no influence on the students´ behaviour during writing tests **was refused.**

	p-value	Cramer's V
Do you copy other persons´ texts in your midterm projects, bachelor's or diploma theses without station of the source?	0.042	0.112
Do you use not existing sources and fabricated data in your works?	0.000	0.266
Do you let another person to do your work?	0.000	0.227
Do you use Internet or other sources for downloading the works of someone else?	0.122	
Do you resubmit a paper that was submitted in another course, without major adjustment?	0.037	0.114

Table 2: The dependency of nationality and the behaviour during writing assessments

Another set of question was connected with the H2: The nationality has no influence on the students´ behaviour during writing assessments. The hypothesis **was refused** for four out of five questions (see Table 2). It is perceptible from the values of the Cramer's V that only two dependencies are stronger – in the case of relation between nationality and stating not existing sources and fabricated data (Cramer's V = 0.266) and nationality and downloading of anyone else's work (Cramer's V = 0.227).

The more detailed analysis demonstrated that 61% of foreign and 87.5% of Czech students have never cited non existing sources. Similar numbers are also for presenting other person's work: never have done that 88.5% of Czech and 63.4% of foreign students.

	p-value	Cramer's V
Do you thing that your school has enough instruments to prevent the cheating?	0.000	0.192
Is there any threat of penalty in case of unethical behaviour? Are you afraid?	0.000	0.233
Do you think that the unethical behaviour is frequent at your school?	0.037	0.114
Do you feel pangs of conscience when cheating?	0.440	

Table 3: The dependency of nationality and the students´ attitude towards the unethical behaviour

The last set of questions dealt with the students´ attitude towards the unethical behaviour. The hypothesis H3: The nationality has no influence on the students´ attitude towards

unethical behaviour and the moral judgement **was refused**. The answers for three from four questions do not support the hypothesis. The strongest dependency (Cramer's V = 0.233) between the nationality and the differences in answers was proved for the question: "Are you afraid of the penalty for unethical behaviour?"

58% of foreign students and only 34.0% of Czech students think that the university has enough instruments to prevent cheating and other forms of academic misconduct (see Table 4).

The university may have less preventive measures that other universities and should introduce some more. If it helps, that is not quite clear. The use of computers has made academic dishonesty easier but faculty can learn several techniques for identifying student papers that were plagiarized from the Internet or other technology sources (Austin and Brown, 1999). The results of Saidin and Isa (2013) showed that a majority of students (82%) had cheated before and did so albeit knowing the consequences.

Do you thing that your school has enough instruments to prevent the cheating?				
	Yes	No	Do not know	Total
Czech nationality	34.0%	22.0%	44.0%	100.0%
Other nationality	58.5%	18.3%	23.2%	100.0%
Total	37.9%	21.4%	40.7%	100.0%

Table 4: Contingency table of dependencies

All the hypotheses were refused that means that there are remarkable differences in understanding and active involvement in unethical behaviour between Czech students and other nationalities. The result of the final question "Do you feel pangs of conscience when cheating?" brought approximately the same result for both Czech ("yes" in 66.4%) and foreign students ("yes" in 70.7%).

The negative influence of the behaviour during the studies and the professional carrier is definitely an area for further research. According to Saidin and Isa (2013) many respondents do not feel their cheating habits in university define the type of employee they would be.

Conclusion

The results of the investigation have confirmed that majority of student try to reach the best results without own intensive and regular work as it was proved in the previous study of the authors made only among Czech students (Dömeová and Jindrová, 2013). The research did not proved substantial differences in the total frequency of the academic misconduct, more likely it proved differences in the way of cheating.

While the Czech students prefer personal communication (copying and prompting), the foreign students are more dependent on the electronic communication devices. The reason may be in the closer personal relations without language barriers among Czech students.

The foreign students are more often afraid of some form of penalty. Probably they have more experiences with punishment from the universities in their home countries and they suppose the same practice in the Czech Republic. The teachers in Prague may be more permissive and the Czech University of Life Sciences in Prague has not yet established appropriate preventive instrument which would include the control of electronic communication via social networks and the Internet.

The investigation could be carried on in searching for the other factors which can be predictive for the academic misconduct, e.g. the gender, age, religion, cultural background, motivation for studies, and previous results.

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IMPROVING INTERCULTURAL CONTACT (A CASE STUDY AT A CZECH UNIVERSITY)

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Abstract

This article is concerned with intercultural contact between university students. By analysing the level of intercultural contact and its relationships to other variables, the article aims to explore features of intercultural contact that are common to Czech (host) as well as non-Czech (international) students. Additionally, it searches for differences between subgroups of the sample to provide educated suggestions for improving the contact. A questionnaire survey was conducted on 159 university students. The article seeks to combine empirical data with extant theory in order to gain a deeper understanding of the concept of intercultural relations and its possible applications. The findings suggest that frequent communication (preferably voluntary and during informal activities) with out-group friends, and possessing certain intercultural personality characteristics (motivational) can be associated with a higher number of out-group friends. Additionally, mainly students of courses taught in English show better overall results in terms of intercultural contact.

Keywords

Intercultural contact, intercultural communication, intercultural relations, international students

Introduction

Almost any higher education institution is composed of both host-country students and international students. The number of international students is always seen as an indicator of attractiveness and even quality of the institution, which is reflected in a growing tendency of all universities to achieve a greater level of internationalization. However, the potential to make use of a culturally diverse environment is greater than universities usually accomplish.

The presence of international students at a higher education institution allows intercultural learning to take place. Students bring their own cultural capital to campus and thus diverse ideas, values, experiences and behaviours can be shared. This cultural exchange is said to create more interculturally competent graduates, who will be better prepared for a globalized world (Sexton, 2012). Moreover, intergroup contact contributes to positive intercultural relations and decreases prejudice, as Allport (1954) claims in his well-known intergroup contact theory. Research pursuing his theory indicates that frequent contact with members of a different culture can lead to decreased intergroup anxiety.

Nevertheless, when the level of genuine intergroup contact is low, the cultural exchange or the improvement of relations doesn't have to happen at all. A low level of intercultural contact on a multicultural campus can remain unnoticed even by students themselves. Halualani (2007) for example noticed that students sometimes equate just "being on a culturally diverse campus" with actual "intercultural interaction", which is why scholars

sometimes use the number of outgroup friends to report the level of genuine intercultural contact (e.g. Williams, 2011).

For intercultural contact to have positive effects, it should also play out on a voluntary basis (Pettigrew and Tropp, 2008). However, voluntarily seeking contact with a different cultural group might impede with the students' comfort zone. Very often, international students choose to develop friendships with students of the same ethnicity. Host students also tend to have a lack of interest in forming relationships with international students. This strategy is effective, logical and can be easily explained by the concept of "homophily" (Lazarsfeld & Merton, 1954). People choose to interact more with people who have similar traits (physical, cultural, and attitudinal characteristics) than with people with dissimilar traits (Centola et al, 2007). So, it seems effective for students to seek contact with their "similar" peers. On the other hand, choosing the multicultural strategy in forming friendships also has numerous benefits (Volet, 1998) and leads to more adaptive outcomes, as Sam (2006) and Berry (2011), the leading pioneers of acculturation research, claim.

Nonetheless, what motivates students to voluntarily interact with members of the out-group is not well understood. Similarly, intercultural personality characteristics are an issue where clear results have not been obtained yet (Kosic, 2006). Various researchers try to reveal what personal factors are important for a successful sojourn, because these could help to identify and predict attitudes toward interacting with members of an out-group. Additionally, although most research has been conducted solely from the viewpoint of the acculturating group (e.g. immigrants, sojourners, or international students), based on a review of 94 studies of acculturation experiences of international students, further research should focus on the pivotal role of host students in intercultural contact (Smith and Khawaja, 2013).

This paper aims to reveal the level of genuine intercultural contact and communication between international and host university students at one specific university environment. A better understanding of intercultural contact should help guide future research as well as help implement potential improvements to the university environment. Both sides of the contact are incorporated in the research in order to reveal features of intercultural contact that are common to both of these groups and thus avoid bias of one of the groups. University students rank the level of intercultural contact by reporting the number of out-group friends (NOOF) and the frequency of communication (FOC) with them during different activities available for university students (school, social, cultural and sport). Students also report on how often the contact is voluntary (initiated by students) or instructed (ordered by teachers), and indicate a level of their intercultural personality characteristics. The paper then explores relationships between the NOOF and other variables, and tests whether different subgroups of the sample report similar rankings. The subgroups of participants are divided by nationality (Czech and non-Czech), language of courses (Czech and English) and a previous study abroad experience (with and without). Results of the research are then applied to the specific environment of the Czech University of Life Sciences Prague in order to develop an educated recommendation to effectively manage a culturally diverse environment. Suggestions that target both sides of the contact as well as specific subgroups and aim to improve and intensify the contact are proposed.

Materials and Methods

159 university students participated in the research. They can be divided either by nationality or by the language of courses. 55 of them have a Czech nationality and 104 are international students, 85 study courses taught in Czech language and 74 study courses taught in English. The distribution of national cultures of international students (IS) in the studied samples of Czech and English courses roughly corresponds to the general pattern of all IS at the university.

International students studying Czech courses (50) mainly come from the former soviet countries. The biggest group of Russians is followed by a substantial group of Kazakhs and smaller groups of Slovaks, Ukrainians, and other countries (Vietnam, Azerbaijan, Uzbekistan). These students are largely attracted by the possibility to study a university for free if they accomplish a certain level of Czech language. On average, they come for the entire degree (3-5 years). National cultures are more evenly distributed in the group of IS studying English courses (54). Around 30 nationalities from all around the world compose this diverse group (France, Spain, Greece, Turkey, etc.). These students usually come for a shorter time (4-8 months – exchange students, or around 1-3 years – degree students). Regarding Czech students (CS), 31 study a course in English and 24 in Czech language.

Two in-depth questionnaires were developed in both languages and administered to university students. Although the ratio of IS is higher in English courses (about 41%) than in Czech courses (less then 8%), when targeting CS in Czech courses, the research deliberately aimed at culturally mixed student groups. Czech students who reported not having an IS in their study group to cooperate with were excluded from the research. Although students can form out-group friendships beyond school group activities, this was done to ensure that all participants have a more or less same opportunity to form relationships and engage in intercultural communication and a thus to avoid objections to the research in this regard.

Part of the questionnaire asked socio-demographic questions concerning the participant's gender, age, length of residence, nationality, language of courses or a previous study abroad experience. The major part of the questionnaire concerned questions related to intercultural contact and communication. The level of intercultural contact was operationalized as the number of out-group friends (NOOF). The NOOF is measured on a 1-5 scale (none, only one, a few, some, many) with the question: "*How many Czech friends do you have at the CULS?*" (for IS and vice versa for CS). The question was created to assess current friendships with out-group students.

The level of intercultural communication was operationalized as the frequency of communication (FOC) with out-group friends during different activities (school, social, cultural, sport) or during different types of contact (voluntary or instructed). It is measured on a 1-5 scale (never, seldom, some-times, often, almost always) with the question: "*How often do you communicate with Czechs during activities connected with the CULS (school, social, cultural and sport*)?", "*How often do YOU look for opportunities to interact with Czechs at the CULS?*", and "*How often are you instructed by teachers to cooperate with Czechs?*" (for IS and vice versa for CS). These questions were created to assess when and how do university students communicate with out-group friends.

Another part of the questionnaire concerned questions related to intercultural personality characteristics. Earley and Ang's (2003) CQ (cultural intelligence) refers to "a person's capability to adapt effectively to new cultural contexts". It is a four-facet concept (general,

cognitive, motivational and behavioural). The 5 items of the motivational facet (e.g. "*I enjoy interacting with people from different cultures.*", "*I am confident that I can socialize with locals in a culture that is unfamiliar to me.*", etc.) were used in the questionnaire. By indicating their dis/agreement with the statements on a 5-point scale (totally disagree-totally agree), participants revealed their level of CQ connected to motivation for intercultural contact.

By using the SPSS software, descriptive statistics were obtained for each of the variables. Shapiro-Wilk's test of normality showed that the data violate the assumption of a normal distribution, and therefore guided the analysis to use non-parametric tests. Whether relationships exist between the variables and Likert-type ratings was analysed by Spearman's bivariate correlation coefficient. Whether mean rankings of the variables are different between particular group categories was analysed by the Mann-Whitney U-test, a non-parametric two individual-samples test.

Results

Out of the 159 participants, 19 students (12%) don't have any out-group friends, 20 (13%) have one, 71 (45%) have a few, 36 (23%) have some, and 13 (8%) have many. The average of the ranking is M=3.03 (SD=1.08, median=3). So, on average participants have "a few" out-group friends. The frequency of communication (FOC) tends to be higher during school and social activities than during cultural and sport activities. However, this corresponds to "sometimes" and "seldom" rankings of the scale. Students seem to possess a high level of MCQ. A variable of an average FOC during all four activities was added. All the results are depicted in Table 1.

	NOOF	FOC average	FOC school	FOC social	FOC sport	FOC cultural	FOC voluntary	FOC instructed	MCQ
M	3.02	2.70	3.29	3.04	2.30	2.17	3.29	3.08	3.98
SD	1.091	0.858	1.067	1.297	1.300	1.094	1.093	1.187	0.736
Median	3	3	3	3	2	2	3	3	4

Table 1. Intercultural contact, communication and personality

Spearman's correlations coefficients between the NOOF and other variables are depicted in Table 2. They show statistically significant relationships at the level $p < 0.01$. The correlation matrix is restricted to correlations with the NOOF only.

	FOC average	FOC school	FOC social	FOC sport	FOC cultural	FOC voluntary	FOC instructed	MCQ
NOOF	.521**	.350**	.384**	.347**	.419**	.435**	.242**	.358**

**. Spearman Correlation - significant at the 0.01 level (2-tailed).

Table 2. Correlations with the Number of out-group friends

The Mann-Whitney U-test analysed whether the mean rankings of variables concerning intercultural contact are the same across categories of two samples. In particular, it tested 15 null hypotheses in the following form: the mean ranking of the NOOF, the frequency of communication (average, voluntary and instructed), and the level of motivational CQ are the same across categories divided by nationality (Czech, non-Czech), language of courses (Czech, English), and a previous study abroad experience (with, without). All of the tests were done at the significance level of .05. Table 3 shows which hypotheses were rejected (H_a) and which couldn't be rejected (H_0) and at what *p*-value.

	NOOF	FOC gen.	FOC vol.	FOC ins.	MCQ
1) Czech	H_0 (.757)	H_0 (.689)	**H_0 (.075)**	H_0 (.977)	H_a (.009)
2) Non-Czech					
1) Czech courses	H_a (.005)	H_a (.033)	H_0 (.900)	H_0 (.258)	H_a (.010)
2) English courses					
1) Without a SAE	H_a (.027)	H_0 (.224)	H_0 (.688)	H_0 (.900)	H_0 (.383)
2) With a SAE					

Table 3. Results of Mann-Whitney U-test

Table 4 shows the sample sizes of the groups of two independent-samples, the mean rankings from the Mann-Whitney U-test (only the ones concerning the null hypotheses that were rejected) and the corresponding mean averages in the brackets.

	N	NOOF	FOC gen.	MCQ
1) Czech	55	No dif.	No dif.	68.38 (3,78)
2) Non-Czech	97			**81.10** (4,13)
1) Czech courses	74	69.59 (2.76)	71.70 (2.57)	67.02 (3.83)
2) English courses	85	**89.06** (3.26)	**87.23** (2.82)	**85.42** (4.15)
1) No for SA exp.	122	75.79 (2,92)	No dif.	No dif.
2) Yes for SA exp.	37	**93.89** (3,38)		

Table 4. Mean rankings of the Mann-Whitney U-test

Discussion

All the forms of out-group communication that were researched can be positively associated with the NOOF. Although informal activities (cultural, sport, social) were reported as slightly less frequent than formal (school), they actually showed a similar or slightly higher correlation coefficient. This could suggest that informal activities are similarly or even more important for forming out-group friendships than formal activities, where the contact is more intensive. However, positive correlations only show us that both values increase together, they don't disentangle the cause. We cannot state that more out-group communication leads to more out-group friends or that having more out-group friends leads to more out-group communication. There can always be a third variable causing the effect.

Looking at the average frequency of voluntary and instructed communication, although they are on average approximately similar, the correlation with the NOOF seams to be stronger during voluntary contact. This could suggest that personal motivation for intercultural contact is important and that it precedes the creation of out-group friendships. However, even instructed communication positively correlated with the NOOF, implying

that pushing students into intercultural contact doesn't have to be associated with a lower NOOF. The results also imply that possessing intercultural personality characteristics, in particular those connected to motivation, can be associated with a larger NOOF. In this sense, personality traits seem to play a certain role in forming out-group friendships. They could be viewed as predispositions for voluntarily seeking intercultural contact, since variables for frequency of voluntary communication and variables for MCQ positively correlated (+.409**)[1].

Looking at the different subgroups of participants involved in the research, not all of them responded similarly on the studied issues. Starting with the focus of the research, the NOOF, no difference was revealed between Czechs and non-Czechs in the mean rankings of this variable. However, regarding the language groups, students of courses taught in English tend to report a larger NOOF. Although it could imply better intercultural relationships in this group, the language factor itself doesn't necessarily have to be the cause of the difference. Though the research chose only students from a culturally mixed group, a generally lower ratio of IS in Czech courses at the CULS could have had an impact on the result. The presence of more members of an out-group simply offers more opportunities for friendships. Additionally, students who have had a previous study abroad experience tend to report a larger average NOOF than students who haven't. This suggests that a previous study abroad experience might have a positive effect on the creation of out-group friendships.

No difference was found between the groups of Czech and non-Czech students in the mean rankings of the FOC, or between students with or without a previous study abroad experience in this issue. However, students of English courses tend to report more frequent intercultural communication than students of Czech courses. Again, suggesting more intensive intercultural relationships in the courses taught in English.

Concerning motivational CQ, there is a difference between the groups of Czechs and non-Czechs in the mean rankings of this measure. Similarly, between the groups of students of Czech and English courses. On average, non-Czechs and students of English courses tend to achieve better results on the MCQ facet. International students' reports of a higher MCQ might reflect the fact that they are the ones who chose to study abroad and thus represent a more motivated side of the contact. They also reported to engage more in voluntary intercultural communication. Although the H_0 wasn't rejected statistically, the *p*-values suggest a slight difference (p .075 > .05).

Conclusion and Applications

Regarding university students in general, certain features of intercultural contact are common to all. In particular, frequent communication, preferably voluntary and during informal activities, is associated with more out-group friendships. Moreover, possessing certain characteristics that show motivation for intercultural contact is also related to having more out-group friends. Concerning the groups of students at the CULS, students of courses taught in English tend to show better intercultural relations results (in forming more out-group friendships, in communicating with out-group members more often, and in possessing more intercultural personality traits) than students of courses taught in Czech. International students, oppose to Czech students, tend to be more motivated for intercultural contact (in possessing more intercultural personality traits connected to motivation, and in seeking voluntary intercultural contact more often). Oppose to students

[1] Spearman Correlation - significant at the 0.01 level (2-tailed).

with no study abroad experience, students having these experiences tend to have more out-group friends.

These three aspects of a culturally diverse university environment (international students, courses taught in English, and study abroad experiences) have been supported by the school administration for years and according to the long-term plan of internationalization, the CULS aims to continue in this direction; supporting the inflow of international students, developing courses taught in English, and participating in student exchange programs. Further research in this area should aim to reveal specific benefits of an intensified intercultural contact at the CULS, in particular, its relation to university students' psychological and sociocultural adaptation.

Building on the premise that only bringing students of diverse cultural backgrounds together on one campus isn't enough to achieve effective intercultural learning, the university should expand its activities toward providing more opportunities for forming intercultural friendships. The findings suggest that the focus should be on informal and preferably voluntary activities, since these are associated with a higher number of out-group friends. Regarding different groups of students, in order to intensify and improve intercultural contact at the CULS, the key focus should be aimed at increasing motivation of Czech students to voluntarily participate in informal activities with international students. In particular with international students of English courses, because they seem to be more motivated and show more effort in voluntarily seeking out-group contact.

The existing official initiatives connected to international students (e.g. orientation week and buddy program) are focused on short-term exchange students (e.g. Erasmus). A few Czech students are involved in the buddy program and help incoming international students with practical and educational matters during their first days at CULS (e.g. applying for an ISIC card or a public transportation ticket). Some of these Czech students formed a group (Buddy Go) and voluntarily organize additional social and cultural events for Erasmus students during the semester. Their motivation is inspired by their own study abroad experience in other European countries, where they engaged in events that enabled students to informally learn and exchange cultural knowledge and practices. Now, the student group's aim is to offer similarly exciting activities at the CULS. Starting in spring 2014, they organized about 15 events. In the long run, they would like to involve more Czech students, who usually don't know about these events or don't see benefits in participating.

Through institutional support, this student group could achieve to leverage the potential of intercultural learning at the CULS. Firstly, students who are planning to go study abroad would be offered to register to the buddy program and participate in tasks that help international students. As an incentive, their proven effort would be reflected in the application process for their own study abroad. In other words, they would have a higher chance to be accepted for their desired study destination. This would, as a side effect, facilitate work with the application process done by international relations offices of each faculty. Furthermore, the group of "buddies" would grow its member base by attracting Czech students returning from their study abroad, who have fresh experiences and might bring new ideas to the table. These students would be offered an opportunity to organize social, cultural and sport events. In this way, the group would be able to expand and target also degree international students in English and Czech courses. The ultimate goal of the group would be to manage applications for its members, who would be interested in participating in the Erasmus+ program, which now offers various intercultural training courses and workshops abroad and supports building strategic intercultural

partnerships within the European Union. This would generally help to raise awareness about the benefits of intercultural communication, provide meaningful opportunities for intercultural contact, and motivate students to interact. Overall, it would help to create an environment supportive of cultural learning and guide the university towards responsible and effective cross-cultural management.

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LIFELONG LEARNING IN THE TOURIST REGION OF JESENÍKY – EAST

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Abstract

The paper deals with the primary research, aimed at residents of the tourist region of Jeseníky - East, realized in the autumn 2013. The principal aim of this paper is to determine the attitudes of citizens to their own lifelong learning sector of tourism services. A secondary goal is to determine what form and type of the educational institution would give local residents priority to lifelong learning. The survey was implemented by participatory observation and the questionnaire.

The first part of this paper is devoted to the current state of the research questions in the area, resulting from historical roots and the attention is also paid to the issue of the research questions, methodology and research techniques formulated in the following chapters. The next section introduces the objectives and defined the material and research results. The last part of this paper includes collected data specifying the resulting specialization of education of the population, its form and content, which could be applied to corporate training in tourism.

Keywords

Education, knowledge, lifelong learning, methods, pilot survey, skills

Introduction

The need for quality human resources for the development of the tourism sector analysis is presented in the Concept of the State Policy on Tourism in the Czech Republic in the years 2007 - 2013 and in the SWOT analysis, from which it is clearly shown that the development of tourism in the Czech Republic is still below its potential. The quality of human resources in this sector depends on their development. It is all about lifelong learning, including learning from experience to help find better employment, improving skills and performance of teams and individuals. It focuses on a wide range of activities, opportunities and incentives in the education system, economic practice, public administration and other sectors. (Kajzar, 2006) Modern training methods are based on the conditions that are necessary to work with the reality of human resources, as given here and now - using all the skills, knowledge and experience of the trainees. (Kajzar a Kozubková, 2007)

Jesenicko was for many centuries the almost unpopulated area belonging to the massive forest border separating Bohemia and Moravia and Silesia, which the Celts named the Sudetenland (Boar Forest). The change came up in the High Middle Ages, when at the instigation of the bishops of Wroclaw it was the colonization foothill area Jeseníky Rychlebske. (Spurný, 2006) The once prosperous region is still heavily just looking for its face. When in the census in 1930 it was found that there were almost 72,000 inhabitants in the Jesenicko area, then the early 21st century their number was only 57% of the original. This statistical information to a large extent still saves the development of their former

district centre - the town of Jesenik and its nearby surroundings. In marginal areas of Jesenicka the devastation of the settlement was drastic. The entire region is then magically „became republic peripherals with the shattered industrial structure and neglected communication networks. Unfortunately, this phenomenon of Jesenicko just influenced almost all of the borderlands of the Czech Republic.[1]

The region of Jeseníky is an area in the northern part of the Olomouc region which corresponds to the area of the former district of Jeseník. This includes 24 municipalities of different sizes, which are grouped into four micro-regions - Javorník, Žulová, Jesenicko and Zlaté Hory. In the region of Jeseníky today the population is about 40,000 people. This region boasts about many natural beauties and cultural monuments such as mountains, Žulová hills, Rychlebské Mountains, the spa of Jeseník, the Jeseník castle in Javorník, etc.[2]

The once prosperous region is still having hard time looking for the former face. The area is cut off from the rest of Moravia by mountains, there is a low density of population, the large unemployment rate, the people have low incomes and there is markedly a lot of abandoned properties, including properties that are inhabited by socially excluded people. Table 1 defines the administrative (right statistic) area of interest of Jeseníky in regional registers of 24 municipalities (according to a system NUTS)

NUTS	Administrative divisions
NUTS I	Czech Republic
NUTS II (region of cohesiveness)	Central Moravia
NUTS III (region)	Olomouc region
NUTS IV (district)	Jeseník
NUTS V (village)	Bělá pod Pradědem, Bernartice, Bílá Voda, Černá Voda, Česká Ves, Hradec -Nová Ves, Javorník, Jeseník, Kobylá nad Vidnávkou, Lipová-Lázně, Mikulovice, Ostružná, Písečná, Skorošice, Stará Červená Voda, Supíkovice, Uhelná, Vápenná, Velká Krš, Velké Kunětice, Vidnava, Vlčice, Zlaté Hory a Žulová

Tab: 1 Delimit of Jeseníky within the regional administration division of the Czech Republic Source: own processing, 2014

The current economy requires for labour language skills, the ability to work with information and manage information and communications technology. As a result of population aging and prolongation of an active life in the future there will be more and more recent adaptation programmes of continuing education needs of middle and older generations, so as to better balance work, study and the personal life. (Kajzar, 2006)

Lifelong learning is a fundamental conceptual change approach to education and its organizational principles, where all learning opportunities, whether in traditional educational institutions or elsewhere, are seen as a single interconnected unit that allows diverse and numerous transitions between education and employment and which provides the same qualification and competence in various ways and at any time of the life. Mužík

[1] *Město Jeseník: Oficiální stránky lázeňského města,* [online], Available: http://www.jesenik.org/jesenicko/36818-historie-regionu.html [12 Mar 2014].

[2] *Jesenicko* (2014) English Heritage position statement on the Valletta Convention, [Online], Available: http://www.socialni-zaclenovani.cz/jesenicko [24 Feb 2014].

(2005) describes this process as „the process of purposeful and systematic intermediation, the acquisition and consolidation of skills, knowledge, habits, attitudes and values of social forms of behaviour and behavioural patterns of persons who left education and preparation for work and entered to the labour market".

The concept of knowledge is by Czech authors used synonymously with the term knowledge, which contributes to the fact that in English there are two concepts expressed by the term „knowledge". Průcha, Walterová a Mareš (1995) defines knowledge as a predominantly cognitive, individually distinct set of ideas and concepts, theories and complex structures that a scholar acquired through schooling, self-learning and other influences. It is the result of the student's perception, learning, thinking, remembering, practical experimentation and life experience.

Skills are the ability to apply knowledge, personal qualities and attitudes in practice in their profession. To do this, we can assume certain business functions, we need to have expert technical skills, analytical and conceptual, socio - cultural communication, etc. (Malátek, Kajzar a Kozubková, 2006)

As reported by Nonaka and Takeuchi (1995), in terms of their options for registration retention and transfer of knowledge it can be divided into tacit knowledge and explicit knowledge. Tacit knowledge is hidden knowledge of the individual. But it is not possible to represent or to pass in a written form. These skills do not stay in business if people leave it. They need both physical and temporal proximity with their own, if to be shared. This is empirical knowledge that the person is a source of personal experience, views, expertise, know-how and specific skills, which are created in course of learning and at the corporate level it is supported by the appropriate organizational structure (Mládková, 2005).

The basic objective of the survey was to determine what the attitude of the people of the region to lifelong learning is, whether they are interested to pursue lifelong learning in the field of services in the tourism sector. A secondary goal is to determine the form and type of the educational institution would prefer to support lifelong learning.

Materials and Methods

Malátek (2001) states that: "The pilot survey must specify the organizational aspects of research actions required by the proportion of time during the research, the quality and the quantity of the research aids, sufficient funds, readiness of the researcher, etc. It is mainly used to check the indicators of research, a thorough analysis of the field on the analysis of documents (plans for selected structures, functions, policies, reports, etc.) and implementation of research interviews contracting authority, etc.

A pilot survey in this paper had two basic levels:

a) Theoretical research, in which the initial descriptive stage of scientific research clarified the concepts, definitions and categories, enabling to organize and categorize phenomena on the basis of similarity and repetition. In the application - the empirical level was used, the complex of empirical techniques and methodological approaches in order to reduce the suggestive influence of individual subjects that were used from direct interviews and through questionnaires. Questioning was applied, among others, the telephone contact and individual interviews (face to face) with the management Centre of Culture and Education Střecha in Vrbno pod Pradědem, Praděd Euroregion and the Municipal Library and Information Centre Zlaté Hory.

b) To obtain primary information there was selected the complementary method of participatory observation, which continuously used in examining the relational context and attitudes related to the behaviour pattern of the local population. The aim of personal

participation was to observe and understand the situation from the „inside“ of the region and gain sufficient insight.

The questionnaire survey was conducted in Vrbno Pradědem, Zlaté Hory and Jeseník in the autumn of 2013 for a period of one month. The main aim of this paper was to determine what attitude the people living in the region Jeseníky to lifelong learning have. The main objective follows up with hypothesis H 1, in which it is expected that the majority of the population of these localities is interested to learn.

Results and Discussion

The questionnaire in the preparatory phase came through certain qualitative development, during which some of the questions had to be modified and then the questions were verified by structural interviews with managers of participating establishments. The sample consisted of 100 random visitors surveyed institutions. There were obtained 89 full-scale responses. Interpretation of the results was discussed with the managers of the institutions in which the survey was conducted.

Of the total number of respondents, the largest group came from Jeseník (48%), followed by Vrbno pod Pradědem 41%, and 14% of the Zlaté Hory. Most respondents (33%) were in the age 50-63 years, 25% of the participants represented the age 63 and over, and the third largest age group of 34-49 years comprised 13% of respondents. From these data logically resulted the economic status of respondents – from 89 interested in the research 44 respondents were in the position of the retired, in the position of students 19 and in the position of employees 13 respondents participated. The group consisted of 8 unemployed respondents. The survey also showed that 85% of respondents to the concept of lifelong learning have been found, 8% responded negatively and 7% did not respond to the question. Under the concept of lifelong learning 24% of the respondents remembered updating, 16% expressed for education in any form, and learning new knowledge is assumed by 13% of respondents. The necessity to educate themselves throughout their lives is expected by the majority of respondents in the surveyed areas. The aim of the lifelong learning in all surveyed locations is for 36% of respondents obtaining a general overview of what is happening in the society, 18% expect better assert of themselves on the labour market, 16% intend to increase qualifications in their chosen field. In this sample 46% of respondents prefer lifelong learning at the University of the 3rd age, 22% choose web-based forms of education (e-learning, etc.) with the possibility of obtaining a certificate of formal education, 14% of respondents would prefer the classic form of education in the college. In terms of the availability of educational institutions logically the most of the respondents (61%) would rpefer educational institutions in the area, 25% of respondents would welcome lectures at the local library and 9% would prefer learning at school. Assuming that the respondents could increase the qualifications in the sector of tourism, 86% of respondents responded positively, including 30% of respondents who are motivated by gaining new knowledge, 25% expect to make use of new knowledge in the workplace and 12% envisage that increasing the qualification could improve their financial situation.

The most significant advantage of growing competition regions is the qualification of people, their creativity and the ability of continuous learning. Learning becomes a major way for Jeseníky. The purpose of the pilot survey of lifelong learning was to help reduce the rate of slowing the peripheral tourism region of Jeseníky - East and it focuses on lifelong learning for the population to increase qualification in tourism services in this area. The determined hypothesis H 1 formulated the assumption that most of the

population, more than 50% of the total number of participating respondents is interested in training in the tourism sector. The hypothesis was confirmed, as 86% of respondents expressed interest getting skills in the area.
The research showed the potential population of the region, which is located in the retirement age from 50 to 63 years. The term lifelong learning remembers updating in order to obtain a general overview of what is happening in the society, giving priority to lifelong learning at the University of the 3rd age. Increasing the qualification in terms of availability realized in neighbouring educational institutions, while the potentialities of this education was directed to tourism services in local businesses.

Conclusion

This research showed that residents of the tourist region of Jeseníky - East are interested to pursue lifelong learning - to increase their skills in retirement too. The principal obstacle seems to be the fact that the tourist regions on the massif of Jeseníky do not correspond to Jeseníky administrative borders, causing tourism organizations difficulties with granting competence with financing from regional budgets, especially if the region extends beyond the region. Summarized results confirmed the positive attitude of the inhabitants of the region to lifelong learning. The Moravian-Silesian region in addition to historical reasons look for the reasons for this low level of cooperation between particular destination management and tourism in Euroregion Praděd with the insufficient level of coordination of activities at the regional and national levels.[3] It is also obvious, but not insignificant deficit provided with the quality knowledge workforce. By providing eventuality the increase of vocational training in the framework of lifelong learning for the local population can create jobs in the improvement of tourism services. It was suitable for the development of specifically designed training programme within corporate training in local tourism businesses. Creating a training programme based on lifelong learning in business education for the population in economically backward regions will be one of the most feasible starting points out of the difficult economic situation.

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LEARNING OUTCOMES SCORES AND RELATION TO OTHER COUNTRY CHARACTERISTICS

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Abstract

The goal of this analysis is to assess the learning outcomes levels in a group of countries and relate the performance to several characteristics of the education system. This could help the educators and policy makers better understand how to increase the skills of the population in the future.
The results of the analysis suggest that when considering the countries with a rather comparable level of development, it seems that the development of high performance levels in numeracy and literacy skills is strongly supported in an environment which builds on wide-spread usage of the modern communication networks. It seems that the technologies related to internet provide efficient tools for sharing the knowledge and also provide a suitable environment for the development of problem solving skills.

Keywords

Education system, internet usage, learning outcomes, literacy skills, numeracy skills

Introduction

The goals of the education activities include providing the knowledge and skills needed in life, preparation for successful activities in the job and providing the necessary background for a valuable life in the human society in general. In addition to subjective evaluations of learning success, the formal measurements of learning outcomes provide necessary feedback regarding how successful the education process actually is in achieving the goals. The results of such evaluations then may suggest, what should be improved in the education process and what are the strengths of particular social groups with respect to education. There exist several widely applied systems of standardized learning outcomes measurements. Tsatsaroni and Evans (2014) provide a discussion of such leasing outcomes surveys and the implications of using such surveys for educational governance. The results of the large-scale studies are analyzed and the measures for improvement of the situations are being developed and applied – see for example (Novotná et al., 2013) regarding mathematics education. The recent learning outcomes surveys include the Programme for the International Assessment of Adult Competencies (PIAAC) designed to be used in by OECD. The survey study was designed to provide results which can be used for cross-country comparisons and also for comparisons over time (for the details on the purpose and the design of the survey see the survey website (PIAAC-OECD).
The goal of this analysis is to assess the learning outcomes levels in a group of countries and relate the performance to several characteristics of the education system. This could help the educators and policy makers better understand how to increase the skills of the population in the future. That is try to find a sort of drivers of high performance. The organization of this paper is as follows: first the PIAAC survey is briefly introduced, then the performance in the survey is analysed using basic descriptive statistics on country

aggregation level and finally an attempt to find if there are some characteristics which could determine the performance of countries is made.

Materials and Methods

Data Description

The data used for the analysis are coming from the World Bank database on Education Statistics, which can be reached via the web interface – see (World Bank DataBank). The data considered are country level aggregations, collected yearly.

Regarding the data on performance levels, the most recent (and at this time the only available) data on the PIAAC survey learning outcomes are from the year 2012. The PIAAC survey is focused both on the Young adults group and on the Adults group. The focus in this analysis is on the Young adults group only, which includes the people aged 16 to 24 years. It can be assumed that the performance of such young people should reflect the recent situation in the education system more closely than the performance of people over 25 years. The survey outcome includes the Literacy proficiency score related to the ability to use and understand written texts and the Numeracy proficiency score related to the ability to use mathematical concepts.

The analysis covers only the countries, for which the relevant data are available at the moment - Australia, Austria, Canada, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Italy, Japan, Korea, Netherlands, Norway, Poland, Slovakia, Spain, Sweden, United States - that is basically the developed countries. Data from more countries are to be collected in the future.

As there are many missing values in the explanatory (i.e. the non-performance related) variables included in the analysis and since it makes more sense to consider the values of the previous years regarding the variables which are supposed to have an impact on the performance, the values of variables other than the actual learning outcomes are taken as the average values over several previous years.

The characteristics of the education system in the country considered in this analysis include the following variables: the duration of compulsory education, the enrollment ratio and the ending age of compulsory education, tertiary first degree completion ratio. Then also several variables on the general background are included in the analysis, namely the GDP per capita to adjust for the economic development level mortality ratio under 5 years and the number of Internet users (per 100 people).

Statistical Analysis

In an exploratory analysis, the dependence between the earning outcomes scores in particular fields is reported using the Pearson correlation coefficient and the 95% confidence interval for the value of the Pearson correlation coefficient is reported, after an assessment of normality of the investigated variables using the Shapiro-Wilk test and after an inspection of plots of probability density estimates. Since the values considered are actually mean values of the test outcome obtained from a large sample, it is not surprising that the values can be regarded as coming from the normal distribution.

Since the preliminary analysis has shown that the numeracy skills performance and the literacy skills performance are highly correlated, the mean numeracy score and the mean literacy score are merged into total score and only this single score is considered in further analyses as a performance measure. The dependence structure is further studied using the standard linear models framework with the score as the outcome variable and the other variables as predictors.

The R software for statistical computing (Hornik and Leisch (2004) and R Core Team (2013)) is used for the calculations and the 0.05 level is used for the assessment of statistical significance. As a reference for the statistical methods used, see (Venables and Ripley, 2002).

Results and Discussion

Basic summary characteristics of the mean numeracy proficiency score and of the literacy proficiency score is shown in Table 1.

Characteristic	Literacy proficiency	Numeracy proficiency
Minimum	260.8	249.4
1st quartile	275.0	264.2
Median	277.7	273.1
Mean	279.4	271.1
3rd quartile	284.1	278.5
Maximum	299.4	285.4

Tab. 1: Summary characteristics for mean country scores

The mean scores in both the numeracy proficiency and the literacy proficiency by country are shown in Figure 1. Good news for the people in the Czech Republic is, that its mean literacy score (280.5) is not below the average and its mean numeracy score, which is 278 is clearly above average performance level. In the Figure 1 it can be observed, that the countries with higher scores in one of the fields achieve better results also in the other field. This can be formally assessed using the correlation coefficient analysis, which gives the value 0.84 for the Pearson correlation coefficient, with the 95% confidence interval between 0.65 and 0.93. This suggests, that the two scores may be merged into single total mean score for further analyses.

When building the regression model for mean total score, the only variable which was found to have a statistically significant coefficient is the percentage of internet users (the p-value for the coefficient is below 0.001), nevertheless, the accuracy of the model with all the predictors included is higher (the adjusted R squared is 0.7) and is also preferred when considering the results of the ANOVA test of the model with the whole set of predictors in comparison with the submodel including just the internet usage penetration in the predictors set (since this test gives a p-value below 0.05).

The relation of internet usage penetration and mean scores of the countries is shown in Figure 2, which also includes the regression line fit to the data. In this figure, the departures from the regression line suggest the evidence of factors not included in the internet usage penetration variable. For example the Czech Republic can be considered as having comparatively high achievement score when adjusting for the number of internet usage penetration. This is even more pronounced in case of Japan (which, as a technologically more advanced country, has higher number of internet users). On the other hand, the USA or Spain are performing below the level which may be considered as corresponding to the internet usage penetration in the country.

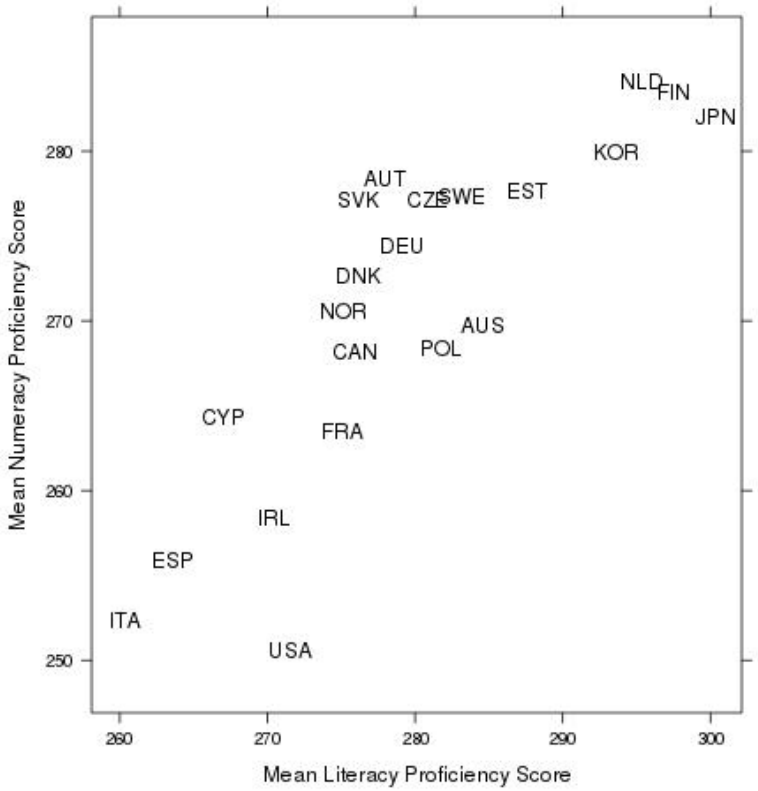

Fig. 1: Dependence of Literacy and Numeracy Scores

The results of the analysis suggest that the development of high achievements levels is supported in an environment which builds on wide-spread usage of the modern communication networks. The technologies related to internet seem to provide an efficient tools for sharing the knowledge and also provide a suitable environment for the development of problem solving skills. The situation in social networks is reported in (Lohr, Tesař and Brožek, 2013) It seems that the point is to make such technologies available to rather wide group of people, not just to elite groups. The ICT also started to be heavily used in formal education process in the developed countries. The availability of online learning management systems enhances the opportunities for distance learning and also for the life-long learning, including further education of working professionals, among others. Recent discussions and evaluations of the application of such tools in education include (Mošna, 2013) for mathematics teaching and (Majovská, 2013). One of the advantages of using the ICT in education is that it allows performing experiments easily, but still it is not straightforward how to use the full potential for education (Robová and Vondrová, 2013).

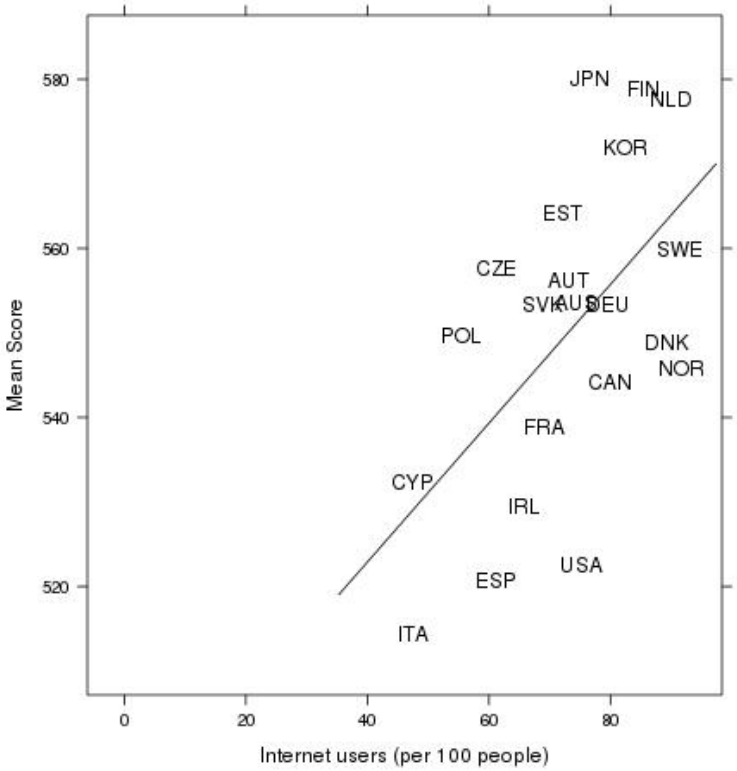

Fig. 2: Dependence of score and the number of Internet users

We have discussed a rather homogeneous group of countries in our analysis. The countries included in our analysis may all be regarded as rather developed ones. The question is, what would be the situation in countries, for which there is no PIAAC score available so far. When looking at the internet usage penetration data across the countries - see the density plot of internet usage penetration by achievement score availability in Figure 3 – it is obvious, that the density of internet usage penetration is bimodal (even if the countries are not split into groups by achievement score availability). And that there exists a natural classification structure – there are two segments with a cut-off value at approximately 50%. This further supports the hypothesis that the internet usage variable may be a valuable one when discussing the learning outcomes performance level. It may be expected, that as the performance in the countries which were not included in the PIAAC survey would be lower.

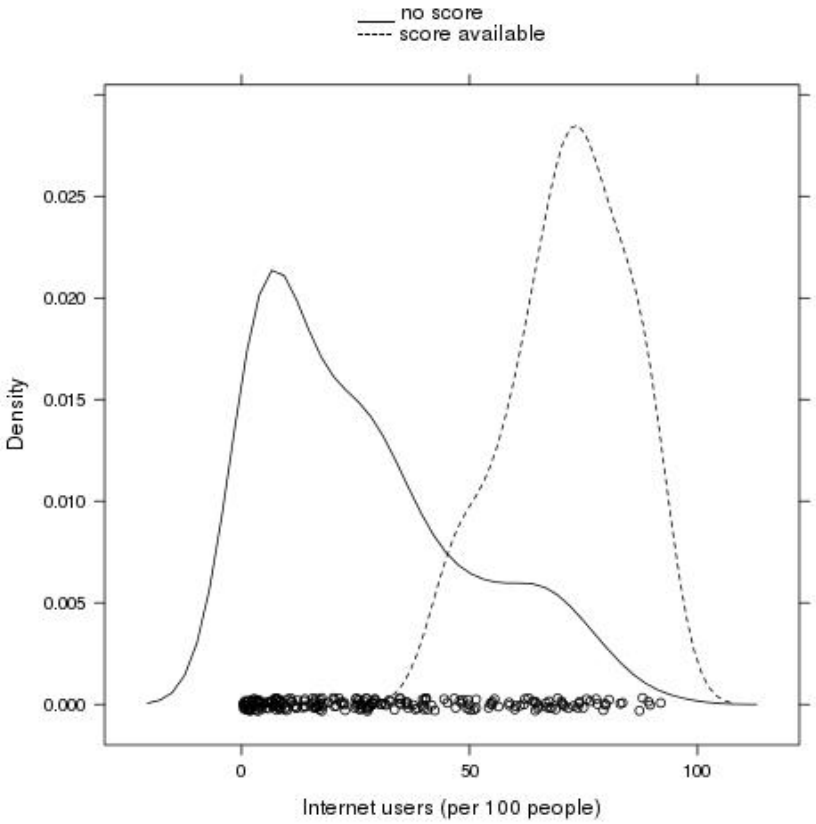

Fig. 3: Density estimate of he Number of Internet users by Score availability

Conclusion

The results of the analysis suggest that when considering the countries with a rather comparable level of development, it seems that the development of high performance levels in numeracy and literacy skills is strongly supported in an environment which builds on wide-spread usage of the modern communication networks. Clearly the technologies related to internet provide an efficient tools for sharing the knowledge and also provide a suitable environment for the development of problem solving skills. And the availability of such technologies in the society should be supported.

The countries considered in the analysis may all be regarded as rather developed ones. The question is, what would be the situation in countries, for which there is no PIAAC score available so far. It may be expected, that as the performance in the countries which were not included in the PIAAC survey would be lower. This could be verified in future research in case that there are some data which would allow a comparison of learning outcomes performance levels available.

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‘WHY DO THEY DROP OUT: 2006 AND 2013 COHORTS´ COMPARISON’

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Abstract

The paper compares two time-separated researches which focus on possible causes which lead to students dropouts of business faculties in the Czech Republic. The aims of the paper are to identify causes leading to students´ dropouts in the Czech business faculties and to identify the variance in the sets of dropouts´ causes at business faculties in students´ cohorts 2006 and 2013. In the first research, performed in 2006, respondents were students of business faculties in Prague. The second research was performed in 2013 among students of business faculties in the Czech Republic. For identification of causes of students´ dropout were used group focus techniques, interviews, and content analysis. We identified general categories and specific reasons which lead to barriers which may cause students dropouts. We also identified the shift between the dropouts´ causes between Czech business students´ cohorts 2006 and 2013 in appearance of new study problems.

Keywords

Students retention, dropout, cohort, college, higher education, business faculty

Introduction

Students retention is significant to higher education system around the world as many authors state. Mantz and Bernard (2004) explain the retention as a tool focusing on the effectiveness and efficiency of an institution or a system of higher education. Wild and Ebbers (2002) support this statement as they see retention also as significant for measuring institutional effectiveness with broader impact to relevant stakeholders of higher education system – internal administrators, faculty, taxpayers, legislators, state policy makers, etc. Brunsden, et al. (2000) even see the retention as complex issue which affects each aspect of higher education – personal, institutional, and societal aspects with its costs and implications to all stakeholders. Ozga and Sukhnandan (2004) also support the importance of retention in economic way – the attrition they see as (i) waste of university resources which are limited, (ii) damage of the institution´s reputation, (iii) and negative long-term consequences for attracting new students. The retention from point of government describe Mantz and Bernard (2004) as very important issue for labour market considerations and distribution of public financial sources.

Students retention is not fully developed research field in the Czech Republic. Ministry of Education Youth and Sports of the Czech Republic nor the universities do not pay an extra attention to this neglected area. Taxpayers can find few information about students retention in the annual reports of the universities each year in the structure prescribed by the Ministry of Education Youth and Sports of the Czech Republic in the section about learning and teaching - the learning failures (divided into fields of study programs, academic years, faculties and universities).

Till now we find four studies written about students retention in higher education in the Czech Republic. The first study deals with a failure rate of the freshmen in technical study programs (Menclová et al., 2004). The second study researches the freshmen of all universities in the Czech Republic (Matějů et al., 2004). The third study assessed the causes of failure of students from Prague Economic faculties on public universities (Švec and Tichá, 2007) and the fourth study was interested in causes of failure at the Czech universities generally (Mouralová and Tomášková, 2007).
The aim of the paper is to identify whether the specific dropouts´ causes in the Czech business faculties differ from dropouts´ causes identified in general, and to identify the variance in the sets of dropouts´ causes between years 2006 and 2013.

Materials and Methods

The paper compares two time-separated researches of possible causes which lead students to leave university at the Czech business faculties. It classifies and categorizes the identified causes. The first survey was performed in 2006 (Švec and Tichá, 2007). Respondents were students of economic faculties in Prague (Faculty of Finance and Accounting, Faculty of International Relations, Faculty of Business Administration, Faculty of Informatics and Statistics, Faculty of Economics - all of them from the University of Economics in Prague, Faculty of Economics and Management at Czech university of life sciences in Prague).
The second survey was performed in 2013 between students of business faculties in the Czech Republic (Czech University of Life Sciences in Prague, University of South Bohemia in České Budějovice, The Institute of Technology and Business in České Budějovice, Brno University of Technology, Technical University of Liberec, VŠB – Technical University of Ostrava, University of Silesia, Opava, Masaryk University in Brno, Mendel University Brno, University of West Bohemia and Tomas Bata University in Zlín).
For identification of the causes of students dropout was used group focus and content analysis. In the research (Švec and Tichá, 2007) was used group focus, where respondents discussed the problems presented by the researcher and developed specified topics. They performed three group focuses with the students of the economic faculties. Each group consisted from 10 to 12 participants. The total number of respondents were 33. We analysed the content of students applications in each case they reported some possible studying barrier which may lead to dropout. Because the first academic year is always known as the highest risky, we analysed the applications of first-year students. We have identified the general category and the specific reasons causing the learning barriers.
In the follow-up research (2013) we used a combination of semi-structured interviews and groups focus for the same purpose as in previous research - to identify the possible causes of students dropout but in year 2013. We applied the qualitative group or individual interviews, always at least in an active group of students from the first year, from the last years, between these years (2.-4. years) and students who left the faculty without successful completion of their study. This research was conducted with 143 respondents in 35 semi-structured interviews and 27 groups focus. The research was applied in public universities with students and former students of business faculties which have more than 2000 of students, i. e. the Czech University of Life Sciences in Prague, University of South Bohemia in České Budějovice, The Institute of Technology and Business in České Budějovice, Brno University of Technology, Technical University of Liberec, VŠB – Technical University of Ostrava, University of Silesia, Opava, Masaryk University in Brno, Mendel University Brno, University of West Bohemia and Tomas Bata University

in Zlín.
After the research we classified and categorized the results in basic categories and groups taking into account already existing models in this field of science: (i) sociological models (Hossler et al., 1989, March, Olsen, 1995; Vossensteyn, 2005), (ii) economic models (Hossler et al., 1989 Leppel, 2001; Mankiw, 2004), and (iii) information-processing models (Hossler et al., 1989 Stinchcombe, 1990, Coleman 1990; Vossensteyn, 2005).

Causes which lead to dropouts

As you can see in the Table 1 we compared the main reasons for students dropouts in the U.S.A. and in the Czech Republic (Koláčková and Švec, 2013).

Reasons	USA	Czech Republic
1.	A blind eye and a low expectation of academic demand	Dissatisfaction with the form of teaching
2.	Life situations and other outside demands	Dissatisfaction with the field of study
3.	Lack of skills	The discrepancy between wish and reality
4.	Broken Relationships	Incompatibility with the college or university environment
5.	Homesickness	Lack of skills
6.	Job Force: Short Term vs. Long Term	Other (external) factors
7.	No Individual Attention or Guidance	

Tab. 1: The Main reasons why students drop the colleges out in the U.S.A. and the Czech Republic in general. Source: StateUniversity.com, 2009; Mouralová, M. and Tomášková, 2007: 19 – 21; Menclová, Baštová and Kronrádová, 2004; Švec and Tichá, 2007.

What is the same on both sides (U.S. and Czech) is the reason named "lack of skills". 'During the course taking students recognize, that the course content may not be what they expected, or too difficult, and they leave the college' (Koláčková and Švec, 2013: 276).
Also personal reasons can interrupt someone´s studies. Interesting is, that higher amount of U.S. students leave because of 'personal issue, which includes lifestyle, relationship, case of illness in family - especially for students from rural areas, childcare or care of elderly arrangements may collapse' (Koláčková and Švec, 2013).
The most different issue is "No individual attention" paid to U.S. students. In the U.S.A. it is one of the most usual reasons for leave the college. Not knowing where to go, how to deal with problems, leads to a dropout. 'In the U.S. colleges are students used to have the special office for counseling, mentoring or giving guidance, if they lack this support in time of troubles it leads to leaving the college' (Koláčková and Švec, 2013: 276).
On the other hand in the EU the main reason for leave the university is financial situation of the student. Students may have 'unrealistic expectations which become lifestyle driving them into debt and early leaving or fear of debt may be an issue for some students' (National Audit Office, 2007). Eventhough this 'financial problem does not apply to the Czech Republic' (Menclová et al., 2004; Švec and Tichá, 2007). There are more often as reasons for leave some kind of dissatisfaction or incompatibility with expectations. Personal reasons are not so important in the Czech Republic.
The above mentioned causes for leaving the colleges and universities are in general. The paper compares more specific dropouts causes of researches from years 2006 and 2013.

Results and Discussion

As a general result of the research we find out that the majority of examined students was in a situation, in which they face some element which we could call studying barrier. However, the perception of the concept "studying barrier" was presented by respondents as inconsistent. Respondents talked about studying barriers in very different ways.

From the interviews we have identified two possible insights into the definition of studying barrier. The first one says that the studying barrier is any problem or obstacle impeding the study. The second point of view on studying barrier have those students, who perceive the studying barrier as the situation when their study at the university is directly threatened. For the needs of further research and work with the data we defined studying barrier as a study problem which makes difficult or impossible to continue the study at the university.

The Dropouts´ Causes

During the groups focus in 2006 we identified as the study problems following:

- **issue of accommodation**, the proportion of students which have to commute a long distance;
- **range of subjects**, which was negatively evaluated by a small range of elective courses and little opportunity to influence their choice, when students have to study a subject which is not interesting for them; displacement of exams in the 3rd and 5th year;
- **demanding exams and subjects**;
- **teachers´ behaviour to students,** which is arrogant, oblivious, harsh and stern;
- **ways of obtaining information about study matters, diversity of the provided information** (e.g., information based on diversity of study department and the supervisor of bachelor or master theses);
- **administrative problems, behaviour of employees or study department.**

The respondents mentioned the reasons leading to the potential dropout:

- **small range of elective courses** (inability to choose subjects of students interest);
- **teachers´ behaviour** (students are not taken as adults working people);
- **not able to handle with learning and exams**, repeating the subjects next year, discontinued studying at university.

The Content Analysis of Documents

To extend the set of identified study problems, we have used a content analysis of students´ requests applications reporting different sorts of studying situations.

We considered the assumption that the highest frequency of the study problems can be expected in first-year students in their transition from high school to the university. The assumption was considered after the analysis of the activities pursued by the universities in the universities´ annual reports (Švec and Tichá, 2007:1): 'The number of students who drop out from the study are different in years. According to long-term monitoring - in average 20% of students leave the university during the first and second year. 7% of students leave the university in the fourth and fifth year. '

Among study problems which arise from the **demands of study** were included **underestimation of self-preparation** (for passing the exams), as well as high requirements of teachers and not managed **accumulation of tests**.

Another group of study problem has been identified the **family problems**. It exists the feelings, that student has to take care about a financial security of the family members, where is not possible to study anymore; necessary medical care for a family member

hedged by student, death in the family; termination of the relationship with the partner, or other serious personal emotional problems.

Another group of the study problems are **health problems**. We have identified from the content analysis of student applications following: the treatment of long-term illness (1 month or more), treatment of mental disorders, the treatment of short-term illness during the examination period, the operation and recovery, accident and recovery, nausea in a day (during the test, seminar, lecture), study limitations due to long used drugs.

We have identified the study problems caused by **ignorance university environment**: nervousness of students during the exams; inability to perform the exam or credit for occupancy dates for exams, credits; general ignorance university campus; ignorance during an examination or because of the teachers´ style how they test the students; difficult to obtain information on study issues, the variety of information about study issues from study departments and teachers.

Other study problems are (Švec and Tichá, 2007:1): **personal financial problems** (lack of funding for the study and the need to work while studying), **faculty selection** (students could not study the preferred school - the motivation is lower, **motivation to study** (for the other reasons than the faculty selection), **concurrent study** (another faculty), **study abroad** (some students have trouble to study at home because they know, how was it abroad) and the **quality of teaching**, i.e. lectures, seminars, teachers (teachers´ behavior to students), provided background material for students, a range of subjects (small range of optional subjects).

The Results of Group Interviews 2013/14

Via focus groups conducted during final trimester of year 2013 were identified following study problems:

- administrative problems
- the issue of accommodation and commuting,
- behaviour of teachers,
- low level of knowledge (ignorance of an academic environment),
- fear or stress from exams passing before performing the test (high demands)
- the impossibility to use the theory in practice (motivation to study)
- pedagogical rigidity - teachers not responding to the changes in global environment, teachers´ reluctance to change something and use the modern techniques (motivation to study),
- demanding schedule - long delay time during the day at university between the seminars/lectures what is leading to exhaustion and inactivity of the student and his/her lack of preparation for the next day (motivation to study),
- only a few number of activities in the university, especially for students from higher quality high schools, where students had a chance to cooperate at the international projects with external workers (motivation to study),
- teachers do not evaluate correctly – e.g., only one teacher evaluates tests / orally tested the student, the student feels that the teacher has antipathy against him and because he/she received no credit (motivation to study).

The reasons leading to potential dropout students were identified as:

- teachers´ behaviour,
- demanding of study,
- inability of the subject to be applicable in practice,
- offer of lucrative employment (financial problems)

- subjects, which are repeating in cycles (if the student cannot handle any subject in the previous semester, he could not study the subject what is following, lack of credits, leaving the study) (ignorance university environment).

Cohorts´ Variances

The main intention of the paper was to find out whether there are any differences in the reasons why students might drop out from study university between cohorts of students studying in 2006 and in 2013.

According to results we did not find any new category of studying barriers during the research of 2013 cohorts in view of already identified studying barriers of cohorts 2006. But in students cohorts of 2013 we found the expansion of specific causes (study problems) which is possible to group with already existing categories.

As a new study problem found in cohort from year 2013 in the first year of their study leading to dropout we identified the fear from passing the exams before performing the test itself. For many students is the fear so great, that they cannot the exam even try. Students are more often changing the date of the exam to the next term several times till next semester starts. Some students not overcome this barrier at all and leave the university. This behaviour also leads to increase of the teaching costs.

Another new study problem is **a scheduling** of academic semester. First-year students at some universities have a disadvantage that they do not have a choice (preferably students from higher grades have the choice to choose a good time schedule) and the study is for them very time consuming in term of wasting the time in the campus. It is not uncommon that the student begins courses at 7 o´clock a.m., followed by a pause of 6 hours and after a seminar ends at 9 o´clock p.m. The day after the student has to be at the university at 7 o´clock a.m. again.

As a study problems coming from ignorance of academic environment were newly identified: the needs of the **exclusivity of a teacher** during exam period (follow-up personal dislike); **lack of awareness** of the study program and the realization that the field of study is not suitable for him/her; the student's slow response to other conditions showing up with the **transition from high school to the university**.

Other new identified study problems which were not assigned to any specific category and due to non-repeating character must be grouped to category "others" are: **repeating the topic of subjects** (a name of subject is different, but a topic is very similar, student feels that he/she is not learning anything new and is losing time); **cancellation of the learning centres**, student must commute elsewhere; small range of activities at the university.

Conclusions

According to the qualitative research we conducted and its results we can summarize that the dropouts´ causes in the Czech business faculties do not differ in the term of range from dropouts´ causes found in other studies from the Czech higher education context (Mouralová and Tomášková, 2007: 19 – 21; Menclová, Baštová and Kronrádová, 2004). In each study were found similar categories of causes which lead to possible dropouts from higher education. But the studies differ in the criterions used for categorization and depth level of identified causes.

The main research question is whether is there any variance in the sets of dropouts´ causes between cohorts questioned in years 2006 and 2013. Categories generated within research from 2006 remain the same. Eventhough we found new study problems among students from cohort 2013: the untimely fear from passing the exams, the impossibility to create

a good schedule of academic year, the needs of the exclusive selection of an examiner, the lack of awareness of the study program, repeating the content of subjects, and closings of the learning centers - commuting. With new study problems we extended the following categories of studying barriers: teachers' behavior, ignorance of the academic environment, demands of study, accommodation/commuting, and motivation.

We have found new study problems after repetition of the research, so we came up with possible explanations which our results show. The unexceptionable fact is that the students´ perception of the university studies have changed in some categories in past 7 years. The students´ perception is just the reflection of the actual situation in the Czech higher education which may indicate some changes in attitude of not only students, but (according to extended categories) also faculty members and universities themselves.

The results published in this paper we will use as the placement categories in next phase of our research in which we will identify the frequency of each identified study problems among students of the business faculties in the Czech Republic. The obtained results we will compare with the results from research conducted in year 2006 to see the possible shift in the monitored field.

Acknowledgements

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THE IMPACT OF E-LEARNING TO SCORE IN THE EXAM IN EMM COURSE

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Abstract

The aim of this paper is to investigate whether there is a difference between the study results of students using e-learning support and those who do not.

Questions have been raised by several authors on how to contribute to improvement in the quality and efficiency of education in a compulsory course such as Economic Mathematical Methods (EMM) at the Faculty of Business and Economics, Mendel University in Brno. First of all, the authors would like to provide effective e-learning support for students in part-time form of study, whose range of hours has dropped to 16 (in full-time form of study is 52 hours). E-learning support has two aspects: solved examples regarding topics in the course as well as computer programs designed for practising the methods. The programs were developed to match the practices used in the lessons. The goal was to encourage students‘ interest in mastering their chosen methods in their studies. In case of difficulties, so the user can clearly determine whether the error made is numerical or as a result of failure of the algorithm.

So far five computer programs have been created and given to students of the course via e-learning support available in Czech and English languages.

Keywords

Efficiency, e-learning, simplex method, EMM

Introduction

In Czech and foreign-language literature there is a number of publications devoted to different aspects of e-learning. The term e-learning is inconsistently interpreted and explained by Czech authors. Examples of research in e-learning including works Egerová (2008), Klement et al (2012), Klement (2011), Kopecký (2006), Kunstová (2012), Průcha (2009), Zlámalová (2008), Zounek (2009). In these publications, different variations of e-learning can be observed in terms of advantages and disadvantages as well as possibilities of its use.

Authors of this paper concluded that it is necessary for students to create and provide an e-learning course. The course is included in the plans of Business management and economics (full-time and part-time), and the Economic Informatics (full-time) at the bachelor degree level.

The need to create supportive e-learning materials originated primarily due to a significant reduction in the number of hours of lessons in the part-time form of study. It was necessary to prepare materials that would help students in a separate home study which will enhance successful knowledge acquisition on skills presented during consultations. It became clear that it is not sufficient to only provide students with examples for practising the different methods although the solutions were given in the examples. Students who are normally faced with problems of getting the correct solutions from the examples have no idea about

the sources of the problem. This barrier has often led to the resignation of students from their study, and it demotivates. In other cases a relatively large number of students fail examinations in this particular course. Therefore, the authors decided to prepare computer programs for practicing various methods that allow candidates to check for errors or mistakes in the algorithm process and to rectify it in deriving the right solution (Prepared programs were finally made available in the university system for all students who have subscribed to this course. In both cases, the programs should serve to complement traditional teaching methods and in this context they can be understood as a form of e-learning, which is referred to as blended learning. (E-learning is understood as one of the modern forms of education, in which the important role is played by information and communication technologies. E-learning development when used as a study support can significantly help both teachers and students. Application of IT/ICT can enhance students' interest in the issues studied and their motivation.)

The programs were created and introduced to the courses gradually. The response of students after their disclosure was very positive in all cases, as appeared from the views and opinions of students during the semester and after the exams (as in a personal meeting, as well as part of the evaluation of the course in the university information system). Notably favourable in this context was the opinion of students who have completed teaching without benefiting from such programs and, subsequently repeating the course and already had this option! In the following text, the authors want to try to assess how to meet the expected goals associated with the program for training the simplex method.

Materials and Methods

The program is available in the university information system for all students of the bachelor degree level, who in the current semester are enrolled in the EMM course in full or part-time form of study. A significant part of the course is focused on the methods used to solve linear programming problems. From the different methods (algorithms), the simplex method plays the most important role.

Based on previous experience, we concluded that the students of part-time (and full-time) forms of study have difficulty to:

1. formulate a mathematical model of a given problem,
2. create the canonical form of the model,
3. perform the necessary calculations,
4. interpret the results obtained by calculation.

Especially for training items 2-4 above, the program was created that specifically for solving the procedure used in teaching (i.e. lectures and exercises in full-time study and consultation in part-time form of study) and in the recommended textbooks. Students can check the accuracy of the procedure on a step by step basis. To verify the knowledge and skills necessary for solving of linear programming problems a set of extensive examples is used. Series of mathematical models have been formulated and their solutions are provided to students. The program offers the option of mastering the simplex method as well as verifying the correctness of their solutions. It also provides the option of downloading the program from the information system. In cases of mistakes, the program will clearly show, the stage of calculation that the error occurred and whether it was a numerical error or an error due to non-compliance to the simplex algorithm. Finally, students can verify whether they correctly interpret the result they reached using the simplex method. (The program currently exists in Czech and English version and can be used for example for post-optimality analysis and for practicing the dual simplex method.)

The authors of the paper also teach the EMM and were interested in the impact of e-learning support on the level of knowledge and skills of students. The evaluation of the effects of education on knowledge and skills can be approached in different ways as shown e.g. Dostál (2008) or Popelková and Kovářová (2013).

Results and Discussion

To evaluate the impact of the program on study results, the results from winter semester 2013/2014 were used. In both forms of study in the Economics Mathematical Methods course, a total of 269 students (236 full-time/33 part-time) were registered, of whom 196 (177/19) successfully passed the exam (grade A–E), 35 (31/4) failed (grade F) and the remaining 38 (28/10), for various unknown reasons, did not participate at the exam. From 15 examination attempts, in 9 of these attempts the simplex method was part of the exams. In these 9 exam attempts, the simplex method was evaluated a total of 225 times. A total of 170 (151/19) students had an exam on that method. From these students only 122 (112/10) had it once 41 (34/7) students twice and the remaining 7 (5/2) students with this method met in all three attempts.

The example with simplex method was always just one part of the exam and therefore evaluation of the method itself does not depend on the outcome of the exam result. When evaluating the simplex method, the following areas are reviewed:

1. the accuracy of the generated canonical form of the model as a prerequisite for successful solutions of the problem,
2. correct procedure of calculating as a prerequisite for correct interpretation of results,
3. correct interpretation of the result obtained.

The mentioned program was available to all the 269 students for practising their knowledge and skills. The program from the UIS (University Information System) was downloaded by 190 (186/4) students, and 79 (50/29) did not use this option. Here it should be noted that the authors are not able to determine (from UIS), whether the program was downloaded only, or also actively used in the study.

1. Formulation of canonical form has been carried out correctly in 205 (181/24) cases and incorrectly in 20 (12/8) cases. In doing so, the correct formulation of the 205 was in 58 (39/21) of the cases where the desired result was achieved without downloading the program. There were 20 incorrect formulations and from these incorrect formulations 8 (7/1) students did not download the program and 12 students did.
2. Calculation was evaluated as correct in 160 (146/14) cases, and as wrong in 65 (47/18) cases. From 160 positive calculations, 43 (33/10) was achieved without the preparation using the described program and in 65 unsuccessful attempts there were 23 (8/15) cases, where the result was achieved without the aid of the program.
3. Correct interpretation of the result was detected in 106 (98/8) cases, incorrect in the remaining 119 (96/23) cases. At the same time, from 106 correct responses, there was 28 (22/6) without the use of the program, of the 119 incorrect assessment of the results it was 38 (19/19) cases without electronic support offered.

Based on the mentioned information, authors wanted to verify the following working hypothesis:

1. Is the mentioned program used by students? Is there a difference in use between full-time and part-time forms of study?
2. Does the use of the program affect the students' results at the final exam?

Statistical methods were used to answer the following hypotheses: a test of relative frequency was used to verify the difference in usage between the students of full-time and part-time test and to validate the results at the examination two middle values test (to verify the normality of data it was used the chi-square test) was used.

The program is primarily designed for part-time form of study students, from a total of 34 part time students only 4 downloaded the program, which corresponds to 12% of the students. In the case of full-time form of study, the was a total of 235 students and this number, 186 students downloaded the program at least once which corresponds to 80% of students and 49 students never downloaded!

When testing the differences of relative frequencies of downloads (H_0: $\pi_1 - \pi_2 = 0$: no difference in frequency of download, H_1: $\pi_1 \neq \pi_2$: there is a difference in the frequency of download), the test statistic U = 24.6 was calculated. Using a significance level of 1 % and the choice of two-tailed test field, the critical value is 2.57. It can be argued that there is a statistically significant difference between the frequency of downloading a program for full-time and part-time study a result which contradicts the expectation of the study. Here is the place to reflect on the reason why such a conspicuous difference in the utilization of the full-time and part-time form of study exists and to try to identify and then eliminate the cause of this discrepancy.

What are the results of the evaluation at the exam, when students use or do not use the program? There will be comparison of only the students who have received credit and also had the simplex method at test. If any of the students did the exam more than once, he/she will be counted only in attempts, in which he/she had the simplex method.

When evaluating the result, it will be done only based on the ability to solve this example, there will be no comparison to the overall success or failure in the exam. The aim of the authors of the article is to determine whether this e-learning tool has statistically significant effect on the ability to correct solution of simplex method.

In case that a student had the simplex method at the test, it was assessed according to the following criteria:

1. formulation of the canonical form,
2. solving the model,
3. writing the correct answer.

The proper resolution of the relevant part, the student received a point, and for incorrect resolution zero point was given. In total, they can get 0–3 points. Summary data on the results and input data for testing differences are shown in the table below:

Number of points	Students that downloaded program	Students they did not download the program
0	12	8
1	31	15
2	37	16
3	77	29
Total	157	68

Tab. 1: Number of points obtained by students at EMM exam.

Using the χ^2 test, normality of the data was tested. In both groups the χ^2 value measured 0.124 (downloaded) and 0.11 (not downloaded) was lower than the critical value $\chi^2_{0.95}(1)=3.84$. Since none of the chi-square values was greater than the critical value, normality in both groups was not rejected and the parametric one-tailed test of difference

of two mean values was used, where the null hypothesis was set H_0: $\mu_1 - \mu_2 = 0$ (i.e. there is no statistically significant difference between points obtained in both groups), compared to the alternative H1: $\mu 1 > \mu 2$ (points obtained in withdrawn group was significantly higher than in the group of students they did not download).
5% significance level was used and the calculated statistics U=1.11 was lower than the critical value 1.64, it therefore failed to demonstrate a significant difference between the two groups of students. However, the calculated p-value is 0.87, so there is an objective reason for further measurements, because at larger data set, the statistically significant difference could be identified.

Conclusion

Although the e-learning support is primarily intended for students of part-time form of study, the Simplex method is used more by full-time students. This finding was also quantified under the relative frequency test, where high statistically significant difference between two observed groups was found.
The presumption of authors, that the use of the program has a higher success rate in solving the example at the exam, was not statistically proved. Although there is a difference in the average number of points between the two groups, it is not statistically significant.
Both findings were contrary to initial expectations of the authors, although in the second detection an open space remains for other observation, which in a larger sample of students would have to demonstrate a statistically significant difference.

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TEACHING IDIOMS AND RIDDLES TO STIMULATE THINKING IN STUDENTS OF LANGUAGES

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Abstract

The author of this paper has tried to implement teaching idioms and riddles in the classes of a foreign language as an inevitable tool to challenge students' thinking skill. How students master academic material does not depend on their ability to memorise but on their skill to think. To initiate learners' thinking skill by finding the meaning of figurative English phrases and riddles was the point of this study. Certain techniques developed by the author were used to help stimulate the analytical skill of the students of intermediate English level. The thinking skill plays a crucial role in bridging the gap between students' ability to comprehend and remember. Students' metaphoric awareness in a foreign language accomplished by means of the thinking skill and not memorising was the main objective of this paper.

Keywords

Analytical skill, challenge, idiom, metaphoric awareness, riddle, thinking skill

Introduction

English language is full of peculiar and obscure expressions, many of them have fascinating and hidden meanings which are a lot of fun to introduce to students but can also cause difficulties involved in understanding the meaning of expressions. Idioms, indeed, constitute a notoriously difficult area of a foreign language learning and teaching because, by definition, idioms are conventionalized expressions whose overall meaning cannot be determined from the meaning of their constituent parts (Rodrigues, 2008). Teaching them though plays the fundamental role in developing an analytical thinking in students thus broadening their comprehension and learning skill. As Audrey Farley (2007) points out the analytical thinking skills are required of students in diverse subject areas, including core subjects like mathematics, science, language arts and social studies, as well as in tasks and activities beyond the classrooms. To prepare students to succeed academically and in the outside world, it is critical to teach them to think analytically (Farley, 2007). Idioms and riddles provide enjoyable material for students to find themselves in a relaxed position.

The objectives of this paper are to stimulate students' thinking skill by analysing idioms and riddles during English language class based on certain techniques that build students' metaphoric awareness while expanding new vocabulary and speaking skills within an interesting game of words or the background origin. This paper shows that although they (riddles and idioms) are not always easy to learn, they still add familiarity and comfort to an often stressful situation for students when they are asked to express their opinion or solve the task in a foreign language. They (riddles and idioms) can be presented in many amusing ways which make students repose and at the same time open up their will to think.

The methodology used in this paper comprises several techniques that introduce idioms and riddles to B1 (intermediate) level learners of English language classes at Czech University of Life Sciences in Prague. The students got involved in analysing the meaning of some figurative phrases (idioms) and riddles through different approach every time, either applying them into their personal experience and life; comparing them with parallels in their native language or even searching for the background origin of individual phrases thus finding various perspectives to broaden their cultural background and thinking skill. All of these activities described within suggested techniques and performed by students of both genders were observed by the author within the period of two semesters. Observation was then complemented by specific questionnaire given to the students after the surveyed period. The answers are also valuated by points (0-9), which give the students 'comments mathematical value. Subsequently, this paper provides three tables comprising breakdown of the learners' assessments (answers and points) which have become the base of this papers' findings.

Materials and Methods

According to the author's teaching experience most students of all education levels perform hardly any thinking abilities. They are used to perceive academic material in a passive way through being lectured and subsequently assessed by filling in the exercises. Teachers often tend to use teacher-centred learning approach and learner-centred approach is being forgotten or not used (Sves, 2012). According to Masduqui (2006) students are not given adequate opportunities to do meaningful collaborative tasks in which they discuss, share and challenge ideas communicatively and critically. Masduqui (2006) then continues that English teaching is still teacher-centred and deals mainly with complex grammar, long reading passages, and other activities that are far from the real purpose of the Competency-Based Curriculum.

The basic principle of this study was to offer some techniques which challenge and support students' thinking skill by implementing idioms and riddles into teaching process. The research methods and techniques were applied in 7 classes of the students of intermediate (B1) level of English (135 students in total, 72 boys, 63 girls) studying at the University of Life Sciences in Prague at different faculties (41% of the students study at the Faculty of Economics and Management, 23% at the Faculty of Tropical Agro-Sciences, 18% at Faculty of Forestry and Wood Sciences, 18% at Faculty of Agrobiology, Food and Natural Resources)). The survey was applied on the full-time students covering an age range of 19 – 21 year olds. The majority of the students were native speakers of Czech; however some of them were the students of Spanish, Russian and Kazah origin. Observation of changes of the learners' approach to thinking was executed by the author during the surveyed period of two semesters of the academic year 2012-13 (24 lessons, once per week, 90 minutes). The survey was conducted in the form of an anonymous questionnaire consisting of 3 questions given to the learners at the end of the surveyed period. Although only three questions were provided, they offered variety of possible approaches as could be seen in the answers. The students have expressed their personal assessment of improvement of their thinking abilities and at the same time they associated their answers with points in a scale from 0-9 where zero point was no improvement, no thinking, memorising only; while valuation in 9 points meant high enjoyment, strong analytical approach and attempt to see connectedness, thinking skill improved. Findings were then summarized in percentage by counting up the amount of particular points for each answer

- Do you enjoy expressing your thoughts in English? Why? Why not? (0-9 points)
- Do you find it easier to explain your thoughts and opinion after learning riddles and idioms? (0-9 points)
- Has working with riddles and idioms helped you to think and analyse situation or a word combination? (0-9 points)

There is no specific order in which they should be applied. They complement each other and can be used either individually or within combined structure.

METHOD: IMPLEMENTING IDIOMS TO STIMULATE THE THINKING SKILL.

An idiom is an expression that cannot be understood literally. This method offers a few techniques through which the students come across figurative expressions (idioms) during the lesson and comprehend their meaning without memorising them.

- *Technique 1*: Idioms mirroring students' mood as part of teacher's speech.
- *Technique 2*: Idioms of comparison and their parallels in the native language.
- *Technique 3*: Idioms in the 'picture vs. meaning' matching exercise.
- *Technique 4*: Searching for the background origin of idioms.
- *Technique 5*: A multiple choice exercise with idiom in a small context.

Technique1: Idioms mirroring students' mood as part of teacher's speech.

When implementing figurative phrases (idioms) into teaching aiming at warming up the classroom's atmosphere, teacher should choose that kind of idiom which corresponds with learner's mood. Idioms are introduced either to relieve eventual stress in the class or tranquilize the preoccupied students. *'Feeling blue*' is the one that can be very often used either at the beginning of the week or just the lesson. Fear, lack of confidence or just tiredness might be the reason why participants in the language classes do not find sitting there as a lot of fun. The lesson has just started. The teacher welcomes her students but she can see there is something wrong. '*Are you feeling blue today? What is wrong?'* or '*Are you having a blue Monday? You look sad*', *Do you feel tired because you had a whale of a time at the party yesterday?'*. One of the ways how to explain idiom is through teacher's supplementing questions that belong among fundamental tools which guide learners through their analytical thinking process. For example: What mood do you think blue colour represents? Is it a good mood or a bad mood? Is whale a big or a small animal? What does 'a big size' represent when you think of a time spent with friends? As Rodriguez (2008) points out adopting a cognitive approach, idioms are seen as being motivated by conceptual metaphors which tend to be grounded in our embodied experiences and which very often involve mental imagery. To prepare students to succeed academically and in the outside world, it is critical to teach them to think analytically (Farley, 2007). They (questions) should introduce some hints to draw students closer to the correct answer.

Technique 2: Idioms of comparison and their parallels in the native language.

Teaching idioms of comparison like '*as busy as a bee, as free as a bird, as fresh as daisy, as clear as the nose on your face'* not only brings enjoyment into the class but also naturally challenges students to think of a reason for these particular comparisons. Looking for the same expressions in students' native language stimulates thinking even more. Recalling learners' own experience is a very productive way how to brainstorm their ability to think and analyse. As Farley (2007) points out no matter the subject area, brainstorming reinforces critical thinking skill and encourages mental development. The

ability to make connections between personal experience to new material or concept is an essential component of analytical thinking (Farley, 2007).

Technique 3: Idioms in the 'picture vs. meaning' matching exercise.

Learning idioms can be even more fun when teacher presents them through pictures. *'Put the cat among the pigeons, Like a cat on a hot tin roof, It's raining Cats and Dogs'* are some examples where the magic of fun was expressed through pictures and the thinking skill initiated through matching them with the correct meanings. The visuals add concreteness to the figurative expressions and thus make them more amenable to dual coding (Paivio, 1986, as cited in Boers, 2000). The pictures of particularly humorous idioms were shown to the students who then were offered a set of mixed meanings out of which they had to choose the correct one.

Technique 4: Searching for the background origin of idioms.

This technique compliments further awakening of students' thinking skill in a way they (students) have to figure out the meaning of idiom through guessing the background origin of individual similes. There is a matching exercise in which different kinds of tales and stories are mixed and given as idioms' origins with few extra 'tales' to make it more challenging for students.

1. *'It's raining cats and dogs'*
2. *'Once in a Blue Moon'*
    a) *It is said that the stage actors are very superstitious. They don't say 'Macbath' in a theatre, they don't whistle backstage, and they never wish each other good luck before a performance. They don't want to talk about positive outcomes in advance.*
    b) *Houses in the 1500s had thatched roofs-thick straw-piled high, with no wood underneath. It was the only place for animals to get warm, so all the cats and other small animals lived in the roof. When it rained it became slippery and sometimes the animals would slip and fall off the roof.*
    c) *It happens whenever there is a full moon TWICE in the same month. There was a blue moon on New Year's Eve 2009, since there had been a full moon in early December. Just recently we had another blue moon in August31, 2012. If you missed it, you will have to wait a few years to see another blue moon.*

Technique 5: A multiple choice exercise with idiom in a small context.

A multiple choice exercise encourages students' analytical skill because they have to figure out idiom's meaning by choosing one correct option out of a few when all of them sound very likely. A small context into which idiom is implied is a very helpful tool because it draws students near their everyday reality thus helping them associate it with them (students). Kolb (1984, as cited in Svec, 2012) defines learning as the process whereby knowledge is created through the transformation of experience. For example:

Example: Jean: How did you know it was my birthday today?
Susan: Oh, *a little birdie told me*!

a) Jean told Susan it was her birthday.
b) Susan told Jean it was her birthday.
c) An unnamed person told Susan about Jean's birthday.

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This method provides students with the matching exercise. They are asked to complete the riddle and explain its wit. Since riddles' humour is based upon 'playing' with language and there might be some words or phrases that sound the same but have different meanings, learners should be introduced to the point of word-play beforehand but only generally so there is an opportunity for the thinking skill to be applied. Students are given the first part of the riddle:

- Why did the boy eat his homework?
- Why should not you believe a person in bed?
- Why did the man throw the butter out of the window?

'Punch line', the statement which contains the answer or resolution to the problem, is only given afterwards. Here comes the first challenge for thinking process to get started. Students should try to provide their own ending or the answer. After getting their (learners') input, teacher should give the 'punch lines', but not in the right order.

- He wanted to see a butterfly.
- His teacher said it was a piece of cake.
- Because it is always lying.

Learners' thinking process is approached at least three times during this task. The first time when students try to suggest the answer by themselves, they wonder and they seek. The second time when they look for the correct matching part and the final brainstorming happens when learners are busy to comprehend the meaning of the riddle and its wit. Comparison of learners' suggested endings or resolutions to the correct riddle's ending usually brings even more fun and analytical discussion.

Results and Discussion

There are several teaching strategies. Huddleston and Unwin, (1997 as cited in Svec, 2012) see these strategies as the teacher-centred methods at one end to the learner-centred methods at the other end. According to Huddleston, Unwin (1997, as cited in Svec, 2012) the teacher-centred methods are: lecture, examination, demonstration while among learner-centred methods there is research-based project, group work, self-directed study, trial and error activity. Stimulating thinking skills in students learning a foreign language by implementing idioms and riddles into learning process was the fundamental aim of this paper. The acquisition of figurative phrases (idioms) and riddles is one of the most outstanding and amusing tools to challenge students' thinking.

Findings which have been carried out by specific questionnaire complemented the author's observation during the surveyed period of two semesters.

QUESTIONNAIRE
Do you enjoy expressing your thoughts in English? Why? Why not?
Before we started working with riddles I could not really find the way how to approach them, how to explain what I think. I did not enjoy it. But after few lessons I found it easier because I learned to see how things are connected and what is important. (7p)
Matching exercises have helped me to find the logic in the meaning first and explain slowly what I think. It makes me think more than during filling the grammar exercises. (7points)
I could not enjoy it before because it was hard to start, I did not find any important points. Working with riddles helped me to see connectedness of things and even hidden meaning. (8points)
Do you find it easier to explain your thoughts and opinion after learning riddles and idioms?
Since we started playing with idioms and riddles I know I have to pay more attention because there will be some point in it which I want to catch. (8points)
I have to admit that riddles are so much fun because they make me think instead of giving me straight answers. (9points)
I am fascinated especially by the hidden meaning in such simple wording which I did not see before. (8points)
Now I enjoy it very much because I see the improvement in my vocabulary and I can use and compare different meanings and metaphors. (8points)
Has working with riddles and idioms helped you to think and analyse the situation or a word?
I think I am much better at approaching the problem when I have to explain something. I have learned to look for the logic in my real life first and apply it into explaining my opinion. (7points)
I feel more comfortable when I am asked to express my opinion because I have learned the trick how to look at the things. (7points)
I do not try to memorise things any more. I find it much easier to remember the word when I associate it with some picture from reality. (8points)
It is amazing how many different meanings language can have. And it is so funny. I learned to look for the other meaning of the word, not just one and that helps me to see the situation in many different ways. (9points)

Tab. 1: //Breakdown of the results: Questionnaire//

METHOD: IMPLEMENTING IDIOMS TO STIMULATE THE THINKING SKILL.

The aim of *Technique 1* was to challenge students' thinking by implementing idioms which would reflect students' mood in the natural lesson's atmosphere. Findings experienced through observation and complemented by the questionnaire afterwards have shown that in case of the students' bad mood or stress present in the class, idioms carefully and sensitively chosen by the teacher exorcised any kind of discomfort in 99% observed participants. The students (95%) started participating in discovering the similes' meaning. Stimulating the thinking skill and the teacher's caring approach has thus become the essential tool to avoid general memorizing.

Teaching idioms of comparison (*Technique 2*) has created a very fruitful atmosphere in the class because it inspired the students not only translate the idiom but also look for similar idioms in their native language. When learners are interested in a topic and are given chances to negotiate meaning, they will be motivated to discuss things critically and

at the same time, acquire language to communicate (Darn, 2006; Rfaner, 2006, as cited in Masduqi, 2006). 90% of the students found it very amusing to compare idioms with parallels in their language which motivated them to find the reason of particular word play. Rationalising figural phrases has thus become the motivational tool to start analysing. Among adult learning theorists is a general consensus that the experiences which the students have gained during their lives are important part of any learning activity they will join (Huddleston, Unwin, 1997, as cited in Svec, 2012).

This study has also shown that visualizing idioms (*Technique 3*) and looking for their connectedness with everyday life definitely enhanced the analytical skill in 98% of the students. Part of undeniable benefit of presenting idioms through pictures was also maintaining a low anxiety level among the students supporting comfortable and stress-less environment. Only tranquillity enables students to acquire English language in a manner similar to the way they learned their native language, naturally and through regular interaction with others who already know the language (Krashen, 1983). Teacher should also not only pass the knowledge but he/she should become an advocate of bringing humour and wit into the classroom (Kral, 1994). Using visuals as clues for guided meaning-guessing (Boers, 2000) has proved as rather productive. The author's observation has shown that 99% of the students benefited from idioms' pictorial presenting.

Technique 4 has offered the students view from the other side of idiom's meaning and that was guessing its background origin. The author's own experience in teaching has motivated her into an interesting conclusion which describes 90% of her students as very inquisitive as long as some historical episode or tale is included in the task. 98% of the learners were successful in guessing the idioms' origins thanks to similitude of the 'narrative stories' with their idioms. Nevertheless when it came to figuring out the meaning, there were following outcomes. The questionnaires have revealed that about 40% of the participants had found it difficult to guess the meaning, another 40% of the learners had been quite literary which made it much easier for them to accomplish the correct answers and 20% of the students could not come to any result. Despite of this slight non-success 100% of the learners have definitely appreciated the enjoyment in reading idioms' history and highlighted its effectiveness in remembering their meanings. As the questionnaires' results have shown, they found *Technique 4* as one of the most stimulating ways how to remember idioms' meanings. Boers (2000) reports that information about the origin of idioms was a helpful clue for students to identify the right paraphrase of their figurative meaning in a multiple choice task. *Technique 5* has implemented idioms into a small context which 80% of the learners have found as helpful in figuring out the meaning. The multiple choice exercise had not only enhanced common sense in all learners but it also encouraged those 20% of less-comprehensive students to find the right answer.

METHOD: IMPLEMENTING IDIOMS TO STIMULATE THE THINKING SKILL	
	Before
	Sometimes it is hard to be in a mood to study early in the morning.
	I could not figure out the background origin of the idiom at all.
Technique 1,2	After
	After our teacher asked me to define the colour of my mood, I got hooked in learning idioms, it really made me think. (8points)
	It was such fun to analyse our mood and compare it to the animal and then discover the meaning of the whole idiom. (9points)
	Before
	I do not really like talking generally but analysing idioms in pictures and looking for the meaning helped me relax.
	After
Technique 3,4,5	Explaining the meaning of idioms through funny pictures has finally released stress from my head and I even remember their meaning much easier. (8points)
	I feel I improved my thinking and communicative skills because we played with the words and their meaning a lot. (7points)
	I read a lot so it was very amusing for me to look for the right historical background of the idioms and think of the reason. (8points)

Tab. 2: //Breakdown of the results: Implementing idioms to stimulate thinking skill//

METHOD: TEACHING RIDDLES TO STIMULATE THINKING SKILL.

As it has been observed by the author teaching riddles enormously motivates students to think. The humorous side of the riddle and its hidden meaning which the students were forever competing to find has become an interesting motivational tool. It has been revealed that this method can be used as the assessment of students' thinking skill and its progress. The observation has shown that 10% of the students were able to figure out the correct 'punch line' of riddle right after the first three examples had been explained and analysed. The important point is that the students have been introduced to word-play beforehand although only generally. 15% of them noticed the point of the word-play right after the first few riddles were explained looking for double meanings or spelling hints. Seeing such a quick progress in the students' thinking was one of the greatest outcomes of this study. 'Playing' with language was not immediately apparent to all of the students (50%) but the teacher's questioning has guided them to find and see the hidden wit. For example, the students' replies when using their common sense have initiated enormous entertainment. The answers like '*The boy had eaten his homework because he did not want to do it never mind it was a piece of cake*' or '*the man threw the butter out of the window because he thought it would not fall but fly*' definitely created amusement that consequently helped the students remember the correct answer. Bringing riddles into the language classes exposes students to humorous aspects of English language and creates a cheerful classroom atmosphere and a positive orientation to the language (Thomas Kral, 1994). Kral (1994) then continues that their analysing reinforces vocabulary and give learners practise in listening, speaking and most importantly thinking but their underlying goal is also to produce a smile and awareness that communicating in English has a lighter side and a potential for fun. If students' psychological disposition is supported by friendly atmosphere in the class, it consequently and naturally awakes their will to think.

METHOD: TEACHING RIDDLES TO STIMULATE THINKING SKILL	
Before	I really could not find the answer, the question felt so weird to me.
	Explaining anything in English used to be quite difficult for me.
After	It truly helped me to pay attention to our teacher's hints because they finally helped me think and see the point and get the riddle right.
	After I got the answer to the first riddle, I found the trick how to get the other riddle correct. It made me think.
	It is funny but when you do more riddles, you get the hint how to understand the rest of them. It teaches you how to think.

Tab. 3: //Breakdown of the results: Teaching riddles to stimulate thinking skill//

Conclusion

Teaching idioms and riddles should definitely be brought to language classes as they have enormously encouraged the students' greater use of the thinking skill during this paper's study. Its methods have also generated a good learning outcome in expanded vocabulary and enhanced metaphorical awareness in the students. Techniques developed by the author can be used in language classes to either stimulate or build general thinking skill for the purpose of better comprehending thus accomplishing language competency. Another inevitable benefit of implementing idioms and riddles into language classes is broadening not only metaphoric awareness of learners but also cultural. Looking into the background origin of the figurative phrases has become an inspirational tool for the students to get familiar with their own history and perceive the world and learning process in a different way than just consuming and memorising academic material. At the same time analysing idioms and riddles made the learners feel at ease which contributed to opening up their will to think. The aim of language learning is not only to achieve academic success carried out by fluent speaking and mastering the grammar and vocabulary, but it is also focused on psychological comfort of students to participate in their education (Kotekova, 2013). As soon as the students were amused by humorous point of idioms or riddles, they consequently initiated their thinking skill willing to find hidden meaning or just integrate them (idioms and riddles) into their own utterances so they would impress their friends. To make students approach the task from the thinking point of view instead of passively accepting information certainly needs some practise but '*no bees, no honey, no work, no money'*.

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THE IMPACT OF TEACHING THE MATHEMATICAL METHODS IN ECONOMISTS

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Abstract

The paper describes the impact of teaching the basics of hard operational research on economic practice. Results show a positive impact of the teaching. On the contrary, using the same data sources to reflect the unrealised potential in the field of operational research. At first, we analysed the impact of bachelor and diploma theses written defended at the Department of Systems Engineering at the Czech University of Life Sciences in Prague, Faculty of Economics and Management. At second, we compared the current teaching practice with recommended styles and tools and identified the weaknesses of that practice. At third, we synthesized the findings to identify implicit obstacle in teaching the mathematical methods in economists. As a result we state the responsibility of the teacher of such subject.

Keywords

Education, operational research, case-based learning, thesis

Introduction

"Why should we study these unusable things?" once in a while we face such question or its variation from some of our students. Despite the obvious courage of the student, such question means that the student did not understand the topic. The reason is not always the students' concentration or study capacity, the reason could also lie in teaching style or the topic itself. On the other hand, we can understand the question as a challenge. Each professor should be able to answer such question, moreover good teaching practice should prevent such question to occur.

Mathematical Methods in Economics, or its alternative, is a common part of almost all study programmes at the Czech University of Life Sciences in Prague (CULS), Faculty of Economics and Management (FEM). These courses (usually with two semesters time donation) prepared by Department of Systems Engineering contain basics of operational research (mainly hard OR) and usually the very brief introduction to system dynamics. More than one thousand students pass these courses each semester.

Drucker (1970: 193) criticized the operational research (and management science) for its focusing 'on techniques rather than on principles, on mechanics rather than on decisions, on tools rather than on results, and, above all, on efficiency of the part rather than on performance of the whole'. The last point clearly indicated the wrong direction for the discipline of system science. But in general, the critique was focused (similarly to Ackoff (1979)) on losing the touch with the managerial practice.

Current state of art is not so pessimistic (Royston, 2013). But it is hardly a coincidence that 2012 Operational Research Society presidential address (Royston, 2013) and 2013 System Dynamics Society presidential address (Warren, 2013) both stresses the practical impacts of the field. In somewhat simplified terms, both the addresses speak about

unrealised potential, about better picture of the methodology; both emphasize some kind of promotion and advertisement – bridging the methodology and public. Reading the addresses reminds us the second students' frequently asked question (that arises especially after lecture on basics of system dynamics): "Why, if people know all this, they still do not use it?"

William and Dickson (2000: 1440) explicitly define the typical aim of MSc course in operational research: 'to convert high quality graduates in numerate disciplines into good OR practitioners appropriate to the needs of the practising profession.' Students' reasons for studying are mostly an investment into usefulness in personal life and society (Zamkova, Blaskova, 2013), thus the practicality is also a significant attribute of the study course from the students' point of view.

To build the bridge between the theory and practice in the field of operational research or system dynamics, many authors recommend the case studies and/or project based learning (see e.g. Tate 1977; Bell and von Lanzenauer, 2000; Pruyt, 2010; Pelikan and Fabry, 2012; Cochran 2012). Case studies are also in accordance with Kolb (1984: 33) experiential learning cycle (…→ concrete experiments → reflective observations → abstract conceptualisation → active experimentation → concrete experiments →…), which is stressed for the purposes of operational research teaching by William and Dickson (2000). To support the study process the role of software disposal is often emphasized (see e.g. Cochran, 2009; Jablonsky and Dlouhy, 2010). See Cochran (2009) for comprehensive review on operational research pedagogy.

The aim of this paper is to describe the impact of teaching the basics of hard operational research on economic practice. Secondary aim is to identify current deficiencies in teaching Mathematical Methods in Economics at FEM CULS. Secondary (but not unessential) aim is pointing out the general issue connected with the teaching operational research and system dynamics, which leads to students' confusion or misunderstanding. At first, we analysed the bachelor and diploma theses written and defended at the Department of Systems Engineering. At second, we compared the current teaching practice with recommended styles and tools. At third, we synthesized the findings to define the natural implicit obstacles in teaching the mentioned subject.

Materials and Methods

At first, we analysed 269 bachelor and diploma theses between 6/2009 and 2/2014. Because the problems solved and results obtained in these theses are far from homogenous ones and statistical analysis would not provide reliable results regarding our aim, we had to define the approach and kind of data at the beginning.

We focused on type of problem, kind and category of the company (according to the classification by European Commission (2014)), and possible value added in case of application of the thesis results. For many reasons some companies that provided data to students wanted to remain anonymous. The biggest issue was the value added. Not always the statement in the thesis was correct and to stay objective we take the results in account only in case the thesis compared the proposal with reality of the firm and only in case that the problem was not simplified for the thesis (e.g. some students applied simple heuristics on travelling salesman problem, but the original problem included time intervals for delivery; or student aggregated different kinds of inventory for inventory management optimisation).

Table 1 summarises the total frequencies of problems solved in theses. Sum is greater than 100% because of intersections of themes in some theses. Only categories that reached at

least 5% are present. Category 'Others' contains theses focused on linear and nonlinear programming, data envelope analysis, queuing theory, simulations, Markov chains, processes' analysis etc.

Category	Multi Criteria Decision Making	Project Management	Traveling salesman problem	Inventory Management	Others
Percentage	42.75	19.38	17.01	9.67	29.74

Tab. 1: Main themes in theses

According to the findings, we interviewed three middle managers from three logistics firms that hold the first positions in Prague (according to the turnover). In these interviews we tried to specify the applied planning process and use of operational research methods. For interviews, we used online conference (one for each company). Interviews were open and two rounded, after summarising the findings we contacted the managers to compare the practices with other firms.

Results and Discussion

Similarly to Kucera and Krejci (2013), our survey does not deal with the generalisation of the results and earnings from different methods but to show that when even the simple approximation methods are used, the effort results in significant savings and improvement of the analysed processes.

In our analysis of bachelor and diploma theses, it was possible to identify 34 big companies (including banks, international logistics firms, cosmetics firms or food and beverage producers) and 21 middle companies, also Czech post, police, hospitals, public transport companies and municipalities were problem owners more than once. These numbers does not cover the companies from the theses that were excluded for simplification of the problem.

More than 42.75% of bachelor and diploma theses dealt with multi-criteria decision analysis (mainly application of weighted sum approach, TOPSIS and analytic hierarchy process). For such work, it is impossible to quantify the results. Moreover, the decision is often impossible to compare with the real alternative solution, because different choice was not applied. We found 22 theses that explicitly proclaimed the choice done in thesis was really applied on the basis of achieved results.

Similarly, for project management theses (19.38%) the value added is hard to identify of quantify from the theses. Very often the results cannot be compared with its old applied alternative because it does not exist.

17.01% of theses were focused on travelling salesman problem or vehicle routing problem. After excluding the theses that contained the simplification of the real problem, we found that the application of simple methods (nearest neighbour algorithm, Vogel approximation method, savings method, etc.) brought possible savings from 3.70% to 28.80%. Three theses contained also programming of software for solving travelling salesman problem by approximation methods. One diploma thesis ended with software implementation in the company.

As demonstration of occasional firing blanks, one firm was the owner of exactly same problem two times. Despite the bachelor thesis in 2010 demonstrated the possible savings (more than 10%) achieved by simple nearest neighbour algorithm, exactly the same firm was problem owner in different bachelor thesis in 2012 with (again) more than 10%

of possible saving when the nearest neighbour algorithm was applied on the problem, originally solved only intuitively.

Similar results were achieved in theses focused on inventory management (9.67%). Depending on the type of inventories and firm, the savings started from 4.21% and the top savings crossed the threshold of 50.00% (in this case, the firm was of the micro category and inventory stock was not managed at all). In one case the firm achieved saving of more than one million CZK (approximately 37,000 EUR) per month. Again, we identified one firm (medium category) that acted as owner of inventory management problem twice (2009 and 2012), with nearly same results (more than 5% savings in 2009 and nearly 7% in 2012).

The rest of theses were focused on categories that did not reach the 5% share (e.g. linear programming, queuing theory, Markov chains, simulation and analysis of process).

These results served as impulse for another step. On the basis of significant improvements achieved by the simplest methods for travelling salesman problem and vehicle routing problem, we interviewed the middle managers that participate on planning the routes in three logistics firms. The situation here was quite different from the most of the firms in theses; all these firms have some kind of planning software product and apply it on the problems where they consider it as possible. Still, in two companies the route optimisation is not applied when the route (time interval of some delivery) is changed during the day. And one company (the youngest from the three, with Czech origin) do not use the optimisation, when the van is assigned to service without time intervals for delivery. During their study at university, all interviewed managers passed some kind of operational research course that included the travelling salesman problem.

Findings from specialised firms could be interpreted as not being at the end of the process of implementation of specialised methods. Consider all the instances of firms in bachelor and diploma theses (including bakeries, breweries that consider the distribution as secondary service, but also medium truck distribution firms) that does not use even the simplest approximation algorithms. Comparing these results with the record of optimal travelling salesman problem with nearly 86 thousands of towns (see Applegate et al, 2006) reminds us the critique by Ackoff (1979). Compare that record with bachelor thesis (not defended yet) where the problem owner is the multinational food company that has more than one thousand nodes in Vehicle Routing Problem only in the smallest region of the Czech Republic. This firm uses for planning and organising only paper maps, pins and intuition. We do not want to discuss the size of the gap between the theory of operational research (with unexceptionable successes in the field), but to stress that the general awareness of operational research or system dynamics in is still on very low level.

It is possible to generalise Fig. 1 to whole mathematical methods in economics. The reason often lies in the managers' perspective that must reach at least the intersection of the cost lines, to use simulation (or operational research in general). But the question remains 'what can the teacher do with it?'

Back to Drucker (1970: 195, double inverted commas from original), he noticed that for example 155 dissertations contained application of linear programming but he has 'not seen any published study on "typical business opportunities and their characteristics"'. Considering the stress on case studies and detailed characterisation of the problems that is frequently included in core text books (see e.g. Anderson et al (2011) for operational research or Sterman (2000) for system dynamics), we believe that problem is solved at least from the information availability point of view.

Department of Systems Engineering, FEM, CULS provides students with the wide range

of free software products (Kucera et al, 2010). Moreover, the lessons are supported by successful and frequently used video lectures (Houska and Houskova Berankova, 2011). Despite the great effort aimed at learning support, despite the other authors recommendations, despite the fact that project based learning is used in specialised course (Bartoska, Svobodova and Jarkovska, 2011), despite the students proves their ability or willingness to apply the operational research in their theses, the case study or project based learning course of operational research is missing.

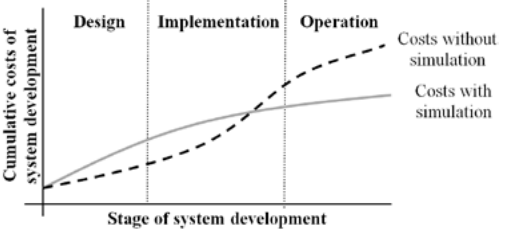

Fig. 1: Comparison of cumulative system costs (Harrell, Ghosh, Bowden (2012: 20))

The Institute for Operations Research and the Management Sciences (INFORMS, 2014) defines the operations research as 'discipline that deals with the application of advanced analytical methods to help make better decisions'. As such, Anderson et al (2011: 6) emphasize the role of quantitative analysis in step between the criteria determination and summary and evaluation in decision making process. The same author (Anderson et al, 2011: 5) shows that the decision making process is part of problem solving process.

That brings us back to case studies and project based learning. The process of problem solving ends with the implementation phase (e.g. Tate, 1977; Forrester, 1994; Anderson et al, 2011). The core idea of case studies and project based learning is 'learning by doing' (Bell, von Lanzenauer, 2000; Cochran, 2012). Even though benefits related to the case oriented teaching (activation, holding the interest, experience giving, etc.) are accompanied also by traps (risk of opt out, could be frustrating, etc.), see Armistead (1984), when applied correctly, such approach is reasonable for the theme that should be presented as practical one. Moreover, despite the position of taught methods in the problem solving process, presenting only part of the process does not show the whole benefit of using them.

The competition position of Mathematical Methods in Economists course at economics faculties is relatively weak when compared to many other subjects. Thus, the role of the teacher must be different. The course of accounting presents something that is necessary, required by law. It is the nature of marketing to present itself; students notice its outputs every day. The responsible teacher of the operational research does not only teach. That teacher must also persuade the students about advantages of the topic.

Experiential learning (Kolb, 1984: 30) contains ability to use theories 'to make decisions and solve problems', active experimentation is inseparable part of the experiential learning process, thus it must occupy the appropriate part of the educational process. Therefore, we recommend organising case study courses and progressively developing project based learning courses. It takes time to develop a course, which brings real outputs on the level as e.g. Armacost and Lowe (2003) did, but from the beginning, each case study should be completed with the presentation of real solution and the impact of used methods, containing problem owner opinion as best, in other words – the implementation phase (for example Pelikan and Fabry (2012) does not mention this significant part). Since

the experiential learning is based also on some kind of willingness and motivation, we are getting back to advertisement. Case studies should be attractive and actual i.e. 'hot' (see e.g. Pruyt (2010) for examples).

Conclusion

In this paper, we showed that even basic knowledge of operational research could provide significant improvements of company's processes. Moreover, it repeatedly provides and even simple approximation methods bring noteworthy savings. At first sight, the results from 269 bachelor and diploma theses seemed as favourable outcome and it can serve as answer on the original students' question. On the other hand, these results reflect the low impact in practice, especially when the examined process is not the main production/ transformation process in the company.

Even Kolb (1977: 32-33) shows the relation between the decision making, problem solving and experiential learning process. Based on this and on the basis of the position of the courses of Mathematical Methods in Economics, we support the argumentation for the case studies and project based learning as a logical consequence of basic courses. Improving the courses that way also provides the answer to the original question, moreover it helps to prevent such questions.

Problem of unrealised potential of operational research or system dynamics is connected with the low society awareness of these methods and benefits associated with their application. But if we really believe that the methods we teach are useful, it is our responsibility as teachers to improve that situation.

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PROCEDURAL AND DECLARATIVE INFORMATIOM PROCESSING SYSTEMS IN DYSLEXIA

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Abstract

The text introduces the specific procedural learning difficulties hypothesis (SPLD hypothesis) which was recently described by R. I. Nicolson and A. Fawcett as a new explanation of dyslexia aetiology. The hypothesis focuses on complex information processing systems combining resources from neural circles as well as cognitive functions which offers much broader options to efficient prevention and intervention approaches.
A quaziexperimental research study aimed at verification of the SPLD was conducted in the Czech Republic. For this purpose a new research methods was created which was sensitive to language skills and required a transmission from declarative to procedural information processing system. Current results which compare achievements of individuals with dyslexia with intact population suggest a significantly more complicated proceduralisation in the observed target group.

Keywords

Dyslexia, declarative information processing, procedural information processing, SPLD hypothesis, quaziexperiment

Introduction

Reading belongs among natural activities of people living in the modern information society. Once we learn to read it becomes very natural to look at every letter and every text as a source of readable information (Milne, 2005). Furthermore, university students and professionals are expected to read highly structured texts which bear knowledge of their field (Houška, Rauchová, 2013). Modern education is dependent on mediating knowledge via reading. Under such conditions dyslexia represents a great obstacle to efficient education. However, people with dyslexia have the potential to learn on secondary and tertiary level. It is often the responsibility of their teachers to find ways how to teach in more appropriate ways.
Dyslexia is nowadays most commonly explained by the 2002 definition of The International Dyslexia Association which declares: “Dyslexia is a specific learning disability that is neurological in origin. It is characterized by difficulties with accurate and / or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction. Secondary consequences may include problems in reading comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge. Studies show that individuals with dyslexia process information in a different area of the brain than do non-dyslexics. Many people who are dyslexic are of average to above average intelligence” (The International Dyslexia Association, 2002).

There are three major approaches explaining dyslexia aetiology: 1) the difficulties stem from phonological awareness deficits which are connected with language processing weaknesses (Anthony et al, 2003; Snowling, 2000); 2) the deficit of manglocelular system which is linked with visual stimuli processing (Stein, 2001); 3) the cerebellar theory which emphasizes inefficient functions of the cerebellum (Nicolson and Fawcett, 2008).
Each approach focuses on slightly different sources of difficulties and explains dyslexia symptoms from a different perspective. Furthermore, each of the approaches involves certain most typical symptoms of dyslexia but somehow omits others which are also often connected with dyslexia. The most common cognitive symptoms of dyslexia include: phonological awareness deficit, visual perception deficit, short-term memory deficit, working memory deficit, sequencing deficit, spatial orientation deficit, verbal skills deficit, and attention deficit (Reid, 2011; Smith-Spark et al, 2004; Snowling, 2000; Zelinková, 2009).
Nicolson and Fawcett reacted to a rather unclear and vague situation in the field and they introduced the specific procedural learning difficulties hypothesis (Nicolson and Fawcett, 2006; Nicolson and Fawcett, 2008). They argue it is time to move from theories which search for particular sources of difficulties and specific areas explaining the aetiology to approaches which cover complex neural circles responsible for information processing. Their activity has thus impact on various forms of possible deficiencies in learning and skill development. Nicolson and Fawcett (2006) further claim that this approach much better combines our knowledge from neural disciplines, cognitive disciplines and education.
In case of dyslexia the authors pay close attention to procedural and declarative information processing systems which are also known as declarative and procedural memory (Ullman, 2001). Ullman (2001) describes the two systems as a dual model of learning. Each system processes different information. However, from dyslexia perspective language learning and verbal skills acquisition seem the most crucial. Declarative system primarily focuses on remembering events, facts and vocabulary while procedural system is active when remembering habits, skills and grammar rules (Ullman, 2004). Furthermore, the systems process information differently - declarative system is based on explicit information whereas procedural system uses implicit learning. Thus the declarative system is efficient when facts are clearly acknowledged while the procedural system relies on unintentional automatic learning.
Apart from specific characteristics of information which is used by each system, the systems are also active at a different stage of learning. Traditional learning usually first requires the declarative system. When information becomes more automatised, the procedural system takes the leading role (Ullman, 2004). Under standard conditions both systems work mutually and contribute to each other. In case one of the systems is deficient, the other starts responding to all learning situations more frequently and becomes more important.
The figure 1 shows links between neural circles, information processing systems and possible learning difficulties.

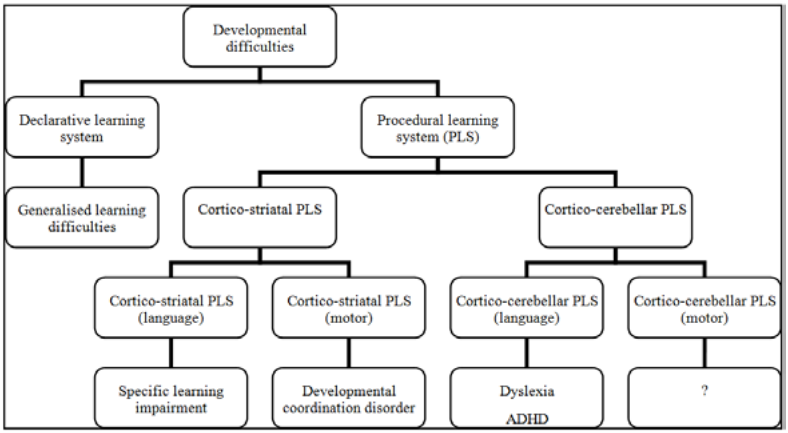

Fig. 1: Typology of learning disabilities based on declarative and procedural information processing systems (taken from Nicolson and Fawcett, 2011:123)

The SPLD hypothesis presumes that deficient procedural learning, particularly its language part which is managed by cortico-striatal neural system, leads to dyslexia (Nicolson and Fawcett, 2011). The aim of the paper is to look closer at SPLD hypothesis and attempt to verify its principles in the population of Czech individuals with dyslexia.

Materials and Methods

The research design was a quaziexperimental study. Respondents were supposed to learn rules of artificial grammar which they were asked to apply in a course of a learning process and finally in a test situation.

Research sample

The sample involved adolescents aged 11-18 and adults aged 19-45. Both groups included individuals with dyslexia and controls without dyslexia. The samples were equalised as for gender (Fisher exact test, $p = 0.718$ in the group of adolescents; $p = 0.740$ in the adult group), age ($U (n1 = 14, n2 = 14) = 72$; $p = 0.222$, $r = -0.23$ in the group of adolescents; $U (n1 = 11, n2 = 36) = 163$; $p = 0.377$; $r = -0.13$ in the adult group) and a level of fluid intelligence (T-I-P: $(t (9) = -1.548$; $p = 0.156$, $d = -0.94)$; I-S-T: $(t (15) = 1.058$; $p = 0.307$; $d = 0.51$ in the group of adolescents; $t (45) = -1.646$; $p = 0.107$; $d = -0.57$ in the adult group). In the adult group the highest education level was also observed which was equal for both groups as well (tested by Fisher exact test, $p = \text{min. } 0.310$).

The tables 1 and 2 show characteristics of both observed groups, i.e. adolescents and adults.

Adolescents	Dyslectics	Non-dyslectics
Total number	14	14
Gender	9 M / 5 F	8 M / 6 F
Age - M/SD/Min/Max	14.29 / 1.77 / 11 / 17	15.21 / 1.72 / 13 / 18
School	PS = 13, 8G = 1, SS = 0	PS = 5, 8G = 5, SS = 4
Intelligence (T-I-P) - M/SD	21.67 / 2.94	24.40 / 2.88
Intelligence (I-S-T 2000 R) - M/SD	10.75 / 3.73	9.11 / 2.62

Tab. 1: Characteristics of adolescent group of dyslectics and non-dyslectics (note: PS = primary school, 8G = 8-year comprehensive secondary school, SS = secondary school)

Adults	Dyslectics	Non-dyslectics
Total number	11	36
Gender	6 M / 5 F	17 M / 19 F
Age - M/SD/Min/Max	24.82 / 2.6 / 22 / 31	25.39 / 6.59 / 20 / 45
School	8G = 0, SS = 1, Un. = 8, ? = 2	8G = 1, SS = 5, Un. = 19, ? = 11
Intelligence (I-S-T 2000 R) - M/SD	10.55 / 3.05	12.47 / 3.49

Tab. 2: Characteristics of adult group of dyslectics and non-dyslectics (note: 8G = 8-year comprehensive secondary school, SS = secondary school, un. = university, ? = unknown)

Methods

To simulate a learning situation and a process of proceduralisation we used artificial grammar. The method was sensitive to language use but its artificial aspect prevented respondents from using their previous knowledge. Furthermore, a rather long-lasting process of administration expected a shift from the use of declarative information processing system to the use of procedural information processing system.

The artificial grammar consisted of eight rules and two exceptions of these rules. The rules were defined on a list of one- and/or two-syllable pseudo-words (e.g. ČUF, POS, LO, ZULU, LELU) and they followed some of real Czech grammar rules (e.g. words ČUF, MOKR, MRO always have to be followed by the word LÍK). The respondents were introduced to the rules at the first session. Afterwards, they repeatedly completed four grammar exercises. They were instructed to complete missing words in sentences in accordance with the rules (e.g. „ČUF ___ SÁ LO ZAN ___ KED LUD.“). Grammar learning was divided into three sessions. The interval between the sessions was 3-7 days. In the course of the first two sessions the respondents filled in the whole set of grammar exercises four times. The time gap between grammar learning was 5-7 minutes. At that time the respondents completed another task, which was another part of the whole study. While filling in the grammar exercises the respondents were allowed to use the grammar reviews whenever they needed. They also had the option to consult any learning problems with the administrator and after completion of each set of grammar exercises they received a feedback on their results. At the last session the respondents only filled the set of grammar exercises once. After having done some other tasks they were given a grammar test. At this moment the respondents could not use grammar reviews and/or consult with the administrator. The aim of the test was to observe the effect of previous learning which was expected to lead to automatisation of the grammar rules and their easy recall in a situation which differed from the previous easier training (e.g. the respondents had to state whether sentences were correct or false, they were asked to correct wrong sentences).

The outcomes of the test involved a number of correct answers and time needed to complete the whole test. Both these variables were used to compare the use of procedural information processing system in the group of individuals with dyslexia and in the group of individuals without dyslexia. We hypothesised faster and more precise work in the latter group.

Apart from artificial grammar we also used tests of fluid intelligence to screen a level of cognitive functions of our respondents. The aim was to gain comparative groups of respondents and exclude any respondent whose characteristics would affect the sample

distribution in a way which was incompatible with the other group. We used two different tests depending on the age of the respondents. Říčan's Test of intellectual potential (T-I-P, time limit - 12 minutes, 29 items) was used in the age-group between 11-14 years. The older respondents were administered a matrices subtest from the Intelligence Structure Test (I-S-T 2000 R, time limit - 10 minutes, 20 items). Both tests were included at the last session.

Results and Discussion

The table 3 shows average results, standard deviations and 95% interval of confidence in the group of adolescents.

Adolescents	M	SD	95%CI
Correct answers - dyslexics	29.14	9.88	23.97-34.32
Correct answers - non-dyslexics	39.64	3.52	37.80-41.49
Time to complete the test - dyslexics (s)	553.07	165.55	466.35-639.79
Time to complete the test - non-dyslexics (s)	719.14	156.13	637.36-800.93

Tab. 3: Results of artificial grammar test in the group of adolescents

The results showed noteworthy differences not only between dyslexic and non-dyslexic groups but also between age groups. In the adolescent group the respondents with dyslexia scored statistically significantly lower than their peers without dyslexia ($t(26) = -3.747$; $p = 0.002$). The results have a strong effect size ($d = -1.24$) and the regression analysis confirmed that dyslexia is a significant predictor of a number of correct answers even when controlled for age, gender, and type of school (see table 4).

	B	SE B	β	p
Constant	29.00	13.44		0.04
Dyslexia	-8.96	3.42	-.0.51	0.02
Age	0.35	0.90	0.07	0.70
Gender	5.73	2.84	0.32	0.06
8G	4.98	3.99	0.23	0.23
SS	0.70	5.24	0.03	0.89

Tab. 4: Frequency of mistakes in the artificial grammar test in the group of adolescents when controlled for other variables (results of regression analysis)

However, adolescents with dyslexia needed less time to complete the test than controls ($t(26) = -2.731$; $p = 0.011$). The results have a strong effect size ($d = -1.03$).
The adults group of dyslexics reached a similar number of correct answers (see table 5) as the non-dyslexic controls ($t(45) = 0.675$; $p = 0.503$). The results have weak effect size ($d = 0.23$).

Adults	M	SD	95%CI
Correct answers - dyslexics	40.91	8.09	36.13-45.69
Correct answers - non-dyslexics	38.97	8.40	36.23-41.72
Time to complete the test - dyslexics (s)	1166.09	483.22	880.53-1451.65
Time to complete the test - non-dyslexics (s)	814.50	331.02	706.37-922.63

Tab. 5: Results of artificial grammar test in the group of adults

On the contrary, the time needed to complete the test was statistically significantly higher in the dyslexic group than in the non-dyslexic group ($t(45) = 2.756$; $p = 0.008$). The results have strong effect size ($d = 0.95$) and the regression analysis confirmed that dyslexia is a

strong predictor of time needed to work on the test even when controlled for age, gender, type of school, and intelligence (see table 6).

	B	SE B	β	p
Constant	241.12	370.99		0.52
Dyslexia	364.22	130.53	0.39	0.01
Age	8.55	9.87	0.13	0.39
Gender	222.18	109.47	0.28	0.05
8G	-99.18	388.81	-0.04	0.80
SS	-23.42	183.22	-0.02	0.90
Un.	42.28	133.25	-0.02	0.90
Gf (IST)	18.86	13.32	0.16	0.25

Tab. 6: The length of time of the artificial grammar test completion in the group of adults when controlled for other variables (results of regression analysis) (note: coding of category variables was carried out by using dummy variables; in case of type of school the default value was "? = unknown school")

We hypothesised that both age groups of dyslexics would show more mistakes and longer time to complete the test. However, the results showed a different pattern in each group. The differences may stem from two possible explanations. First, in accordance with SPLD hypothesis individuals with dyslexia have deficient procedural information processing system (Nicolson, and Fawcett, 2010). Under standard conditions this system enables an individual to switch from slower declarative information processing system to a faster and more automatised one while the efficiency of work stays on appropriately high level. When such mechanism is negatively affected, the work of procedural system (not only in the language area) becomes unreliable. A possible solution to such problem is to rely more on declarative information processing system even though it is slower. In accordance with the results we presume that adults with dyslexia use declarative system as one of their compensatory strategies in the field of language skills as has been suggested above (Ullman, 2004). Thus they are able to answer rather precisely but they need much more time to work on language tasks as they do not get the procedural processing character.

Second, when thinking about adolescents, they apparently do not use such sophisticated compensatory strategies as adults therefore their approach to language work may differ from the older observed group. We presume the adolescents with dyslexia still rely on their dysfunctional information processing system which led to much higher amount of mistakes when compared with controls. Such attitudes to work meant they did not differ in the length of time needed to complete the test. However, when adolescents are confronted with a language task they may tend - in accordance with their developmental period - to give up the kind of work which they find discomfort as it requires intense work of their deficient information processing system. Therefore they completed the test rather fast and apparently without the interest to reach a high score. On the other hand, adults showed strong effort to complete the task precisely and work as efficiently as possible. They managed to process the information which, however, affected the necessary time of their work.

Providing we accept our presumption concerning the overall results and also the differences between the age groups, the outcomes of the study may suggest efficient educational interventions. We particularly propose the emphasis on metacognitive strategies which may support explicit focus on information processing when the implicit information processing cannot be used. An individual needs to realize how to respond in a particular

situation. In other words, the one does not rely on mere automatisation of skills and activities but within the intervention we declare how to process the information and how to think about a task. This idea is supported by a research conducted among adults with dyslexia. The ones who described more intense use of metacognitive strategies at their work also declared fewer everyday cognitive lapses connected with dyslexia, and they showed higher self-efficacy concerning their profession and also higher job satisfaction (Leather et al, 2011). Another study with children with special educational needs (Kozulin et al, 2010) also confirmed the effect of purposeful metacognitive strategies development which led to a general cognitive abilities development.

Conclusion

Even though the results somehow contrast with our primary predictions, they pretty much confirm the SPLD hypothesis. The procedural information processing system appears deficient in the group of individuals with dyslexia. Depending on age they apparently either use the system regardless the deficits, or they compensate for it by using the declarative information processing system.

Further research should certainly include alternative explanations of the results - among others co-morbidity of dyslexia and ADHD syndrome, the strength of individual dyslexia profiles but also the way of research design (e.g. group versus individual testing, number of respondents etc.).

Another noteworthy field of a following research should focus on the use of metacognitive strategies to prove (or deny) this approach as the efficient educational intervention when language use is concerned.

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INFLUENCE OF THE E-LEARNING AND FORM OF STUDY ON THE STUDY RESULTS

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Abstract

The main aim of this paper is to compare the study results of the selected subjects of the full time and combined forms of study at the study programme Economics and Management. This programme is offered at the College of Polytechnics Jihlava and covers two fields of study - Travel and Tourism, Finance and Management. The comparison is aimed at the results of the period before the start of the e-learning (2008 for full time students and 2010 for combined form) with the year 2012 (after the e-learning implementation). The results from six biggest subjects are tested via Chi-square test of independence. It should answer the question if the e-learning has had an impact on the study results and if it is possible to find dependence between results of two different types of study, two different years or two different study branches. The comparison has shown the differences of combined/full time students but we have not proved the influence of the e-learning on the evaluation.

Keywords

Comparison, Moodle, Study Subjects, Marks, Chi-square Test of Independence

Introduction

E-learning nowadays forms an important part of study at all colleges and universities. It has been usually prepared for students in distance study programmes to provide them more materials as well as for the self-study. Clark and Mayer (2011) define e-learning as "instruction delivered on a digital device such as a computer or mobile device that is intended to support learning". They describe also different features that e-learning might have such as the usage of various media elements to deliver the needed content (words, pictures, videos, sounds, presentations, CD-ROMs) or the inclusion of the instructional methods (examples, practice, feedback) to promote e-learning. Zounek (2011) thinks that the letter "e" will probably disappear from the word e-learning and ICT usage during learning process will be ordinary. The preparation of the e-learning courses is widely spread especially because of the new technologies and also in order to offer students easily accessible materials of study.

The comparison of student results connected with e-learning or distance learning is one of the topics that are mentioned in various articles. Houška and Beránková (2011) studied the impact of additional contact lectures on students' results. Carnwell (2000) analyzed the influence of e-learning materials used instead of direct teaching and found out the influence of well designed e-courses with benchmarks and deadlines on the self-study. The impact of e-learning on study results was tested also in the paper of Popelkova and Kovarova (2013) with the result of any statistically significant relationship between results and final exam. Also in other study (Manochehri, Young 2006) the difference in final evaluation in different forms of education has not been confirmed. In this article we investigate the influence of e-learning, forms of study and years of study on the final

evaluation. Three hypotheses concerning the independence of these factors are tested via Chi-square test of independence. The main aim is to find out if the e-learning usage has improved the results of study.

Materials and Methods

The College of Polytechnics Jihlava has five accredited study programmes and Economics and Management is one of them. It covers two fields of study: Travel and Tourism (TT), Finance and Management (FM). By March 2014 there were more than 2600 students enrolled in the full-time and combined forms of study in all programmes and 70% of them study in the programme Economics and Management. The combined form students represent 30% of these students. During the years 2009-2012 the project "Introducing E-learning System into Teaching and Creating E-Courses at College of Polytechnics Jihlava" subsidized from the Operational Programme Education for Competitiveness in the priority axis 2 with the project registration number CZ.1.07/2.2.00/07.0317 has been executed. The main aim of the project was the creation of 150 e-courses in the learning management system Moodle. We have written about the project and its evaluation in previous papers (Vojackova, Kuncova, Benesova 2011; Kuncova, Vojackova 2012; Kuncova, Vojackova 2013). The e-courses have been prepared especially for the students from combined (a form of distance) form of study as well as for the full-time students. They contain not only study materials but also interactive homework or tests for students to know how they understand the topic.

In this article we would like to compare the study results of full-time and combined form students in selected subjects. We are aware of the fact that the study results are influenced by a lot of different factors (such as learning style, personality traits, students' characteristics – Kunstova 2013) and e-learning materials can be only one of them. But on the other hand we try to find out the differences between full-time and combined students and between students from the two study fields (TT, FM) as all of them could use the same materials. So the first part of our research is aimed at the subjects that are obligatory for both study fields which use the e-learning materials. These subjects are:

- Business Economy (BE)
- Macroeconomics (MAE)
- Marketing A (MGA)
- Microeconomics (MIE)
- Financial Accounting (FIA)
- Public Finance (PF)

First four subjects are taught in the first year of study, FIA is taught in the second year and PF in the third (and last) year of bachelor study programme. All these subjects end with the final exam mark on the scale A-F (A-E means the students have passed, F is for those who have failed). Each student has 3 attempts to do the final exam so we have taken only the final marks (the marks from the last term). For the comparison we use the percentage of students with each mark instead of real number of students but for the statistical tests we use the real data. As an example see Tab. 1 where the results of the subject Marketing A from the year 2012 are shown. The differences between the students of the fields TT and FM are not so big but the difference between combined form students and full-time students does exist.

mark	TT – combined f.	TT – full-time	FM – combined f.	FM – full-time
A	4.69%	18.88%	7.07%	16.84%
B	7.03%	15.73%	12.12%	16.33%
C	22.66%	22.73%	16.16%	17.86%
D	10.94%	20.98%	18.18%	15.31%
E	21.09%	11.54%	22.22%	13.27%
F	3.91%	2.45%	1.01%	5.61%

Tab. 1: Marketing A results (year 2012, Travel and Tourism TT, Financed and Management FM)

In all selected subjects we have excluded those who failed and have the mark "F" written in Information system by this system. It means that they did not try any final exam or test. In the first year of study it can be a lot of students as they stop the attendance of the school during the first semester. For example in 2012 in the course Microeconomics (1.semester for both study fields) 27% of students obtained "F" mark from information system. The reason for the exception of these students is the fact that they probably did not use e-learning materials at all (especially in the first year of study they stop attendance in the middle of the first semester).

We divided the students first into field of study groups (TT and FM) to test the difference between their marks and second into the type of study groups to test the difference between full-time and combined form of study (Tab.2). As we cannot say that this difference is influenced only by the system of study (contact lessons and e-learning) the next part of our research is dedicated to the comparison of the results of the selected subjects over several years starting with 2008 (full-time) and 2010 (started the combined study form) – during this period no e-learning materials were prepared, and finished by 2012 (with all e-learning materials). Yearly results are taken from two semesters of study i.e. for 2008 we have taken results from the summer semester 2007/2008 and winter semester 2008/2009. All selected subjects are taught in both semesters during a year.

No. of student	full-time						combined form			
subject / years	2008		2010		2012		2010		2012	
	TT	FM	TT	FM	TT	FM	TT	FM	TT	FM
BE	304	213	678	597	326	199	157	452	168	159
MAE	285	176	294	245	259	188	0	156	125	100
MGA	317	176	265	233	286	196	0	144	128	99
MIE	283	423	440	334	332	204	161	216	166	155
FIA	295	188	276	259	310	200	0	144	95	107
PF	245	155	227	160	258	160	0	118	74	78

Tab. 2: Number of students in the selected subject (Travel and Tourism TT, Financed and Management FM)

Based on the groups mentioned above we have formulated these hypotheses:

1. The results of the two selected years of study are independent.
2. The results of the students of TT and FM fields of study in all selected subjects are not dependent on the study field.

3. The results of the students of full-time and combined form of study in all selected subjects are not dependent on the form of study.

For the comparison we use Chi-square test for independence using categorical data (marks, field of study, type of study, year of study) and contingency tables (Kanji 2006).

Results and Discussion

The comparison of results for each subject shows that not all final marks are normally distributed. It is influenced by the conditions how to pass the given subject. For example we can see (Fig. 1) that the results from Macroeconomics are nearly normally distributed and they are similar in the full-time type of study and in the combined form. In the full-time the results in 2012 and 2010 are better than in 2008 where a lot of "E" marks have been given. On the other hand the results of combined student seem to be worse in 2012 than in 2010 (the teachers are still the same, the final test also so there is no influence of the different teacher).

When we look at the results of Financial Accounting (Fig. 2) we cannot confirm the normality of the final marks distribution. It is given by the conditions (valid from 2008 till now) that the minimum percentage for the success in this subject (studied in the second year of study) is 70 % but to succeed in Microeconomics or Macroeconomics only 60 % is required at least. Based on this we do not test the average marks via t-test but we calculate the average just to see the differences in this mean value for the selected subject during years and for the study fields and type of study. For the calculation mark "A" is equal to 1, "B" = 1.5, "C" = 2, "D" = 2.5, "E" = 3 and "F" = 4.

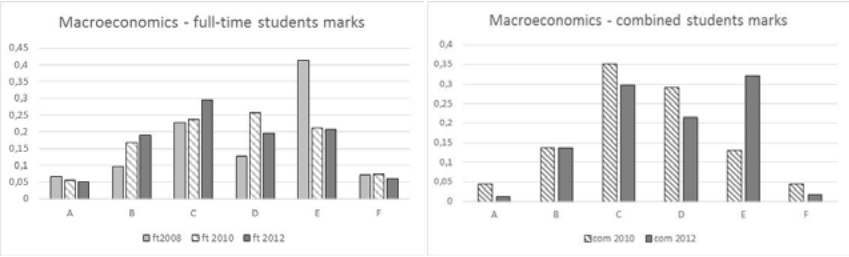

Fig. 1: Macroeconomics – comparison of results (% of students with given mark)

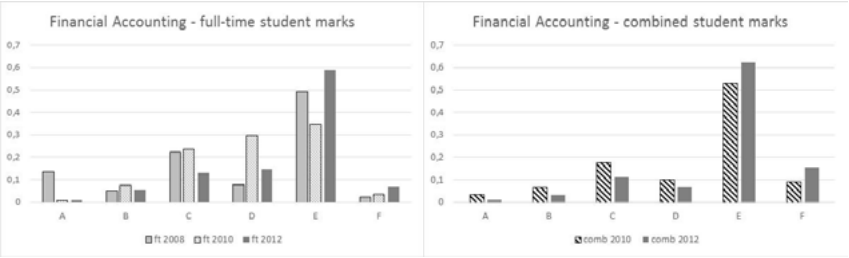

Fig. 2: Financial Accounting – comparison of results (% of students with given mark)

In the first part of our research we have obtained Chi-square test results for the comparison of different years of study. They are 2008, 2010 and 2012 for full-time students and 2010 and 2012 for combined students. The e-learning materials started to be created in 2009 so

some of the subjects could use them in 2010 and all subjects used it in 2012. According to the first hypothesis we have tested the independence of the results in different years. Tab. 3 shows all p-values for full-time students and for all subjects selected. As the significance level is equal to 0.05 (the critical value from the Chi-square distribution with 5 degrees of freedom is 11.07, all values are higher) and all p-values are lower than this (Tab. 3) we reject the first null hypothesis (for all subjects) and we may say that there exist differences between the results of each subject in selected years. In this situation we can compare also the average marks. Only for MAE and MGA we may say that the results improved from 2008 to 2012. In MIE the average mark is better in 2010 than in 2008 but in 2012 is again making worse. Those subjects are taught in first year of study and a lot of effort has been put into the e-learning materials preparation for the early students. So the results show that the e-learning materials in combination with face-to-face lessons probably help the student to cope with these subjects. On the other hand FIA (second year of study) and PF (third year) have rising average mark. In FIA it might be cause by the higher level of passing (70 %) that causes for some students the effect to pass with minimum points (and "E" is enough).

	p-value (Chi-test value)		Average marks (full time students)		
subject / years	2008/2012	2010/2012	2008	2010	2012
BE	0.00000 (44.69)	0.00000 (24.07)	2.17678	2.65939	2.76239
MAE	0.00000 (22.83)	0.00021 (22.74)	2.50129	2.50283	2.28012
MGA	0.00036 (13.25)	0.00038 (41.42)	2.17991	2.25055	2.03364
MIE	0.02114 (78.33)	0.00000 (45.11)	2.85575	2.54139	2.85000
FIA	0.00000 (85.64)	0.0000 (151.37)	2.42031	2.51759	2.76339
PF	0.0000 (162.67)	0.0000 (371.04)	1.95093	2.16353	1.98593

Tab. 3: Dependence on the year (deg. of freedom=5; critical value=11.07) and average marks

When we compare the results of the combined form of study (Tab. 4) we can again reject the null hypothesis about the independence of the marks between years (only p-values shown as it give us the same information as Chi-test values that are all higher than 11.07). But here except of MAE all other subjects have worse average marks in 2012 than in 2010. May be it is cause by the lower quality of students but it can also show us that the e-learning materials do not help much or can be counter-productive as some students thinks that it is not necessary to use any other materials (for example books) than e-learning materials.

	p-value	Average marks (comb. form students)	
subject / years	2010/2012	2010	2012
MAE	0.00000	2.25191	2.38393
MGA	0.00037	1.97196	2.37222
MIE	0.00000	2.23544	2.54592
FIA	0.00000	2.69748	2.93889
PF	0.00000	2.19231	2.38202
BE	0,00233	2.65441	2.90097

Tab. 4: Dependence on the year ((deg. of freedom=5; critical value=11.07) and average marks

	p-value		Average marks (full time students)			
subject / years	2008	2012	2008 TT	2008 FM	2012 TT	2012 FM
BE	0.07366	0.32075	2.59570	2.34507	2.75632	2.76506
MAE	0.52413	0.16283	2.44958	2.58389	2.20918	2.38235
MGA	0.10218	0.26220	2.10536	2.32095	2.00189	2.08383
MIE	0.00000	0.08931	2.81225	2.89808	2.88095	2.80201
FIA	0.00022	0.91254	2.30819	2.58599	2.76364	2.76301
PF	0.20556	0.63099	1.87393	2.07692	1.94748	2.04575

Tab. 5: Dependence on the study field (full time students, Travel and Tourism - TT, Finance and Management – FM; deg. of freedom=5; critical value=11.07) and average marks

The second hypothesis was aimed at the independence of the results in both study fields. In Tab. 5 we see that only two p-values are lower than the significance level (grey background) and so in these cases we can reject the hypothesis and say that in 2008 there were differences in marks between full-time students of TT and FM in MIE and FIA. The average marks show that the students of FM have been worse. It can be caused by the fact that in this year both subjects were taught each semester for different study field (the groups of students were from the same study field) but from 2010 the groups of students were mixed from both fields.

	p-value		Average marks			
subject / years	2010	2012	2010 ft	2010 com	2012 ft	2012 com
MAE	0.00045	0,00501	2.50283	2.25191	2.28012	2.38393
MGA	0.00000	0.00000	2.25055	1.97196	2.03364	2.37222
MIE	0.00000	0.00000	2.54139	2.23544	2.85000	2.54592
FIA	0.00000	0.04622	2.51759	2.69748	2.76339	2.93889
PF	0.08433	0.00000	2.16353	2.19231	1.98593	2.38202
BE	0.00000	0.00000	2.65939	2.65441	2.76239	2.90097

Tab. 6: Dependence on the type of study ((deg. of freedom=5; critical value=11.07) and average marks (full time, combined students)

The last hypothesis focuses on the independence between the results of full-time and combined forms of study. Only in one case (PF, 2010) we cannot reject the null hypothesis and say that the study results in full-time and combined form differ. When we compare the average marks (Tab. 6) it might be interesting that the average for PF and 2010 is closer than for example the average for BE in 2010 where the null hypothesis was rejected and so here the results are dependent on the type of study. But if we compare the histograms (Fig. 3) it is clear that there are bigger differences in BE than in PF. On the other hand nearly all average marks of combined students are worse than for full-time ones. So we still see that it is harder to study in the combined form regardless of the e-learning materials.

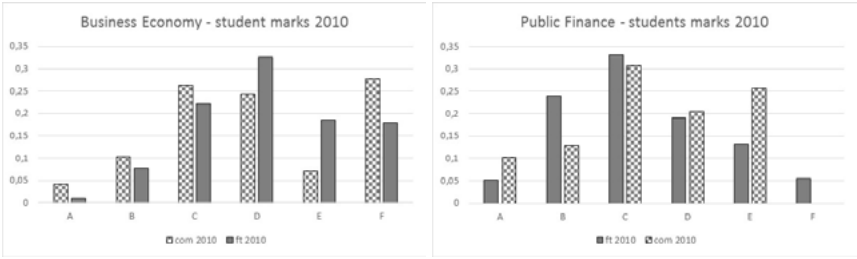

Fig. 3: Business Economy and Public Finance – comparison of results (% of students with given mark)

Conclusion

The comparison of results between different years of study – before e-learning usage and after it – showed that the differences between students' final marks both in full-time and combined form of study exist. But it is not possible to say that these differences are caused only by using of the e-learning materials as in some subjects the results are worse than before. The difference between the students of the two study fields has not been proved. We have only confirmed that the results between the study forms (full-time and combined) differ and students of the combined form have worse average marks. If this is the reason of few materials in e-learning, no effort to study more than from e-learning, students' ability to study, fewer time or lack of face-to-face lessons it can be a part of further research. As the other authors (mentioned in the introduction) reached the same results such as very small or any influence of the e-learning onto the evaluation we may conclude that the e-learning is a useful help for students but it cannot be considered as the only way how to give materials to students and how to study – as we see it on the marks of combined form students.

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CZECH UNIVERSITIES: PURPOSES OF INTELLECTUAL CAPITAL REPORTING

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Abstract

This paper deals with the concept of intellectual capital (IC) in higher education in the knowledge economy. Based on literature review it focuses on the era of knowledge society and the role of universities, the concept of IC is also introduced. It is accepted nowadays that European universities are facing several changes and are undergoing deep transformation process. Given the fact of changing and turbulent environment, higher education institutions should adapt their management practices in order to be more competitive, dynamic and transparent. Under discussion are new methods for measuring and reporting university performance and efficiency. The objective of this research is twofold. On one hand, to provide some insights into the role of IC in higher education, on the other hand, to examine the current IC management and reporting practices of Czech universities.

Keywords

Higher education, intellectual capital, intellectual capital report, knowledge economy, universities, pilot study

Introduction

Since the end of the 20th century the economy has become significantly different from the industrial economy. The business landscape has changed enormously in the 21st century as we are entering a knowledge society. The wealth creation is associated with the development and maintenance of competitive advantages based on intangibles[1] (Meritum, 2002). Economists consider that the main feature of this new economic environment is the important role played by IC as a basic determinant of value creation in companies. As Kanigolzar et al (2013) state, IC is one of the important organizational resources that can help organizations to create sustainable competitive advantage. In Husak's and Volkanova's (2011) opinion, knowledge, learning processes and education become an integral part of the development of the whole society.

The advent of the knowledge economy has increased the importance of knowledge resources; however, the majority of these resources are not reported in traditional financial statements. This has created an information gap in the market, and more firms are calling for voluntary disclosure of these intangibles to close this gap (Mouristen et al, 2005). Thus, increased attention to knowledge resources to create value has called for new frameworks to manage and report organizational performance (Meritum, 2002, Eustace, 2003).

Previously the researchers focused their attention on IC definitions and classification and nowadays the research is more focused on IC reporting and factors influencing it (Bezhani, 2010). As Sánchez and Elena (2006) state, this issue have become crucial not only for

[1] The terms such as intangibles, intellectual capital, knowledge resources, and intangible assets are used in the same meanings in this paper.

academics, but also for governments, regulators and other stakeholders during last decade and they add that although most IC analysis refers to private sector, this growing interest has extended from private firms to public ones. According to Secundo et al (2010), the attention to IC has primarily emerged in the business world but there is today a growing interest also in non profit organisations. Likewise, as Kong (2007) states, unlike concepts as industrial organisation, the concept of IC can be used as a valid strategic management framework and competitive management tool for non-profit institutions.

European higher education

European higher education has been undergoing a process of in-depth transformation (Sánchez et al, 2009) and is facing a number of changes that directly affect the conceptualization and functioning of universities (Córcoles et al, 2011). The Lisbon Agenda calls for their specific involvement in the creation of the Europe of knowledge. Bologna process is introducing structural transformations toward the homogenisation of the European higher education sector (Sánchez et al, 2007). The aim is to increase the level of quality of universities, their flexibility and quick response to changes, their transparency and competitiveness in order to make them more comparable, flexible, transparent and competitive. Also Komárek (2011) deals with the Bologna Process in his article titled "Some Pitfalls of efficiency in the contemporary higher education".

IC in public sector and universities in the knowledge-based economy

Public sector tends to have multiple objectives of a non-financial nature, uses human resources and knowledge, its final product of the public administration is a service and this is essentially intangible therefore the public sector is an ideal framework for the application of the ideas related to IC theory (Cinca et al, 2003).

If a knowledge-based economy is mainly characterised by the production, transmission and dissemination of knowledge and universities' main goals are the production and diffusion of knowledge, and their most important investments are in research and human resources, so they are unique in all these processes, because of to the key role they play in the research and exploitation of its results. Universities' main inputs and outputs are basically intangibles and only a small part of these are identified and very limited instruments exist to measure and manage them (European Commission, 2003, Canibano and Sánchez, 2004).

As asserted by the European Commission (2003; p.13) "universities have a duty to their stakeholders (students, public authorities funding universities, labour market, society as a whole) to maximise the social return of the investment." According to Cañibano and Sánchez (2004) IC and knowledge management approaches become crucial in the field of higher education in order to reinforce universities' role in national innovation systems. The idea of IC reporting has gained an increased attention and a few initiatives were developed (Bezhani, 2010). IC frameworks were developed by national and international institutions as guidelines for organizations to manage and report IC (Ricceri, 2008). These initiatives come from various academics, practitioners, authorities, and interest groups (Ross et al, 2005).

To date, there is no commonly agreed-on terminology or definition for the construct of IC. The reasons for this is probably to be that this field is still in its embryonic stage and that no one is willing to give up their own nomenclature and build on each other's work (Andriessen, 2004).

The definitions, although initially established for companies, can be easily adapted for universities. According to Córcoles et al (2011), IC, when referring to a university, is

a term used to cover all the university's intangibles, including processes, capacity for innovation, patents, the tacit knowledge of employees, their talents and skills, the recognition of society, its collaboration network etc. The tripartite classification is the most widely accepted in IC literature (Bezhani, 2010, Secundo et al, 2010, Leitner, 2004 etc.)

Human capital is defined as the knowledge that the human resources (teachers, researches, PhD students and administrative staff in this case) would take with them if they left the institution. It is the sum of the explicit and tacit knowledge of the university employees. Organisational capital is defined as the knowledge that stays within the institution at the end of the working day. It comprises the governance principles, the organisational routines, procedures, systems, cultures, databases, intellectual property, etc. Relational capital is defined as all resources linked to the external relationships of the institution such as customers, suppliers, R&D partners, government, etc. It also includes the perception others have of the university (its image, appeal, reliability etc.) Within each category we can distinguish between resources and activities (Sánchez et al, 2006).

IC reporting is the process of creating a story that shows how an organization creates value for its customers by developing and using its IC. It is about identifying, measuring, and reporting IC and also constructing a logical presentation of how the organization uses its intangibles in order to create a use value (European Commission, 2006). This process often leads to the creation of an IC Statement, a report on the organisation's IC that combines numbers with narratives and visualizations (Danish Guidelines, 2007). As Bezhani (2010) mentions, there is a lack of research for IC reporting in public sector and more specifically universities.

The authors recognise several reasons why universities should report their IC. Fazlagic (2006) mentions following reasons such as the increased demand of transparency, constant and comprehensive access to the information when public funds are allocated, the press ranking lists of universities need to be compared with other benchmarking methodologies, etc. The main reasons to develop an IC report according to Austrian Research Centres (2000) are as follows: transparency in the use of public funds, understanding that "research is not self-explanatory: its benefits must be interpreted and communicated in a comprehensible way" and the requirement for openness. According to Leitner (2005) there are several specific challenges that are confronted with universities: performance-based public funding mechanisms, greater autonomy, competition for grants and research contracts, measurement and evaluation of outputs which are intangible by nature, increasing demand for strategic development and systematic management of the most valuable resources, which are intangibles and general call for accountability and transparency. Sánchez et al (2007) deal with similar reasons.

Based on literature review, the authors agree upon the need of new management and reporting instruments for universities. As Sánchez et al (2009) state, in order to cope with multiple missions and fulfil universities' accountability duties, they need to improve management and reporting mechanisms. Chatterton and Goddard (2003, p. 19) recognise "responding to the new demands requires new kinds of resources and new forms of management that enable universities as institutions to make a dynamic contribution to the development process". As Leitner (2002) states, a creation of IC report of a university is more difficult than that for the firms because universities have a range of goals that determine their performance.

According to European Commission (2006), IC report has two main functions: complement management information (internal management function) and complement

the financial statement (external reporting function). The benefits of using IC report fall into two categories, one category is its potential to function as a management tool and the other category is its potential to function as a communication device linking the university to the external environment (Sánchez et al, 2007). The potential benefits perceived by Czech universities were examined in this research.
The purpose of this research is to analyse IC reporting practices of Czech universities and achieve the following objectives: to provide some insights into the role of IC in higher education in the knowledge-based economy, to examine the IC management practices of Czech universities, to examine the opinion of Czech universities on mandatory disclosure of IC and to investigate the potential benefits of IC reports perceived by Czech universities.

Materials and Methods

The methodology considered quantitative research method and identified questionnaire as most appropriate for gathering primary data. This paper is considered as a pilot study. It was conducted on a limited scale that allowed getting a clearer idea of this topic in the content of Czech higher education. This pilot study was followed then by a full-fledged research study. Literature review was used in order to short review of the current state in the explored area. The paper refers to significant sources, particularly scientific journals and books.

Sampling and research design

The population comprises all Czech universities (public, private and state universities) in total 77 universities. The questionnaire was electronically distributed to all Czech universities (28 public, 2 state and 47 private universities). Questionnaire as research technique helped to determine Czech universities opinion on IC management and reporting. Questions were based on reviewed literature especially focused on benefits of IC report as well as questionnaire used by Bezhani (2010).
The rectors, vice-rectors for strategies and development, chancellors and others responsible persons for the preparation of annual reports and development of a university were selected as participants. An on line survey software was used to construct a user-friendly questionnaire. The questionnaire consisted of three parts. The first part provided the university and job position information, six questions in the second part provided information about IC reporting practices and importance of IC, and twenty-two questions in the third part referred to external and internal purposes of IC reports for universities. The participants answered each question by selecting the relevant answer based on how they feel about the statement. A total of three colleagues helped with the pilot testing of the questionnaire to make sure that the questions mean the same to everyone and to test the time taken to complete. The questionnaire had twenty-eight questions, twenty-four semantic differential scale questions were close-ended and a six-point scale (1 - strongly disagree to 6 - strongly agree) was used, two questions were open-ended and in dichotomous form, two questions took the multiple-choice question form.

Results and Discussion

Due to the low returns over the next three weeks after distribution, the request to complete the questionnaire was repeated. A total 17 universities submitted the questionnaire representing a 22 per cent response rate. Universities that submitted the questionnaires were from different types as showed in Table 1.

Type of University	n
Public university	10
Private university	5
State university	2
Total	17

Tab. 1: Universities responding to the questionnaire grouped by university type

Czech universities do not create separate IC reports, but six universities consider its' preparation. Czech universities have no IC job position or IC department responsible for reporting on knowledge resources. The same negative responses were received to the question, which examined whether each departments or faculties must regularly provide data on intangible resources to the relevant department. The only one positive answer was obtained by a state university.

Another question investigated the reasons why the university does not report its IC. Respondents had the option to select multiple reasons of total of six possible reasons; respondents could also specify their own reasons. According to Figure 1, the most common reason why Czech universities do not prepare IC reports is the lack of experience, followed by duration and lack of interest of this type of information from the stakeholders. According to five respondents, there is no reason to create such a report, because it is not mandatory under the University Law, four universities also acknowledged financial intensity and one university the lack of management's interest.

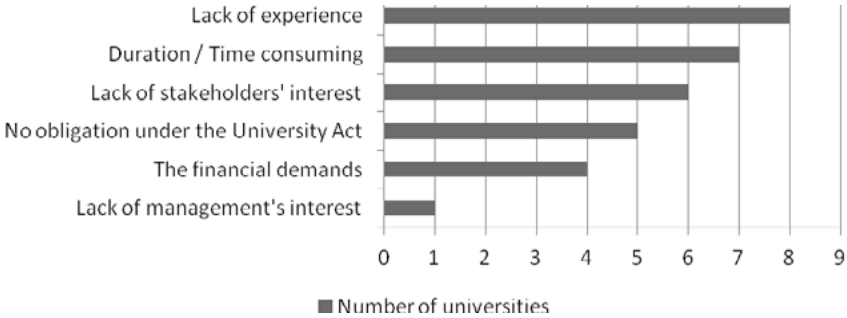

Fig. 1: Reasons why universities do not disclose IC

The Austrian Government decided in 2002 that IC reporting would be mandatory for all universities by 2007. The Universities Act 2002 (Section 13, subsection 6) defines that each university shall submit an IC report which would present the university's activities, social goals and self-imposed objectives and strategies and its intellectual capital, broken down into human, structural and relational capital. The Ministry adopted the idea of IC reporting to enhance transparency, foster the management of intangibles, and set initiatives for performance orientation. Given this fact, the opinion of respondents on the mandatory IC reporting in the Czech Republic was investigated. Czech universities occupy a rather negative to neutral attitude towards the introduction of mandatory IC reporting (mean value 2.88).

According to Czech universities (mean value 5.05), human capital (knowledge, skills, creativity, motivation, loyalty of academics, etc.), organizational capital (databases, IT, organizational structure, routine procedures and processes, etc.) and relational capital (relations with partner schools, student satisfaction and loyalty, reputation etc.) significantly affect the university's performance.

Table 2 below shows the benefits of IC report for external purposes. The table is sorted by the proportion of respondents that agree (the scale from 4 to 6) on external purposes of IC reports. 9 universities agree with the purpose "Showing that knowledge and human resources are the most important resources in the knowledge economy". For the remaining thirteen external purposes, the proportion of universities in agreement is lower than a half of universities. The second highest agreement of 6 universities is on showed five purposes. In the next question the benefits of internal IC reporting were examined.

Table 3 below shows the proportion of those that agree with internal purposes of IC reports. The highest agreement of 7 universities is on "A tool for career planning" and "Supporting supplementary training", followed by 6 universities that agree on "Insuring systematic management and distribution of knowledge" and "Allow universities to discuss strategy and objectives".

Respondents agree to a slightly higher degree on internal purposes compare to external purposes of IC reports. However, the proportion of agreement is lower to that of disagreement.

External purposes of IC reporting	Positive agreement (n)
Showing that knowledge and human resources are the most important	9
Increasing the likelihood of success in applying for grants	6
Attracting new international partners	6
Showing that the university applies newest technology	6
Attracting more students	6
Attracting more employees	6
Positioning in relation to competitors	5
Showing an innovative institution	5
Reduce isolation from the external world and enhance openness of university	5
Attracting and maintaining industry partners	5
Provide the ministry a better overview over the development of higher education	3
Supplementing the data and information in traditional university reports	3
Improve transparency in the use of public funds	2
Provide statistical data and facilitate the ministry formulating policy	2

Tab. 2: External purposes of IC reporting

Internal purposes of IC reporting	Positive agreement (n)
A tool for career planning	7
Supporting supplementary training	7
Insuring systematic management and distribution of knowledge	6
Allow universities to discuss strategy and objectives	6
Allow the learning process of knowledge-production process within the university	5
Increasing the employee loyalty	5
Generating innovation	2
Provision of information necessary for investment decisions with respect to investments in intangible assets	2

Tab. 3: Internal purposes of IC reporting

Conclusion

Czech universities have neither IC department nor prepare any IC reports and they were not aware of mandatory IC reporting for Austrian universities. IC management and reporting practices at Czech universities are still at its embryonic stage. The awareness of IC concept seems to be quite low. Czech universities do not see yet the advantages of IC reports. Czech universities do not prepare IC reports, but some universities consider their preparation. The low awareness of the importance of IC concept is also evidenced by identified reasons, why they do not create such reports. Given the fact that no university creates an IC report, there is logically any reporting department responsible for creating it. However, all respondents expressed relatively strong level of agreement on the importance of IC as a resource affecting university's performance in the knowledge-based economy.

Regarding the benefits of external and internal purposes, the proportion of agreement is lower to that disagreement, but Czech universities do not see any potential benefits of such reports. Czech universities should participate in the transformation process that higher education is undergoing. It can be recommended to become more familiar with the new initiatives, guidelines, and experiences in IC disclosure from others and gradually discover an appropriate way to manage their IC – to identify intangibles, measure and report them both for internal and external unquestionable benefits. Czech universities do not realize yet the benefits of disclosing IC statements. Preparation of IC reports can fulfil two aims; it serves as an important management tool for the university as well as a communication instrument between universities and stakeholders. It can improve the development of a university with regard to intangibles; it can also raise its image and therefore attract new employees, more students as well as more research contracts and so demanded cooperation with industry.

Another research was conducted after this expertise. This research aimed to verify the applicability of an integrated theoretical framework of voluntary IC disclosure in the context of Czech public higher education sector. Partial goals were to verify the theories and the premises of chosen theoretical framework and to identify the current trends, as well as to determine the importance of IC in terms of satisfying the information needs of selected stakeholders and finally to determine the extent and quality of reporting IC and to investigate the impact of the identified factors. No previous research has been conducted

for Czech universities in this area. This brings new expertise and more research is still needed.

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SOCIAL RESPONSIBILITY OF HIGHER EDUCATIONAL INSTITUTIONS – THE STUDENTS´ VIEW

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Abstract

The paper discusses the concept of social responsibility of higher educational institutions (HEI). The concept of corporate social responsibility was initially created for the commercial sector. With changes occurring in the external environment, this concept is now also being introduced in other areas, e.g. in HEI. The paper describes the qualitative part of research on the application of the concept of social responsibility within public HEI in the Czech Republic. By applying the "focus groups" method, the opinions and expectations of an important stakeholder group, i.e. today`s students, were collected and analysed, with reference to the concept of social responsibility of HEI.

Keywords

Corporate social responsibility, higher education, stakeholders, focus groupss

Introduction

Corporate social responsibility (CSR) has become an important part of firms' operations over the past decade. Social Responsibility has become an increasingly important concept both within the European Union and globally, and it has become part of the debate about competitiveness and sustainability in the globalization context (Vasilescu et al., 2010). Many organizations have increased their investment in CSR either voluntarily as part of their strategy and vision or as a result of pressure from activist shareholders. Many organizations also publish annual CSR reports that provide detailed information about their CSR activities and achievements or devote large sections of their annual reports to a description of their CSR activities (Deng, Kang and Lowet, 2013). In the European Union, the promotion of Corporate Social Responsibility (CSR) also reflects the need to defend common values and increase the sense of solidarity and cohesion. Enterprises of all sizes, in cooperation with their stakeholders, can help by means of CSR to reconcile economic, social and environmental ambitions (Vasilescu et al., 2010)

Current definitions

´CSR is a continuous and long-term process guided by organisational and personal values. It is concerned with people (as stakeholders), the environment and organisational policies, and is influenced by political concerns. Adoption of CSR is often associated with monetary gain or profit for the initiator´ (Isa, 2012: 335). ´Baron (2007) supported that corporate social responsibility has become an important part in the business strategy of a growing number of companies worldwide, since the performance of a business organization is affected by their strategies in the market, as well as non-market environments´ (In Mustafa, Othman and Perumal, 2012: 898).

Stakeholders in Corporate Social Responsibility

Stakeholders play a key role in corporate social responsibility (Bearle and Means, 2002; Costa and Menichini, 2013; Murray and Vogel, 1997). According to Freeman`s theory a stakeholder is anyone susceptible to be impacted by the goals of an enterprise and anyone that could be impacted by their realisation (Freeman 2010). The stakeholder theory is based on the necessity of producing outcomes, which can optimise the advantages for important stakeholders, without favouring only one stakeholder (Jones, 1999). The main point in the concept of corporate social responsibility is to understand the expectations of those, who can influence an organisation, and are influenced by an organisation (Steinerova, Václavíková and Mervart, 2008). Trnková (2004), states that the application of CSR principles is a process of building trust in target groups functioning within the organisation. An organisation becomes trusted, when it systematically tries to cooperate with stakeholders. Falck and Helbich (2007) assume that CSR can be applied in a strategic way for satisfying the requirements of each stakeholder. The management of an enterprise can use CSR as a normative instrument for making plans that will satisfy the shareholders, as well as stakeholders.

Costa and Menichini (2013) mention the negative impact that a lack of social responsibility of any given organisation has on stakeholders. Organisations that present themselves as socially responsible, yet are found not to be responsible by some stakeholders, can be severely damaged. Melé (2008) even claims that if the social responsibility of a company is understood in a broader sense, then the stakeholder theory can be considered as a theory of social responsibility, because it proposes a normative framework with reference to accountability.

Social responsibility of higher educational institutions

The economic, political and social changes that took place over the past decades have had an impact also on the European higher education institutions, which have undergone an ample reform process meant to meet the new challenges they are facing. Globalisation, the knowledge society, innovation, the development of technologies, a growing emphasis on the market forces are among the key-factors which influence the universities' mission, organisation and profile, the mode of operation and delivery of higher education (Vasilescu et al., 2010). HEI increasingly need more professional management structures, similar to corporate type organisations. A highly competitive market requires that HEI develop competences and skills that were previously not required. Specifically, this refers to resources management and management of the relations to students, or in matters of university branding (Michael 2004). The mission of an HEI has been expanded beyond the framework of teaching and research. Today it includes service to the community in which the HEI is situated, partnership with surrounding communities and other stakeholders (Jongbloed, Enders and Salerno, 2008). Research shows that currently one the most important stakeholders are students, who are actually studying at a given HEI (Alves, Mainardes and Raposo, 2010; Chapleo, Simms, 2010; Kantanen, 2007).

In this paper we will try to find out more about student`s attitudes concerning the concept of social responsibility of public HEI in the Czech Republic.

Materials and Methods

The attitudes and expectations of students will be determined by the focus group method, recommended for this purpose by Mainardes, Alves and Raposo (2010). The focus group method is a useful and effective tool for determining collective opinions, values and faiths

(Jayasekara 2012). Huston and Hobson (2008) describes the focus group method as a structured and planned group discussion designed in such a way as to gain a rational idea about a defined area of interest. The discussion should take place in pleasant and convivial surrounding.

Krueger and Casey (2000: 6-7), who have described the method in detail, mention its main aspects as follows:

- There should be 4 to 12 members in a focus group
- The main characteristic of the focus group is its homogeneity, with reference to the goal of the given study. It is the basic prerequisite for the functioning of a focus group. It ensures that the participants have the same mind-set from the very start of the discussion.
- Collecting qualitative data – the goal of the focus group is to collect data, with reference to the requirements of the researcher. By comparing the outcomes one can come to the desired conclusions, e.g. reaching a consensus, getting recommendation, or a choice of relevant decisions.

The discussion is prepared and led by the researcher. All the questions are formulated purposefully in logical sequences. The design of the questions is crucial for the research outcomes. Questions are classified from general to specific. The most relevant questions appear at the end of the research.

Veisová (2009) classifies typical questions raised during focus group discussions as follows:

- Opening questions that lead to the identification of common characteristics of participants.
- Introductory questions focused on the research theme, i.e. questions that define the issue that will be at the centre of discussions. Transitional questions that lead the conversation to the key issues.
- Key questions, crucial for the entire study.
- Final questions which close the discussion.

The structure of the focus group discussions outcomes refers to the type of questions (Veisová, 2009).

Specific types of questions are mentioned in Tab 1.

Typical Questions	Specific types of questions
Opening questions	Identification of respondent (name of HEI, year of studies)
Introductory questions	Awareness of the concept of social responsibility of HEI
	Awareness of socially responsible activities of the HEI
Key questions	Ways of acquiring information
	Attitude to issues related to social responsibility of the HEI
	Requirements and expectations with reference to the HEI
Final questions	Conclusion and amendments

Tab. 1: Structure of scenarios implemented during group discussions with focus group "Current Students")

The main advantages of this method can be summarised as follows: the focus group is a quite inexpensive (Veisová, 2009) and fast method for collecting qualitative data (Huston

and Hobson, 2008). A properly set up group can stimulate thought exchange amongst participants, ensuring that nothing will be omitted (Klein, Tellefsen and Herskovitz, 2007). Group interaction helps participants in developing and focusing their thoughts (Freeman, 2000).

Results

For identifying the attitudes and requirements of current HEI students the above mentioned focus group method was used. The group discussions with HEI students had 8 participants – 5 females and 3 males. The division of students according to their HEI is indicated in Tab 2.

Name of HEI	Number of respondents
Czech University of Life Sciences Prague	2
Jan Evangelista Purkyně University in Ústí nad Labem	2
University of Economics, Prague	2
Technical University of Liberec	1
Masaryk University	1

Tab. 2: Respondents according to HEI

Tab 3. indicates students according to the year of studies at HEI.

Year of study	Number of respondents
1.	1
2.	2
3.	2
4.	2
5.	1

Tab. 3: Respondents according to the year of studies at HEI

Awareness of the issue of social responsibility

The initial question in the group discussion focused on identifying awareness of the issue of social responsibility, in general as well as with reference to HEI. The majority of respondents were unaware of the concept. Some respondents admitted that, *´the term is familiar to me, yet I do not know what it really means´*. When requested to define to some extent what the term meant, they usually assumed that *´it had something to do with charity´*.

The concept of social responsibility had thus to be explained. The EU definition as published in the Green Paper - Promoting a European framework for corporate social responsibility (2001: 6) was cited: ´Corporate social responsibility is essentially a concept whereby companies integrate social and environmental concerns in their business operations and in their interaction with their stakeholders on a voluntary basis´. Social responsibility was also discussed in a broader context.

Another part of the discussion addressed the possibility of applying the concept of social responsibility in the conditions of Czech HEI. All respondents agreed that the concept can be applied in HEI and that HEI in Czech Republic should act as socially responsible organizations.

Once the concept has been clarified, students could easily discern socially responsible activities in their HEI. Most often they thought of sports and cultural activities offered to employees and students (e.g. *´ball dances´*, *´concerts´*, *´festivals´*, *´sporting tournaments´*),

sporting events for the public (e.g. *´we offer the sporting grounds of the Department of Physical Education for use by the public´*) as well as ecologically minded activities (e.g. *´we separate waste´*).

Information channels

Ways in which students get information about socially responsible activities at their HEI, have also been investigated. The most often cited information channel were posters in the campus. Students also mentioned that the teachers have informed them during their classes.

Students thought that they have enough information about the abovementioned activities of social responsibility (*´I think that information are available when someone is looking for them and he can find it´*) and they don´t need to obtain information in another way.

Involvement of students in socially responsible activities at HEI

Controversies arose around this issue. One section of students was willing to take part in socially responsible activities of the HEI in their free time, provided it *´had a meaning´* and provided they found the project *´beneficial´*. Another section refused to take part, with explanations ranging from *´I have enough of my own work´*, or *´I prefer to work and make money´*. If a socially beneficial project would be implemented as a part of their curricula, all respondents replied that they would take part.

Requirements of students

Key issue addressed during group discussion. Students would require more facilities, such as reading rooms, access to internet, a user friendly IT system, etc. They would also want more cooperation between HEI and the industry, more specialists involved in teaching, the possibility to have internships at companies, possibility to write one`s thesis while doing an internship, etc. Students would of course require adequate housing and meals to be provided. 36 student requirements have been generated from our survey.

Discussion

Interaction between HEI and their stakeholders is a relatively new concept within academia, however it has been increasingly acknowledged by HEI Boards as well as by academics specialised in the area of HEI management (Alves, Mainardes and Raposo, 2010).

Despite the growing interest in the issue of universities stakeholder the current research are focus only on the first step in analysing universities stakeholders - to the identification of relevant interest groups. Brown (1999) in his article identify the most important stakeholders: students, government, employers - teaching staff. And he highlights the relationships between an HEI and these stakeholders as a ´survival route for this type of institutions´.

The research are focused on the next step in the analysis of stakeholders (identifying the requirements of important stakeholders for HEI) are missing despite the fact that research show that the satisfaction of students need is the crucial for HEI. The necessity of such analysis confirms Wiliams (2002) in his article. He sets that the students' feedback is necessary for HEI. His study findings confirmed the importance of measuring student satisfaction as a relevant HEI management tool.

The concept of social responsibility is widespread in the commercial sector. However the researches in this area are primary focused on the customers' perception of concept CSR in companies (Trapero, Lozada and García, 2010). Other studies are focused on the

question: how influence have the stakeholders to CSR activities in corporations (Park, Chidlow and Choi, 2014). But the identification of stakeholders' requirements are missing in these studies. This article presents an extended view of social responsibility associated primarily with the requirements of HEI´s stakeholders.

Conclusion

The article summarises the attitudes and expectations of an important stakeholder group in a HEI with reference to social responsibility of HEI in the Czech Republic. The group discussions indicates that today`s students do not have enough theoretical knowledge of the concept of corporate social responsibility. Their understanding of the concept is limited, and takes only sports and social events into consideration. A section of understands the concept to be related to ecological activities of their HEI. As to personal involvement of students in socially responsible activities, the study has shown some incongruity. Some students would be willing to get involved during their free time in socially responsible activities, provided such activity would be considered as meaningful by them.

Students considered current dissemination of information about the social responsibility of HEI as satisfactory in case of active involvement. Passive involvement comes through posters and flyers, or through information shared by the teacher during a course.

At the end of the focus group sessions the requirement of students with reference to social responsibility of the HEI, were analysed. On the basis of respondent`s answers a list of relevant requirements of students on the HEI was drawn. This list will be used in subsequent quantitative research. The requirements will be tested using the 5 point Lickert` Chart. In a survey, using factor analysis, various factors will be identified and evaluated with reference to benefits generated for each stakeholder.

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INTERCULTURALEDUCATIONANDITSCONNECTIONTOAVAILABILITY OF INFORMATION SOURCES

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Abstract

The article deals with the availability of information sources about China, the Chinese culture and psychology of work, and its influence on the use of the given information by students of the Chinese language. It is based on a survey focused on the increase of the knowledge of China in the conditions of the Czech Republic. The aim of the survey was to use the tested hypotheses to verify whether the availability of information sources adds to higher efficiency in intercultural education. 73 filled-in questionnaires have been procured from the Czech Republic and from Spain. These countries were chosen because of their different possibilities of access to information sources and cultural events given the different number of migrants from China. The differences among students in terms of the endeavour to travel to China and the level of reliance on the information acquired from their lecturers were statistically important.

Keywords

Communication, cooperation, education, LMS, potential, social software applications

Introduction

Intercultural communication has been constantly growing in importance over the past decades. People are in routine contact with persons from different cultures and their opinions, attitudes and approaches mingle, which results in the necessity to look for ways to cope with these intercultural differences, both at work and outside it.

Intercultural communication can be understood as a process in which verbal and non-verbal communication takes place in various situations. Naturally, it also concerns scientific theory and research devoted to these real processes of communication between cultures. Thirdly, intercultural communication can be understood also as various activities of educational and supportive type, such as workshops and trainings, which offer participants advice, recommendations and models on how to cope with various social situations in which the differences between the cultures of individual partakers in the given situation play an important part.

Review of Literature

Intercultural aspects of communication have been only mentioned marginally in Czech psychology of communication so far. In this respect, Czech science is far behind the world research. L. Kolman introduced intercultural communication as a research topic in his textbook “Communication between Cultures” (Průcha, 2010:18,26). The research in the world started already after WWII in America. The term “intercultural communication” was used for the first time in 1954 in the book “Culture as Communication” (Hall, Trager in Průcha, 2010:19). The basis of communication between cultures lies in the cultures themselves. Multiple classifications of cultures according to various aspects, often similar,

but not the same, have been carried out in the past. One of those who introduced a new division was Geert Hofstede with his typology of national cultures (Hofstede, 2007). Based on very extensive research, Hofstede (2007) wrote down a typology of five dimensions of national cultures. M. Godelier reminds that culture is thus a way of understanding life, but at the same time also a way of living, while economy is only a part of a dimension of culture (Godelier in Hurtado Sánchez, 1999). One of the side effects of encounters between different cultures is so-called culture shock, which is characteristic for persons who have been living abroad for a longer time. According to Šroněk (2000), culture shock is accompanied by homesickness, boredom, retreating within oneself, contacts only with citizens of one's country, family tension and conflicts, among other things. Průcha (2010) says that as soon as two different cultures get into permanent or long-term contact, culture shock is followed by acculturation by means of communication. By acculturation, we mean a social process in which elements of one culture are being taken over by members of another culture. Typical example is the integration of immigrants, in this case of the Chinese, in the host country, Spain, whereas this integration has not been taking place on such a scale in the Czech Republic yet.

Arasaratnam and Banerjee (2011) have been dealing with intercultural communication competences (ICC). They came to the conclusion that higher intercultural communication competences of immigrants, depending also on their country of origin, anticipate their easier integration and lower number of criminal offences on the host territory. The development of intercultural competences represents a rather complex process. The person goes through the feelings of disgust and fear, while the stereotypes are being concurrently emphasised and questioned, and feelings and emotions monitored. In spite of the confusion, it is necessary to work and cope with the complexity (Holmes, O'Neill 2012).

The notion of cultural metacognition forms the basis of the research of Chua et al. (2012). Based on three studies, the authors recommend managers to develop their abilities further, because it has been proven that managers with higher cultural intelligence (CQ) are more creative and use their potential during cooperation with managers from other cultures in a better way. Regarding the research carried out by means of content analysis, the work of Hu and Fan (2011) is interesting. The outcomes of content analysis comparing Chinese and American professional journals focusing on the issues of intercultural communication show that the research of intercultural communication in China differs very much from the research abroad with respect to the contents and methods of research. While multicultural adaptation and intercultural training are the main contents of the work of research workers abroad (or, more precisely, in the United States), researchers in China focus above all on intercultural pragmatics, most studies in China do not contain empirical research, but analysis of secondary data. One of the few empirical studies dealt with the process of integration, seen above all through the viewpoint of language socialisation, of Chinese MBA students during their five-month study visit at a business science course in south-eastern United States. It described the successes in "trading" which Chinese students had gradually achieved through the improvement of their knowledge about the habits in the expression of the other party (Shi 2010). Regarding the Czech Republic and Spain, it has been confirmed that despite the significant cultural differences, the graduates in both countries are willing to study languages as well as migrate for work (Luhanova, Michalek et al. 2012). The outcomes show that more Spaniards would like to move within the framework of the EU, even though in Europe they are exposed to the language barrier, which they fear, whereas in South America, for example, they would more likely find

employment from the viewpoint of language. Hofstede (1986) published the outcomes of his research referring to four dimensions of culture: Individualism versus collectivism, Power distance (high versus low), Uncertainty avoidance (strong versus weak) and Masculinity versus femininity. The fifth dimension, Short-term versus long-term orientation, was added later (Hofstede, Hofstede, 2007). All three countries concerned by this article, namely the Czech Republic, Spain and China, show big differences in these dimensions and it can therefore be expected that the access to information and dealing with it will differ. This article is based on research concerning the availability of information sources about China in the Czech Republic (CR) and in Spain, and their efficiency. The level of the motivation of students for independent utilisation of these sources has been investigated. Dietrich, Kujala et al. (2013) recommend further studying of the consequences of individual and cultural differences in teamwork in their article. The study of languages is one of the preconditions of the increase of intercultural competences (Shi 2010). Not only students and graduates have been more willing to study languages, including Chinese, recently (Luhanova, Michalek et al. 2012).

Materials and Methods

The research had the form of a questionnaire survey with outcomes processed for the purpose of verification of set hypotheses among the students of Chinese, from whom the highest motivation for the acquisition of information and intercultural education is expected. The author also aimed at determining whether the length of study is related to the language level achieved and whether the Spaniards need Chinese language in the work rather than the Czech workers. The survey was a quantitative one, using the deductive method based on testing the hypotheses about groups. Sample groups were available, with the extent shown below. Students of the Chinese language both in the CR and in Spain have been polled. The translation of the questionnaires into Spanish with the help of native speakers achieved the aim of the highest possible identity of the stimuli (in this case, questions) for both sample groups, thus ensuring that one of the conditions necessary for testing was satisfied (Disman, 2007).

The survey was preceded by the research of literary sources in Czech libraries discussing Chinese psychology of work and management carried out by the author. It has been discovered that access to specific, thus oriented literature is rather limited at present. For the purposes of the research, we can assume that even the students of Chinese are not aware of where to find useful sources or whom to ask about them. Most of the current research in the CR is focused on the Vietnamese, as there were 57,360 of persons of this nationality on the CR territory as of 31 December 2012, compared to mere 5,607 Chinese (CSU, 2014). According to the census (encuesta de la población), 54,000 immigrants from China lived on the territory of Spain in 2007. This is a rather high figure, higher at as much as by 20,000 than the number of immigrants from South America, who do not encounter the language barrier. The most represented age group includes young people aged 20–29 (approximately 19,000) who are coming above all to seek work (INE, 2013). There are 62,000 Chinese workers in total who are employed in Spain, 31% of them working as self-employed persons and 69% as employees (INE in Beltrán, Sáiz López, 2009). According to El País (2013), the number of the Chinese at the Spanish territory in 2013 is estimated to be as high as 170,000. According to Beltrán (2010), Spain plays the part of a frontier country, in which business-people come from China, often with ideas already proven, which they spread to other countries later. These often seek the possibilities of trading with China, while Spain gains numerous advantages stemming from being the frontier, a

transition country where workers from Asia arrive, either to stay, or to continue to other European countries later on.

The countries in question therefore have different levels of public awareness. Four null hypotheses have been created based on this fact and verified statistically. Other entries in the questionnaire were used for better interpretation of the results, and some were also processed graphically.

Survey

The polled students in the Czech Republic received the questionnaire in both printed and electronic versions, whereas the respondents in Spain answered electronically. In order to maximise the relevancy of the results, both versions were handed and sent out in the period of February and March 2014.

Two questionnaires, one in Czech and one in Spanish, were used. Each questionnaire contained several types of questions with partially structured answers. Closed-ended, semi-closed-ended and open-ended questions were all used, including filtering questions. Some questions were created directly for two different tests of statistical hypotheses, while the answers to the remaining ones only served for better interpretation of the results obtained by summing up individual answers and their subsequent analysis. For illustration, the answers to selected questions have been depicted graphically (Disman, 2007).

	Questionnaires	
	Czech Republic	Spain
Number of the questionnaires	48	25
Men	17=35.4%	10=40%
Women	31=64.6%	15=60%

Tab. 1: Distribution of the questionnaires

A total of 73 filled-in questionnaires were obtained from respondents within the framework of the research. Out of this overall number, 48 questionnaires, or 66%, were from the Czech Republic. The respondents in the CR were the students of language schools, such as Chinesepoint, Confucius Academy in Olomouc, Březinka, Institute for Language Education. The answers obtained from respondents from Spain came from courses organised by Casa china in Seville and by Instituto de idiomas at Universidad de Sevilla.

		Age	Length of study	Language level	Trip to China	Information – teacher
N	Valid	73	73	73	73	73
	Missing	0	0	0	0	0
Mean		2.8904	1.5890	1.8767	2.6986	.1233
Median		3.0000	1.0000	2.0000	3.0000	.0000
Std. Deviation		1.07447	.68385	.81556	.95285	.33104

Tab. 2: Statistics of selected variables

Table 2 summarizes results obtained by answers to questions where the answers were obtained by means of Likert scales. In the column Age the average 2,89 means that the average age of the respondents was between 26 and 33. In the second column the average

Length of study was from 3 years to 6 years. In the last column subjects checked 0 when for them the only information source was the teacher, and they checked 1 otherwise. In this case the average of 0,12 means that for only 12% of the respondents the teacher was not the only information source. In case of the Trip to China the average of 2,7 means that the most replies were – I have never been to China, but I would like to.
Four hypotheses were defined:
H_{01}: There is no difference between the level of travels to China by Chinese language students in the Czech Republic and in Spain.
H_{02}: When obtaining information about China, Chinese habits and culture, students in both countries rely on their lecturer in the same manner.
H_{03}: There is no difference in terms of the attendance of cultural events with Chinese themes between students in the Czech Republic and in Spain.
H_{04}: The level of satisfaction with the accessibility of information sources on China is the same for the students in both countries.
These hypotheses were verified using a test for equality of two relative frequencies, and one with a two-tailed test comparing the means of two samples with the same variance, or two-sample t-test. One selected question and the answers to it were processed graphically, with other results being described verbally.

Results and Discussion

The evaluation of the data indicated that students who have been learning the language for less than two years slightly prevail among Czech respondents (67%), whereas they have been occupying themselves with the studies for 2.5 to 4 years in Spain (72%). This distribution of respondents is in accordance with the fact that beginner courses are predominantly opened in the Czech Republic. Chinese is considered a demanding language and not everyone occupies themselves with it for a long period. This is also proven by the results, according to which even after four years of studies, 44% (Spain) and 58% (Czech Republic) of students state that they have achieved the language level A2 (Pre-Intermediate) according to the Common European Framework of Reference for Languages.

Correlations

		Length of study	Language level	Country
Length of study	Pearson Correlation	1	.755**	-.309**
	Sig. (2-tailed)		.000	.008
	N	73	73	73
Language level achieved	Pearson Correlation	.755**	1	-.324**
	Sig. (2-tailed)	.000		.005
	N	73	73	73
Country of origin	Pearson Correlation	-.309**	-.324**	1
	Sig. (2-tailed)	.008	.005	
	N	73	73	73

** Correlation is significant at the 0.01 level (2-tailed).

Tab. 3: Correlation between the length of study, language level achieved and the country of origin

A statistically significant difference between the length of study and the level achieved was proved. The Spanish students study for a longer time, teaching of the Chinese language has longer tradition, and they reach higher level of language. The country of origin slightly reduces the correlation and it would be interesting for further research to determine the reasons for this reduction. The first tested hypothesis, H_{01}, corresponded to the questions whether the students had ever been to China. Two-sample test, or test for equality of two relative frequencies, was applied to it. The null hypothesis was rejected, which means that statistically important differences in the willingness to travel to China exist.

	Yes, more than 14 days	Yes, 14 days at maximum	No, but I am planning to go	No, I am not thinking about going
Czech Republic	25	16.6	48	10.4
Spain	0	12	56	32

Tab. 4: Question "Have you ever been to China?" (in %)

It is apparent from the summary results that the highest percentage of respondents plan to go to China, but many more people in the Czech Republic have had this experience.

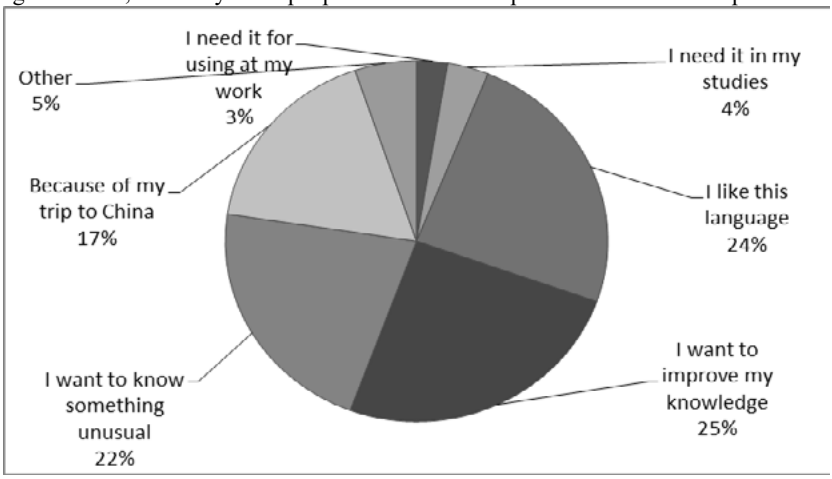

Fig. 1: Reasons for studying Chinese – Czech students

However, only 17% respondents from the Czech Republic and mere 7% from Spain study the language because of travelling to China. Reasons of purely subjective character (I like Chinese language) as well as reasons related to an improvement of one's position on the labour market (I want to improve my education; I want to know something unusual) reached the top positions in both states. This is in accordance with the results of the work of Luhanova, Michalek et al. (2012), i.e. that young Czechs and Spaniards alike are ever more willing to study foreign languages in the current economic situation.

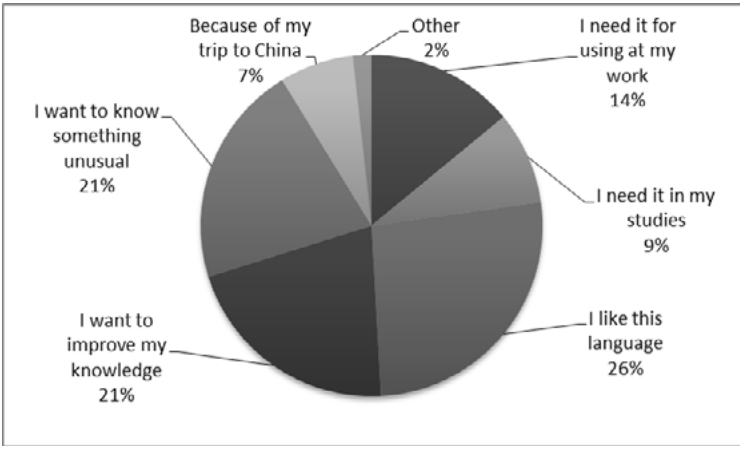

Fig. 2: Reasons for studying Chinese – Spanish students

ANOVA

		Sum of squares	df	Mean square	F	Sig.
Reasons – I need it in my work	Among groups	1.090	1	1.090	9.377	.003
	Within groups	8.253	71	.116		
	Total	9.342	72			

Tab. 5: F-test – question about the need for using the Chinese at work

The F-test has shown a statistically significant difference in the reasons for learning Chinese. Respondents from Spain increasingly state the need to use Chinese in their work. The H_{04} null hypothesis related to the level of satisfaction with the accessibility of information sources about China has been confirmed. There are no statistically important differences, even though students from Spain stated dissatisfaction more often. The H_{03} hypothesis concerning non-existence of differences in the attendance of cultural events has also been confirmed. Although most students did not attend cultural events focused on China, those who did described a great number of events. Among these, lectures, celebrations of the Chinese New Year, concerts of the Chinese Classical Orchestra, the Chinese National Circus, the Beijing opera, Sinokino, the Ball of the Department of Asian Studies, and, in Spain, conferences, calligraphy courses, celebrations of the Chinese New Year can be listed as examples. Despite diverse events with Chinese themes, a statistically important difference has been discovered in the reliance solely on the lecturer in the study of the language (H_{02}). More students, with statistical importance, are content with information about China from their teachers in Spain. This is true even though they have better initial conditions (more organisations focused on Asian cultures, higher number of Chinese arriving to the country). Czech as well as Spanish students who actively search for information use the Internet the most, namely the official website and advice of travellers; they also buy books. They rely for example on literature available in the language school or academy in the smallest extent.

Conclusion

Despite the problems of returnability of the questionnaires, the research has proven that sources of information play an important part in intercultural education. Therefore, it can be seen as a preliminary research for expressing the hypotheses for further research, in which it will be necessary to eliminate these problems. A questionnaire survey that took place in two countries with a different number of migrants from China (the Czech Republic and Spain) – and thus also with different possibilities of access to information – has shown that statistically important differences exist among the students of Chinese in these two countries. A large number of them plan to go to China, where they also hope to acquire more information and a different perspective to view it from. However, only Czech students have actually travelled there in a greater extent. Further statistically important differences exist concerning the question of whether they rely only on the information from their lecturer in their study. In this respect, Spaniards rely more on their teachers. Those students who actively seek information use the Internet the most. The dissatisfaction with the accessibility of information is higher among Spaniards. It would be interesting to find the reasons for this dissatisfaction in further work, especially as, in spite of it, they rely only on the lecturer or on the Internet sources, i.e. the same ones that Czech students have at their disposal. Intercultural competences are emphasised ever more in connection with the increasing amount of work in multicultural teams, and the study of language is one of the preconditions of their development.

Acknowledgement

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IS IT POSSIBLE TO TEACH ECONOMETRICS EFFECTIVELY?

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Abstract

Ragnar Frisch, one of the founders of the Econometric Society, defined econometrics by these words: "Experience has shown that each of these three view-points, that of statistics, economic theory, and mathematics, is a necessary, but not by itself a sufficient, condition for a real understanding of the quantitative relations in modern economic life. It is the unification of all three that is powerful. And it is this unification that constitutes econometrics." He wrote these words in 1933. We would expect the econometrics during many years to become speech of every economist and it will be learned and sought by every student of economy. Now, more than 80 years after, it isn't quite true and the question is whether it is a mistake to teachers of econometrics or problem is deeper. We summarize classical teaching of econometrics and try to suggest how we should improve the efficiency of this teaching and we look at the possibility of updating of undergraduate courses of classical econometrics as well.

Keywords

Undergraduate econometric courses and textbooks, classical linear regression model, economic applications, simulations, instruments, weak exogeneity, stationarity, co-integration

Introduction

If we study and analyze actual courses of undergraduate econometrics at various universities offering economic education, we would find a wide consensus on the content offered. They are based on the logic of undergraduate econometric textbooks, which uses a well-established sequence of teaching econometrics. Courses typically begin with a probabilistic concept of regression analysis followed by a presentation of the classical linear regression model in typical annotation $y_i = \beta_0 + \beta_1 x_{1i} + ... + \beta_k x_{ki} + u_i$ with well-known assumptions:

1. Mean value of additive stochastic term is equal to zero, $E(u_i) = 0$;
2. No heteroskedasticity of stochastic term, $\text{var}(u_i) = \sigma^2$;
3. No serial correlation of stochastic term, $\text{cov}(u_i u_j) = 0$, $i \neq j$;
4. No perfect multicollinearity among explanatory variables, $h(\mathbf{X}) = k + 1 \leq n$;
5. Explanatory variables X are non-stochastic, $\text{cov}(u_i x_j) = 0$;
6. Stochastic term is distributed normally, $u_i \sim N(0,\sigma^2)$.

After the introduction of two-variable and multiple variable regression models the following chapters investigate the consequences of the failure of one of the above assumptions. Heteroskedasticity, autocorrelation and multicollinearity are tested for and dealt with.

At this point, several courses are completed. Other courses add an analysis of simultaneous equations model in the context of failure of the fifth assumption or at least

are concerned with instruments and instrumental methods as well. The course content is usually completed by prognostic or another application of estimated model. The typical developed example of this approach is online course of Slovak University of Agriculture in Nitra (Majorová, 2008).
This and more or less similar progression of topics can be found in most textbooks used. The list of textbooks (see Tab. 1), which was presented by Becker and Greene (2001), although currently represented by newer editions, confirms this.

Amemiya, T., *Introduction to Statistics and Econometrics*, Oxford University Press, 1994.
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Johnston, J. and DiNardo, *Econometric Methods*, McGraw-Hill, 1997.
Kennedy, P., *Guide to Econometrics*, MIT Press, 1998.
Kmenta, J., *Elements of Econometrics*, University of Michigan Press, 1998.
Lawler, K. et al., *Econometrics: A Practical Approach*, Routledge Press, 2001.
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Peracchi, F., *Econometrics*, John Wiley and Sons, 2001.
Pindyck, R. and Rubinfeld, *Econometric Models and Economic Forecasts*, McGraw-Hill, 1998.
Poirier, D., *Intermediate Statistics and Econometrics*, MIT Press, 1995.
Ramanathan, R., *Introductory Econometrics with Applications*, Harcourt, 1998.
Studenmund, A., *Using Econometrics: A Practical Guide*, Addison-Wesley, 2001.
Wooldridge, J., *Introductory Econometrics: A Modern Approach*, Southwestern, 2000.

Tab. 1: Undergraduate econometrics textbooks (Becker and Greene, 2001)

While econometric textbooks and courses fit, nevertheless students used to ask questions as: "What is the purpose of dealing with all these mathematical and statistical tools? How does it all help us to understand economics? Why is it all so tedious and abstract?" Becker and Greene (2001) mentioned that the focus in the textbooks and teaching materials is on presenting and explaining theory and technical details with secondary attention given to applications, which are often manufactured to fit the procedure at hand. They also admit that several of the econometric texts listed are oriented to theory, yet contain many applications.
In this paper, we will try to suggest how to teach econometrics to improve the course efficiency. It isn't only the problem of the preferable software as in the case of operational

research education suggested by Zouharova and Zouhar (2012). We will also focus on the possibility to update the undergraduate econometric courses with the new methods that are even more relevant in the terms of current science. Gagliardini (2007) puts forward the same issues as we do, but at the postgraduate level of teaching econometrics.

Material and Methods

Wooldridge (2002) in his book stated that "the greatest challenge in teaching econometrics to undergraduates is simply to get them interested in the subject. When students get to econometrics, they find themselves immersed in statistical and mathematical concepts like probability density function or minimizing sums of squared errors. So, many of them are inclined to think, that if they had wanted to study this sort of thing, they would have majored in statistics or mathematics, not in economics."

Problem of motivating students in econometrics classes is by Wooldridge the problem of seeing the material as our students see it, and presenting it in a way that will help them approach it and understand its relevance to the subjects of their own interest. Wooldridge also present his solution – two keys to teaching econometrics effectively. The first key is to present students with as many connections between the statistical material and the economic problems it addresses as possible. The mission of teacher is to show students not only how econometrics works, but primarily what it is good for. The second key is to understand how students learn econometrics and to present material to students in a way that best suits their needs. Teaching effectively requires the instructor to use a variety of approaches, depending on what material is being covered and what will work best for the particular students.

Stock and Watson (2011) offer their experience that to make econometrics relevant in an introductory course, interesting applications must motivate the theory and the theory must match the applications. By their opinion this principle represents a departure from classical books, in which theoretical models and assumptions do not match the applications. Stock and Watson believe that it is far better to motivate the need for tools with a concrete application, and then to provide a few simple assumptions that match the application. Because the theory is immediately relevant to the applications, this approach can make econometrics come alive. The topics they cover in their book reflect the best of contemporary applied econometrics. They focus on procedures and tests that are commonly used in practice.

Hendry and Nielsen (2010) emphasize computer-based teaching in automatic modelling software PCGive within OxMetrics, so that students can conduct their own empirical work. Hendry and Nielsen recommend the creation of a large databank of long historical time series and using this series for visualization of every task in modelling. A detailed knowledge of the historical context is imparted as a key aspect of modelling any time series. Starting discussion with historical connections is inviting introductions into analysis, see for example Fig. 1.

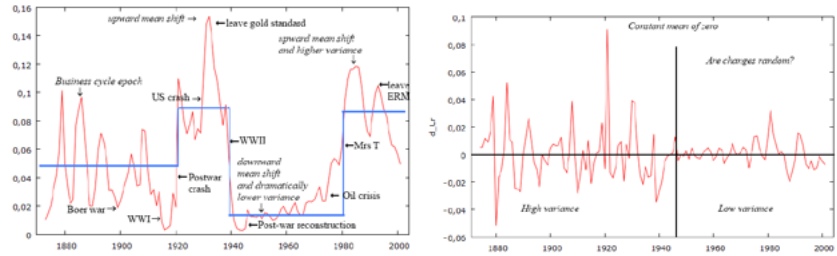

Fig. 1: Graphs of UK unemployment rate and its difference (Hendry and Nielsen, 2010)

A detailed visualization not only show the trend of the series or its differences, but also help identify persistence, changes, relates to other variables or other important characteristics. Visualization of regression by scatter plots, histograms of distributions and correlograms is an important task after detailed inspecting of source data. The importance of visualization is necessary not only for raising of interest in the analysis, but in particular to understand to context and relationships of key variables, see for example Fig. 2.

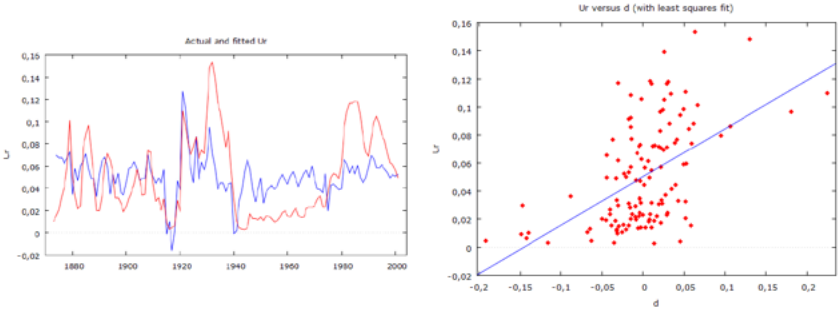

Fig. 2: Graphs of UK unemployment rate and difference between the real cost of capital and the real growth rate in time and as a scatter graph (Hendry and Nielsen, 2010)

Having established the basics of regression, Hendry and Nielsen target their focus to the five key concepts that underpin linear regression: exogeneity of the regressors, identically and independent distributed of error terms, normality, linear functional form and parameter constancy. Then one can explain well-specified models as needing all the properties of the variables in a model to match simultaneously – in terms of dynamics, breaks, distributions, linear relations, etc. – otherwise there will be systematic departures from any claimed properties. Tests of each null hypothesis are then discussed, namely: k^{th}-order serial correlation test, heteroskedasticity test, functional form of RESET test, k^{th}-order autoregressive conditional heteroskedasticity test, parameter constancy of Chow test and normality test. The graphical analyses of residuals visually confirms the formal tests (Fig. 3).

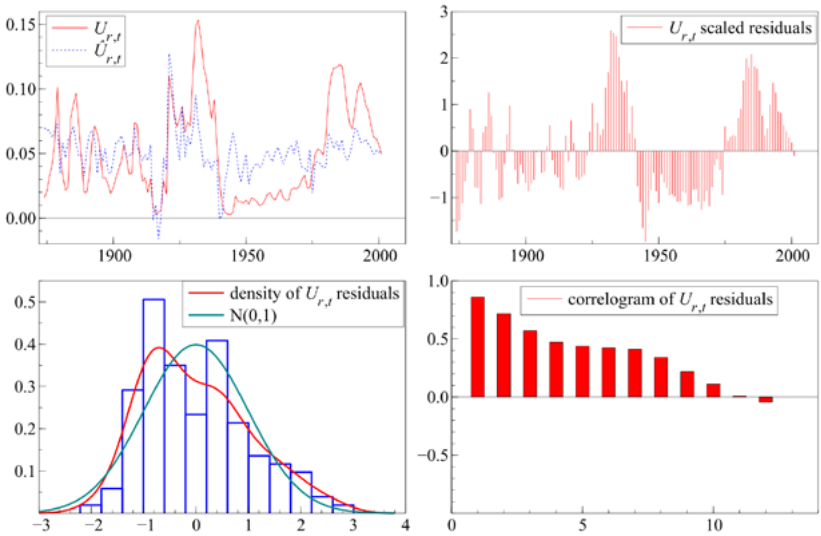

Fig. 3: Graphical analysis of residuals in static model of UK unemployment (Hendry and Nielsen, 2010)

The first specification of model for estimation in courses is common static model. In this type of model we typically find strong rejection on several tests of specification, so something has gone wrong. Hendry and Nielsen emphasize that multiple testing concepts must be clarified: each test is derived under its separate null, but assuming all other aspects are well specified. Consequently, any other misspecification rejections contradict the assumptions behind such derivations: once any test rejects, none of the others is trustworthy as the assumptions underlying their calculation are also invalidated. So, they prefer the general-to-simple approach of analysis. This approach requires an understanding of more general models. In a general dynamic model, one cannot know in advance which variables will matter: some will, but some will not, so selection is required and students should understand model selection. Model selection and tests for reductions of general models are main essence of London School of Economics approach, whose main representative is currently Hendry.

Results and Discussion

What situation is in Czech and Slovak study of econometrics? Some answers about econometrics tuition can be found at Kuncová and co-authors (2007). We tried to complete textbooks used in Czech and Slovak public universities containing similar content as those listed by Becker and Greene for university students attending introduction course of econometrics. An overview of most of these textbooks is in Tab. 2.

Hančlová, J. *Ekonometrické modelování. Klasické přístupy s aplikacemi* (*Econometric Modelling. Classical Approaches with Applications*), Praha: Professional Publishing, 2012.

Hatrák, M. *Ekonometria* (*Econometrics*), Bratislava: IURA Edition, 2007.

Hušek, R. *Ekonometrická analýza* (*Econometric Analysis*), Praha: Oeconomica, 2007.

Hušek, R. *Aplikovaná ekonometrie: teorie a praxe* (*Applied Econometrics: Theory and Practice*), Praha: Oeconomica, 2009.

Ivaničová, Z., Chocholatá, M., Surmanová, K. *Ekonometrické modelovanie* (*Econometric Modelling*),Bratislava: Ekonóm, 2012.

Klímek, P. *Úvod do ekonometrie a hospodářské statistiky* (*Introduction to Econometrics and Economic Statistics*). Zlín: UTB, 2006.

Lukáčiková, A., Lukáčik, M., Szomolányi, K. *Ekonometria 1* (*Econometrics 1*), Bratislava: Ekonóm, 2013.

Marček, D. *Ekonometria* (*Econometrics*), Žilina: EDIS ŽU, 1999.

Obtulovič, P. *Ekonometria* (*Econometrics*), Nitra: SPU, 2010.

Tvrdoň, J. *Ekonometrie* (*Econometrics*), 5. vyd., Praha: Česká zemědělská univerzita v Praze, 2013.

Tab. 2: Econometric textbooks used in Czech and Slovak public universities (authors' own investigation)

Every of mentioned well-known econometrician help to improve the efficiency of teaching according to his experience. Our view to improving the effectiveness of teaching involves many of mentioned practices, but we try to complete them in our manner.

We agree with Hendry, that it is useful to build up a sufficient evidence base for analysis of solely economic problems. Of course, we can't compete in the length of time series with United Kingdom or USA, so when problems requiring large samples to use in addition to our data we use also UK and US data. If you teach students with different focus as in our case this task represents a challenge to collect all available type of economic data. Specialized servers such as Economagic, Yahoo Finance or Bluenomics are greatly helpful with collecting data.

Each taught topic should start with practical problems that help to explain given econometric theme. Creating student's interest requires a very thorough knowledge of the problem. For example presentation of the production functions requires knowledge of genesis from Cobb-Douglas through Solow to Arrow (see Stewart, 2004), so – as Hendry and Nielsen argued – historical connections are very important.

Computer-based teaching is now commonplace. For simple problems we use spreadsheets familiar for students. It is not sensual to teach any new specialized software, if students do not want to be rigorous analysts. It is preferable to conduct courses in open source econometric or statistic software to elude license problems. For specialists (those, who will continue to study advanced econometrics) is logical to conduct courses in specialized software, which will be pursued in further studies.

Computers and software as key tools help us not only with data visualization, but they test and give us an important support for decisions in analysis as well. Common problems with repeated samples in case of time series data or problems with probability distributions and statistical inference can be solved by simulations. Simulations are a good tool to explain the nature of regression technique, the importance of standard deviations as a measure of effectiveness of estimates and they help identify critical values. Barretto and Howland (2005) show different options of simulations in econometrics useful in introductory

courses.
The topics covered in course should reflect the best of contemporary applied econometrics. One should focus on procedures and tests that are commonly used in practice. In addition, the themes that represent the classical approach should be extended by more challenging topics as stationarity, unit root testing and co-integration useful for forecasting and estimation of dynamic causal effects and study of long-run theories or instrumental variable regression with tests of over-identifying restrictions and diagnostics for weak instruments with introduction to general method of moments. This modern treatment should be presented as simple as possible keeping the mathematics at a level that requires only algebra.
Empirical applications have obviously not such characteristics as theoretical examples: the data sets are large, regressors are not fixed, the data are not normally distributed and the stochastic errors are not spherical (without heteroskedasticity and autocorrelations). The most difficult task for teacher is preparing students to real situations, where any assumption is not true. Good teacher shouldn't forget to show what to do in case of missing values, leverage points and influential observations in data and in other specific situations typical for real data.
We can see that improving the efficiency of teaching econometrics requires in addition, perfect theoretical knowledge experiences with practical applications from the teacher, despite the constantly improving the quality of textbooks with many real examples, the software offering the latest features and increasing availability of relevant data. Moreover teacher has the best chance to increase interest of demanding auditorium of students by presenting teacher‘s own research.

Conclusion

The econometrics has undergone extensive development for many years and has become a challenging scientific discipline useful for every economist, requiring knowledge of many disciplines. The role of econometric teachers is almost Sisyphean, i.e. to stimulate interest in methods of probability theory, statistics and applied mathematics. Although econometric tools and methods are best motivated by empirical applications, students need to learn basic econometric theory to understand the advantages and limitations of those tools. It should be just a major task for introductory courses – presentation of current econometric methods using real applications without congestion challenging mathematical and theoretical justification for their use. Facing this challenge would gradually shifted econometrics to where it really belongs, towards the center of economic sciences.

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EFFICIENT IMPLEMENTATION OF ESP IN A PRE-INTERMEDIATE LEVEL UNIVERSITY CLASSROOM

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Abstract

Given the nature of the study, the objectives of this paper are to verify the feasibility of teaching ESP to A2 level learners and larger, suitable integration of ESP into more university-level classrooms based on practical implementation of specific teaching tools using the groups of A2 Technical English students of the Czech University of Life Sciences Prague as a researched sample. The study explores the challenges and barriers of teaching ESP to students with low proficiency of English offering procedures to make ESP teaching at A2 levels efficient. It focuses on selected teaching methods which can be implemented in the teaching-learning process and support fulfilment of the students' needs. Based on actual classroom research, this study demonstrates that meaningful implementation of ESP to university study programs even at low-levels is feasible and efficient and should be promoted and supported considering the dynamic multilanguage and multicultural environment of professional world.

Keywords

Authentic problem-solving tasks, ESP, pre-intermediate, task-based learning, Technical English, video usage

Introduction

As English has increasingly become the accepted "lingua franca" internationally, many learners of the language seek course-based opportunities to suit their specific professional needs. As such, there is a growing demand for English for Specific Purposes (ESP) courses not only within professional environments, but also in various academic and vocational contexts. This paper focuses on teaching Technical English (TE) at the university level, with special consideration given to the challenges and limitations of teaching TE to students with pre-intermediate level and/or inadequate knowledge of general English fundamentals and often, without any prior professional experience.

'English for specific purposes' has been defined by a multitude of writers and researchers. The frequently cited definition of Hutchinson and Waters (1987: 21) stipulates that ESP represents a type of language teaching in which all decisions as to content and method are based on the learner's motivation for education, "ESP is an approach to language teaching which aims to meet the needs of particular learner." TE is distinguished from General English by its more specialised vocabulary and its more narrowly defined field of vocabulary (e.g. production, planning, maintenance, purchasing, testing, laboratory work, project work, and quality issues). Teaching TE also involves coaching learners in such skills as speaking and listening, essential to on-the-job tasks. Other important skills comprise reading and understanding technical documentation, as well as writing technically-complicated emails, as highlighted by Hollet (2005:4).

The objectives of this paper are to verify the viability of teaching ESP to A2 (pre-intermediate) level learners and larger integration of ESP into a growing number of university-level classrooms, based on practical implementation of specific teaching tools. This paper discusses challenges and limitations of teaching ESP to pre-intermediate-level students, offering procedures to make ESP teaching at A2 levels feasible and efficient. It focuses on selected teaching methods which can be implemented in the teaching-learning process to support the fulfilment of both the students' needs and societies' requirements.
The methodology used to formulate this paper comprises a scholarly assessment of teaching ESP to A2 students, suggesting multiple methods to make the teaching of ESP at A2 levels more achievable within the university context. This is followed by a description of their implementation in practise. The concluding assessment is accompanied by an examination of the students' attitude, satisfaction, and need-factors based on survey results. All of the described procedures are classroom-tested, as evidenced by the number of students, genders, ages, professional goals and students' survey results, thus offering direct solutions and opportunities for the ESP field at large. Subsequently, this paper provides discussion of the challenges and limitations of ESP implementation into language teaching programmes to A2 levels, including those faced by both the teacher, as well as the student.

Material and Methods

The following research is based on observing, monitoring and questioning the classes of the A2 Technical English course, who had little or no experience within the professional world. For the purpose of this study, 'pre-intermediate-level' students were defined based on the Common European Framework of Reference as A2 students. The educational establishment, the Czech University of Life Science Prague (CULS), was the research site for this paper. The research methods and subsequent results below were executed and analysed over the course of four full-length university semesters in the classes of 80 A2 TE students. Before its introduction, the syllabus was elaborated and the course designed, eventually implementing essential improvements, based on the monitoring during the first two semesters. Likewise the students' feedback and attitudes survey were assessed at the course-end by the students (76 out of 80 which actually returned the questionnaire complete). The survey was conducted in the form of a questionnaire consisting of 10 questions. Where appropriate, the answers were given in a scale from 0 to 10. Class sizes varied from 15 to 23 students, included both genders (however the majority were male - 90 %) and covered an age range of 19 – 21 year olds, mostly first-year students. The courses were aimed at full-time students. The majority of the students were native speakers of Czech; however some of them came from multinational backgrounds (including Ukrainian and Vietnamese families). The TE course was a course specifically designed for B.A. students of the Faculty of Engineering. The course comprised 24 contact lessons (once per week, 90 minutes) per semester held over 12 weeks.

Method-in-Practise: Authentic problem-solving tasks for the course

Several authentic problem-solving tasks, based especially on the learners' subject-related experiences, were designed to extensively practise all of the language skills within realistic technical contexts and moreover to "make every class unforgettable including variety, new challenges, and the surprise element being always present" as Onofrei, Precup-Stiegelbauer, Narcisa Tirban stated (2013: 341).

TASK 1 required the students to prepare comprehensive presentations, comparing two companies from the same industry with a focus on the companies' logistics. The actual web pages of the selected companies were presented. Essential vocabulary was highlighted and either explained or translated into native language (L1). Active participation by both the presenting student and the responsive colleague students made for a dynamic lesson and considerable enthusiasm. Within the presentation, other technical topics were also discussed, as pertinent to the given companies, and related vocabulary was practised. The class delivery of the findings (5 minutes in length) required both reading and researching of on-line documents. Presentation skills were not assessed and evaluated, as the A2 level of English proficiency did not enable the students to focus on proper presentation skills and other soft skills. However, after the initial feelings of embarrassment or self-consciousness were overcome, it was obvious that the presentation skills of the students were indeed improving and this, in and of itself, served as a first step to helping students face similar situations in their future studies and careers. As confirmed by Harmer (2007: 282), such "webquest is a good example of a multi-skill project. There is reading and writing, and speaking and listening (in the discussions sessions with the teacher and other students which can occur at various stages of the process)." In order to encourage linguistic growth from all the students present, the student colleagues-audience was required to ask 'open' questions. As the presentations progressed throughout the semester, the cumulative improvement on both the part of the student presenters and the student audience was evident. This was demonstrated by less prompts required from the teacher and a longer time needed to be allotted for the question-answers sessions.

For TASK 2, students were asked to bring technical objects of their own choice (e.g. small, hand-held farm equipment, portable tools, etc.) and deliver as detailed a description as possible in front of the class and/or within groups of four. Length of presentations varied, depending on the complicated nature of the technical item, but averaged out to approximately 4 minutes. The students practised both old and new vocabulary, use of passive structures and phrases of causes and effects. This prompted a short follow-up exercise, designed to be student-generated, within the classroom. Students described the object without telling or showing what was in fact being described; the rest of the class or group had to guess what the object was without seeing the real object. By touching and holding the individual parts and physically having the object present in the classroom, the students' interest was maintained and even raised significantly. Such settings established a genuine environment and the students were exceedingly motivated to deliver as accurate descriptions as possible. On several occasions throughout the semester, the teacher was asked to repeat TASK 2. This was considered a stimulating success rate.

Aiming to provide as true a technical context as possible, students were asked in TASK 3 to design and make a drawing of their own simple device for putting out a candle, squeezing a toothpaste onto a toothbrush, turning off an alarm clock or any another device design of their choice. The schemes were presented to the entire class. The technical language was practised extensively. All the schemes were also submitted in a printout version, with a detailed written description of individual parts and of how the device's mechanism functioned (minimum of 10 sentences). The teacher's feedback on both the speaking and writing part of the project was much appreciated. Even very simple schemes provided students with enough opportunities to consolidate their language skills and practise speaking, writing and listening in a great extent. As an authentic problem-solving task, with designs largely invented by the students themselves, the presentations, schemes, and pictures brought a lot of humour and fun into the class and helped establish

a friendly, non-judgmental atmosphere. The audience was invited to ask questions. 100% of the students were engaged in the project with enthusiasm and creativity.

Developed to practise test procedure vocabulary, TASK 4 required students to bring in their own small toy-sized or remote-controlled cars and motorcycle or skiing helmets to be tested. Once in the classroom, several sample safety-test recordings were presented to them ahead of time as reference tools. After the recordings, specific technical vocabulary and grammar structures that were pertinent to safety tests were discussed and studied. The students were then asked to present their own safety tests of the items they had brought. After approximately 15 minutes of preparation in small groups, students began playing the roles of dummies used for car or helmet safety tests in real-environment demonstrations. It was obvious that this type of exercise, when the students were allowed to stand up and move freely about the classroom to perform and demonstrate the tests accounted for a varied, inspiring teaching-learning environment, whilst focusing on consolidation of technical vocabulary. This task required a significant amount of teacher monitoring, as the initial concept of role-playing was not inherent to all the students. With some small encouragement, however, the task was enjoyed by most of the students.

To further provide genuine technical contexts during the lesson, students were grouped and invited to browse for technical drawings and documentation as a part of TASK 5. The drawings and documentation were part of technical and business-oriented magazines, books and manuals which the teacher had brought into the classroom. Students were then asked to write down open questions for other groups based on the drawings, within the language capabilities they possessed. This was followed by a question and answer session. The overall process was monitored by the remainder of the class, which delivered fruitful feedback on grammar and pronunciation mistakes, in particular. Although this exercise was quite strenuous for the majority of the students, they indeed prised the praise for their efforts and subsequent feedback on the task. Helping to overcome any previous known language obstacles, TASK 5 was designed by the teacher to help drill basic questions about dimensions and sizes, as well as fixed knowledge of numbers and pronunciation of unit measurements. It was noted that the students acted responsibly during the group work. The groups were systematically rearranged as advised by Harmer (2007: 167).

Method-in-Practise: Real video session tasks

Throughout the academic year, several authentic technical video recordings were selected and presented to the students. The following are several examples of the recordings used during the lessons:

- video 'Wacky Warnings' (http://www.youtube.com/watch?v=IXHeC8dvfaM)
  The overview of funny warning labels, recorded around the world, yet likewise often seen by students in their daily lives, brought immediacy to the classroom. It also brought good humour, setting a friendly atmosphere in the classroom. This led to the follow-up exercise of the learners designing their own wacky labels and warnings or inventing a new gadget and the eventual presentation of this to the class.
- Video of how to replace an oil filter (http://www.ehow.com/video_7876560_replace-oil-filter.html#ixzz2KFTMfHGQ)
  This recording of the actual activity of replacing an oil filter in an ordinary car, which is regularly carried out by most of the students, received enormous interest. The language for instruction-giving and for carrying-out procedures was practised.
- Hoover dam video (http://www.youtube.com/watch?v=D7_rzojvKdE).
  This video served as a backdrop for practising numbers, dimensions and measurement

units, which were derived from the actual language in the video. Another goal, using this video, was to generate questions concerning any other monumental engineering construction worldwide and give answers in pairs or groups.

- James Bond's gadgets video (http://www.youtube.com/watch?v=knSw_q6CTns)
  This video was especially well-received by the learners, since the students were familiar with most of the James Bond movies and the devices used therein. Besides practising basic technical vocabulary, this video helped provide a basis for reviewing object description vocabulary.

All of the above stated examples of recordings were used sensitively, so as not to overwhelm the students; otherwise, the original language of these videos would make an overly difficult listening and comprehension exercise for A2 students. Without proper pre-sessions of video preparation, the lessons would not have met the objectives desired by the teacher and would have consequently diminished the students' motivation. All the students received hand-outs of the audio scripts in advance. Following the initial viewing of each video, the students were given another audio script hand-out with some of the technical items left blank. Their task was to listen for and fill in the designated technical words, numbers, measurements, etc. which were omitted in the hand-outs. The follow-up discussions and speaking exercises made for effective exercises, as the level of difficulty was not over-challenging, yet still stimulated growth.

Results and Discussion

This paper has demonstrated the fruitful application of tools and strategies for teaching ESP within a TE context, specifically to pre-intermediate students at the university level. The above-described and documented scholarly work confirms that ESP/TE is feasible for A2 level students and may be progressively implemented into more university-level language classrooms. It was observed that the authentic problem-solving tasks and real video session tasks, targeted as a tool to overcome the challenges and limitations of teaching TE to A2 classes of English learners, proved to be highly effectual.

This paper has likewise confirmed the findings of Lustigova (2013: 319) that the productivity of the process on the whole depends on multiple variables, comprising not only the teacher's preparation, presentation, follow-up and assessment, but also the students' motivation. The course was usually attended by students of the Faculty of Engineering who were quite receptive to the course's technical content. By using the authentic problem-solving tasks and real video session tasks, it was possible to offer A2 TE-content material that both addressed the life situations outside the classroom and challenged the students to make the most of the classroom experience, spurring on-going student interest. The benefits of task-based learning were especially obvious in discussions over the drawings and object descriptions, which proved the findings of Kavaliauskiene (2005: 70). As the course progressed over the semester, the teacher observed that the entire class benefited from a friendlier, more interactive atmosphere. In terms of teacher-to-student ratios, the authentic problem-solving tasks and real video session projects could be used more successfully when the class size was smaller; ideally, the number of students ranged at 15-17. Smaller classes were also more resourceful from a management point of view, especially given the limited classroom time, the continued need for teacher monitoring and guidance, the students' own attention span and participation, and the vital student-teacher feedback.

By and large, the course's effectiveness was correspondingly established by the fact that the students manifestly improved their speaking, writing, reading and listening skills. This was evidenced by interim and year-end testing, the students' preparation for the lessons, the regular submission of required homework (presentations, schemes, etc.) and increased responsibility in terms of classroom activities. Course attendance was maintained at a stable level of 85%. Looking at the larger, out-of-classroom context, the students also benefited from the lessons by gaining initial presentation skills and other soft skills which could be developed further on for their future career benefit.

In order to validate the above-recorded teacher's observations a student survey was taken at the end of each academic year. The survey was meant as an indicator of the students' attitudes and satisfaction with the course, summarising their needs. Based on the students' responses, it was obvious that the initial motivation of the students was quite high, since they expected and aimed to study new content which focused more on their potential future technical careers. The course was assessed as highly beneficial, meeting the students' expectations to a great extent. Likewise, they appreciated the significantly high level of gained knowledge. Most of them would appreciate a follow-up continuation course which is, unfortunately, not offered at the Czech University of Life Sciences Prague at present. The implementation of the authentic problem-solving tasks and real video sessions among other activities was highly valued. Of particular note is that the learners were aware of the fact, that even though the focus of the technical content was the priority, they also needed to work on grammar and function structures. The survey content and selected answers are shown in Table 1. The students expressed their opinions and suggestions mostly in the form of written answers; the most typical and prevailing responses are provided below in their shortened version.

	Questions	Students' answers
1.	Why did you enrol into this A2 TE course?	*'... it was recommended by some students from the last year.'* *'I'm interested in technical stuff.'* *"Any specialized and content focused English is more beneficial than General English.'*
2.	Will you need ESP focused language in your future professional career?	'*Yes, for sure.'* *'Definitely. Even now I read technical documentation in English in my part-time job.'* *'I think, A2 represents the very basics required by most of the employers.'*
3.	How useful is the introduction of an A2 TE course into the university curriculum? (0 – 10, where 0 marks the lowest level and 10 the highest)	The average score is 9.
4.	Did the course meet your expectations? If the answer is lower than 5, please explain why. (0 – 10, where 0 marks the lowest level and 10 the highest)	The average score is 9.

5.	Do you consider the length of the two-semester A2 TE course sufficient or would you appreciate a continuation course?	*'I would welcome follow-up course.'* *'I would make the subject compulsory for all Technical Faculty students.'* *'The B1 TE course should be offered at the university as well.'*
6.	What is your evaluation of the course, considering the knowledge gained? (0 – 10)	The average score is 8.
7.	What parts of the lessons did you consider the most efficient or beneficial?	*'Device and machines descriptions while having the object present in the classroom.'* *'... technical vocabulary.'* *'...listening and watching real dialogues and videos.'*
8.	What parts of the lessons do you consider inefficient or not as beneficial?	Very few responses. The students that did respond wrote that they did not see the value of group and pair work.
9.	What did you miss in the lessons or course as a whole?	Very few responses. A few students suggested that *'Even more presentations would be a bonus.'*
10.	What activities would you like to focus on in a future course?	*'I would need more listening exercises to really comprehend spoken Technical English.'* *'... more grammar practice might improve the fluency of my speaking.'*

Table 1: Survey of student's attitudes, satisfaction and needs

The following bullets summarise the teacher's observations, as noted throughout the course over four semesters:

- The pedagogical aim of the course and individual activities must be defined and strictly maintained, always bearing in mind the pre-intermediate-level of the learners and their needs;
- Appropriate up-to-date ESP textbooks and other materials must be identified carefully to enable learners to adapt;
- The content of the texts should be selected judiciously to meet the students' practical interests and actual needs, whilst keeping the technical focus at a more general level, considering the pre-intermediate level;
- The balance between interesting content and important language must be maintained in order not to overwhelm the students;
- A focus on developing more generic skills that are not as dependent on language is beneficial;
- Providing authentic technical contexts and other life contexts (as permitted within the framework of the specific ESP course) which learners may encounter is imperative;
- The selective and sympathetic feedback on any fulfilled tasks should be immediate;
- The teacher must be well-prepared and confident to manage the authentic technical settings and firmly convinced of the importance and efficiency of the tools employed;
- Students should be encouraged to become active participants of the teaching-learning process, thus, their motivation should be maintained at a high level by varied interesting topics, as well as flexible teaching methods.

As shown in the student survey, students' views and needs must be taken into account and should aid in determining the course objectives and selection of teaching methods

and tools. Based on the students' needs, Katz, in Kashani, Soheili and Hatmi (2006: 85), emphasizes "the appropriateness of the tasks and activities to the learning style of the learners and their knowledge" which must be maintained at all times and under any circumstances. Another challenge to be considered is the balance between the language and content taught in A2 ESP classes. Whilst students value content which is usually linked with their study field and their future professional focus, they also need certain language structures and grammar to offer opinions and fulfil given tasks. In terms of the students' motivation and participation, it was made clear that an authentic technical and life context should be established and accommodated, in order to successfully communicate and to augment students' positive attitudes and participation. TE, in particular, enables an entirely authentic technical context to be constituted early on within the lessons, thus simulating the actual situations in companies which students will join in the very near future.

Despite all of the above-mentioned, worthwhile results in terms of A2 TE course, a set of potential barriers is also engaged by the teacher as described by Lustigova (2013: 324):

- classroom time constraints due to the low number of lessons throughout the academic year
- classroom time constraints due to class size
- the teacher's sensitive involvement in the teaching-learning process
- the teacher's potential low competence level in ESP/TE
- the students' limited knowledge and various language capabilities
- institutional support of ESP at more general level

To overcome the time constraints within the lessons, the teacher must be well-prepared and devote enough time to lesson preparation to be well-versed in employing the above-described tasks in A2 TE lessons. The issue of class size represents a large-scale problem in language teaching and ESP in particular. Governmental policies regarding the educational sector in certain countries has led to an enormous increase of students attending universities, thus the overall quality of the educational process may decrease. The teacher's competence can be further enhanced by attending and/or providing sufficient teacher training opportunities for ESP projects. Teacher training can also be complemented with intensive self-study, as well as research and discussion of other teachers' experiences. Another barrier to efficient integration of pre-intermediate-level ESP course into university language teaching may be the limited knowledge of the students and sometimes heterogeneous groups of learners, comprising multiple levels of knowledge. This can be tackled with suggested home preparation as a definite prerequisite to the students' success. Finally, despite the students very positive attitude to ESP, the inadequate promotion and support of ESP at the institutional level is considered one of the most significant limitations to further implementation of these courses. However with time and the progression of the market on the whole, the university's approaches may transform as well.

Conclusion

The classroom-based research for this paper aimed to prove the feasibility and efficiency of implementing ESP and TE, in particular, to the pre-intermediate classrooms. The research was executed in the classes of Technical English students at the Czech University of Life Sciences Prague during the two following academic years. The tool of task-based learning was utilised in a form of authentic problem-solving tasks and real video sessions tasks to prove the fact that that wisely used teaching methods make teaching ESP even to

A2 students feasible and efficient. The method of observation in combination with the students' survey of their attitudes, satisfaction and needs was chosen. Described activities provoked attention, motivation and the ultimate active participation of the TE students and made the initial steps in their preparation for actual workplaces and future studies.

Since multilanguage and multicultural environment became a general standard of most companies, the need to acquire necessary language knowledge is paramount. The traditional university environment should follow the learners' needs for eventual professional positions, as the students need to "function in the workplaces of today's society" (Bingimlas, 2009: 236). Although it might be simple to say that ESP, as a field, should keep pace with the world which it serves, this operation is often decelerated by numerous barriers, as detailed previously. Such challenges establish an extensive space for expansive research towards solutions, including eventual textbook writing and more extensive teacher training in ESP possibilities on a larger scale and in terms of the A2 classroom. Likewise the level of exposure to either content or grammar should be further researched for different levels and various ESP courses. This paper serves as a recommendation for future research on ESP materials development and issues of their authenticity and modification.

Given the potential ideal situation where educational establishments support ESP course development and students call for ESP courses, either directly via exposure to other similar courses or indirectly via professional pressures, this type of tailoring ultimately rests in the hands of a teacher. If curiosity can be tapped or triggered on the part of the teacher, any students, including those with low-level of English proficiency, will likewise respond favourably, aiding in classroom teacher-student integration in larger measure than may ever have been expected.

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THE EXPERIMENTAL VERIFICATION OF THE EFFICIENCY OF TEACHING TYPING – A SUMMARY

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Abstract

The article describes an implemented pedagogical experiment whose aim was to verify the efficiency of teaching typing to pupils attending 6th grade at primary schools. During the research the experimental plan was carried out and included the using of a pre-test and post-test. For getting the research data a speed test was used that was then statistically evaluated. The findings of the research conducted in the described method proved an increase of the speed of typing on the basis of attending typing lessons. The shift was statistically significant. (108 keystrokes after attending typing lessons in comparison with 52 keystrokes before attending typing lessons).

Keywords

Typing, experiment, speed test

Introduction

Informational and communication technology (ICT) have been accepted as a component of lifestyle especially in advanced societies. The ubiquity of ICT has brought rapid changes in technology as well as a social, political and global economical transformation (Moradi, 2009). Digital technology has become a typical part of our lives. Almost all parts of human activity involve working with information in an electronic form (Chupíková, Zahumenská, 2002).

Typing with all ten fingers is a standard skill for success on today's labor market. Entering of data into a computer by keyboard is required for a lot of jobs. If a person can use all ten fingers for typing then the work goes much faster while also eliminating potential health hazards (Bullock, 2009; Desetiprstová hmatová metoda, 2012).

Working with informational and communication technologies is compulsory at primary schools under the Framework Educational Programme for Elementary Education (FEP EE) (2007). On the basis of this document, the pupils have to learn elementary skills for the qualified use of computer technology. Typing with all ten fingers is a component of these skills. It is common abroad (Bildungsplan 2012: Werkrealschule, 2012; Bildungswesen in Österreich, 2012; Informationstechnologie: Gesamtkonzept, 2008; Lehrplan Wahlpflichtfach: Textverarbeitung, 1999; Lehrpläne der Fächer, für die keine Bildungsstandards der Kultusministerkonferenz vorliegen: Erweiterte Realschule 9, 2001; Plan d'études romand, 2008; Stundentafeln der Volkschule: Primarstufe und Sekundarstufe I: Stand: Schuljahr 2011-2012, 2011). Although teaching typing isn´t contained in the Framework Educational Programme for Elementary Education, thanks to this document, which enables using available lessons at the discretion of individual schools, space is provided for the development of keyboard literacy at primary schools.

Elementary education should lead to the development of key competences and provide a base of general education which is oriented on situations from life and practice (the

Framework Educational Programme for Elementary Education (with the changes carried out on September 1, 2007) 2007). On the basis of these reasons, the method of typing with all ten fingers should become a standard part of elementary education.

The aim of the research, research questions and hypotheses formulation

The aim of the research was the verification of the efficiency of our proposed documents (school curriculum and methodological recommendations for teaching) through the implementation of teaching typing at an elementary school for pupils in the age group 11-12 years.

The basic research question comes from the aim of the research. It was defined as:

Are pupils, who are 11 – 12 years old capable of attending typing lessons with all ten fingers? Can they achieve improvement in typing speed?

There are hypotheses, which were formulated for this question:

To these basic research questions the following material hypotheses were formulated:

H1: Pupils (11 – 12 years old) who attended typing lessons with all ten fingers, achieved a higher number of keystrokes than pupils (11 -12 years old) who didn´t attend these lessons.

H2: The difference between the post-test and pre-test of pupils (11 – 12 years old) who attended typing lessons with all ten fingers is statistically significant.

Materials and Methods

To verify the effectiveness of our proposed documents an experiment was chosen. "The experiment must have some basic elements. There must be at least two groups of people, which work in different conditions. These conditions are strictly checked. At the end of the experiment their effect in both groups is evaluated." (Gavora, 2000: 125)

During the realization an experimental plan was used by employing a pre-test and post-test. A speed test was used in order to obtain research data. "These tests look into how fast a pupil deal with specific kinds of tests. These speed tests have a fixed time limit for a solution and usually contain very easy exercises. It is presumed that all pupils who were tested will manage these exercises and that only their speed of solution will differ" (Chrástka, 2007: 185). The same test was assigned to pupils at the end of the experiment.

The experimental verification of the effectiveness of teaching typing was carried out in two parallel groups of pupils of 6th grade during two school years. The experimental group was made up of 79 pupils who attended 30 typing lessons in the framework of the subject IT. In the control group there were 86 pupils of 6th grade at primary school who didn´t attend the lessons. They attended typical IT lessons, in which an IT curriculum was taught under the FEP EE. The pupils therefore spent the same amount time on the subject IT but had different course contents.

Both groups of pupils took the pretest – typing speed test. In order to obtain objective and reliable tests, a free test which available on the website (Download, ©2005) was used. A text for beginners was chosen (text without diacritics). The test lasted 5 minutes. For every mistake, four keystrokes were subtracted. The keys Backspace and Delete weren't allowed (defaulted settings of test).

After finishing the experiment, where 30 lessons of typing was chosen as the independent variable, the pupils did the same test which should have proven the influence on the typing speed of pupils in 6th grade at primary schools.

The pupils who attended both tests (pretest and posttest) were included in the final evaluation. The results of the pre-test and post-test, which were expressed by the number of keystrokes a minute achieved, were processed in tabulator processor MS Excel 2010 with an analysis of the data.

Graphical methods of exploratory data analysis were used for testing the normality of the data file – histogram and rankit Q-Q plot (Meloun, Militký, 2002). Both methods proved the normal probability distribution. For next statistic testing of hypothesis parametrical tests were used.

First the Fisher-Snedecor´s F-test to compare the variance was conducted, which is a prerequisite for the correct selection of the student's t-test. In this test, the significance was assessed using the variance test criterion F (Chrástka, 2007). According to the values of the F-test to test the H1 hypothesis a two-sample T-test with equal variances was used. The mean value of the monitored files was tested, meaning the characteristic positions specifying the data center of the whole group around which all values fluctuate (Lašek, Maněnová, 2009).

For testing hypothesis H2 the paired t-test was used, which can be used in cases where repeated measurements of the same group of people with a particular variable and need to decide whether the results of these two measurements are statistically significant differences (Chrástka: 2007). As the comparison of the results that we have obtained from two measurements made from a single choice, an F-test is not used.

The results and their interpretation

The first test carried was the Fisher-Snedecor F-test. The test is for checking the validity of hypotheses about the equality of the dispersions of the data sets, assuming their normal probability distribution (Kubanová, 2003). Specifically, by using this test we verify if the dispersion of the arithmetic average of the number of achieved keystrokes a minute in the pretest is the same for persons in the control and experimental group.

For this aim the null hypothesis was formulated:

H_0*: The dispersion of both choices is equal.*

Alternative hypothesis:

H_A*: The dispersion of both choices isn´t equal.*

The results are represented in table number 1. The mean value expresses the arithmetic average of achieved keystrokes a minute in the pretest in the group of pupils. The dispersion indicates the value of dispersion in both groups. In the line Observation how many respondents were included in each group is stated. The difference provides the number of degrees of looseness. From the results it is apparent that with a significance level $\alpha = 0.05$ we will not reject hypothesis H_0.

Two-sided F-test for dispersion Pretest		
Level of significance 0,05	Control group	Experimental group
Arithmetic Mean	53, 00	51,620
Variance	274, 466	265,290
Observation	86	79
Difference	85	78
F	1,035	
P(F<=f) (1)	0,440	p ≥ 0,05
F krit (1)	1,446	Dispersion is the same

Tab. 1: Fisher-Snedecor F-test

In this phase of the test, the results of the pretest were evaluated. They are represented in table number 2. The aim was the comparison of the parameters of the control and experimental group. It is for the purpose of confirming the precondition of independent choice.

For these aims, the null hypothesis was formulated:

H_0: There is no difference between the result of the control and experimental group in the pretest (it was measured by the mean values in both choices).

The alternative hypothesis:

H_A: There is a difference between the results of the control and experimental group in the pretest (it was measured by the mean values in both choices).

Two-sided t-test with equality of dispersion Pretest		
Level of significance 0,05	Control group	Experimental group
Arithmetic Mean	53,802	51,620
Variance	274, 446	265,290
Observation	86	79
Common variance	270, 075	
Hyp. Difference of Arithmetic Mean	0	
Difference	163	t Stat < t krit
t Stat	0,852	No difference
P(T<=t) (1)	0,198	
T krit (1)	1,654	
P(T<=t) (2)	0,395	
t krit (2)	1,975	

Tab. 2: Processing of the result of the pre-test

To assess the acceptance of the null hypothesis H_0 against the alternative hypothesis H_A the sided t-test with equal variance at a level of significance of 0,05 was chosen. We compare the absolute values of t Stat and t krit (2) in order to evaluate the t-test (Chrástka, 2007). The value of t-statistics pre-test results is situated in the field of permissible values of hypothesis H_0 for the two-sided t-test with equal dispersion at a significance level of 0,05. We don´t reject the hypothesis H_0. The initial knowledge of both groups can be considered as equal.

The same method was used in the evaluation of the results of the post-test. The aim was to determine if the pupils, who are 11-12 years old and who attended the typing lesson with all ten fingers achieved a higher number of keystrokes than pupils who are 11-12 years old and who didn´t attend the typing lessons with all ten fingers. The lesson of IT took place in accordance with FEP EE.

The evaluated results of the post-test are stated in table number 3.

To verify the validity of the factual hypothesis H1, the null and alternative hypothesis was formulated.

$H1_0$: There isn't a difference between the results of the control and experimental group in the post-test (it was measured by comparison of the mean value of both choices).

$H1_A$: There is a difference between the result of the control and experimental group in the post-test (it was measured by comparison of the mean value of both choices).

We reject the null hypothesis $H1_0$ because the calculated value of test criteria t is absolutely higher than the critical value. We found out that there is an important difference between the average number of keystrokes in the experimental group and the average number

of keystrokes in the control group. Everything is at a level of significance of 0,05. We can declare that the mentioned method proved the increase of the performance of the pupils in the experimental group if the mid. values are higher and if there is a rejection of hypothesis $H1_0$. (There is an acceptance of hypothesis $H1_A$).

Two-sided t-test with equality of dispersion Posttest		
Level of significance 0,05	Control group	Experimental group
Arithmetic Mean	51,128	108,165
Variance	288,960	3076,524
Observation	86	79
Common variance	1622,886	
Hyp. Difference of Arithmetic Mean	0	
Difference	163	t Stat < t krit
t Stat	-9,085	difference
P(T<=t) (1)	1,67584E-16	
T krit (1)	1,654	
P(T<=t) (2)	3,35169E-16	
t krit (2)	1,975	

Tab. 3: Processing of the results of the post-test

We were also interested if there is a statistically important shift (the difference between pre-test and post-test) in the number of keystrokes by pupils who are 11-12 years old and who attended the typing lessons with all ten fingers. To assess of this data the paired t-test was used (Chrástka, 2007). To verify the validity of the objective of hypothesis H2 the null and alternative hypothesis was formulated. The results of it are in table number 4.

$H2_0$: There isn't a difference between the results of the experimental group in the pre-test and post-test (it was measured by comparison of the mean value of both choices).

$H2_A$: There is a difference between the results of the experimental group in the pre-test and post-test (it was measured by comparison of the mean value of both choices).

Two-sided paired t-test at middle value Experimental group		
Level of significance 0,05	Pre-test	Post-test
Arithmetic Mean	51,620	108,165
Variance	265,290	3076,524
Observation	79	79
Pears. correlation	0,613	
Hyp. Difference of Arithmetic Mean	0	
Difference	78	t Stat < t krit
t Stat	-10,634	difference
P(T<=t) (1)	3,8713E-17	
T krit (1)	1,665	
P(T<=t) (2)	7,7426E-17	
t krit (2)	1,991	

Tab. 4: Processing of the results of the difference between the post-test and pre-test of the experimental group

The absolute t-statistic value is higher than the critical value so we reject the null hypothesis at the level of significance of 0,05. The difference between the post-test and pre-test from the pupils who attended the typing lessons is statistically significant.

Conclusion

The findings of the research which was carried out in the described method confirms that pupils who are 11-12 years old are able to attend typing lessons with all ten fingers. They are also able to achieve distinct improvement in their typing speed. This improvement is statistically important. There were 108 keystrokes after attending typing lessons and 52 keystrokes before attending the lessons. We can confirm the claim through our long-term experience with the teaching of typing. The general argument for the teaching of typing at an early age is especially avoiding bad habits which are difficult to remove.

Nowadays, children are in contact with modern technology – with computers and their indispensable input peripheral – the keyboard, at an early age. The qualified operation of the keyboard should become a part of lessons with computers at primary schools.

Research project

The paper is a result of the research project entitled "Experimental verification of efficiency of teaching typing" at the University of Hradec Králové.

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E-LEARNING COURSES EFFECTIVENESS EVALUATION BASED ON THE USAGE OF INTERACTIVE ANIMATIONS

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Abstract

This contribution deals with the evaluation of effectiveness of the study material, in which interactive animations have been implemented. Experiment for the verification of quality, effectiveness and didactic effectiveness was realized in the winter semester of the academic year 2013/2014. Interactive animations, which can have an impact on the transition of a student through the e-learning course, were used for the verification of effectiveness instead of the classical method of evaluation. Both experimental and reference groups had access to the study materials, which were identical as to their contents. The difference between the experimental group and the reference one was in the method of transition through the course by the student. The experimental group realized the transition through the course using linear method, without using interactive animations. Based on the usage of interactive animations the control group used dynamical transition based on interactivity of the student and the particular study materials.

Keywords

Efficiency, interactive animations, LMS Moodle, didactic effectiveness

Introduction

Today, ICT are fundamental for our society. Their task is to make information accessible from every place in the world, quickly and without effort (Tinio, 2009). ICT are the means, which from the global point of view can contribute to the development of knowledge and skills (Ollo-López and Aramendía-Muneta, 2012; Jakobs, 2009). Development of new, as well as modernization of old-fashioned technologies, cause also fundamental changes in the development of our society. People are thus pressed to permanent education and acquiring new theoretical and practical knowledge from many fields. It is possible to see an analogy of the statement for example at the current utilization of ICT in educational context. Regarding accessibility of Internet and enhancement of social networks these have become something like a possibility of using e-learning systems for storing necessary study materials at one place (they are accessible from here for everyone in need) so that they facilitate and accelerate the process of acquisition of new knowledge. We can state that ICT can support not only classical, but also current and innovative pedagogical methods and procedures.

Development of adaptive techniques for the sphere of e-learning systems, which allow for personalization of the student has been known for long (Hsiao et al., 2010). However, during the last 5 years there came to a real progress in opportunities for utilization of these technologies (Brusilovsky et al., 2011; Sun et al., 2012; Kostolányová et al, 2013). Wide spectrum of opportunities and open space for experimenting allows us applyinh our creativity on the topmost level (DeLeeuw et al., 2010; Mayer, 2010). Such system of learning by means of ICT, for example in cooperation with the opportunities provided by

e-learning systems and technologies Web 2.0, has been actively used mainly in the last two decades (Chen et al., 2011; Miller, 2005).

Research in the implementation of new forms and methods into the educational process focuses also on creation, testing and formation of such systems in schools. As it is a relatively new method of providing information, there does not exist enough proofs to lean on when stating that it is more effective than the classical method. Moreno and Mayer (2007) point into the fact that this method of acquiring information means revolution and a certain notional entry into a new era of learning, but it is not possible to state that it is 100% correct from the point of view of pedagogy and psychologyy. The reason is an absence of a lecturer as well as a lack of social interaction, which upon standard method of education, allows for strongly enough influencing of the student and his concentration at perception. Therefore, both methods of providing study material are mostly used in schools.

The whole problem is based on the fact that the term effectiveness (effectivity) does not represent a stable term in pedagogy and there exist different definitions of this term, while they considerably differ one from the other. According to Petlák (2004) effectiveness represents the ratio between the obtained educational results to the costs spent for their creation. Petlák understands under the term pedagogical effect of material didactic aids. In ordere to present definition of this term he states that it is suitable to compare results of instruction reached by the use of a particular didactic aid, according to the aims defined in advance. Průcha, Walterová and Mareš understand the term effectiveness as a part of the term effectivity. In their pedagogical dictionary they state that effectiveness is: *„a complex concept, expressing the conditions under which certain inputs lead to certain educational process outputs. Inputs are factors that characteristics of the subjects and content of education and Conditions constitute the characteristics of the processes of teaching and learning outcomes are the results and effects of education. Measurement and evaluation of effectiveness is very difficult, although research in this area is intensively developed"* (Průcha, Walterová and Mareš, 2003).

Materials and Methods

Students of bachelor´s studies – first year students of the field Applied informatics and second year of studies of the study programme Teaching academic subjects (Informatics in combination with another subject) were target groups of our research. E-learning course in LMS Moodle, within the framework of which the experiment was carried out, is designed for the subject Architecture of computers 1 (with the focus on logic circuits). The content of education of the course is organized in 9 lessons. As a rule one lesson is an equivalent content of one lecture. E-course provides materials, which are included in the module *Kniha (Book)*. This module allows also for the possibility to implement medial elements (e.g. interactive animations). In the course are available also dictionaries, forum for discussion, self-tests for the case when the student wants to test his current knowledge. Interactive animations, which can have an impact on the transition of a student through the e-learning course, were used for the verification of effectiveness instead of the classical method of evaluation. According to Englan and Finne (2011) they represent integration of medial elements, including combinations of texts, graphic, moving pictures, sounds implemented in the structured interactive computer environs, which allow for people communicating with data for the particular puirposes. In order to obtain a more accurate idea of the term animation, we should consider the opinion of Beckerman, who stated

„objects in animations do not move in reality, but we get impression of movement by projecting pictures in a stable time interval, during which they are depicted in various positions. That means that every frame represents a certain moment of animation and we receive an illusion of movement by tagging these moments together" (Beckerman, 2003). By interactivity in animation we enable the user control the course of animation, thus creating a feedback between the system and the user. Animation in this case will not always give back the same result, so its course will not be linear, but will depend on the choice of the user. Interactive animation has a very good potential for the improvement of human education, especially when the aim is depth understanding (Mayer and Moreno, 2002).

The time course of the experiment was between September 16, 2013 and February 17, 2014. Students were divided into the reference (EDU, https://edu.ukf.sk) and experimental groups (DIVAI, http://www.ki.fpv.ukf.sk/moodle). Both groups have an access to an identical e-learning course with identical as to the contents study materials. The difference between the experimental group and the reference one was in the method of transition through the course by the student. The experimental group realized the transition through the course using linear method, without using interactive animations. One interactive animation, which explained the contents educated and suitably complemented the study material, was implemented in every lesson

Hypotheses

Results of the transition of the student through the course and the final average of evaluation of the whole group were the parameters of effectiveness of the e-learning course. By knowing these parameters and their comparing we can define the following research hypotheses:

- **H1.** At using interactive animations there comes to an increase in quality of acquired knowledge and thus the resulting mark from the subject should be better that at the initial method of transition through the e-course.
- **H2.** Transition through the course while using interactive animations motivates students to browse through the study materials of the subject Architecture of computers more frequently and in details.

Based on the hypotheses we can expect an increased didactic effectiveness in the subject Architecture of computers 1, which means reaching better study results at the end of the semester when compared with the reference group. Assessment of students´ performance during the semester is carried out by the system itself and the final evaluation is available after the passing of the final exam. Thus the results of analysis of effectiveness of both groups are indicators of quality and effectiveness.

Results of experiment and Discussion

Statistics of using interactive animations and transition through the course at the group DIVAI was obtained based on the statistic module *Interactive Element Stat* programmed by us (Magdin et al., 2013). Statistic records of accesses to the materials and contributions for the group EDU were obtained by a standard method from the configuration *Report*. In table 1 are presented data on how each group viewed the course on average and how many contributions it had in the course. Number of views is incremented by accessing the course. According to that we can analyse, which group and how many times accessed the e-course. Table 1 shows the number of contributions of each group within one month period during the whole semester. Data were processed and calculated on average per

one student, due to inequality of the number of students. Since also other groups studied in EDU course, LMS Moodle recorded statistics also for them.

	GROUP EDU, Number of students: 137		GROUP DIVAI, Number of students: 15	
	Average 1 student		Average 1 student	
Period	Thumbnails EDU	Comments EDU	Thumbnails DIVAI	Comments DIVAI
17-Feb-14	14.77	0.17	0.27	0.00
31-Jan-14	62.77	1.31	34.07	0.07
31-Dec-13	36.71	2.34	134.20	9.80
30-Nov-13	42.21	2.26	66.47	15.40
31-Oct-13	85.09	3.20	133.87	12.00
16-Sep-13	30.74	0.45	17.87	0.53

Tab. 1: Statistics of views of the course and contributions in the course

Table 2 shows data on accesses of study mateerials for both groups. These data provide information on how often students worked with the module Kniha (Book). Table shows the number of all depiction for each lesson and also calculation of the average per one student. It is possible to determine from the data which group studied more and which group was more mlotivated and showed greater necessity to read the study material more times. We would need to explore a wider spectrum of students and larger groups in order to obtain more accurate statistics and more relevant results. The sample is too small and the results may not be considered faithful, but can be a motivation and basic material for further investigation and evaluation.

	GROUP EDU, Number of students: 137		GROUP DIVAI, Number of students: 15	
	Overviews of materials, module Book		Overviews of materials, module Book	
Lessons	Number of accesses	Average 1 student	Number of accesses	Average 1 student
Lesson 1	6175	45.07	809	53.93
Lesson 2	7415	54.12	1125	75.00
Lesson 3	4341	31.69	543	36.20
Lesson 4	2796	20.41	374	24.93
Lesson 5	974	7.11	185	12.33
Lesson 6	2220	16.20	361	24.07
Lesson 7	1369	9.99	204	13.60
Lesson 8	676	4.93	168	11.20
Lesson 9	1039	7.58	224	14.93
	Average	21.90	Average	29.58

Tab. 2: Statistics of accessing the materials in the course

By comparing the data in tables 1 and 2 we are able to consider and verify veracity of hypotheses. Fig. 1 depicts assessment of students self-tests in points during the semester (group DIVAI dominates in results). The highest number of points, which can be potentially reached by both groups, was 10 points for 1 task.

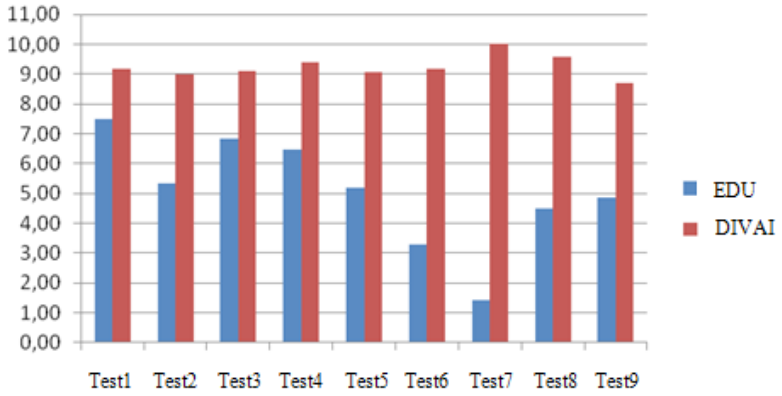

Fig. 1: Assessment of students tests in points

By analysing fig. 2 we shall find that relevancy of the previous statement (fig. 1) decreases. Group EDU did not repeat the test and withdrew from improving the result. On the other hand group DIVAI, which was using study materials with implemented interactive animations accessed the test also for the second time. Regardless the number of attempts we can assume that students who accomplished the test for 80 percent, should have better knowledge and should understand the problem better.

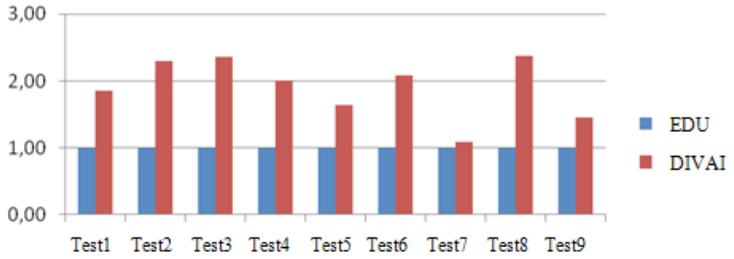

Fig. 2: Ratio of attempts of both groups at elaborating tests

The decisive factor for us was the final exam. Average mark obtained by the group DIVAI was 1.88 and for group EDU 1.68. We thus refuse H1 and at the same time we come to the conclusion that group DIVAI reached worse result in the final exam. We can thus presume that the higher number of attempts, the lower level of veracity of the resulting mark of the self-test. For the relevancy of results we recommend to define exactly the input conditions for the repetition of the experiment, to implement identical input conditions. By this experiment we also proved that neither interactive animations can very often have big influence on reaching better assessment of a student at exam.

In fig. 3 the ratio of realized activities of both groups is graphically depicted. Group

DIVAI was much more active in the course and they also had more contributions. We can assume that by implementing interactive animations we motivated students to participate in the discussion and also we motivated tham to use the e-learning system more frequently.

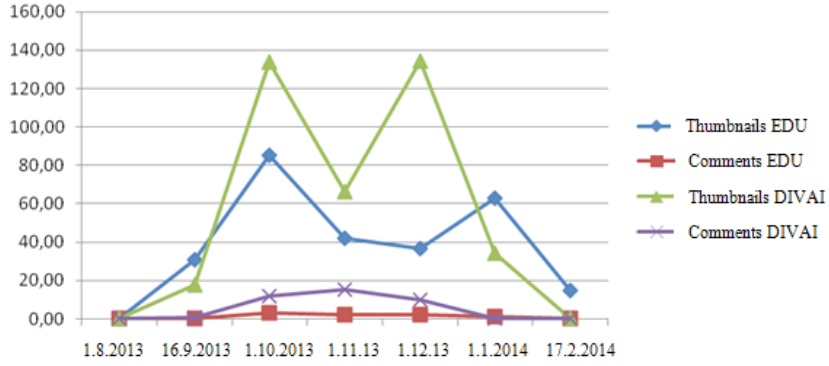

Fig. 3: Ratio of realized activities

Fig. 4 depicts accesses to the module Kniha (Book) for both groups.

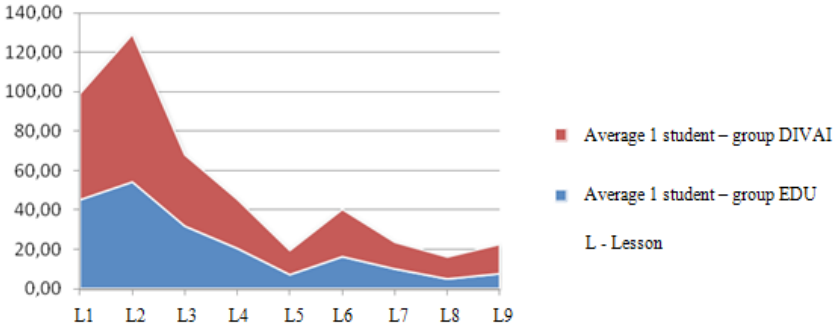

Fig. 4: Ratio of viewing the materials in module Kniha (Book)

By comparing accesses we definitely accept H2. It is possible to meditate for further academic debate why the group, which was more successful in self-tests, and was more active in the course with more accesses to study materials, reached worse final result at final exam.

Conclusion

In order to be able to define effectiveness of educational proces by using the modern ICT aids, it is necessary to know various factors closer. In the contribution we presented as an example implementation of interactive animations. Creation of educational study materials, into which interactive animations are implemented so that they reached rather high effectiveness represents a challenge, since information mediated by means of them are often too complex. Interactive animations are not the solution of pedagogical

problems, since if they are not correctly designed they can be counter-productive for the proces of learning.

Theoretical analysis of problems points to the fact that mastering interactive animation need not be correct and clear for each student and therefore during manipulation with it students often would not understand the given issues or the overal essence of the presented problem despite the development of sense perception. When designing an interactive type of animation it is important not to forget the stratégy of creating animation based on the knowledge of the target group (Lowe, 2004). In accord with Lowe and Rauterberg et al (2013) it is not sufficient to design an interactive animation only from the programming point of view, but first of all it is inevitable to be respectful of the possibilities and abilities of people, who will actively use it.

Various teams of scientists, programmers, psychologists and pedagogues in the whole world deal with this idea, they improve it and apply into the practice in the form of various models. This is evidenced also by permanent increase in new materials related to this sphere. Several conferences have been held during the last two years, at which authors of contributions prove this fact by their theories, statements and experiments (Vekiri, 2002; Stull and Mayer, 2007; Balogh et al, 2011; Kunstová, 2012; Milková, 2012; Turčáni and Kuna, 2013, Magdin et al, 2013).

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RESPONSIBILITY FOR MATHEMATICAL LITERACY

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Abstract

In this paper we deal with the poor mathematical knowledge and bad attitude towards mathematics of students coming from secondary schools to the Faculty of Economics, VŠB - Technical University of Ostrava (VSB-TUO) and with some possibilities how to overcome these problems. We prepared new more clear study materials and the set of suitable online calculators and PC programs. We carried out the research in which we wanted to detect whether the inclusion of new simplified mathematical study materials and suitable ICT support in the teaching of mathematics can improve students' knowledge and attitude towards mathematics. To evaluate the teaching experiment we used descriptive and inductive statistical methods. Statistically verified results of the tests and questionnaires confirmed that the new study materials and appropriate integration of ICT into mathematical education can improve the students´ knowledge and the attitude towards new technologies.

Keywords

Mathematical literacy, mathematical program, parametric methods, permanent knowledge, statistical inference

Introduction

Nowadays mathematical competence and literacy open doors to productive futures. But many students have troubles with mathematics and a lack of mathematical knowledge and skills keeps these doors closed. Present mathematical education battles with serious problems. Abolition of compulsory secondary-school leaving exam in mathematics moved this important subject among subjects of the second category, and although it is clear that it was a serious mistake, any correction seems to be unrealistic at this time. Mathematics belongs to the most difficult and feared subject at all levels and types of schools where mathematics is taught as the subject for "non-mathematicians". Most students fail to achieve the mathematical skills which are necessary to pursue a technical, economic or other career.

Problems with mathematics and the poor level of mathematical knowledge of students from primary and secondary schools are discussing during last years (PISA, 2009), (PISA, 2012a). In the whole world there are discussions about the content and methods which teachers should use. Scientists and teachers from different schools and institutes think over how to make mathematics more interesting, more objective, more accessible. They believe that mathematics can be taught in such a way that it forces us to think, solve problems around us and think about the context of mathematics with other subjects.

On the other hand many teachers believe that quality teaching means to give students a great amount of knowledge at the highest professional level. Then the encyclopedic teaching predominates, teachers examine facts not skills. However, the results are

paradoxically opposite. Many students come to the university with poorer knowledge than before, they often do not know the basic concepts such as functions or they know the definitions but they are not able to imagine what the definitions mean. They have also significant lacks in basic arithmetic and geometric skills, the students cannot count with great or small numbers, with decimal numbers as well as with fractions or with percentages, they cannot draw a simple sketch or graph.

At the Faculty of Economics, VSB-TUO we can seriously say that such students with problems in mathematics constitute the majority. They have not ever heard about limits, differentiations, integrals, financial mathematics, statistics and other. Their knowledge is completely missing a lot of modern and applied topics, which were not implemented into the curriculum due to the general conservative approach to teaching, although in practice they are commonly used (matrices and linear algebra, probability and statistics, mathematical logic, etc.). Students are not able to use the calculator, they have not seen any online calculator or mathematical program on internet. Teachers force them to use classical mechanical practices that had been common before computer technologies begun to influence our lives. The students' skills are similar. They use mechanical procedures to solve some typical tasks, but they do not know what they are counting and why (Cuban, Kirkpatrick and Peck, 2001).

Teaching of mathematics and mathematics itself is detached from reality. One of major problems concerning the mathematical education consists in the fact that the most of teachers lead their lectures without any trivial application on problems of present world. A teacher only tells students what he enquires and shows how to do it. Maybe it is connected with one very unfavourable result obtained from PISA testing. In PISA (2012b) research the OECD countries were ranked in descending order of the percentage of students who agreed or strongly agreed with the statement "I feel happy at school". Czech students were in the last but one place. However, teachers often underestimate these statistics and point out that the Czech Republic still belongs to the better half in selected mathematical competitions. But the truth is that some years ago the results of Czech students were much better than nowadays. It is the high time for question if teachers teach mathematics well. Maybe teachers should have more responsibility for mathematical education. The often mentioned argument is that present students are worse than the generation of their parents and grandparents. The question is whether these students have less academic abilities or are only worse prepared for a university education, especially in mathematics. If today's students get a better grounding in mathematics, their knowledge and skills could be comparable to those of previous generations.

We have tried to help students to overcome their mathematical troubles for several years. Firstly, we prepared mathematical courses with new study materials. The mathematical theory was clarified and solving problems and examples were concentrated on real situations and topics from other economic subjects. Students were informed about online calculators, mathematical programs which they can use. New learning methods including electronic testing (Hanclova, 2013) help students to overcome some difficulties with mathematics and present mathematics as the powerful tool for problem solving in the real word. New study materials and links to online calculators and mathematical programs including applets were put into CMS Moodle which we use from the year 2003 (Majovska, 2006). Students who have used modern ICT have improved their study results. New texts, learning methods and suitable ICT help students to overcome their aversion and difficulties with mathematics and change their attitude (Majovska, 2013).

The purpose of this paper is to show that the clear and clarified mathematical theory, assignments solving real problem and implementation of appropriate modern information and communication technologies not only improve students‘ results in mathematics but obtained fundamental mathematical knowledge is more permanent. Further we verify if students begin to use online calculators and mathematical PC programs when the suitable electronic tools are prepared for them. And finally we scan the student´s attitude to mathematical education and the opinion of the importance of mathematics in economic study. To assess these objectives we use the didactic test and questionnaire. We use parametric methods of statistical inference to evaluate results of the didactic test and students‘ opinions on the changes in the mathematics education caused by including new study materials and appropriate forms of ICT.

Materials and Methods

To improve the knowledge of students in mathematics and particularly to strengthen their ability to apply mathematical methods in their economic study, we have tried to change mathematical education at the Faculty of Economics, VSB-TUO for several years. We have prepared new more clear study materials, interactive applets (Majovska, 2013), the access to the set of online calculators and open source mathematical programs in order to challenge student to deal with mathematics much more as in previous years in secondary schools. All study supports, applets and PC programs are available for students in CMS Moodle.

Research objectives and hypotheses

In the academic year 2013/2014 we realized a small research. The aim of our research was to explore whether the inclusion of new mathematical study materials and suitable information and communication technologies in the teaching of mathematics can improve students' knowledge and attitude towards mathematics. In accordance with our experience and assumptions we formulated two working hypotheses:

H1: Clarified study materials and appropriate using of online calculators and applets enable students to overcome difficulties in mathematics education and to obtain more permanent knowledge.

H2: Appropriate integration of information and communication technologies in mathematics enables students to improve their attitude towards mathematics.

Because we know students' gender and type of secondary school they attended, we could examine these hypotheses for the entire study population and then selectively by gender and school. In this article we present the comparison of the results by gender.

Methodology and research organizations

The research was realized in the form of the experiment. The experiment had two parts - at the beginning and at the end of the winter semester. We chose a sample of 112 students from three study groups of the first grade of bachelor study. In the first lesson in the middle of September 2013, four months after students finished secondary school, they wrote the test and filled out the questionnaire. To verify the hypothesis H1 students solved six exercises in which they should find the domain of the function, draw three graphs of functions of one real variable (one linear and two non-linear – quadratic and exponential), evaluate the arithmetic sequence and derive the function of one real variable. The students had access to internet and were informed about the possibility to use any calculators, computers, tables, applets during writing the test.

To verify the hypothesis H2 students filled out a small questionnaire consisting of four questions, which explored their attitude towards mathematics. The students answered how they evaluate performance of mathematics, whether mathematics is interesting for them, how they perceive the necessity and usefulness of mathematics and whether they use some computer programs in mathematics. Five-point ordinal scale was selected for all four questions where the higher the value, the better the relationship to mathematics was expressed.

In the middle of March 2014, approximately four months after the students finished above mentioned mathematical topics in the winter semester at the Faculty of Economics, the same students participated in the second part of experiment. They wrote the same test and fulfilled the same questionnaire. The conditions did not changed beside the fact that they were regularly encouraged to use ICT tools which were very easy available from the course in CMS Moodle during their study.

Statistical methods

Results of both parts of the experiment were compared using statistical methods. Both descriptive and inductive methods were used to assess results of the didactic tests and the questionnaires and to test the working hypotheses H1 and H2. To process these data the statistical program IBM SPSS Statistics was used.

To compare the results of both knowledge tests each task was scored with 0 or 1 points. The students obtained 1 point if they solved the task correctly or with a small error at most. The final assessment test score is a sum of all the task points, i.e. each student could get from 0 to 6 points.

To describe the results of both tests the counts and percentages for each task were calculated. To calculate the relative frequencies in the percentages of the total number of participating students ($n = 112$) were used, because there was a significant decrease of the respondents between the first and second test, so that results of the second test would be overestimated. The missing results were coded as zero.

To verify the hypothesis H1 the fourfold contingency table (2 x 2) was created for each task (Table 1) and one-sided McNemar test was realized to identify the significant changes between first and second part of experiment.

Fourfold Table		Final Test		Σ
		No	Yes	
Entrance Test	No	*a*	*b*	*a+b*
	Yes	*c*	*d*	*c+d*
Σ		*a+c*	*b+d*	*n=a+b+c+d*

Tab. 1: Fourfold contingency table (Friedrich and Hradecky, 2013: 5-20)

McNemar test is based on the statistic:

$$K = \frac{\left(|b-c|-1\right)^2}{b+c} \tag{1}$$

which has asymptotically χ^2 -distribution with 1 degree of freedom (McNemar, 1947). This test was realized in SPSS (Nonparametric Tests > 2 Related Samples > McNemar).

To verify the hypothesis H2 the nonparametric Wilcoxon signed rank test was used for all the four questionnaire variables. Test works with absolute differences between paired values that are sorted by size and summed into two groups (W+ and W-) according to the

fact whether it is the increase or decrease in value. The test is based on the statistic value:

$$W = \min\left(W+; \mathrm{W}-\right) \tag{2}$$

which has the special W distribution. Its critical values are tabulated or they can be found in statistical programs like SPSS (Nonparametric Tests > 2 Related Samples > Wilcoxon). More detailed information about the used statistical methods can be found in any advanced statistical manual.

Results and Discussion

As it was already mentioned, 112 students took part in the research, including 47 males and 65 females. This reflects the fact that the Faculty of Economics, VSB-TUO has more female students than male ones. Not all students, however, participated in both parts of the research. Some students did not complete the initial test and did not fill out the questionnaire. Only 79 students took part in the second part of the research in March 2014. The specific counts including distribution of men and women are shown in Table 2.

Statistics	Count	Men	Women
participation in the survey	112	47	65
1st test – before the course	108	45	63
entrance questionnaire	103	42	61
2nd test – after the course	79	34	45
final questionnaire	79	34	45

Tab. 2: Student participation in research

The results of each task in the initial test (for all the students together and separately for men and women) are shown in Table 3. It is clear that the graph of the linear function was the most successful task, but even in this case the result is not convincing at all. Similarly the results of the final test in the same structure are displayed in Table 4. Using simple comparison of these tables we can see that there is a significant increase of the success in all the categories. This observation is consistent with the hypothesis H1 that the clarified study materials and appropriate using online calculators and applets enable students to overcome difficulties in mathematics education and to obtain more permanent knowledge.

Task	Together	Men	Women
domain of function	6 (5,4 %)	3 (6,3 %)	3 (4,6 %)
graph of linear function	18 (16,1 %)	9 (19,1 %)	9 (13,8 %)
graph of quadratic function	8 (7,1 %)	4 (8,5 %)	4 (6,2 %)
graph of exponential function	1 (0,9 %)	1 (2,1 %)	0 (--)
arithmetic sequence	4 (3,6 %)	1 (2,1 %)	3 (4,6 %)
differentiation	4 (3,6 %)	1 (2,1 %)	3 (4,6 %)

Tab. 3: The results of the initial test – September 2013

Task	Together	Men	Women
domain of function	48 (42,9 %)	19 (40,4 %)	29 (44,6 %)
graph of linear function	64 (57,1 %)	26 (55,3 %)	38 (58,5 %)
graph of quadratic function	48 (42,9 %)	20 (42,6 %)	28 (43,1 %)
graph of exponential function	21 (18,8 %)	9 (19,1 %)	12 (18,5 %)
arithmetic sequence	51 (45,5 %)	15 (31,9 %)	36 (55,4 %)
differentiation	23 (20,5 %)	10 (21,3 %)	13 (20,0 %)

Tab. 4: The results of the final test – March 2014

The changes between the first and second test of experiment were tested using McNemar test in fourfold table for each task. The results of statistic tests are shown in Table 5. We can see that there is a significant change between both parts of experiment for all six tasks (asymptotic significance < 0,05). Therefore we can say that hypothesis H1 is accepted.
To describe the questionnaire results before and after mathematical course the medial values for answer scales were calculated for all four questions. The results are shown in Table 6. We can see that students consider the mathematics rather necessary for economics study in spite of the fact that the subject is difficult for them.

Test Statistics

	Chi-Square	Asymp. Sig.
Task 1	38,205	,000
Task 2	36,161	,000
Task 3	36,214	,000
Task 4	18,050	,000
Task 5	41,490	,000
Task 6	14,087	,000

Tab. 5: The results of the tests comparison

	Medial values	
	before the course	after the course
performance of mathematics	difficult (2)	difficult (2)
interest of mathematics	neutral (3)	neutral (3)
necessity and usefulness	rather necessary (4)	rather necessary (4)
use of computer programs	rarely (2)	sometimes (3)

Tab. 6: The questionnaires results

Although there are no significant changes in measured level of first three answers (the medial values is the same), we can found some significant changes in structure of answers which may be interesting for further analyses. The correspondence analysis can be used to solve this problem but this topic is beyond the scope of our paper. Authors' impact on correspondence analysis used to describe relation between categorical variables can be found for example in Suchacek, Seda and Friedrich (2013).

To confirm the hypothesis H2 Wilcoxon test was performed for all questions from the questionnaire before and after completion of the mathematical course. The results of the tests are shown in Table 7.

Test Statistics

	W	Asymp. Sig. (2-tailed)
performance of mathematics	48,0	,772
interest of mathematics	175,0	,139
necessity and usefulness	246,0	,511
use of computer programs	345,5	,000

Tab. 7: The results of questionnaires comparison

The change in the first three answers in the questionnaire is not significant (Sig > 0,05). It means that the students' attitude towards mathematics did not change during one semester. It is quite clear that after many years of negative experiences with mathematical education it is impossible to change students´ attitude towards mathematics during one semester. There is only one question in which the results were significantly changed during the mathematical course. It is the use of online calculators and computer programs in mathematical calculations which was significantly changed in favour of these programs.

Conclusion

We can claim that both the working hypotheses H1 and H2 can be accepted. While the hypothesis H1 about the positive influence of modern mathematics educational methods to students' knowledge was confirmed in all six tasks in the control test, the hypothesis H2 had significant change "for the better" only in one question concerning the use of computer programs in mathematics. Remaining answers did not confirm any significant change in the students´ attitude towards mathematical education.

We were very surprised with students´ positive opinions on usefulness of mathematics to their economic studies. At the beginning as well as in the end of our experiments students mostly evaluated the mathematics to be rather useful for economic studies. Therefore it should be the stimulus to teachers to pay attention to this opinion and take greater responsibility for mathematical teaching.

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KNOWLEDGE SHARING IN THE FIELD OF HIGHER EDUCATION IN THE CZECH REPUBLIC

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Abstract

Nowadays universities are expected to play crucial role in the process of knowledge creation, development and sharing. To meet these expectations universities are required to have an active approach to manage the knowledge. This paper discusses the area of knowledge acquisition and sharing in the field of higher education in the Czech Republic. The main objective is to identify the approaches of Czech universities to knowledge sharing. The study focuses on methods of employees' knowledge development, environment and tools that support knowledge sharing as well as on the importance of this process. Presented conclusions are based on questionnaire survey among rectors, vice-rectors for strategies and development and chancellors.

Keywords

Higher education, universities, employee training and development, tacit knowledge, explicit knowledge, knowledge sharing

Introduction

The Lisbon agenda calls for efforts from a wide range of players. These include the universities that have a particularly important role to play. This is because of their twofold traditional vocation of research, teaching and their increasing role in the complex process of innovation, alongside with their other contributions to economic competitiveness and social cohesion (Commission of the European Communities, 2003).

Key activities of the universities are associated with creation and dissemination of knowledge as well as learning (Rowley, 2000). According to Letiner (2002) universities and research organisations are confronted with specific challenges: new public funding mechanism and greater autonomy; competition for grants and research contracts; measurement and evaluation of outputs intangible by nature; increasing demand for strategic development and systematic management of their most valuable resources, which are their intangibles; general call for accountability and transparency.

Universities and their staff have to recognize and respond to their changing role in a knowledge based society. Universities need to be consciously and explicitly managing the processes associated with the creation of their knowledge assets (Rowley, 2000). For this reason according to Psarras (2006), knowledge management is absolutely necessary to universities. The relevance and importance of knowledge sharing for the field of higher education could be also proved by current publications (Hou, Sung and Chang, 2009; Howell, Annansingh, 2013; Li et al, 2014).

In knowledge age an organisation is one that learns, remembers, and acts based on the best available knowledge (Dalkir, 2005). Although knowledge is described as the only meaningful economic resource in the knowledge society (Drucker, 1993), there are many barriers that prevent knowledge sharing (Riege, 2005). And also many organisations are

unable to function as knowledge based organisations, because they suffer from learning disabilities (Senge, 1990).

Knowledge management is the deliberate and systematic coordination of an organisation´s people, technology, processes, and organisational structure in order to add value through reuse and innovation. One possible way to achieve this is by creating, sharing and applying knowledge (Dalkir, 2005). According to Nonaka and Takeuchi (1995), there are 2 basic types of knowledge. According to its availability, knowledge can be either tacit or explicit. Explicit knowledge is formal and systematic. It can be easily communicated and shared. Typically, it has been documented. Tacit knowledge is not so easily expressed. It is highly personal, hard to formalize and difficult to communicate to others.

The main objective of this study is to identify the approaches of Czech universities to acquire and share knowledge. In the backdrop of this, the presented research study aims to determine the importance that universities attach to knowledge sharing and methods used to spread explicit as well as tacit knowledge among academic staff. To achieve these objectives secondary as well as primary data will be used.

Materials and Methods

Literature review was used in order to create a short review of the current state in the explored area. The paper refers to significant sources, particularly scientific journals and books.

The study was conducted via online survey that was administered in a tertiary educational institution in the Czech Republic. The population consisted of all Czech universities (public, private and state universities). A sum of 77 questionnaires was distributed (28 public, 2 state and 47 private universities). The rectors, vice-rectors for strategies and development, chancellors and others responsible for the preparation of annual reports and development of a university were selected as participants. To achieve participants' convenience online survey software was used to construct a user-friendly questionnaire. The terms (as Communities of practice, Knowledge networks, Knowledge database, Retrospect, Storytelling etc.) which could be confusing for respondents were provided with definition.

Out of 77 questionnaires distributed in total, 17 questionnaires were returned. The overall response rate was 22%. The survey was attended by 10 public universities, as well as 5 private universities and 2 state universities. The questionnaire was structured into several sections. The knowledge sharing strategy part had 8 questions, for 6 of them 6-point scale was used. The respondents were asked to measure the respondent's attitude ranging from (1) strongly disagree to (6) strongly agree. Other 2 questions were multiple choice options.

Results and Discussion

Training and development programs provided by the employer are one of the basic options how to ensure professional growth of employees. Therefore, respondents were asked about the approach used in their organisation. They were provided with following options –traditional methods (e.g. participation on conferences, workshops, case studies, task delegation) as well as other methods (such as mentoring, coaching, consulting or learning from one another) that are considered to have significant potential in terms of transmission of implicit and tacit knowledge (Mládková, 2005, 2008).

Result shows (see Tab. 1) that universities mostly use traditional methods. As expected based on character of researched organisation (universities) the most frequented approach is participation on conferences.

Used training and development methods	Abs.	Pct. [%]
Participation on conferences	16	94.12
Meetings	14	82.35
Consulting	12	70.59
Workshops	12	70.59
Make responsible for a task	11	64.71

Tab. 1: The most applied training and development methods

Frequency of the answers shows that universities are mainly concerned on transfer of explicit knowledge. Only 1 out of the 5 most frequent options (consulting) has higher potential for transfer tacit knowledge.

Fig. 1 shows usage of methods that support transfer of tacit knowledge. In contrast to more traditional methods such as participation on conferences or meeting, the other approaches are not as widely used. This not only potentially reduces the transfer of tacit knowledge but also is partially in conflict with the opinion of the respondents who stated that learning is a social process (64.71%). Thus, learning takes place in interaction with other people within social networks rather than individually (Lave and Wenger, 1991).

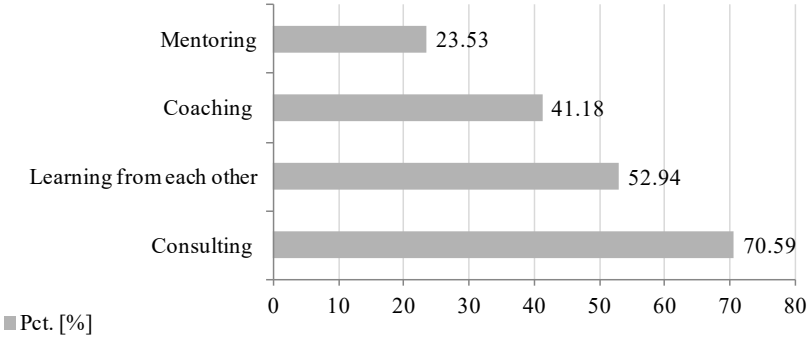

Fig. 1: Tacit knowledge transfer tools

Regardless to the used methods, all respondents confirmed that their university has defined the approach to knowledge development of the employees. In accordance with this assumption, majority of the respondents (82.35%) stated that knowledge sharing is one of the key elements for the creation of competitive advantage of the university. Only 3 (17.65%) disagree with this statement. This finding is also supported by other results. For example, only one respondent stated that the university does not have a strategy for knowledge sharing. The results of the study also show that the universities seek to create an environment that encourages knowledge sharing (see Tab. 2).

Used training and development methods	Abs.	Pct. [%]
The collaborative working environment	13	76.47
The environment that allows the emergence of networks	13	76.47
The IT infrastructure that support knowledge sharing	13	76.47
The reward system that support knowledge sharing	10	58.82

Tab. 2: Environment that support knowledge sharing

Majority of them (76%) tries to establish collaborative rather than competitive working environment, where knowledge sharing seems less likely to occur (Riege, 2005). The same percentage of respondents assumes that the environment at their university allows connection of people with common interests, problems, challenges, etc. (thus, the emergence of networks). The situation is similar in the case of IT infrastructure (such as knowledge database, intranet, groupware, workflow, search patterns or intelligent agents). However, the responses were less positive in the case of the reward system. According to the respondents, only about half of the universities have the reward systems that support knowledge sharing.

Respondents were offered a range of basic tools to facilitate knowledge sharing (Chen, Sandhu and Jain, 2009; Riege, 2005) that consisted of communities of practice, knowledge networks, knowledge database, retrospect and storytelling. In addition, respondents were provided with the possibility to add other tools. However, this option was not used.

Communities of practice –'groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly' (Lave and Wenger, 1991).

Knowledge networks – 'more formal and structured team based collaboration that focuses on domains of knowledge that are critical to the organisation which is part of their standardized job' (UNFPA, 2003).

Knowledge database – capture and storage of published articles, case studies, dissertations, textbooks, books or book chapters, technical reports, etc. In a single database accessible to the employees.

Retrospect – 'an in-depth discussion that happens after completion of an event, project or an activity to basically capture lessons learnt during the entire activity' (Faul and Kemly, 2004).

Storytelling – 'a story telling session whereby the person who attends an event or training session is given the opportunity to disseminate the information/knowledge gained to others within the organisation' (Faul and Kemly, 2004).

Of those respondents who declared the existence of a knowledge sharing strategy, the highest number (64.71%) reported that their strategy is based on support of communities of practice and knowledge networks. About half of the universities (47.06%) have knowledge database to support knowledge sharing. With a significantly lower frequency (23.53% resp. 17.65%), respondents chose the storytelling and retrospect (see Fig. 2).

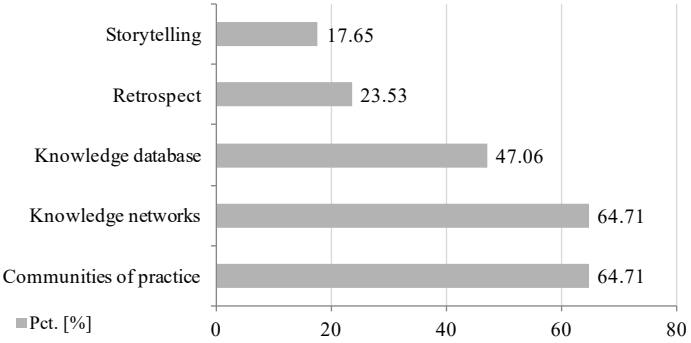

Fig. 2: Knowledge sharing tools

Conclusion

The results show that Czech universities are aware of the importance of knowledge and its sharing. They use wide range of methods for employee training and development as well as various tools for knowledge sharing and dissemination. Universities also facilitate this process by creating environment that support knowledge sharing. Nevertheless, certain issues emerge during the research, such as overuse of traditional training approaches or absence of reward system that supports knowledge sharing.

The dominance of traditional training and development methods suggests that sharing of implicit and tacit knowledge might be limited in field of higher education in the Czech Republic. The impact of the issue is multiplied by the fact that traditional methods usually require more resources to obtain comparable results, then approaches that support transfer of tacit knowledge. The other advantage of the neglected methods, such as mentoring, coaching or participating in some type of network (e.g. communities of practice or knowledge network), is the possibility, that they can be carried out on the job which is considered to be one of the most natural ways to learn.

Another issue is connected to the current reward systems which total of 41.18 % of the sample indicated to be irrespective to knowledge sharing. As some authors (Chen, Sandhu and Jain, 2009; Lee and Ahn, 2007) have suggested, the most effective method to promote knowledge sharing is to link it with rewards and performance appraisal, it could pose a significant barrier.

The last issue is related to the information technology and its usage. Although majority of the respondents declared that their university has a sufficient information infrastructure to support knowledge sharing process, only about half of them is actually using knowledge database accessible to employees.

Based on these findings, future research will be focused on the area of tacit knowledge sharing amongst academics in the Czech universities.

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AUTOMATION OF RICH-MEDIA RECORD PRODUCTION USING PETRI NETS THEORY

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Abstract

Rich-media describes a broad range of digital interactive media that is increasingly used in the Internet and also in the support of education, where the complex visualization of the educational process becomes the necessity for the overall transfer of information from teacher to students. MERLINGO project (MEdia-rich Repository of LearnING Objects) is aimed at the building of the central repository of multimedia learning objects containing teachers' presentations. Last year, a special pilot audio-visual lecture room was built as a part of this project solution. It contains all the elements of the modern lecture room determined for the implementation of presentation recordings based on the rich-media technologies and their publication on-line or on-demand featuring the integrated ergonomic and intuitive control and access of all its elements in the automated mode including automatic editing. The Petri nets theory was significantly applied at the design, verification, simulation and implementation of the parallel algorithms ensuring this lecture room functionality.

Keywords

Rich-media, Petri nets, MERLINGO, automatic editing, lecture room

Introduction

The term *rich-media* describes a broad range of digital interactive media, through which it is possible to share and transfer information and communicate in various ways. Moreover, rich-media enable interactivity, i.e., bidirectional communication. The characteristic feature of the rich-media technologies is their accessibility on-line or on-demand, followed by the support of the dynamics of changes. An example can be online streaming video reporting, which is updated during broadcast, or a record of presentation placed on a web site jointly with the synchronized slide show, which the user can interactively work with. Currently, there are several theories dealing with various aspects of the rich-media implementation, such as *Media Richness Theory* (Daft, 1986), *Media Naturalness Theory* (Kock et al, 2008) and *Social Presence Theory* (Short et al, 1976).

The issue of majority aspects in implementing rich-media technologies at selected universities in the Czech Republic is dealt with in the MERLINGO project (*MEdia-rich Repository of LearnING Objects*) (MERLINGO, 2014).

One of the key objectives of this project last year was the implementation of the cutting edge rich-media technologies in order to build a specialized audio-visual lecture room containing all the elements of a modern lecture room determined for the implementation of presentation recordings and their publication on-line or on-demand featuring the integrated ergonomic and intuitive control and access in the automated mode of all its elements including automatic editing. Next objective was to provide a possibility of parallel sharing and feed-back of lectures presented in the lecture room outfitted as such in real time even

at other audio-visual auditoriums while providing the services of the central repository of educational objects MERLINGO and the possibility of their adaptation for the students with special needs (Martiník, 2013). The implementation of those functionalities significantly contributed in decrease of costs required for the operation of high-capacity lecture halls including reduction of time and space demands mainly required for teaching subjects determined for large groups of students. Currently, the operation of the central repository MERLINGO dramatically simplifies the implementation of the new revolutionary technologies *EduArt* (EduArt, 2014) and *MediaInTouch* (MediaInTouch, 2014), featuring unique characteristics in this area complying with demanding requirements of teachers in the availability and quality of presentation recordings.

The P/T Petri nets theory (Kordic, 2008), (Diaz, 2009), (Reisig and Rozenberg, 1998) has been applied at the design, verification, simulation and implementation phases of software support of the audio-visual lecture room enabling automated recordings of the presentations including automated editing.

Materials and Methods

P/T Petri Nets with Priorities

Let $\boldsymbol{N}$ denotes the set of all natural numbers, $\boldsymbol{N_0}$ the set of all non-negative integer numbers, Æ the empty set and $|A|$ the cardinality of given set A.

P/T Petri net with priorities (PNP) is an ordered 6-tuple $PTNP = (P, T, A, AF, TP, IF)$, where P is a finite non-empty set of **places,** T is a finite set of **transitions**, disjoint from P (i.e., $P \cap T = \emptyset$), A is a finite set of **arcs** (flow relation), $A \subseteq (P \times T) \cup (T \times P)$, AF is the **arc function**, $AF: A \rightarrow \boldsymbol{N_0}$, $AF(x, y) \in \boldsymbol{N}$ iff $(x, y) \in A$, $AF(x, y) = 0$ iff $(x, y) \notin A$, TP is the **transition priority** function (with the default value of 1), $TP: T \rightarrow \boldsymbol{N}$, and IF is the **initialization function** (initial marking), $IF: P \rightarrow \boldsymbol{N_0}$.

PNPs represent a popular formalism connecting advantages of the graphic representation of a modeled system with possibilities of its simulation and the formal analyzability. The system is then described with a bipartite graph containing a finite non-empty set of places P used for expressing of the conditions of a modeled system (we usually use circles for their representation), a finite non-empty set of transitions T describing changes in the system (we usually draw them in the form of rectangles), a finite set of arcs A being principally oriented while connecting the place with transition or transition with place and we usually draw them as lines with arrows, the arc function AF assigning each arc with a natural number (such number has the default value of 1, if not explicitly indicated in the net diagram) expressing the number of removed or added tokens from or to the place associated with that arc when executing a particular transition, priority TP of each transition (again such priority has the default value of 1, if not explicitly indicated in the net diagram) and the initial marking IF expressing the initial status of the modeled system with so called **tokens** considered as mutually unidentifiable and we usually represent them in the form of small circles in particular places of the net. Initial marking is then vizualized as $IF(p)$ tokens in place p ($p \in P$).

Some commonly used notations for PNPs are $\bullet y = \{x \mid (x, y) \in A\}$ for the **preset** and $y\bullet = \{x \mid (y, x) \in A\}$ for the **postset** of a net element y (i.e., place or transition). **Marking** M of the PNP $PTNP$ is a mapping $M: P \rightarrow \boldsymbol{N_0}$. Marking M then express the current status of the modeled system. If $P = \{P1, P2, \ldots, Pn\}$, where $n = |P|$, marking M can then be written as a vector $(M(P1), M(P2), \ldots, M(Pn))$.

As it has been stated, with PNPs not only the current status of the modeled system can be detected, but dynamics of transitions between its individual states, too. Transition t Î T is **enabled** in the marking M of the PNP *PTNP* if at each input place of the transition t is in the marking M at least as many tokens as required by the value of the arc function AF of the particular input arc of the transition i.e., if " $\forall\, p \in \bullet t$: $M(p) \geq AF(p, t)$. If transition t is enabled in the marking M of the *PTPN,* we denote that fact symbolically in the form of t ***en*** M. **Firing of the transition** $t \in T$ itself consists in the removal of as many tokens from each input place of the transition t as required by the value of the arc function AF of the particular input arc of the transition t, and adding of as many tokens into each of the output places of the transition t as required by the value of the arc function AF of the particular output arc of the transition t i.e., it results in changing the marking M into the marking M', where " $\forall\, p \in P$: $M'(p) = M(p) - AF(p, t) + AF(t, p)$, that is denoted by $M\,[t\rangle\, M'$. The set of all markings reachable from the marking M we will denote by the symbol $[M\rangle$.

When enabling individual transitions of given PNP so called **conflicts** can originate in its certain markings (or **conflict transitions**). At the enabling of transitions t_1 and t_2 of the given net in its marking M the conflict occurs, if both transitions t_1 and t_2 have at least one input place, each of the transitions t_1 and t_2 is individually enabled in the marking M, but the transitions t_1 and t_2 are not in the marking M enabled in parallel and enabling of one of them will prevent enabling the other (i.e., $(\bullet t_1 \cap \bullet t_2 \neq \emptyset) \wedge (t_1$ ***en*** $M) \wedge (t_2$ ***en*** $M) \wedge \neg(\{t_1, t_2\}$ ***en*** $M)$) The term of conflict transitions can be obviously easily generalized for the case of finite set $t_1, t_2, \ldots, t_n$ ($n \in \mathbb{N}$) of transitions of given PNP.

A typical example of the conflict transitions in the particular marking of the PNP is shown in Fig. 1, where the transitions T1 and T2 have the common input place P1, both are enabled, but not enabled in parallel. When solving such transitions conflicts we will therefore follow the rule which determines, informally said, that from the set of conflict transitions the one will be enabled, whose value of transition priority function *TP* is the highest. If such transition from the set of conflict transitions does not exist, the given conflict would have to be solved by other means. In our studied example will be then on the basis of that rule the transition T2 enabled (because $TP(T1) = 1$ and $TP(T2) = 2$).

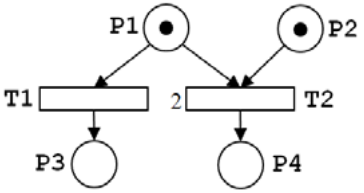

Fig. 1: Conflict transitions in PNP

Audiovisual lecture room with the automatic editing system

Within the MERLINGO project implementation the selected standard audio-visual lecture room was additionally outfitted with the automated editing system consisting of three good quality cameras **Sony BPE NEX-FS100EK** series with the **object lens E18-200mm** to eliminate the problem of insufficient lighting in lecture rooms during recording (see Fig. 2), followed by editing unit **Roland VR-5** including three spatial microphones **Roland R-26** and control system with motion sensors of **AMX 3100** line with converter **RS232/MiDi**. That system ensures editing of video and audio signal read by the camera and microphone in the sectors where the lecturer is moving.

Additionally, this audio-visual lecture room has been outfitted with the programming system *EduArt* enabling transfer of image (video) of the scanned person and transfer of presentation from the work station, interactive board, visualizer and sound in the high resolution via the computer network of the sufficient bandwidth. The output is a recording viewable by the web browser. The integration of the whole unit is ensured by the control system of the **AMX** product line automated in such manner that the lecturer can concentrate on the context of their message and does not need to pay attention to control of presentation tools and means for the recording and transfer of the presentation into the resources of the central repository MERLINGO. There is no need for other persons to make a recording which is a cost saving feature and additionally, the lecturer is not disturbed by them.

Fig. 2: Cameras of Sony BPE NEX-FS100EK line

For the realization of the automated editing were selected and implemented three basic types of shots:

- *detail* - lecturer (one or more) standing by the speaker´s desk - see Fig. 3,

Fig. 3: Shot of *detail* type in audio-visual lecture room

- *board* - lecturer (one or more) are found in the zone of the board or in the zone between the speaker´s desk and board,
- *general view* - lecturer (one or more) are found outside the shot *detail* or *board* - see

Fig. 4.

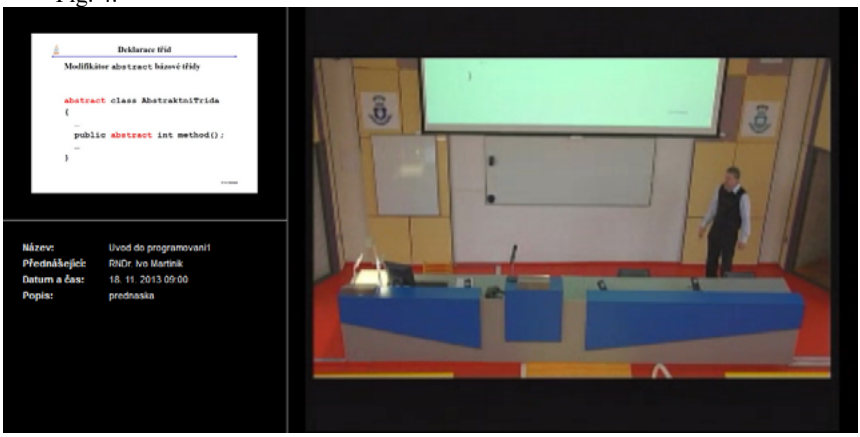

Fig. 4: Shot of *general view* type in the audio-visual lecture hall

Results and Discussion

Design and implementation of the parallel algorithm which realizes the automatic switching of the camera systems and the automatic editing functionality during recordings of presentations in the audio-visual lecture room involved the use of P/T Petri net with priorities formal theory. The simplified PNP model of the given algorithm is shown in the Fig. 5 (a more detailed model is much more complicated and for its design was used the theory of timed P/T Petri nets with priorities (Popova-Zeugmann, 2013)).

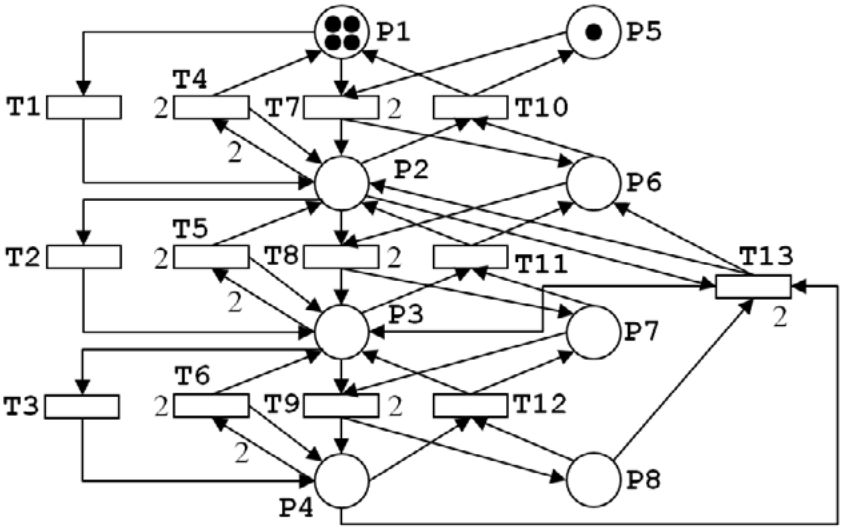

Fig. 5: PNP representing mechanism of automated editing

The place P1 of the net represents camera non-shot space of the audio-visual lecture hall and its tokens then represent individual lecturers who are about to enter to the shot of the *general view* type represented by the place P2. The scanned shot of the *board* type is represented by the place P3 and shot of the *detail* type by the place P4. The place P5 represents the condition when all the cameras are switched off, the place P6 the condition when the shot of the *general view* type is actively scanned, the place P7 the condition when the shot of the *board* type is actively scanned and the place P8 the condition when the shot of the *detail* type is actively scanned. The net is shown in Fig. 5 in its initial marking $M_0 = (4, 0, 0, 0, 1, 0, 0, 0)$, in which the transition T7 can fire because of its value of the transition priority $TP = 2$. Firing of this transition represents entry of one lecturer into the shot of the *general view* type and switch-on of the relevant camera scanning that shot. By firing the transition T7 the net will come into the marking $M_1 = (3, 1, 0, 0, 0, 1, 0, 0)$ (i.e., M_0 [T7ñ M_1). Next lecturers can then enter the shot of the *general view* type only by firing the transition T1 which will not cause re-switching of the relevant camera, or to leave that shot by firing the transition T4, which will not lead to this camera switch-off. If there is just one lecturer in the shot of the *general view* type (i.e., one token in the place P2) and in no other shot (i.e., in the place P3 representing the shot of the *board* type or in the place P4 representing the shot of the *detail* type) no other lecturer appears, the last lecturer will leave the shot of the *general view* type by firing the transition T10, which will also take care of the relevant camera switch-off. Similar philosophy for entering and leaving the shot by the lecturer and accompanying switching-on and off the relevant camera is also applied even in shots of the *board* type (place P3) and the *detail* type (place P4).

An important part of the whole system is a mode of the shot priority while the lecturer in the shot of the *detail* type by the speaker´s desk has such priority of the shot that if other person/persons enter the shot of the other cameras the shot remains unchanged. Moreover it applies, that if the lecturer leaves the shot of the *detail* type and in the shot of *general view* type at least one person is present, the camera will switch to the shot of the *general view* type despite the situation that in the shot of the *board* type at least one lecturer is present. Both situations described are shown in the marking of PNP in Fig. 6. The lecturer in the shot of the *detail* type (represented by the token in the place P4) has the highest priority and the camera (represented by the token in the place P8) is actually scanning him/her. If the stated lecturer leaves the shot of the *detail* type, the transition T13 with the priority value $TP = 2$ is then fired (because in the shot of the *general view* type represented by the place P2 are present lecturers) and the camera scanning the shot of the *general view* type switches on (this camera will be then represented by the token in the place P6, i.e., (0, 2, 1, 1, 0, 0, 0, 1) [T13ñ (0, 2, 2, 0, 0, 1, 0, 0)).

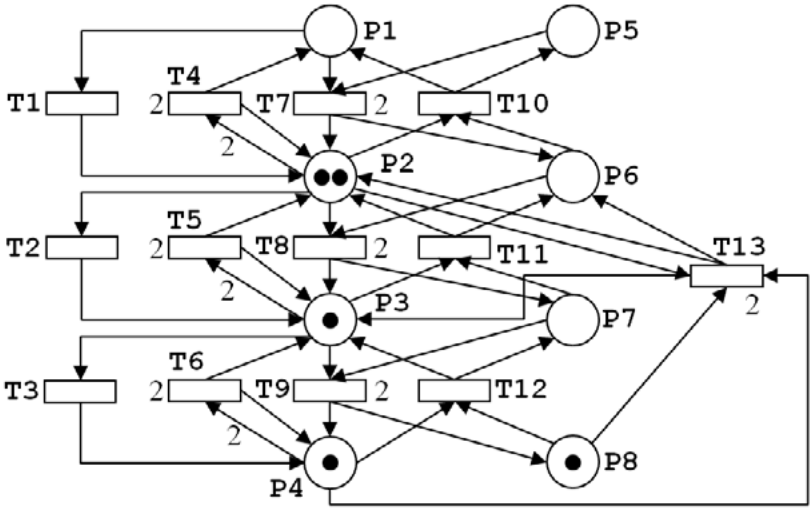

Fig. 6: PNP representing automatic editing mechanism

Conclusion

At the Faculty of Economics, VŠB-Technical University of Ostrava, the recordings of presentations were realized with the support of highly mentioned lecture room with the support of the automated editing and the comprehensive collections of the following subjects are available: Informatics A (1st year of Bachelor studies), Informatics B (1st year of Bachelor studies), Distributed Systems (2nd year of Master studies of Applied Informatics) and Basic Programming (2nd year of Bachelor study discipline of Applied Informatics). The rich-media recordings were published through the *MediaInTouch* programming system that is also integrated with the LMS system *Moodle* in the present time. This integration is based on the presence of the accessibility of the *MediaInTouch* application programming interface based on the web services technology. Thus it is possible to enable (i.e., insert or share) the recordings of presentations from the *MediaInTouch* repository as the organic part of every eLearning course content in the *Moodle* environment. The recordings are such then also the part of the study materials for the mentioned subjects in the Bachelor and Master studies in the *Moodle* environment.

The lecture room with the support of automated editing enables *all-day fully automated* realization of all presentation recordings in the present time. There is then significant financial, personal and time cost reduction joined with the creation and management of rich-media learning objects in comparison of the usual ways of recording. There is also verifiable improvement of the study results of the students (and particularly of the students with special needs) in the context of the availability of the presentation recordings and their accessibility on-line or on-demand as the standard part of the virtual university resources.

Those technologies can be also crucially beneficial during qualitative extension of provided services for the students with special needs, mainly at the establishment of "barrier-free" information access to recordings of presentations adapted to needs mainly for students with locomotive, visual aural disability while using internationally valid

standards. *EduArt* and *MediaInTouch* programming systems are also extensively applied at the practical application of the methodology of adaptation of existing and newly created learning objects which are adapted for students with special needs. The main results achieved in this area currently involve:

- Technical solution of the parallel recording of translation of the lecturer into the sign language and text form. The programming implementation of the stated feature is based on the addition of next video stream containing translation of the lecturer into sign language, or text form in the resulting record and their synchronizing with performed presentation.
- The transcription of standard eLearning text study supports in the audio form and their availability obtained via podcasting as a part of the MERLINGO portal services.
- Automated transcription of spoken text of the lecture recorded by the recording and assistance service into the written text.

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PERCEPTIONS OF PRE-SERVICE LANGUAGE TEACHERS UPON THE DEVELOPMENT OF THE PEDAGOGICAL COMPETENCES

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Abstract

The aim of this study consists in identifying the perceptions of future language teachers regarding the development of the pedagogical competences at the level of the training programmes. The analysis of current studies reveals important and various results related to the perceptions of the pre-service language teachers. The objective of this study consists in the exploration of the perceptions of pre-service language teachers from the Romanian education concerning the development of the pedagogical competences at the level of the training programmes. An interview was applied to 95 students in the second and third academic year. The research results highlight the successful aspects in terms of the development of the pedagogical competences, according to the perception of future language teachers.

Keywords

Pre-service language teachers, interview, pedagogical competences, perceptions

Introduction

The investigation of the perceptions of future language teachers regarding the different aspects involved in the training programmes represents a necessity before initiating a new study. The analysis of different studies in this field provides researchers with a holistic perspective upon the methodologies used, results and, especially, the least studied aspects that need to be explored.

In Table 1, we have presented an integrative analysis of the current research based on the identification of the perceptions of future language teachers. There are highlighted different categories of research reference related to the specific domain of the interest object of pre-service language teachers' perceptions:

- *didactics*, to identify the conceptions in terms of the specific component of teaching language and literature: subject knowledge (Woodgate-Jones, 2006); teaching writing in English (Nguyen et al., 2008); professional education training regarding English language learners (Lo, 2011); presentation of the main language skills in a course book (Aydin, 2012); teaching grammar (Kaçar and Zengin, 2013); literacy practices (O'Neill and Geoghegan, 2011; Masuda and Ebersole, 2013); bbbbbc
- *psychological*, to determine the perceptions toward various components: problem solving skills (Aslan, 2007); the relationship between multiple intelligences and foreign language learning (Savas, 2012); s*elf-efficacy and anxiety* (Fatih and Demet, 2012);
- *technological*, to investigate the opinions regarding the different technological tools used in language teaching: academic blogging (Al-Hebaishi, 2005); asynchronous discussion board (Ajayi, 2009); the practice of e-portfolios in teacher education (Chien, 2012); digital story production (Latiff and Daud, 2013);
- *intercultural*, to assess the attitudes toward the different cultural factors: the impact of

cultural religious values (Gellel and Buchanan, 2011); dialects that students may speak in the classroom (Champion, 2012); intercultural communicative competence (Olaya and Gómez Rodríguez, 2013);
- *pedagogical*, to explore the representations upon curriculum components: instructional strategies (Lo et al., 2010); model of teaching practicum (Yan and He, 2010).

Categories	Authors	Components	Methodology
Didactics	Woodgate-Jones, (2006)	subject knowledge	- 18 teacher education institutions; - questionnaires and focus groups - potential benefits and difficulties
	Nguyen et al. (2008)	teaching writing in English	- 97 pre-service teachers; - open-ended questionnaire; - the motivation to learn to teach English
	Lo (2011)	professional education training regarding English Language Learners (ELL)	- 12 participants; - semi-structured individual interviews; - different views toward their overall training for ELL students
	O'Neill and Geoghegan, (2011)	literacy teaching and learning	- 67 pre-service teachers; - survey; - a sufficient level of knowledge of the English language to teach literacy
	Aydin (2012)	the presentation of the main language skills in a course book	- 48 pre-service teachers of English; - questionnaire; - positive perceptions of the presentation of main skills, problems in terms of speaking skills
	Kaçar and Zengin (2013)	grammar teaching	- 44 pre-service teachers of English; - questionnaire; - the active role in the teaching process
	Masuda and Ebersole (2013)	literacy practices	- 70 participants; - literacy log, literacy reflections; - the influence of the complexities of the dominant school-based literacies upon teaching practices
Psychological	Aslan (2007)	problem solving skills	- 27 pre-service Turkish teachers; - Problem Solving Inventory; - the subject's good level of problem solving skills
	Savas (2012)	the relationship between multiple intelligences and foreign language learning	- 160 pre-service English language teachers; - the use of all intelligence types in the process of foreign language learning
	Fatih and Demet, (2012)	*self-efficacy and anxiety*	- 90 pre-service teachers; - Turkish versions of the Teachers' Sense of Efficacy Scale; - Foreign Language Teaching Anxiety Scale

Technological	Al-Hebaishi (2005)	academic blogging in higher education institutions	- 38 ELT pre-service teachers; - questionnaire and semi-structured interviews; - positive attitudes towards blogs in various terms and perceived
	Ajayi (2009)	asynchronous discussion board (ADB) as a technology tool for learning to teach skills in teaching reading to bilingual elementary students	- 33 pre-service teachers; - oral interviews, written reflections, and participants' postings on the discussion board; - the positive perceptions towards ADB, as an important tool of learning to teach
	Chien (2012)	the practice of e-portfolios in teacher education	- 16 pre-service English teachers; - observation notes, and reflective notes; - the role of the implementation of e-portfolios in teacher education programmes
	Latiff and Daud (2013)	the integration of elements of humour in digital stories	- 25 ESL pre-service teachers; - questionnaire survey; - the appreciation of the opportunity given to them to create the story
Intercultural	Gellel and Buchanan (2011)	the impact of cultural religious values	- pre-service teachers; - comparative study; - the similarities and differences between their perceptions of the role of a teacher in a Catholic school
	Champion et al. (2012)	the attitudes toward African American Vernacular English of pre-service teachers in a multicultural, undergraduate education course	- 136 pre-service teachers; - Language Attitude Scale (LAS); - training of pre-service language teachers depends on the different dialects of English that students may speak in the classroom
	Olaya and Gómez Rodríguez (2013)	cultural content and intercultural communicative competence	- 3 pre-service English teachers; - qualitative research; - the lack full understanding of intercultural competence
Pedagogical	Lo et al. (2010)	instructional strategies	- pre-service teachers; - survey, semi-structured individual interviews - strategies based interaction, student-centered approach, communication
	Yan and He (2010)	model of teaching practicum	- 210 student teachers; - reflective paper-writing; - the need to transform the existing model of teaching practicum

Table 1: The current research focused on the exploration of the perceptions of pre-service language teachers

As a result of the analysis of studies regarding the perceptions of pre-service language teachers, it was found that there prevails the research focused on investigating the opinions regarding the didactic components of pre-service language teacher education. In contrast, there is very little research based on exploring the perceptions of prospective teachers

upon the pedagogical aspects of their training.

Methodology

Objective

The main objective of the research consists in the identification of the perceptions of pre-service language teachers from the Romanian education concerning the development of the pedagogical competences at the level of the training programmes.

Method

The open questions for the interview guide aimed at the following aspects related to pre-service language teachers:

- What are the successful aspects of the discipline of Pedagogy related to the development of pedagogical competences, at the level of the initial training programmes?
- What are the successful aspects of the discipline of Didactics related to the development of pedagogical competences, at the level of the initial training programmes?

Procedure

The interview was organized in November 2013. It was applied to 95 students in the second and third academic year from two universities of Romania ("Vasile Alecsandri" University of Bacau, "Al. I. Cuza" Iasi). The interviews were conducted in a comfortable environment where seats were carefully arranged. The registrations were transcribed and encoded, and the data analyzed and interpreted.

Results and discussions

In order to analyze the results, we have applied the thematic content analysis.
Related to the successful aspects regarding the development of the pedagogical competences at *Pedagogy* subject at the level of the initial training programmes, the answers of students have highlighted different themes (Table 2).

Aspects	Frequency
Becoming consistent with, acquiring and developing/ deepening pedagogical concepts	23
The efficient teaching style of the trainer	14
Building and developing the skills needed to apply pedagogical competences efficiently	13
Building competences in using the teaching methodology	10
The trainers' favourable attitude; Building the ability to adapt pedagogical competences to various contexts	3
The use of modern training means; the practical building of competences based on stimulations and practice; building competences of teaching design; building and developing competences in formulating operational objectives; the efficient achievement of the evaluation of pedagogical competences	2

Providing theoretical support; building and developing competences in using curricular documents; building the teacher's efficient teaching style; the presence of appropriate training material basis; building competences in using teaching means; correlating theory and practice	1

Table 2: The successful aspects of the discipline of *Pedagogy* related to the development of pedagogical competences, at the level of the perceptions of pre-service language teachers

Regarding the successful aspects of the discipline of Didactics related to the development of pedagogical competences, at the level of the initial training programmes, the students' answers have highlighted different themes (Table 3).

Aspects	Frequency
Building and developing competences in lesson design	10
Acquiring and developing/ deepening theoretical concepts	9
Building the teacher's efficient teaching style	7
Predomination of practical activities, practicing competences and applying theory	6
Building and developing competences in using the teaching methodology	5
Using diverse training methods	4
Correlating the evaluation of pedagogical competences with the evaluation criteria from the teacher tenure examination; using modern training means; building competences in using school documents; correlating the building of pedagogical competences with the didactic ones; building and developing the skills needed in applying pedagogical competences efficiently	2
Building the ability to adapt pedagogical competences to various contexts (classroom reality); the trainers' favourable attitude; correlating theory and practice; the trainer's efficient teaching style; building competences in using teaching means	1

Table 3: The successful aspects of the discipline of Didactics related to the development of pedagogical competences, at the level of the perceptions of pre-service language teachers

The results show that for the subject of Pedagogy there prevails theoretical training, whereas for the discipline of Language and Literature Didactics there prevails practical training.

Conclusion

The research results indicate the most important successful aspects appreciated by language teachers regarding the development of pedagogical competences at the level of training programmes. At the *pedagogical* level, in the perceptions of the pre-service language teachers, there are cognitive aspects related to the familiarization, acquisition and development/ deepening of pedagogical concepts, whereas in terms of *didactics*, there are mentioned practical aspect regarding the building and development of lesson planning skills.

Both the pedagogical and didactics aspects from the initial teacher programmes are essential for a successful training of future language teachers. Conducting studies focused on identifying the perceptions of pre-service language teachers upon pedagogical, didactics, technological components, provides an integrating vision of the needs of initial teacher education.

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LEARNING OF MATHEMATICS TEACHER EDUCATOR

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Abstract

In our contribution we present an analysis of learning of novice mathematics teacher educator. At the beginning, there is the learning-off-job as a preparation of content and methodology of the session, including the design of the lesson where research and practice are interrelated. The second area, learning-by-job, is supported by feedback from colleagues. These two strands are followed by learning-on-job, by self-education of the educator.

In the paper we identified several learning situations of teacher educator in professional development course in combinatorics for lower secondary mathematics teachers when the teacher educator used reflection-on-action and reflection-in-action to improve her learning. The role of critical friend supporting reflection-on-action during learning-on-job and subsequent learning-by-job was found crucial.

Keywords

Inquiry-based learning, mathematics education, professional learning, teacher educator

Introduction

During last decades, there have been requirements that students should develop competences in obtaining new knowledge, become creative problem solvers and critical thinkers. One of the possible approaches to address these requirements can be inquiry-based learning, which refers to a teaching culture and to classroom practice in which students inquire, pose questions, explore and evaluate (Maass and Doorman, 2013).

According to these demands, the situation with professional development of teachers in Slovakia was not sufficient for two decades. Since 2009, after the reform of educational law, there has been a renaissance with several courses for professional development (PD). Several PD courses in mathematics and science focused on use of inquiry-based learning were prepared as a part of the 7FP project PRIMAS (www.primas-project.eu) at Constantine the Philosopher University in Nitra, Slovakia. This situation brought also new challenges for preparation of teacher educators of in-service teachers.

Teaching of combinatorics

Combinatorics was traditionally taught in grades 9 and 10, which was in accordance with Inhelder's and Piaget's (1958) claim that only students with developed mathematical thinking (at the age of 16) can handle permutations as a unary operation. This approach possibly influenced the view even of the researcher in mathematics education that "… combinatorics is considered one of the more difficult mathematical topics to teach and to learn." (Eizenberg and Zaslavsky, 2004). On the other hand, when given enough time and hands-on problems, even usually low achieving 9-year-old pupils do well in solving combinatorial problems, but some usually high-achieving students can lose track when dealing with novel problems in combinatorics without sufficient support (English, 1996).

The development of stochastic thinking seems to become a more integral part of the Slovak mathematics curricula after 2008. Combinatorics, probability and statistics used to be included only in upper-secondary mathematics education before the reform. Teachers at primary and lower secondary schools lack experience in teaching these topics. Therefore almost one third (35 out of 110) of the sessions in PD course for lower secondary mathematics teachers developed as a part of the project PRIMAS was focused on teaching stochastics.

According to Jones et al. (1997) and Lockwood (2013) it is important to "convey" the students through different levels of combinatorial thinking to allow them the construction of sufficient knowledge for solving more complicated combinatorial problems. At level 1 (subjective), students solve the problems by listing elements in random order, without looking for systematic strategy. When moving to the level 2 (transitional), they start to use trial-error strategy and discover some generative strategies for small sets of outcomes. The level 3 (informal quantitative) is characterized by adopting generative strategies for bigger sets or three- and more-stage cases. Finally, students with the level 4 (numerical) can apply generative strategies and use formulas/expressions to solve combinatorial problems. Furthermore, Lockwood (2012, 2013) stressed the importance of constructing the set of outcomes even in tertiary education of combinatorics, where students are expected to have achieved the fourth level of combinatorial thinking before the course. Hejný (1989) defined the combinatorial situation as a triplet consisting of: (1) base set of objects inputting to the problem, (2) set of outcomes and (3) the structure of set of outcomes (so called organization principle). Developing the combinatorial thinking, according to Hejný (1989), requires experiencing sufficient amount of combinatorial situations.

Learning of teacher educator

Despite huge amount of research regarding teacher knowledge (Ball et al., 2008; Hill et al., 2008) and teacher learning (Bakkenes et al., 2010, Jaworski, 2006), only few works have been done in the field of preparation and learning of teacher educators, particularly about educators of in-service teachers (Margolin, 2011, Murray and Male, 2005, Zaslavsky and Leikin, 2004).

In this paper we will focus on professional learning of a novice teacher educator. We will identify learning situations occurring during the first three sessions of novice educator of in-service teachers and following reflection on these sessions.

As a frame for categorization of knowledge of novice teacher educator we used existing models, Mathematical knowledge for teaching (Ball et al., 2008; Hill et al., 2008) following Shulman (1986) and classification of specific knowledge of teacher educator as (1) knowledge of mathematics; (2) psychological-pedagogical knowledge; (3) knowledge of learning/teaching mathematics; and (4) knowledge, beliefs and attitudes towards mathematics by (Novotná et al., 2013). Furthermore, according to Schön (1987) the professional growth starts when one is able to look at his work critically. He divides the corresponding reflection into (1) *reflection-in-action* taking place immediately; and (2) *reflection-on-action* which is usually held after the experience to analyze reactions, explore the reasons and find consequences of the action.

In order to characterize learning situations of teacher educator we will categorize the interpretations according to the framework introduced by Müller (2003) defining three main strands of learning: (1) *learning-off-job* which means mainly theoretical preparation, study of literature and attendance on seminars; (2) *learning-on-job* understood as the learning assisted by the colleagues giving a teacher educator feedback to his/her work,

occurring mostly as the reflection-on-action; and (3) *learning-by-job* consisting of self-education and recognition of teacher educator based on both, reflection-in-action and reflection-on-action in sense of Schön (1987).

Material and methods

For analysis of the learning of novice teacher-educator we used classroom observations of the three consequent professional development sessions in combinatorics and probability that in total lasted 8 teaching lessons and interviews after the sessions. Course was designed for mathematics teachers at lower secondary level. Out of 24 participants, only one was male. The sessions and the following reflections were audiotaped. There were also a supporting data of notes from observation. In this paper we will use pseudonym Daniela to address the teacher-educator and Jan for her collaborator and a critical friend. They are two of the authors of this paper.

Research question

What are the learning characteristics of teacher educator growth focused on different kind of knowledge?

Daniela's background

Daniela is a university teacher. She has been teaching combinatorics within the discrete mathematics course for eight years. She usually provides "crash-course" in secondary combinatorics for her students, so she is quite experienced in identifying misconceptions and assessment of the level of combinatorial thinking of tertiary students. She has also a very good understanding of connections and relation between school level and advanced combinatorics. She has never been teaching lower secondary students or in-service lower secondary mathematics teachers.

Jan's background

Daniela's sessions were observed by Jan, also a university teacher and teacher educator in the same course. Jan has more than five years of experience as a teacher of mathematics at lower secondary level. He has two years of experience as an in-service teacher educator.
In this case, Jan has not only a role of a researcher observing Daniela's PD sessions, but he also functioned as a critical friend that supported Daniela's reflection-on-action and her learning-by-job. Within their cooperation, they tried to establish the way of development of teacher educators within the cascade model used for preparation of new teacher educators in project PRIMAS (Maass and Doorman, 2013).

Results and discussion

During Daniela's teaching there occurred several critical moments that influenced the whole orientation of the course as well as Daniela's awareness about creating an active environment that encouraged teachers participating in the course into a more inquiry oriented pedagogy and understanding of teaching of combinatorics and probability. That was the motivation to investigate the processes that occurred during the PD sessions.

Preparation of the content of PD course (Learning-off-job)

In case of Daniela, learning-off-job means mainly theoretical preparation for PD sessions. It was based on a study of literature about inquiry-based learning and about teaching stochastic followed by discourses among group of collaborators in the national PRIMAS group. Searching for suitable tasks is also included in this strand.
Daniela has focused on combinatorics teaching for long period of time and she has quite

robust knowledge of combinatorics and knowledge of learning/teaching combinatorics. When she was preparing for the PD session she needed to abstract from all the particular knowledge partially mentioned in theoretical framework of this paper. She also needed to pick suitable activities that would be effective in limited time and would be beneficial for teachers' day-to-day teaching. We may say that she developed her own theoretical background where she is fluent in categorization of different levels of combinatorial thinking. She structured her teaching based on this knowledge.

Daniela considered the approach of going through all the levels of combinatorial thinking as a good point to show teachers not only how, but also why it is important to use inquiry in their teaching of mathematics.

Session 1 Introduction to combinatorics

The introduction to teaching combinatorics went smoothly. After presenting levels of combinatorial thinking and notion of combinatorial situation, these terms were illustrated by an example. The session continued with a description of different strategies for choice of the structure of set of outcomes. Lockwood's (2012) model of solving combinatorial problems was introduced (see Fig. 1).

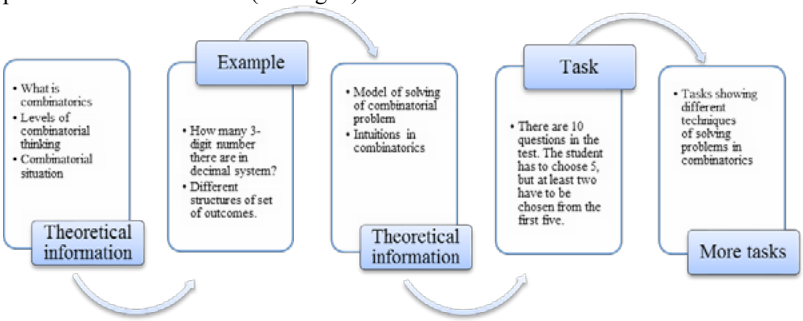

Fig. 1: Structure of the session *Introduction to combinatorics*

The critical moment occurred after the second introduced problem, taken from Lockwood (2012): There are 10 questions in the test. The student has to choose 5, but at least two have to be chosen from the first five. Also the example of student's solution was shown:

$$\binom{10}{2} \cdot \binom{8}{3} = 560 .$$

Daniela: …the student came up with this solution. A test prepared in this way has 226 possibilities to answer and our student's solution was 560 possibilities. So where did those 334 extra possibilities come from? (...) they are not disjoint sets. (...) when we don't have in heads what kind of set it is we can count some cases more than once, so if we do not see the set of outcomes, we will not really realize the term disjoint sets.

Teachers: … (teachers do not respond, they are passive receivers of information)

Daniela is not used to the fact that participants do not respond to her. That is why she became little nervous. But she continued and tried to explain the whole situation more using student's solution. She kept referring to the solution of the task that was on higher level of combinatorics thinking. Most of the teachers found that too fast and could not accommodate the knowledge. Daniela realized that something was going wrong and she needed to address this moment during reflection after PD session. This moment can be

considered as a starter of learning-on-job and also as a base for learning-by-job during following joint reflection.

Later during the reflection Daniela mentioned that she had wanted teachers to understand why it was important for them to use the set of outcomes with students on the lower secondary level. In her explanation she referred to the theory she had introduced at the beginning of the PD session that: And you can see why it is good to have the set of outcomes somewhere in the back and be able to use it, be able to list all items. … it is very important that you, at lower secondary school, won't underestimate combinatorics and allow pupils to come up with a set of outcomes and let them work with it, let them organize letters, numbers or whatever, because this is the way how they can get it "under the skin" to overcome the formalism of straight development on the third level of combinatorics thinking.

When we later analyzed this whole session we assumed that teachers may lack the combinatorics knowledge at an appropriate level, as they had not used it for a long period of time in their teaching, so they did not come up with the solution immediately. Therefore, they had difficulties to follow all the connections that Daniela put together. Special content knowledge needed for development of combinatorial thinking had been presented just a few moments before and the teachers had not chance to adapt it.

As the time went on teachers expressed that they were not following and they wanted to be educated on tasks closer to their day-to-day teaching. Jan who saw these discrepancies for several minutes, created and printed a short exit list for in-service teachers where they might express their opinions about: (1) the session in general, (2) about their expectations, (3) about the connections of the session with their day to day teaching and (4) about what they would like to know more or would like to get to know on this seminar. Then he passed the results of the exit slips to Daniela, so she had enough time to go through the whole situation on the session by herself.

Based on the answers on the exit list, almost all participants found the tasks too demanding and two thirds did not like it at all because they would not be able to use it in their day-to-day teaching. However, one teacher stated that for her "*It is easy to apply more difficult tasks to less demanding for students*". There were also many positive comments like: *"I obtained new point of view, from perspective of upper-secondary school. Now I know where to direct my pupils."* The following day Jan and Daniela went through the situation on the PD session together.

Learning-by-job (Joint reflection after the course session)

At the beginning Jan simply asked Daniela to tell how it had been going in general. Daniela mentioned that "*With the theoretical part I was confident and familiar. It was chosen for the purpose that they [teachers] would need. Why they need to solve tasks where they need to write down all the possibilities.*"

As the discussion continued Daniela started to describe the situation: "*When I was struggling with choosing the tasks I found some tasks too simple. And after the PD I see that those are the tasks I should have used. I shouldn't feel sorry for wasting the talent of teachers (with easy tasks) I should provide them with tangible things into hand, things they can use at school.*"

When reflecting on the session, Daniela saw the difficulty of the task as the crucial factor why the proposed activity had not been successful. She decided to try to find another possible approach to the course. This was a natural move within Daniela's teaching toward inquiry-based approach. It was something that Daniela uses a lot in her teaching.

Then Daniela continued verifying the special content knowledge used with in-service teachers. From the discussion it was clear that she verified and tried to be more confident within the organization of the content, the task decision and the functionality of each item in her presentation. As a final realization of the reflection on the content of the session she put it once again for herself "*It is my mistake, I chose too difficult tasks. They were nice for upper-secondary school….*"

This was the shift that Daniela made within her knowledge of learning/teaching mathematics (in this case in-service teachers are considered as learners).

After the first issue there was another perspective she recognized: "*I did not give the teachers enough time for thinking.*" In this case we may talk about learning-on-job addressing knowledge of content and teaching. This realization was starting point of learning-by-job.

Jan: *What teaching strategies were used?*
Daniela: *Lecture and discussion.*
Jan: *Hmmm.*
Daniela: *Not really a discussion, but common solving of problems.*
Jan: *So, might hands-on activities be missing?*
Daniela: *Yes*
Jan: *The activity which would activate teachers to work, to go through a set of outcomes.*
Daniela: *Yes*
Jan: *I think it would be good to have it, because they [teachers] would have to be learning, they would go through the whole process and would see that just formulas/ expressions make them confused.*
Daniela: *Hmm*
Jan: *To show the teachers how student should go through all the levels.*
(discussion about group work)
Daniela: *I should let the teachers work independently*
Jan: *These teaching strategies, lecture and discussion seem not to work very well. [for enough time of thinking as was discussed at the beginning]*
Daniela: *Yes, I should provide them with more space for group-work. [more discussion about group-work]*

After this session Daniela reorganized the structure of the course (as shown in fig. 2) and changed the tasks. Settings of the classroom were changed, too. We may consider this as quite big changes. She realized what had not worked and what she wanted to try in a different way.

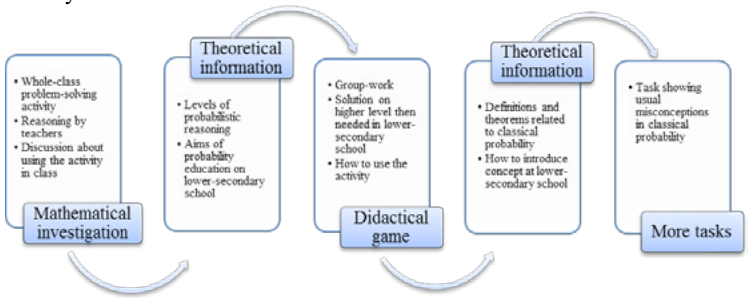

Fig. 2: Structure of session *Introduction to probability*

Session 2: Combinatorics

The second session was mostly focused on solving problems. Daniela decided to use problems with context from other part of mathematics to make teachers more confident with the common content knowledge (learning-off-job). The first task was to find all nets of cube.

Geometrical building kit was given to teachers for confirming that the configuration of 6 squares is a net of cube. After the group-work, Daniela started whole-class discussion about the solution. Although not all of the groups came up with all the nets, all teachers were active and contributing. This activity was followed by a discussion about the problem. Daniela wanted to relate this activity and thinking to the previous session. She simply asked the question.

Daniela: Is this task about combinatorics?

Teacher 1: No, this is geometry. We did this task in a PD focused on geometry.

Teacher 2: Yet, it is combinatorics. You are asked to find all the possibilities.

Teacher 3: And without organizing the possibilities, you can forget some nets.

It was a really successful activity that could be followed by further discussion on special content knowledge on several levels of combinatorial thinking. Within all the different comments and approaches that teachers made during their investigation and with connections they developed, Daniela could easily manage frontal discussion with teachers.

Daniela: What level of combinatorial thinking is this task addressing? [Daniela puts a slide with description of levels of combinatorial thinking from the first session]

Teacher 4: I think it is about moving from level 1 to level 2.

Teacher 5: Yes, students will realize that they have to put structure to the list of nets.

Teacher 6: Yes, to group the outcomes. One generative strategy can be taking 4 squares in a row and then put one more on each side of the strip. So you get 4×4=16 different nets and then you just exclude one of isomorphic pairs.

Teacher 7: But after that you have to move to the strip consisting of 3 squares…

Teacher 6: I think that the kit was very useful. One can just try whether the configuration is a net or not.

The discussion continued with identifying the base set, the set of outcomes and the possible structure of the set of outcomes (Hejný, 1989). Majority of the teachers contributed to the discussion.

Daniela, in her reflection on the session commented the changes she did in different aspects. First she mentioned teaching strategies:

"During the second session I used group-work and some manipulatives to make them [participating teachers] more active. It did work. Teachers seemed confused when they had time for group-work and did not do anything. So, they started to play with manipulatives and then to solve given problems… and based on the experience, the theoretical framework that I gave them at the beginning was more accessible… After the teachers' experience with solving the problem by going through all levels of combinatorial thinking, they were able to comment on different features of the task."

Later she continued by describing other changes and put some reasoning to these changes:

"The nets-of-cubes task was even more difficult than the task about test questions. To solve it at level 4 is impossible with secondary combinatorics. But still, formulation of the question in the task, 'list the nets', leads the solver to a solution on lower levels

[of combinatorial thinking]. I changed all the questions to: list all… or list as much as possible… "

This positive outcome from the session confirmed Daniela's view on effectiveness of inquiry-based teaching strategies within PD courses. Daniela is also more confident in the role of teacher educator. That was supported with the process of her learning in all three strands.

In the reflection on all PD courses Daniela stated:

"*I took into consideration the previous experience. I knew that I had to start with problems, easy problems, use as much of group-work as possible and only after that I should introduce some facts from research. And then I found that I shifted from transmissive teaching to an approach more focused on student (participant) activity; from deductive to inductive instruction. Looking back, I can summarize that the course about inquiry-based learning should be held using inquiry-based pedagogies."*

Conclusions

The case of Daniela showed that even experienced teacher can struggle as a teacher educator. She needed to handle different level of subject matter knowledge among participating teachers, although Daniela expected teachers to have common content knowledge at an advanced level. However, experiencing friction was the crucial moment of her learning. Similar tensions, mainly based on respects to teachers, can be part of development of many novice teacher educators. Collaboration with Jan supporting Daniela's reflection-on-action within learning-by-job was found to be essential. Through these processes they might understand more the inner connections within psychological-pedagogical knowledge and knowledge of learning/teaching mathematics.

Despite critical friend seems to be positive element in teacher educator growth, there are specific requirements for such person. Relation between a critical friend and a novice teacher educator are specific because both are usually experienced teachers. A mentor must be also compatible with the novice in terms of attitude, reliability and a piece of non-directivity. Roles of both are different from those expected in teacher training. Although some directions are available for mentoring a novice teacher, many of them are not applicable in case of teacher educators and further research is needed to evaluate a significance of such collaboration.

Acknowledgements

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STUDY ON THE IMPORTANCE OF THE INTERNSHIPS FOR THE STUDENTS

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Abstract

Developing the students' practical skills is an on-going concern both for universities and for companies. The paper is based on a contradiction that characterizes the labour market from Romania: people complain that there are not enough vacancies on one hand, and on the other hand companies find it difficult to recruit qualified human resources. The problems of the companies are linked to the quality of the human resources. Considering this situation, the paper presents the findings of quantitative research regarding the importance of internships in developing practical skills from the students' point of view, which are tomorrow's employees in companies. In order to do this study the authors used the enquiry based on a questionnaire. In the first part of the paper the authors present the research methodology and the context in which it was carried out. In the second part, the findings of the research are presented.

Keywords

Internships, human resources, practical skills, students, study

Introduction

Normally, upon graduation from faculty, the students start looking for a job. Are the competencies and the knowledge acquired during university curricula enough? It seems that the answer is NO… More and more graduates face the problem of finding a job. The students who, throughout their university years, have taken advantage of the extra-curricular learning opportunities such as internships, volunteering programs etc., present an advantage.

There is no doubt that the level of human capital has an important role at the social and economic development (Fischer and Lipovská, 2013). The effectiveness of a training process can be measured from several specific views and from its content. There are various theories and ways of classification according to different criteria (Staňková and Drdla, 2012).

According to the specialists in training the human resource (the teachers) and recruiting it (the representatives of the companies), only those ambitious students, concerned with their personal and professional development, through putting in practice personal projects, participating in exchange programs and doing internships in multinational companies in the country and abroad, get involved in extra-curricular activities.

Within the focus groups gathering the representatives of the business and university environment, it has been found that:

- many young people (students, graduates) are not interested in their professional development;
- they don't get actively involved in developing their practical skills. They don't take part in the internships required by the curricula of their specializations, plagiarize

the practical projects that help them apply the theoretical knowledge;
- some of the companies are not willing to have internships for pupils/students: "we can't waste time with a student";
- some companies/public institutions issue very easily documents certifying that the student did the internship which in reality they didn't, and they even give them the qualification "very good".

The objective of this paper is to identify to what extent the students from a technical specialization (Engineering and Management) from Romania are interested in developing their practical skills through internships of technological practice. Based on the findings and the analyses of the study, recommendations will be made regarding the development of the students' practical skills with a view to integrating them in the labour market.

The first part of the paper presents the current study of the organization and development of internships for the students in the specialization mentioned, as well as the research methodology. The second part of the paper will present the findings of the study as well as conclusions and recommendations on how to increase the students' interest in developing their practical skills.

Organization and professional practice in educational institutions in Romania, are made according to law 258/2007. "Practice time is included in the curriculum" (Conf. Art. 7 of Law 258/2007). On a theoretical level, the number of hours of professional internships which a student from a technical specialization must perform during the license cycle varies between 90 and 270 hours (Fig. 1). The values shown in Figure 1 were extracted from the curricula of the 4 technical universities specified. We chose the number of hours of professional internships set out in the curricula in order to have a uniform basis for comparison (number of hours per semester allocation varies from one university to another) (Negrut, Alan and Mihartescu, 2010).

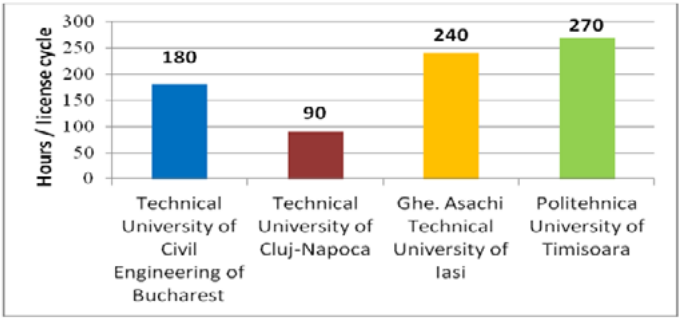

Fig. 1: The number of hours of professional internship (Negrut, Alan and Mihartescu, 2010, pp. 279)

Figure 1 shows that the "Politehnica" University of Timisoara has the highest number of hours of practice, provided by the license cycle (Negrut, Alan and Mihartescu, 2010). Traineeships in Politehnica University Timisoara are organized based on "Regulation on the general frame for organization and development of the practice of UPT students approved in the Senate Bureau meeting dated 13.04.2009 and validated by the University Senate "Politehnica" Timisoara on 21.05.2009" (http://www.upt.ro/pdf.). The Internships within the analysed field are organized at the end of each academic year, in summer, for two weeks (90 hours):

- In the 1st year, individual internship (90 hours): each student must find a company in which to achieve the Technological and professional internship;
- In the 2nd year at the analyzed specialization, the internships are organized in modules as follows:
  Module I: itinerant internship (40 hours) - visiting some companies from the technical domain, to substantiate the students' decision for choosing a specialization in a particular field;
  Module II: individual internship (50 hours) - each student must find a company in which to achieve the Technological and professional internship;
- In the 3rd year, the internship is in a labouratory in which technical and economic activity from a company was simulated (90 hours).

Materials and Methods

Considering the need to develop the practical skills of the human resource, the reorganization of the internships for the 3rd year students from the technical specialization was suggested as follows:

- the supervising teachers should identify partners for the internships from the same domain as the specialization and a partnership to be signed between the company and the university/faculty;
- the company should offer a certain number of places for the internship, according to its capacity of absorption, for the students in the 3rd year.
- the duration of the internship to be established by the partner, minimum 90 hours, according to the curricula of the specialization;
- the selection and recruitment of the students is the responsibility of the internship partner;
- at the end of the internship the student is evaluated by the internship tutor, an evaluation form is created and a qualification is given;
- based on the evaluation made by the internship tutor and on the internship report, the student is evaluated by the teacher supervising the internship so that he can pass the "Practice" subject that appears in the curriculum of the specialization.

The reorganization of internships for the 3rd year students was done at the suggestion of the teachers involved in organizing the activity for the "Practice" subject that appears in the curriculum of the specialization, and with the support of the representatives of the business environment.

The representatives of the business environment (Managers of multinational companies) showed their willingness to get involved in the development of the students' practical skills within the internships by offering vacancies and actively participating in the collabouration programs, academic environment with business environment. Some of the representatives of the business environment imposed a higher number than 90 hours for the internships, considering necessary to dedicate more time in order to develop the practical skills of a young student.

Unfortunately, some of the students are reluctant to (and even reject) the active participation in internships, which offer them the possibility to develop their practical skills and help them make the transition from the status of a student to that of a future "actor" on the labour market.

The conducted study is based on data from:

- Secondary Sources: Curricula, organizational regulations, internships, legislation.
- Primary sources: students. The survey was used as a method of collecting data in

order to identify the importance of internships in developing the students‘ practical skills. To achieve the survey the questionnaire applied to a sample of 124 students in the third year, from a technical specialization was used as a research tool. The questionnaire contains 21 questions out of which 14 are closed and 8 are open.

To achieve the survey the questionnaire applied to a sample of 124 students in the third year, from a technical specialization was used as a research tool.

Results and Discussion

Following the application of the questionnaire on a lot of 124 people, the results obtained were as follows:

- In the first year, 57.26% of the people questioned did not do the internship, 11% of them did a small number of practice hours and 22.5% did almost all the hours requested by the curriculum (90 hours per year of study). 8.87% of the students declared that they did long internships because they work in different domains. (fig. 2, graphic **a**)
- In the second year, the situation improved as far as participating in the internship is concerned, as all the students did the itinerant internship (40 hours of study visits in specialized companies). However, 54.03% of the students did not do the internship of minimum 50 hours in companies. Only 19.53% of them did all the practice hours requested by the curriculum (90 hours of practice per year of study) by joining the two modules: the itinerant internship (40 hours) and the individual internship (50 hours). 12% of the students stated that they did long internship because they work. (fig. 2, graphic **b**)

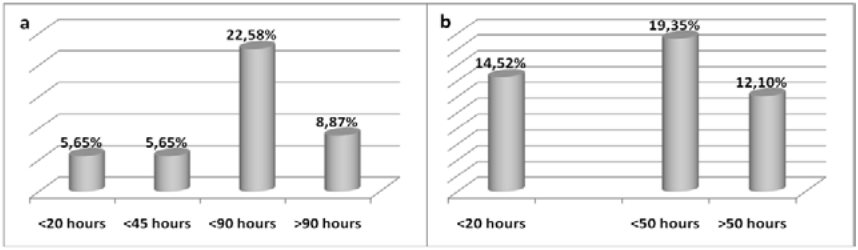

Fig. 2: Number of hours in the first and second years

- From the question regarding the usefulness of the internship was answered only by the students who did the internship, 57 students. 75% of the students who answered this question consider the internship as being useful and very useful.
- From the question regarding the reasons for not doing the internship was answered by the students who did not take part in the internship in specialized companies in the first and second years, a total of 67 students. 62.69% stated that they did not do the internship in the two years of study because they easily obtained a paper from the company (requested by the faculty, in order to take the oral examination for the practical part) certifying that they did the internship and also containing a qualification: good or very good. 23.88% said that they could not find companies to offer them a real internship, but only for a few days, and 13.43% said that they were interested in doing the internship. (fig. 3.)

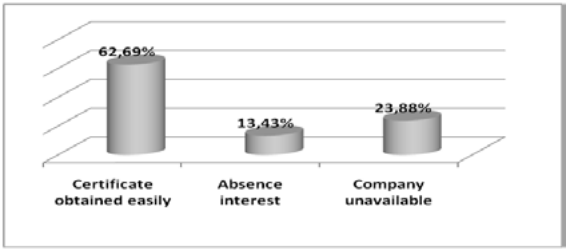

Fig. 3: Reasons why students did not do the internship

- 74% of the participants said that at the end of the third year they would like to do the internship in a specialized company, supporting their statement by the desire to develop their practical skills, to gain experience and to apply the knowledge acquired in the three years of study. 26% of the students interviewed said that they did not want to do the internship in specialized companies for various reasons: the internships are not paid, the internships take place during the summer holiday, etc. Unfortunately, those who stated that they were not interested in doing the internship at the end of the 3rd year belong to the group of students who did not do the internship in the previous years, either.
- 74% of the students interviewed would like to take part in the internship through the partnerships signed between the University/Faculty and companies. Those who would like to do the internship individually belong to the group of students who did not do the internship in the previous two years or to the group of those who work.
- 36.15% of the students interviewed either did not answer the question regarding the practical skills they have, or they said that their practical skills were not clearly defined. Only 10.77% of the students interviewed can use software specific to their field of specialization. Unfortunately, only 16.92% of the students interviewed declared their linguistic competencies. (fig. 4)

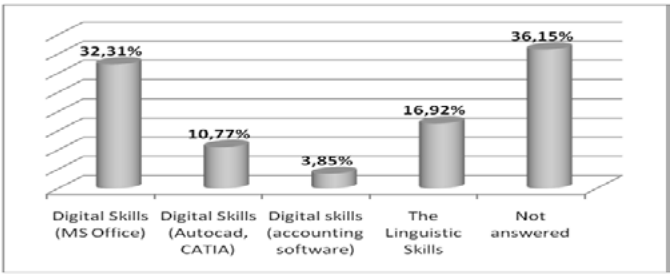

Fig. 4: Practical skills

- 31.45% of the students participating in the study know in what department they would like to work upon graduation. 24.19% of the students are interested in the Logistics department. Only 14.52% of the students interviewed showed interest in the technical domain (engineering, production). 27% of the participants would like to have management positions. (fig. 5)

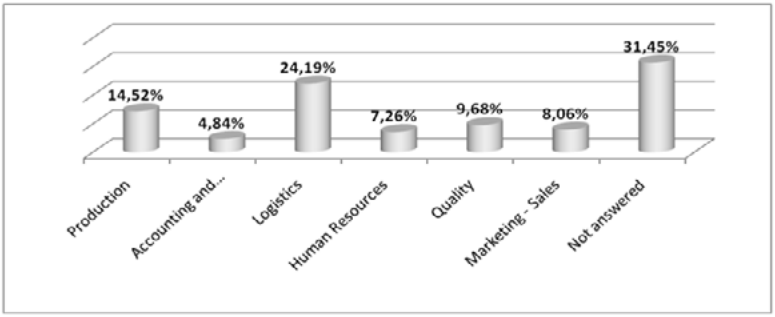

Fig. 5: The targeted department

- 52.42% of the students participating in the study are willing to do an internship of maximum 90 hours, according to the curriculum of their specialization, not being willing to allow more time for the development of their practical skills. Approximately 40% of the students interviewed are willing to dedicate a longer period of time than the one requested by the curriculum for the internship at the end of the third year.
- 52.42% of the participants would like to work in companies after graduation, in various departments (fig. 5). 43.55% of the students would like, in the future, to develop their own business in the domain: production (12.90%), sales (7.26%), services (foods, cosmetics, tourism) (15.32%), etc.

The most obvious question when assessing the limitation of this study is whether students rating are a valid and reliable source of evidence for assessing teaching practices (Clausen, 2002; Kunter and Baumert, 2006).

Lee and Chao (2013) identify influential internship organization factors that affect student interns' industry employment intentions. A mixed-methods approach using both content analysis and questionnaire surveys was utilized to develop a practical scale and objectively reflect a variety of internship situations. Durack (2013) states what we mean by the term internship, with special attention to requirements for compensation; explains the issues that appertain to unpaid student internships; and urges broad engagement and individual as well as collective action on this issue.

Skills and employability are increasingly viewed as crucial issues in curriculum design and teaching, while simultaneously perceived as potentially detrimental to academic standards, (Maurer and Mawdsley, 2014). The author's of the paper comparatively analyses the current European employability agenda and how it was implemented in Britain and the Netherlands. In addition, the author's of the paper critically reflects on the challenges and opportunities of integrating such an agenda into an EU study curriculum, by drawing on practical examples from the universities of Maastricht and Newcastle (Maurer and Mawdsley, 2014).

Many benefits for interns have been identified in the literature. These can be categorized as job-related benefits, career-related benefits, and networking/job market benefits. For most interns, the costs of the internship are minimal. Nevertheless, potential pitfalls stem from the fact that employers and interns often do not have consistent or shared expectations regarding the internship. The benefits of internships for schools can be significant. These include filling an important modern need for experiential and vocational learning. For

employers, hiring an intern for a full-time position after the assignment can lead to savings in the areas of recruitment and selection (Maertz, Stoeberl and Marks, 2014).

Conclusion

After completing this research, it is noticed that over 50% of the participants are not preoccupied with the development of their practical skills, by not taking part in the internships required by the curriculum. All the actors involved are responsible for this situation:

- The students who do not actively get involved in identifying a company interested in developing the human resource and in doing the internship;
- The companies who easily issue papers certifying that the student did the internship, but they are not in accordance with the reality;
- The University which does not penalize the students who disobey the internal regulations, and which does not motivate the companies by creating study programs that would lead to the improved quality of the human resource.

The findings of the study confirm the status quo described initially: The young are not preoccupied with the development of their practical skills. The companies do not offer vacancies for internships. However they issue documents certifying that the students did the internship.

In order to eliminate these deficiencies from the educational system we made a few recommendations for future:

- Creating a symbiosis between: student, company and college / university, so that students can perform internships in specialized companies, which would increase the quality of human resources;
- Developing partnerships between universities and businesses, through their involvement in developing curricula and syllabuses, correlated with specific labour market;
- Organizing a comprehensive internship between third and fourth year, when students have sufficient theoretical knowledge, that practical activities to take place within a company, within the specialization studied.

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MIND MAP: FROM EDUCATION TO ICT PRACTICE

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Abstract

The paper examines mind mapping. Mind mapping is a universal approach, and mind maps have a wide range of applications. Attention here will be focused on mind maps creation related to the skills from university education for practical improvement of ICT project management at an enterprise level. The aim of the paper is to answer the research question whether the mind mapping method is suitable for education of Information managers. To answer this question, there is some evidence from an interview held with undergraduate students with specialization Information Management in the University of Economics, Prague, and comparison with ICT practice. The results show that mind mapping may be a way that will be beneficial for defining the problem in informatics. The paper should be a contribution to university education and to managing informatics' projects.

Keywords

Mind (cognitive) map, education, ICT, problem, project manager, information manager, survey

Introduction

Literary sources show that the effectiveness of ICT sector as a whole is "only" basically average among the rest of the sectors Pavlicek et al. (2011). Effective management of information technologies is necessarily based on the regulatory and supervisory principles, which are set by management of companies. Management needs these mechanisms, because of the opportunity to influence the direction of investment in technologies and to verify their effective support of key business processes. Prosperous ICT project and the achievement of project objectives substantially affect project planning. If the frame of the project is not properly defined, then it is very probable that the project will end in failure (Doucek and Novotny, 2007).

It is reflected in the demands for adequate methodological and methodical support of project management, and generally the work in ICT segment. Many methodologies were developed to achieve the target state in the last half century that provides systematic guidance for the successful achievement of project objectives. It is often based on the PMBOK and PRINCE2 project internationally recognized methodologies (Project Management Institute, 2008).

These developed methodologies and software tools facilitate monitoring of important factors, but their potential use depends on the project manager, who plays a key role for the successful conduct and completion of the project (Calder, 2005). A project manager should appropriately and correctly works with project methodologies and tools. The project manager is one role in the information management, as demonstrated in Kral and Mildeova (2012).

When planning ICT project we come across situations where conventional approaches, such as traditional tools for project management and spreadsheets, do not produce the desired results. In the introduction to project planning, one formulates the purpose of problem solving. To avoid getting into difficulties right at the problem description, we should apply the appropriate methods and procedures that help us clearly define the problem, identify its boundaries and at the same allowing enough time to get to the root of it. Everyone can look in the dictionary for a particular word, the date in the encyclopedia or a formula in the textbook (Molnar et al, 2012). Managers should be able to a holistic worldview, which examined details; whether they are chemical compounds, artificial artefacts, groups of people, firms or market.

In this context, the paper follows up Bartoska, Svobodova and Jarkovska (2011) and examines mind maps for improving learning outcomes and competences of Information management education that trains future ICT project managers at the University of Economics, Prague. As to learning outcomes and competences of Information management studies there: upon successful completion, students will be able to manage enterprise informatics.

The aim of the paper is to answer the research question whether the mind mapping method is suitable for education of Information managers. The paper should be a contribution to university education, and also to bring new knowledge towards the improvement of the methodology for managing ICT projects.

Materials and methods

Research methodology

The research methodology proceeds from qualitative analysis, basic statistics analysis and survey.

The results of an interview are used in the paper. The interview included students of master programme Information Management at the University of Economics, Prague at the University of Economics in Prague. There was performed improbability sampling in the survey, and the interview was anonymous. Interview took place in 2014 and was attended by 75 students. 129 students of the Master program Information Management was sent with a request to complete the questionnaire. The return of the questionnaire was 58%. The questionnaire was online, for the Implementation was used University Intranet. Students were asked in an open question how to evaluate mind map. This question was deliberately raised in this general way. If we would have asked about the advantage or disadvantage of mind map, we would have influenced respondents. They were also asked to compare the mind map with a process map, which is a commonly used tool in ICT projects.

The research questions are follows:

1. evaluate mind map
2. compare mental mapping with process mapping.

To verify meaningful use of mind maps for teaching in the field of Information Management, where the goal is to educate future Information Managers, it is necessary to know the situation in the ICT practice. Therefore at the University of Economics in Prague was conducted survey[1] in ICT practice (Urban, 2013). Thus comparison of results surveys conducted among students with this research of ICT practice is a part of the paper.

[1] The author of the paper was a consultant in the questionnaire creation and assistant person in the survey conduction.

The paper follows up on researches completed by Kral and Mildeova (2012), Mildeova (2013) and Urban (2013) and develops them in other contexts.
The basic term in the paper is "Mind map". At first, it is necessary to explain this term, and how it is perceived in the paper.

Mind (cognitive) map

Collins English Dictionary represents minds map as a 'diagrammatic method of representing ideas, with related concepts arranged around a core concept' (DICTIONARY. COM, 2014), by other definitions it is 'a diagram used to represent ideas or information branching from a central key word or idea and used as an aid in study, organization, problem solving, decision making, and writing'. Buzan (1972, 1974) describes mind mapping as graphical technique for visualizing connections between several ideas or pieces of information, where each idea or fact is written down and then linked by lines or curves to its major or minor (or following or previous) idea or fact, thus creating a web of relationships.
By using mind maps, we are trying to summarize all the areas that have something to do with the main idea. Because the paper deals informatics, as an illustration mind map is used to express the hierarchy of topics and keywords about the problem of software piracy as an actual subject matter in informatics (see Fig.1).

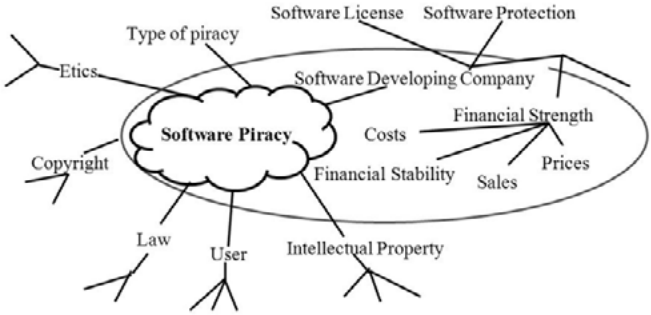

Figure 1: Mind map for software piracy (a cut) (Mildeova, 2013)

Mind maps have a wide range of applications, including applications associated with education. Cunningham (2005) and other studies, for example D'Antoni and Zipp (2006), confirm that mind mapping helps understanding concepts and ideas in a lot of areas. According to Mildeova (2013) the mind map is also the modern way to describe and develop the research problem.
Of course, mind map should be based on a deep analysis of solved problems. For this reason, it may be quite extensive and complex. When solving the problem, it is necessary to take into account all the information that the map contains. So it will be possible to define the untapered framework of the problem.
Despite the additional options of visualizations using for example concept maps, modelling graphs or process map that are typical in project management, mind maps just have a great potential for each problem description. Spiderors "idea sun bursting" character of mind maps help people clarify the topic, define keywords; see the hierarchy of themes and relationships between them.

In many cases appears mind maps drawn „by hand“, however for the creation of mind maps, there are many software products, such as NovaMind, FreeMind or MindMaps. These products allow you to create high-quality graphics diagrams (Mildeova, 2013).

Results and discussion

Survey

In this part, mind maps are discussed in context with Information Management Education at the University of Economics in Prague. At this university mind maps are used by students in the early stages of the creation of software applications in the course of Decision Support Systems. The aim of the course is to make students acquainted with the procedures and instruments of decision process. Upon successful completion of this course, students would be able to muse on various nature of problems (regarding system's complexity) and appropriate possibilities of their solution. They would know to constitute appropriate models and to interpret them as well as to communicate with various experts. They also will acquire some experiences referring to design computer support of decision (Integrated Study Information System, 2014). It is one semestral graded course. Regards level of course, it is master course. The course is a part of Information management studies.
Interview took place in 2014 and was attended by 75 students through University Intranet. Students were asked 1/ how to evaluate mind map and 2/ to compare the mind map with a process map. As it is shown in Table 1, the vast majority of students (82%) with mind map sees only positive site. Here appear answers like:

- ideas, key words and concepts could be together
- it is possible to organize large amounts of information
- may be helpful in grasping problems
- ability to show topic's hierarchy
- hierarchical structuring is useful
- spatial organization is visual
- creative work
- good for a 'description' at the beginning of the project
- shows the way of thinking about the topic, position / view on the given issue
- a good tool for gaining ideas because it is written into through brainstorming, we think up things that we wouldn't thought otherwise
- can occur in everything from Interior (enterprise / problem) to the global environment
- layout the problem for subsequent analysis and search for a suitable solution
- free style notation, without formal rules
- can be used in all situations
- unified view of the system (problem) at teamwork
- provides a comprehensive and detailed view of the various aspects of addressed areas
- good tool for understanding the project requirements
- possibility for feedback and for of introducing metrics
- possibility to gain perspective on the problem as a whole
- help us understand what all the problem can involve from various angles
- possibility of thinking randomly
- possibility to proceed from the general to the more specific
- tool for seeing the problem on a large scale.

To weak points of mind map refers only 14% student. They point to the fact that:

- for their problem, this method is too wide
- could be chaotic and non-specific, so it is difficult to derive a stable conclusions
- does not provide any information on the functioning or condition
- does not leave out, what we might eventually find, that it is not important
- may not bring up to the question of when the problem occurred
- can be extensive and complex
- it is difficult to insert longer text
- can be understood only by the author.

Evaluation	Only strengths	Only weakness	Neutral answer	Both strengths / weaknesses
Number	82%	0%	4%	14%

Tab. 1: Survey results in % of the respondents (students)

There is evidence that a lot of students (26%) see the most potential in combination of both methods. This is proved by the following answers that were often in terms of: super when we combine both methods.

When evaluating the results of the survey, we must take into account that the positive perception of the mind maps taken by students may be partly influenced by the used software. Students form the maps in software NovaMind, which environment is really friendly and intuitive.

This research, made by the author, brought interesting results that need further investigation. And not only toward to the mentioned survey within the meaning of increasing the number of respondents or increase the number of questions, but especially towards the search for other alternatives in creating mind maps, functionalities used in software NovaMind and exploring the possibilities of linking mind maps and process maps.

Feedback from ICT practice

To verify meaningful use of Mind maps for teaching in the field of Information Management, where the goal is to educate future field of Information Managers, at the University of Economics in Prague was conducted survey in ICT practice (Urban, 2013). (The author of the paper was a consultant in the questionnaire creation and assistant person in the survey conduction).

Respondents were identified project managers (30 managers), i.e. persons who are involved in the management of IT projects in companies. Everyone (with one exception) agree that mind map is (very) important in relation to project management. Software applications (various kinds of software) for mind mapping use 46% respondents.

It is interesting to compare the results of our survey among students with this research of ICT practice. Both surveys contained the same open question of how to evaluate mind map, so it is possible to compare the answers. Respondents from ICT practice appreciate lucidity of created maps, opportunity to share ideas through them and to do presentations. Also, they like the “no limitations” of space for ideas and support provided to authors of applications, including number of tutorials. In the evaluation of the deficiencies the respondents were, as in the previous survey students, more concise. They state quite specific issues of a more or less technical nature: ‘better finding nodes interconnected by link’, ‘lack of options for calculating the performance indicators’ and ‘professional appearance prints, graphic adjustments’. From this we can deduce much larger management’ experience with mind mapping than for students, who are starters.

Conclusion

The ability of a correct definition of the problem is very closely related to the ability of the system point of view and correct thinking. The good project (information) manager should think in context. The necessity of modern work is to understand and analyze problems systematically, to change their perception of the problems examined. One of the major barriers to the realization of holistic thinking is probably our limited ability to change their paradigm of thinking. If we overcome this barrier and change your thinking, we will be better able to define and solve problems.

In this sense the paper showed that mind mapping may be a way that could be beneficial for defining the problem. This provide a tool that connections between several ideas or pieces of information are visualizing to summarize all the areas that have something to do with the main idea. Mind maps may enable everyone to develop not only the ability of the system analysis of the problem, but also the ability of creative thinking.

These statements about mind maps were confirmed by communication with students, at a controlled interview. The results from interview held with students, who took part in the course Decision Support Systems at the University of Economics in Prague, show that mind maps have a great potential for students work. Students see an interesting contribution in creative work, in possibility to organize large amounts of information; in fact that key words and concepts could be together, and that hierarchical structuring is useful or spatial organization is visual. To the weak points of a mind map refers only a small part of students, based more on lack of deep knowledge of the method.

Encouraging for the application of mind maps in Information Management education is not only this positive student evaluation, but also finding that software applications for mind mapping use 46% of information (project) managers from ICT practice. This is a high number due to the fact that Project management theory and project management practice are not commonly associated with mental mapping.

Our suggestion is built on these facts and author' recommendation thus seeks to increase the use of mind maps in teaching associated with bringing up Information managers, and empower mental maps besides traditional tools for project management. The answer to the question that was established in the introduction of the paper as 'Is mind mapping suitable method for education of Information managers?' therefore is YES.

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FUTURE ICT TEACHERS - PROGRAMMING APTITUDE

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Abstract

Dehnadi developed a programming aptitude test within his thesis in 2006. The test predicts whether a person can become a programmer without requiring any prior programming experience. A research concerning students' programming capabilities evaluation with regard to the input Dehnadi's test we began at the Faculty of Informatics and Management, University of Hradec Králové, in 2011 and at the Faculty of Sciences in 2012. Some results were presented at the ERIE conferences in 2012 and 2013.
In comparison with the results published in the last year's article describing an in-depth analysis of Dehnadi test on a sample of several hundred students completing an introductory programming course at the Faculty of Informatics and Management, this paper introduces the same analysis performed on students, future teachers studying the Informatics specialization at the Faculty of Sciences.

Keywords

Algorithmic thinking, algorithmic constructions, programming aptitude, Dehnadi's test

Introduction

Previous research concerning students' programming capabilities evaluation with regard to the input Dehnadi's test (see thereinafter) was described in the ERIE 2012 and 2013 papers (see Milková et al, 2012, Petránek et al, 2013 and Milková and Kořínek, 2013). These papers contained information about the subject Algorithms and Data Structures, taught at the University of Hradec Králové (shortly UHK), introduced samples of credit and exam tests as well as described Dehnadi's test. The paper Petránek et al (2013) provided an in-depth analysis of Dehnadi's test on students studying applied informatics at the Faculty of Informatics and Management (shortly FIM).
This article analyses, with regard to results achieved at FIM UHK, Dehnadi's test on students, future teachers who attended an introductory programming course at the Faculty of Sciences, UHK in the academic years 2012/13 and 2013/14.

Materials and Methods

Algorithms and Data Structure subject

Let us briefly remind, that the first programming course, Algorithms and Data Structures, teaches our students their very first steps in algorithm design. The process of algorithm design is explained in Milková et al (2010) using a modular, object-like paradigm – the students are building interesting objects out of a few basic elements.
Students create algorithms in the Czech pseudo-language (based on Pascal programming language), they write them on papers.

In the subject Algorithms and Data Structures we start with basic algorithmic structures (i.e. basic elements from the brick-box) – block of commands, incomplete and complete branching, and loop construction with the condition on the beginning:

blocks of commands	*incomplete branching*	*complete branching*	*loop construction*

begin
statement1;
statement2;
...
statementN;
end
	if *condition* **then**
	statement
	else
	statement2
		if *condition* **then**
		statement1
			while *condition* **do**
			statement

Using three *simple commands* (`read`, `write` and assign `:=`) together with above described basic algorithmic structures students are able to understand soon typical algorithmic structures (for example determining the number of elements with the given property, calculating the sum and the product of some elements, finding the last/first occurrence of the searched value etc.).
Students practise their knowledge not only by solving the whole tasks, but also using various prepared algorithms examining their understanding - see the following two tasks types.

Example 1 (*completion of omitted parts)*

Complete the algorithm solving the following task. In the sequence of *n* integers saved in the array **a** (in items `a[1], ..., a[n]`) determine the first minimum value and then sum all integers behind the found minimum value.

```
begin
   n:=6;
   for i := 1 to n do
      read(a[i]);
   minimum := a[1];
   sum := ..........;
   for i := 2 to n do
   begin
      sum := sum + ..........;
      if a[i] ... min then
      begin
         minimum := ..........;
         sum := ..........;
      end;
   end;
end.
```

Example 2 (completion of values of the given variables)

There are *n* integers saved in the array `a` (see the table). Determine the values in the array `a` after finishing the following algorithm. Write them to the table.

```
begin
   n:=6;
   for i := 1 to n do
      read(a[i]);
   x:=a[1];
   i := 2;
   while i ≤ n - 1 do
   begin
      if a[i] > x then
      begin
         a[1]:= a[i];
         a[i]:= x;
      end;
      i := i + 1;
   end;
end.
```

a[1]	a[2]	a[3]	a[4]	a[5]	a[6]
11	8	19	7	16	17

These types are reflected in the credit as well as in the exam test structure.

Dehnadi's test

Sead Dehnadi designed a test focused on discovering future programmers before they enter their first programming class. Dehnadi's test is based on assessing mental model consistency in the assignment operation.

The test consists of twelve similar questions, all testing an assignment statement. Students are free to choose their own model of what the equality symbol used for relating variables means. To pass the test, students are required to follow one chosen mental model throughout at least 8 of the 12 questions. Number of points from the test corresponds to the maximum number of consistent answers.

Dehnadi's test was designed primary for non-programmers.

For more information see e.g. Dehnadi (2006), Dehnadi and Bornat (2006), Bornat et al (2008), Dehnadi et al (2009).

Research sample

The following students were included into the research.

- Students, future teachers studying the Informatics specialization at the Faculty of Sciences, UHK in the academic years 2012/13 and 2013/14. There were 84 student submissions, performance of 59 of these students was analysed after the course.
- Students studying at FIM UHK in the academic years 2011/12 and 2012/13. There were 407 student submissions, performance of 258 of these students was analysed after the course.

Results and Discussion

In this section let us introduce results of Dehnadi's test evaluation regarding ALGDS subject tests on students, future teachers studying the Informatics specialization at the Faculty of Sciences, UHK in the academic years 2012/13 and 2013/14 in comparison with

results concerning Dehnadi's test on students studying at FIM UHK in the academic years 2011/12 and 2012/13.

Students with no prior programming experience

FIM (Petránek et al, 2013)

The analysis using Wilcoxon rank sum test was performed. Surprisingly, both students who passed Dehnadi's test and those who were unsuccessful had the same ALGDS median score. The p-value of Wilcoxon test is 0.2655, thus we cannot reject the null hypothesis that the medians of the ALGDS score are the same (given significance level to $\alpha = 0.05$). Additionally, a Spearman's rank correlation test was performed, rejecting correlation between Dehnadi's score and ALGDS score with p-value = 0.1559. This means that when given to students with no prior programming experience, Dehnadi's test cannot predict programming aptitude.

Faculty of Sciences

The analysis using Wilcoxon rank sum test was performed as well. The p-value of Wilcoxon test is 0,000027, thus, contrary FIM result, we can reject the null hypothesis that the medians of the ALGDS score are the same by both, in Dehnadi's test successful and unsuccessful students (given significance level to $\alpha = 0.05$). To confirm this hypothesis a Spearman's rank correlation test was performed. However, p-value = 0,555 of Spearman's rank correlation did not confirm correlation between Dehnadi's score and ALGDS score. This means that when given to students with no prior programming experience, Dehnadi's test cannot predict programming aptitude.

Summary

Dehnadi's test ***cannot predict*** success in ALGDS subject of students with no prior programming experience.

Students with prior programming experience

To find out if Dehnadi's test results can predict success and failure for students who reported a previous experience with programming when the *threshold is set higher than 8 points*, students were grouped by success in the ALGDS course and medians of Dehnadi's score were compared using Wilcoxon ranked sum test.

FIM (Petránek et al, 2013)

The test reports a statistically significant difference between the two groups with p-value equal to 0.003464 (given significance level to $\alpha = 0.05$). The box plot in Figure 1 (Petránek et al, 2013) demonstrates this difference can be used to determine the threshold for predicting success. It is apparent that students with previous experience not scoring full points (i.e. 12 points) in Dehnadi's test are likely to fail the course.

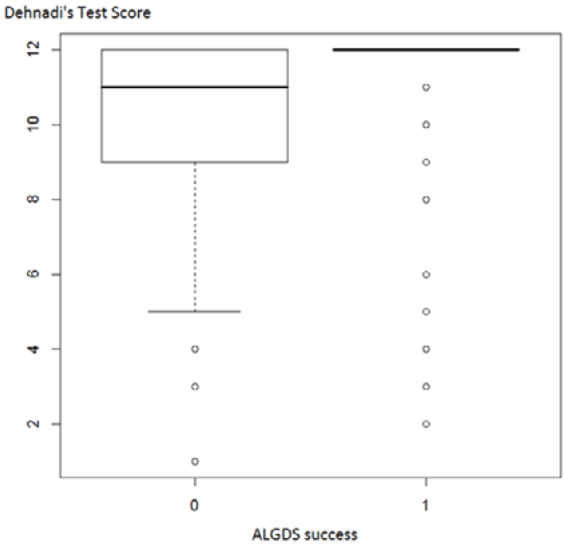

Figure 1: Box plot comparing Dehnadi's test score between students with prior programming experience studying at FIM who failed (0) or succeeded (1) in the ALGDS subject.

Faculty of Sciences

The test reports a statistically significant difference between the two groups with p-value equal to 0,00000019 (given significance level to $\alpha = 0.05$), see. Figure 2. Additionally, a Spearman's rank correlation test was performed, confirming correlation between Dehnadi's score and ALGDS score with p-value = 0,013186.

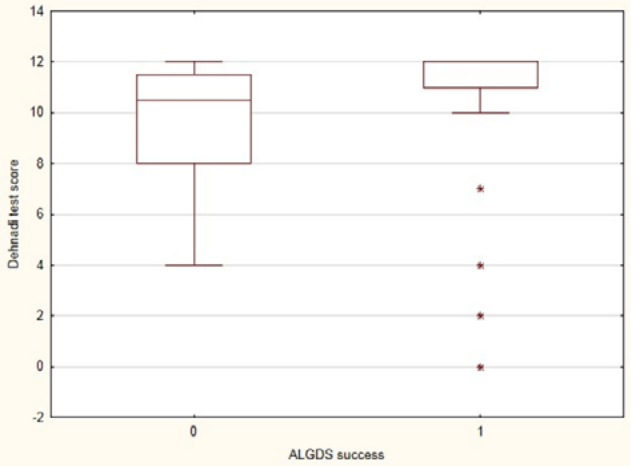

Figure 2: Box plot comparing Dehnadi's test score between students with prior programming experience studying at the Faculty of Science who failed (0) or succeeded (1) in the ALGDS subject.

Summary

Although the result achieved at the Faculty of Science (see Figure 2) is not such decisive as the FIM result (see Figure 1), we can admit that Dehnadi's test results ***can predict*** success and failure in ALGDS subject for students who reported a previous experience with programming when the *threshold is set higher than 8 points*.

Deliberation

Let us think about possible explanations of the fact

1. that there are students who successfully fulfilled the Dehnadi's test (i.e. achieve at least 8 points) but did not succeed in ALGDS subject,
2. that there are students who did not successfully fulfil the Dehnadi's test but they succeeded in ALGDS subject.

Students with prior programming experience usually think that gained previous programming skills are enough to pass the ALGDS subject and do not devote needed attention to the subject matter.

On the other hand students, who do not succeed in the Dehnadi's test are able to pass ALGDS subject thanks to a *systematically development* of algorithmic thinking with *careful explanation of each algorithmic structure*. We found out that devoting enough time explaining *mutual relationships among solved problems* and carefully, together with students, *recognize differences among almost the same algorithms* is very helpful for students.

Conclusion and future work

Knowing in advance whether a student is likely to have difficulties with course materials is inestimable information for teachers. The test result is also useful to the students as it indicates how much effort they have to put in their preparation.

However, contrary to the claims in (Bornat and Dehnadi, 2008), results of our research show that the Dehnadi's test cannot predict success in ALGDS subject of students with no prior programming experience (cf. Caspersen et al, 2007). Nevertheless using the test *we are able to predict success in ALGDS subject of students with prior programming experience*. Supposing that about half students attending ALGDS subject at both faculties have prior programming experience, the Dehnadi's test can serve as useful information for students not achieving full score to devote bigger care to the subject.

We suppose to run on the described research as well as to analyse achieved results with results gained by students succeeded in ALGDS attending later subjects dealing with more complex graph algorithms (cf. Vaněk and Ježek, 2013).

Acknowledgements

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NON-MATHEMATICAL CONTENT OF MATHEMATICS WORD PROBLEMS POSED BY TEACHER TRAINEES

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Abstract

The paper presents analysis of a total of 219 word problems with fractions posed by 60 teacher trainees (36 pre-service primary teachers and 24 in-service teachers studying to extend their qualification for teaching at primary school level). The study was carried out within the frame of research focusing on the potential of problem posing in teacher training and of research focusing of on non-mathematical content of mathematics textbooks, their impact on formation of mental schemas and pupils' everyday practices. Preliminary analysis of mathematics textbooks used in the Czech Republic shows that many word problems used are stereotypical and reinforce conservative values. However, teachers do not rely only on textbook problems and if needed they supplement lessons by problems they pose themselves. How stereotypical or conservative are these problems? Do they offer a wider range of contexts? These are the key questions the here presented paper is trying to tackle.

Keywords

Culture reproduction, non-mathematical context, problem posing, stereotypes

Introduction

As has been pointed out by a number of sociologists, anthropologists and educators, school is an institution responsible for reproduction of cultural patterns of a society and norms of everyday life. While functionalists such as Durkheim or Parsons (Prokop, 2005) see the process of enculturation important for securing functioning of society and believe that transmission of cultural values at schools is for the benefit of all, theorist of culture reproduction and transmission and critical educators point out that this reproduction serves the interests of the hegemonic group in a society and silences and handicaps all other groups as the values transmitted are values legitimating hegemony and values of a specific group (Bourdieu, 1998, Apple, Au and Gandin, 2009, Giroux, 1983)

Havelková (2013) warns that schooling does not keep up with society and, in consequence, pupils view education as irrelevant to their lives. This corresponds to Meany and Lange (2013), who discuss the issue of learners' transition between contexts and warn of the additional difficulties for learners if their experience of home context is very different from contexts they come across at school. Meany and Lange warn that if the transition between these cultures is not good, children might quite naturally do mathematics at home but may fail to do the same in the school/textbook context. While Havelková (2013) suggests that introduction of modern technologies into classroom practices is one of the ways of making experiences from the outside world and from school closer to each other, the author of this paper believes that another possible way of bringing home and school closer is inclusion of contexts and topics which stem from children's not their parents' or

grandparents' everyday experience, of contexts that are closer to everyday life and more appealing.

The impact of mathematics textbooks and other learning texts on mathematics education must always be born in mind and has raised a lot of attention of mathematics educators. As Rezat and Straesser (2012) point out what happens in a lesson of mathematics can never be sufficiently described by the traditional concept of the didactical triangle 'teacher-pupil-mathematics'. There are a number of other factors that structure a mathematics lesson (artifacts, culture, community). Rezat and Straesser redefine the classical notion of the didactical triangle to the more complex and plastic model of a socio-didactical tetrahedron, which depicts the situation in a mathematics lesson much more accurately. Artefacts used within a lesson (i.e. textbooks and also problems posed by teachers) are one of the factors affecting the course of a mathematics lesson and mathematics education in general.

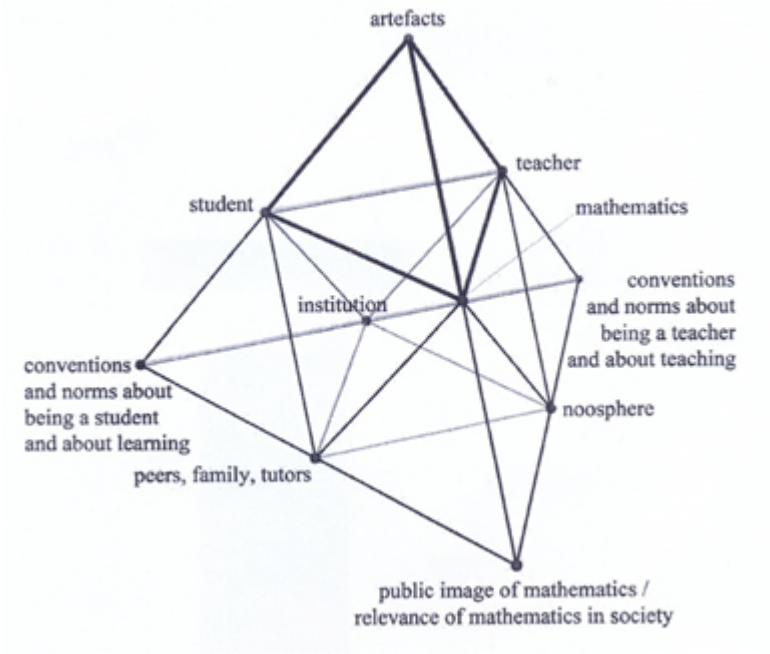

Fig. 1: Sociodidactical tetrahedron according to Rezat and Straesser (2013)

Many mathematics textbooks used in the Czech Republic were first published in the beginnings of the 1990's. Although they have been subject to several revisions to meet the needs of official school documents (curricula, standards, Framework Education Programme), or modifications caused by changes in the outside world (e.g. when hellers stopped circulating or when postage changed), the "literary" content, the setting of the word problems has changed very rarely. Thus the everyday life presented in the textbooks is at the best life lived in the 1990s', i.e. a quarter of a century ago. Needless to say that hobbies, jobs, food habits, interests have changed considerably since then. Moreover, the authors themselves were brought up on decades older textbooks and many authors admit

they had looked for inspiration in older textbooks. Textbooks have become rather old fashioned and culturally distant.

In a different perspective, the problem of realities in education is scrutinized by Jeřábek, Prokýšek and Rambousek (2013) who speak of the advantages (and the need) of adding computer-generated data into real contexts, thus making the environment information-richer than the initial natural environment. This strategy in creation of educational environments and texts is obviously needed in other subjects as well as the goal of pupils' passage through the environment is to learn, to get familiar with new concepts and apply them in problem solving. It is natural that authors of mathematics textbooks and learning texts will always put mathematics core and concepts first and adapt real life settings to their needs. The same happens in fiction, too. Literary theorists inform of the impossibility to depict "reality" and of every text being a mere *simulacrum* (Baudrillard, 1998). No text can ever be taken as a simple mirror of reality. However, authors of textbooks should never ignore the non-mathematical content entirely, as a good setting of a word problem not only makes the problem more motivating and appealing and makes transition between contexts easier, but also every setting leaves imprints on pupils' mental schemas and their understanding of what norm and deviation are in a particular society because these categories are socially constructed. Textbooks and other learning texts (albeit unintentionally) help pupils define norm and otherness (Blackman and Walkerdine, 2001).

According to critical educators, cultural transmission is far from being a static process. Teachers do not merely mechanically transmit the official cultural values. They amend them, modify them, comment on them and work with them dynamically (Giroux, 1983). This subversive activity could be happening in situations when teachers stop using the textbook for a while and use problems they posed themselves. In these situations they have the potential of changing the contexts and of presenting mathematics in contexts comprehensible and natural for their pupils.

The role of word problems in mathematics education as one of the key areas of mathematics education has also been discussed in several perspectives. Tichá and Hošpesová (2013) have focused on the potential of word problem posing on teacher trainees' self-reflection and improvement of their didactical competence. Patáková (2013) tries to propose criteria for evaluation of word problems, Novotná et al. (2013) focus on formulation of word problems and strategies pupils use for their solution. As word problems are related to the outside world, they play a crucial role in developing children's mathematical thinking, solving strategies and applications of mathematics in real-worlds settings.

Considering the importance of word problems in mathematics education and critical educators' belief in the subversive nature of teachers' activity in teaching with respect to hegemony, official ideologies and culture patterns, the author of the paper decided to study word problems posed by teacher trainees. The aim of the author is to answer how creative and subversive Czech teacher trainees are.

Materials and Methods

The method used in the reported study was the method of text analysis of 219 word problems posed by students at Faculty of Education, University of South Bohemia. 117 of these word problems were posed by pre-service primary school teachers in their third year of studies. 102 problems were posed by in-service secondary school teachers who study to extend their qualification to teaching at primary school level. The problems were posed within the seminar of Didactic of Mathematics. The assignment was "Pose three word problems which include fractions ½ and ¾ . Solve the posed problems." The aim of the

activity was to explore the potential of problem posing for discovery of future teachers' misconceptions, for making them more attentive to possible obstacles, to develop their didactical competences. A detailed analysis of the posed problems is presented in Tichá and Hošpesová (2013).

In this research attention was paid to another aspect of the posed problems. In what non-mathematical contexts are the posed problems set? How much attention do teacher trainees pay to cultural, everyday or cross-curricular issues?

Results and Discussion

Pre-service teachers

Out of the 117 word problems posed by pre-service primary school teachers (see Fig. 2), 69, i.e. 59% were set in the context of food. 44 of these, i.e. 64% of all these problems include cakes (cakes, cakes with poppy seed filling and cottage cheese filling – 28), birthday cakes (8), desserts (3), sponge cakes (2), cupcakes (2) and pizza (1). Both sponge cakes were baked by the grandmother, 4 cakes were baked by mothers, 1 cake by grandmother. There is no male baking. One cake is bought by mother, none is bought by father but father eats a cake that mother has left on the table. There are two word problems in which the mother divides it into pieces, this is never done by the father. In one word problem the grandmother prepares a cake to grandfather for breakfast, he comes and leaves a part of it to the grandmother. Obviously, women get the role of providers while men tend to be slightly more often the consumers (in 18 word problems cakes are eaten by girls and boys together, in 12 word problems they are eaten only by boys and in 6 cases cakes are eaten only by girls). In other words in single sex problems boys are twice more likely to be eating cakes than girls. However, in one half of the problems eating is carried out both by girls and boys. Other food categories are chocolates and candies (9 word problems), bread (7 word problems), fruit (4 word problems) and drink (5 word problems). The proportion of girls and boys eating chocolate and candies is about the same (these are eaten by a girl twice, a boy twice, 2 boys once and 1 boy and 1 girl once; in other cases there are no children). In contrast, eating bread is undertaken only by boys (6 times) with the only exception where a girl and boy are eating bread. Once bread is bought by the mother. Drinking is gender neutral, 2 girls drink juice and 2 boys drink milk. Gender division in the category of fruit is again more marked – while Anička makes a fruit snack for her brother, boys eat grapes. Mother and grandmother harvest fruit, mother and father buy it. A special category is picking mushrooms which is done by the grandfather.

A stereotypically male dominated is the category of do it yourself, which is typical also for Czech textbooks of mathematics (Moraová, 2013). There are five word problems set in this category, in 1 the father decorates the bedroom, in 1 he cuts a wooden bar, in 1 he fills up a lawn mower with petrol. In other two word problems from this context, boys are making a kite and a snake. Mothers only bake and cook lunch (2 word problems). Girls are not creative (in this set of word problems). In one word problem, mother asks her son to tidy up in his room. Tidiness seems to be problematic for boys. In another problem a girl uses blotter to help her male classmate get rid of a splotch. Shopping in general is not female dominated. Mother buys bread in one word problem but there are other two problems where boys go to buy bread. In another problem, mother buys ingredients for cooking and a girl a doll. It is really surprising that word problems with bread are so often connected to boys. As far as hobbies are concerned, there are many more word problems in which boys do extracurricular activities than girls. Boys watch television, sleep, go to

a funfair, draw a picture. There are only two word problems where girls do something – they go jogging and play marbles (activities more likely to be associated with boys). The rest of the problems fall into category of other or category no people, which may either be purely mathematical assignments such as *Mark in the circle area which represents one half and one third.* Or *how many times smaller is ½ than ¾,* or problems from real-life without people (train, cups, bowls etc.).

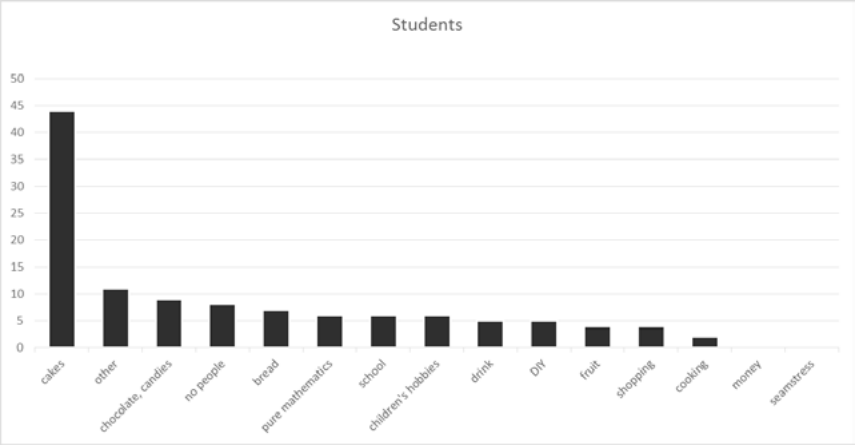

Fig. 2: Problems posed by pre-service teachers

In-service teachers

In case of in-service secondary school teachers studying to extend their qualification for teaching at primary school, the setting of the posed word problems is much more varied (Fig. 3). Although word problems with food setting are also dominant, this dominance is far from the 59% of problems with food posed in the group of pre-service teachers. Out of the 102 word problems posed, 36, i.e. 35% were set in the context of food. Out of these, only 18, i.e. 50%, in contrast to almost two thirds in the pre-service teacher group, were problems with cakes, (13 cakes, 4 birthday cakes and 1 pizza). The variety in the type of cakes was poorer than in the group of pre-service teachers. Fathers are not at the origin of these cakes, all the cakes are bought (2), baked (2) or given by mothers and grandmothers. The two cakes given by grandmother are given to boys. Otherwise 8 cakes are eaten by girls and boys together, 5 only by boys and only the pizza is eaten by girls alone (as well as in the group of pre-service teachers – is pizza associated with girls rather than boys?). In one of the problems father takes a larger piece of cake he has no eaten to his friend and leaves only the rest to the mother.

Other food categories are chocolates and candies (11 word problems, i.e. 30%), fruit (4 word problems) and drink (3 word problems). There were no word problems with bread in this group. Problems with candies and chocolates are fairly distributed (three with girls, four with boys, two with boys and girls and two with no people). There is only one reference to whom has bought the candies – mother for her daughters. Gender division is quite neutral in all the other food categories.

There are only two word problems in the category of Do it yourself, one of them speaks

about a boy who is painting the fence, the other one speaks in the first person about cutting a wooden bar. There are two female seamstresses. Mushroom picking is again a masculine domain – father is in the wood with his two sons. Children's hobbies in this set of word problems are marbles (twice they are played by boys, once by children), playground (boys and girls), sport (two boys). Shopping is done by women (both of them go to buy vegetables). In one problem children go to spend money given to them by their grandfather. There are two word problems that discuss income of the family, in both cases father makes more money than mother and daughter.

In contrast to word problems posed by pre-service teachers, there are many purely mathematical problems and many problems with no people from many different backgrounds and disciplines (volumes of vessels, areas of land, sales, time, years, milk teeth, height, bus).

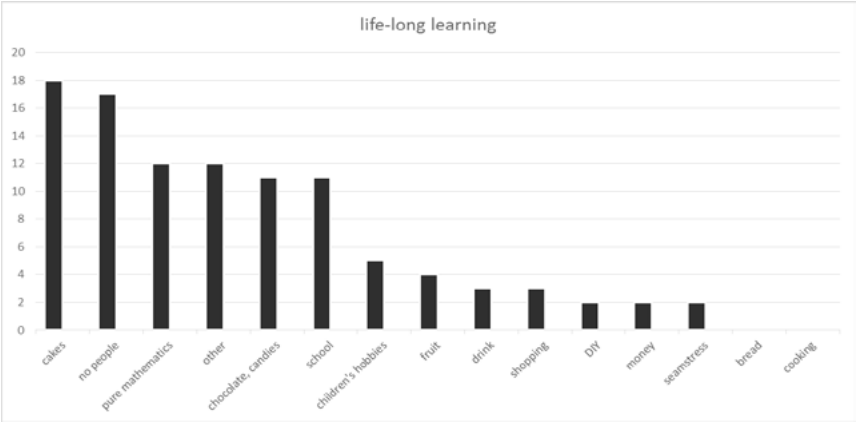

Fig. 3: Problems posed by in-service teachers

The results of analyses of the posed word problems show that teacher trainees tend to be quite conservative with respect to word problems they pose. The group that turned out to be more conservative is the group of pre-service teacher whose experience with word problems is only with word problems they were solving during their schooling. Their word problems tend to be very stereotypical in the context they are set in and roles their characters have. Problems posed by in-service teachers show a richer variety of settings and include problems with cross curricular links to other subjects. Although the most numerous group is also the group with food setting, there are more purely mathematical problems which have no nonmathematical context. There are more cross curricular references (biology, geography, physics etc.). This might be caused by in-service teachers' qualification and experience (either their second qualification or work with older students). However, this type of problems may not be very motivating especially for primary school pupils who will prefer reference to real life.

Primary school children's horizons are undoubtedly broader than eating and dividing cakes or candies. Not many of them are likely to see their fathers in do it yourself activities or mothers baking cakes and pies. In the posed word problems, one could not come across problems introducing modern contexts – computers, mobile phones, mp3 players, neither many problems stemming from free time activities of children (sport, games, toys) or financial sphere (pocket money, buying presents, souvenirs etc.). Men and women are

depicted in the most stereotypical roles – women as mothers, men as fathers, women sewing, cooking, baking, fathers repairing, as breadwinners etc. Picking mushrooms is in both groups a purely masculine domain.

If Meany and Lange (2013) speak of children's failure to connect real-life and school mathematics because of transitions between home and school cultural context and subsequent inability to perform well at school in mathematics topics they master easily at home, problems posed especially by pre-service teachers support this view as their context is quite limiting. Children are more likely to be dividing other things than just cakes and birthday cakes. However, the greater variety of problems posed by in-service teachers suggests that Giroux's (1983) assumption that school does not only reproduce but also melts and remolds cultural values is well justified as teachers who have more experience from work with children at least partially remold the most stereotypical images.

Conclusion

The research clearly shows that problem posing deserves a lot of attention of mathematics educators not only because they can help uncover future teachers' misconceptions or because they raise their awareness and subject didactic competence. It also needs attention with respect to the non-mathematical content and cultural values these problems help to reproduce. Future teachers' awareness of potential dangers of cultural reproduction and the role they should play in defining the most spread stereotypes must be stressed during their training. When reflecting upon problems they pose, teacher trainees should also pay attention to their context.

A question for future research is to interview pre-service teachers and study their motives when selecting contexts of problems they pose. Are they aware of the role they play in reproducing current order or do they do it unintentionally? Where do they get inspiration for their problems?

Acknowledgements

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TALENT MANAGEMENT AS A PART OF EMPLOYEE DEVELOPMENT – CASE STUDY

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Abstract

Employee development is connected with the development of human potential, which is expanding thanks to learning and constant education. For this reason, management of human resources and education connected thereto in an organization is one of the main goals of every company throughout the world. This theme is current in view of the fact that in today's world, identification, development of talents and the maintenance thereof is one of the greatest competitive advantages. Therefore, the aim of this article is to identify and assess the present educational process connected with the Talent Development Program in a specific company. The research as such is conducted in the foreign company XY Ltd. (operating in the area of electrical technology), in which individual approaches and methods of education, with a focus on the Talent Development Program, were analysed and assessed. The data were gathered by means of a quantitative survey. One of the conclusions of the article is the proposal of integration of new educational activities in the talent program for all employees.

Keywords

Talent management, learning, employee, knowledge, development, research

Introduction

Education accompanies everyone from birth, which is why it is an integral part of life in today's hurried world (Chili 2013; Jablonský, 2011). Organizations can have the most modern technologies, but if they do not have capable and educated employees, it is very difficult to endure in competition or to achieve organizational goals (Zhen et al., 2013; Oosthuizen, Nienaber, 2010). Employees are the original capital of a company, and it is necessary to nurture and maintain them. For this reason, both individuals and organizations are endeavouring to meet set goals on the basis of concurrent education and additional training (Shih, Huang, 2011).

The aim of the article is to identify and assess the current education process connected with a specific Talent Development Program for the development of talented employees in foreign companies and thereby form a case study. A partial goal is to propose a recommendation for changes that would lead to increasing the efficiency of development of talented employees in a company.

The first part of the article presents theoretical departure points of the given problem focused on the area of employee education as a part of personal activity, the Talent Development Program and the selection and development of talents connected thereto. This chapter is followed by results which assess the current situation in a specific company. On the basis of the results, recommendations are proposed, and a conclusion summarizes the gained insights.

Materials and Methods

The primary data were gained from a quantitative survey by means of a questionnaire survey (with closed and open questions), which were realized in an international organization operating in the industrial sector. The survey focuses on the Large Drives division, where a total of 2,100 employees work (409 administrative employees, 1,265 production workers and 427 nonproduction workers). The aim of the questionnaire survey was to ascertain the level and quality of the current education process of talents in the scope of the Talent Development Program. The questionnaire contained 11 questions aimed at identifying respondents, evaluation of the program and ascertainment of the respondents' needs. In order to ascertain the degree to which the given sample was representative, the questionnaire (in electronic, printed form) was distributed to 41 nominated employees, to the Country Talent Development Program at various levels of management in the given organization XY Ltd., i.e. the selection was intentional. The list of employees who are currently involved in the talent program was gained from personnel department representatives. 7 women and 34 men were at issue. The questionnaire survey took place in December 2013, and current proposals containing recommendations for increasing the quality and satisfaction of education participants at the given company were presented to the HR department for realization. The recoverability of the questionnaire survey was 73 % (n=30). The results can be generalized only for the given organization and its development program. The case study and its recommendation will serve the organization management to improve the current program and increase efficiency.

Of the total number of 30 returned questionnaires, the group is comprised of 83 % men and only 17 % women. The largest group consists of men aged 26 to 35 years, with a length of employment of up to 5 years, and then with a length of employment from 6 to 10 years. The group formed by women is only within an age bracket of 26 to 35 years, primarily in a length of employment of up to 5 years. On the basis of identifying questions, it can be summarized that men who represent the greatest potential within the first 10 years of employment are most frequently nominated for the surveyed program.

Theoretical methods of insight, i.e. analysis of secondary sources, synthesis of insights, induction and deduction were also used in the article. Instruments of descriptive statistics were utilized in the scope of evaluating results.

Talent management as a part of employee development

Thirty years ago, only manpower management was spoken of in organizations. At a later time, it was found that mainly knowledge and skills were of importance. During this time, however, the next phase began. The real source of competitive advantage is not only knowledge, but rather talent, which is the only rare resource in today's world (Chow, 2012; Horváthová, 2011). A talented person is one who is considered to be apt, intelligent, a team player capable of further development and growth (Sadler, 1993). According to human capital management, talent management is a process of recruitment, management, evaluation, development and preservation of the most important asset an organization has: people (Shukla, 2009). Every organization has its own criteria according to which it searches for and determines talent. Sometimes it could be the criteria of age and knowledge, at other times practice, performance or respect towards other employees (Chow, 2012; Zíková, 2012). Handling of stressful situations, the ability to manage oneself effectively and overcome barriers which emerge in more demanding situations, for instance, are also important factors. The whole process of talent management begins with the identification (i.e. the selection) of suitable employees. The organization then attempts

to secure them for this education program and develop their knowledge and skills with the aid of various training programs, exercises, tasks or involvement in organization projects. For the majority of talented employees, the possibility of applying their abilities or the development thereof is an important motivator (Zhen et al., 2013). The whole process has a longer-term character and is demanding in terms of time. The aim and expected result of the whole talent management program is to cultivate – preferably from the organizations own resources – the future successors of the present managers (Horváthová, 2011).

On the basis of studying professional literature and scientific studies, it can be said that there are a large number of forms of education and that employee development is a long road. Organizations can use both internal and external sources to educate employees. At larger organizations and concerns, it is more expedient to build their own education centres (Shih, Huang, 2011). The realization of talent management is no simple matter. Various problems concerning both employees and employers can emerge in the course of the whole program. The personnel department should devote great attention to talent management at regular meetings with the organization's management and negotiate further steps for the development of talent (Horváthová, 2011; Shukla, 2009). If this program is not sufficiently motivating or inventive for employees, they could soon slacken and lose interest in further development. The program of talent management should therefore undergo evaluation which will ascertain success and especially employee satisfaction.

Research of the given company shows that, in 2012, the republic-wide Country Talent Development program was attended by 136 members divided into three groups: Senior Country talents, Country talents and Emerging talents (structure see Fig. 1). Talent programs bring to participants a development program for managers, in the first place, and newly for experts with potential for further career growth. Participants are required to work actively on projects and also on selected tasks – so-called change projects, which they handle together in groups, over and above the scope of their work duties.

Fig. 1: Talent Development Program (Source: own elaborate)

The development of talent is a part of the changes in new organization culture, such as perfection, innovation, responsibility and cooperation. The fundamental goals of this program are:

- Identification of talents with ambitions and potential exceeding the scope of the area of their standard responsibilities.
- Strengthening and expanding the focus of talents and their involvement in inter-business activities and sharing of responsibilities for the development of the

company.

- Support of personal growth of talents and facilitation of their orientation in development opportunities.
- Promotion in the scope of identification of talents which have the potential to assume more demanding management or the role of an expert in the organization and support in meeting those goals.
- Impact on the nomination of the best for worldwide talent sources.

The goals proposed above are in accordance with Grebosz, Bakalarczyk (2013), Zíková (2012), Shukla (2009), Sadler (1993).

The identification of talents in the given organization takes place on the basis of the PMP process (Performance Management Process), which serves as the main instrument for managing the performance of all THP employees in the given organization by means of setting goals that are beneficial for the organization (see Fig. 2). The performance of the employees is checked and monitored. An action plan and analysis of competence and potential of the employees is then compiled on the basis of the evaluation results. All is consulted with the employee by means of feedback.

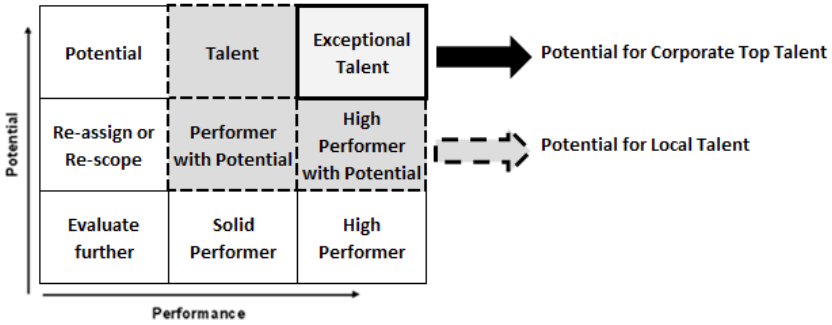

Fig. 2: Performance-Potential Grid (Source: own elaborate)

Results and Discussion

The needs and opinions of the individual employees included in the program were ascertained within the scope of the evaluation of the course of the Talent Development Program. The majority of respondents (63 %) stated that they understand their participation in the Talent Development Program as a possibility for career growth. With the aid of organization projects in which they are involved in the course of the program, they can make visible their potential and the endeavour to grow. A project to transform the intranet pages or improving communication within the organization is an example. The group comprised of 17 men and 2 women. 13 % of respondents think that participation in the program has no influence on their career growth and 23 % consider participation merely as a part of employee education.

The results show that only half of the respondents (50 %), of which there were 14 men and 1 woman, consider the group projects realized by the program participants meaningful. However, a further 40 % of respondents think that all the realized projects are meaningful. 10 % of respondents have no overview of the success of the projects.

In the questionnaires, the respondents also expressed themselves as to the criteria of talent selection. 77% of those questioned indicated the greatest criterion to be the potential

of employees and their endeavour to educate themselves. According to 13% of those questioned, all criteria – from attained education, practice and experience through to the endeavour to educate themselves – are important. 7 % of respondents utilized the "other" possibility and added that the support and assertion of a superior are also of importance, and that they do not take attained education into account in this case.

On the basis of the summarization of the questionnaire survey, it can be said that the respondents find marked inadequacies in the Talent Development Program. They find these inadequacies primarily in the areas of:

- poor support and underestimation of the program on the part of the personnel department,
- absence of goal/output setting or plans for the future,
- absence of clear direction,
- interest of talents in changing something independently,
- setting programs for experts, not only for managers,
- feedback and evaluation thereof – this is simply missing,
- practice and handling of projects, together with their presentation among individual factories,
- setting of the talent program criteria,
- setting of further steps after the end of the program,
- setting of a precise program of education, development and active implementation into new projects.

The results show that, according to feedback which took place on the project of improving communication, the Talent Development Program was more or less unsuccessful and the majority of employees questioned did not notice a shift towards the better. Such an unsuccessful project can be caused, for instance, by poorly set goals or poor support of the project, both on the part of the personnel department and that of the employees. From the general perspective of those questioned, poor support and underestimation of the program on the part of the personnel department and vaguely set goals were the most frequent remark. It is not precisely specified as to where to program is in fact directed and what the individual participants should achieve after its completion. Although the program contains numerous inadequacies, it is considered to be more or less prepared, according to the questionnaire survey. A possible solution for the correct support of employees, setting of talent management and setting of development programs could be a seminar which is organized by an organization such as Top Vision. This is a Talent Management seminar designed primarily for personnel department managers, during which the practical experiences of firms are presented. The cost of the seminar is in the vicinity of CZK 9 thousand per participant, which is a negligible sum outlaid for the development of talents and their upkeep.

In view of the fact that talents are nominated primarily on the basis of their potential and endeavour to educate themselves, it would be good if the organization listened especially to their requirements from the Talent Development Program. At the introductory sitting, where talents are introduced to the course of the program, they should have the possibility to express their views and possibly proposals for development. An integral part of the program should be the implementation of regular meetings with the personnel department and the company management, during which feedback on realized projects and the evaluation of talent activities would take place. In the scope of development, employees are especially interested in language courses which the company organizes. The organization's total budget for language tutorial has been fixed at CZK 980,000 for 2014,

and forms of group, individual and conversation courses fall therein. This also includes the week of training at the Nepustil Language School in Brno, which can be attended only by employees not included in the language courses. Unfortunately, the capacity of these courses is limited and does not suffice for many of those interested. One possible solution would be the introduction of e-learning. This method of learning has become very popular in recent times. A one-year licence for an unlimited number of students costs roughly CZK 70,000 and contains innumerable language courses on many levels, with the possibility of taking monitoring tests. This is also a possibility for organizations to lower their expenses for language tutorial.

A further development possibility in which talents are interested is rotation of work, both within the organization and foreign short-term attachment. Employees view this as a possibility to examine the processes not only of other departments, but also to apply their talents in other areas of manufacture or sale. Each department could thus be assigned a mentor, who would nurture talents and help them in training in a given area of the pertinent department. Connection of knowledge of internal processes and deeper knowledge of the organization would thus occur, which would be a help during realization of projects. These results correspond also with the other surveys (Stacho et al. 2013; Urbancová, Urbanec, 2013; Shukla, 2009) which focused on talent management.

Conclusion

The results showed that the Talent Development Program in company XY Ltd. operating in the area of electrical technology, with an employee count of 2,100 is marked "more or less prepared" under the auspices of the personnel department. Internal research immediately drew attention to several fundamental inadequacies, especially on the part of the personnel department. These include poor program support, the fact that precise and clear goals are not set and participants lacking feedback. After the program finishes, the organization should endeavour to maintain these talents and thus gain a competitive advantage. It corresponds with Stacho et al. (2013). However, if further steps of development are not set, talented employees could move to the competition, which will use their potential immediately. On the basis of these findings, a seminar concerning talent management has been designed for managers of the personnel department. HR employees will thus gain foundations from the experiences of other organizations which have been applying talent management for a longer time. The utilization of e-learning has been proposed for the purposes of development of language abilities, given the small capacity of the in-company language courses already organized. This possibility of tutorial is flexible in terms of time and is thus suitable for time-pressed individuals who do not have the possibility of attending courses taking place regularly during work hours.

Rotation of work not only across the organization, but also, for instance, in individual organization divisions during foreign short-term work attachments have been designed for projects that are realized by talented employees. Firmly fixed mentors should be given the task of induction of talents into the processes of individual departments. The connection of knowledge gained on internal organization processes should result in more efficient handling of projects.

The theoretical contribution of the article is in the verification of theoretical contributions of talent management in a specific company in the industrial sector which is beginning to utilize this new concept. The practical contribution of the article is the presentation of inadequacies in the Talent Development Program in the monitored organization and deduction of recommendations which will be realized should the director of the personnel

department so decide. The limits which reduce the benefits of the program can thus be removed.

The small sample of respondents could be considered to be a limit of the article, but in view of the fact that only 41 employees have been identified and included in the talent program at the present time, the sample 30 respondents can be deemed sufficient and representative. The results can be generalized for the given organization. The survey in the given organization will subsequently be repeated with a focus on the satisfaction of individual employees who are included in the program.

Acknowledgement

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BANKERS MOTIVATIONAL FACTORS ON SOCIAL MEDIA KNOWLEDGE SHARING

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Abstract

Knowledge workers in banking institutions have intended to use social media as one of the way to share knowledge in increasing their learning capabilities. The purpose of this paper was to explore and examine the motivational factors among bankers in using social media such as Facebook in sharing knowledge. The research variables were examined while considering bankers motivational factors dimensions including Need for Online Social Capital (Bridging, Bonding, Maintained), Banker Psychological Well-Being (Life Satisfaction, Self-Esteem) and Bankers Response towards Social Media Knowledge Sharing (Perception, Attitude, Intention). This study was conducted using the survey method. The statistical population consisted of 450 bankers from the six selected commercial banks in Malaysia, which 200 bankers were chosen through stratified randomized sampling as the sample. The information gathering tools were researcher-made Social Media Knowledge Sharing Questionnaire with seventy items. The search findings revealed that the need for online social capital that are bridging and bonding have significant effects towards how do the bankers in Malaysia response to the social media knowledge sharing.

Keywords

Banker psychological well-being, commercial bank, motivational factors, online social capital, social media knowledge sharing

Introduction

New opportunities for bankers to enhance knowledge sharing strategies are created with the existent of technology that allows conversation with each other which before often a one-way communication (Ali and Yusof, 2009). The knowledge sharing strategies that commonly used by the knowledge worker is social media knowledge sharing which embedded in Social Networking Sites (SNS). By using SNS, the users are able to present themselves, build and maintain social connections with others, which later articulate their own social networks (Ellison, Steinfield and Lampe, 2007).

The number of internet users in Malaysia increased from 15.8 million in 2010 to 16.5 million in 2012, the number will escalates to 17.5 million by 2018 (Bank Negara Malaysia, 2013). With the numerous numbers, knowledge managers now tend to invest more on social media for the reason that, the larger the number of target knowledge workers, the larger the possibility for the knowledge sharing efforts to be aware by them. So, their initiatives will not be wasteful as their plan is successfully reach the right target audiences. Another thought is that, social media is the most influential communication approach which later transform into individual channels for communication (Russell, 2009). Hence, day by day either big or small companies start to go for social media knowledge sharing in

building their knowledge based organization. Despite all these benefits, it raises questions about the actual effects and how to optimize it.

The main objective of this paper is to identify the relationship between banker motivation employed in online social networking and the response to the social media knowledge sharing. Also, this research was conducted in order to explore the affects of banker motivation to employ in social networking on response to social media knowledge sharing. Different people will have different driving forces that encourage them to go online. Many have concluded that different motivation factors will bring to different response towards social media knowledge sharing. So, this study will investigate whether need for online social capital and psychological well-being that are the two aspects of banker motivation is true or not.

Literature Review

Bagozzi and Dholakia (2002) claimed that participation motivated by social interaction with a small circle of friends, leading to identification with the group and development of norms. From the research that have been done by them, they concluded that the users go online due to the interaction of the current users which encourage them to involve with the community which later creates the identification among them as they communicate frequently on the internet. From time to time, they become used to interact via social networking sites such as Facebook. However, Ridings, Gefen and Arinze (2002) found that trust is a significant predictor of desire to exchange information and engage in virtual community activities. From the statement, the researcher concludes that one's trust have a significant relation towards their willingness to go online. They only engage to this online community when there is trust exist among them. Best and Krueger (2006) support these two statements when they claimed that online social interactions do not produce strong connection that elicit strong loyalty, but do foster connections that expand networks and produce generalized trust.

Bourdieu (1986) defined social capital as the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance or recognition. Coleman (1988) defined social capital by its function as a variety of entities with two elements in common: they all consist of some aspect of social structures, and they facilitate certain action of actors, either persons or corporate actors within the structure. From different view, Putnam (2000) defined social capital as features of social organization, such as trust, norms and networks that can improve the efficiency of society by facilitating coordinated actions. His view concentrated on national civic association and the general well being of communities in his understanding of social capital. He has aggregated the social capital of individuals to give a description of the "collective social capital" of the population of an area. Stone et al (2003) have generalized the conception of family, friendship, and neighborhood ties as bonding ties. Civic linkages and other more distant ties are clarified as bridging ties, and institutional ties are known as linking ties. To give a clear view of these three types of social capital, Woolcock (2000) have defined bonding social capital as existent in dense or closed networks, and helps people "get by" in life on a daily basis because one's closest and strongest ties are likely to have redundant information (Granovetter, 1973). Lastly, linking social capital involves social relationships with those in authority or positions of power and is useful for gaining resources.

Putnam and Helliwell (2004) founds that social capital is strongly linked to the subjective well-being through many independent channels and in several different forms. They

claimed that the "externalities" of social capital on subjective well-being which arise as the effects of one's social ties on others happiness are neutral to positive. In other words, either the social capital is good or not, it will affect the subjective well-being. Shklovski and Kraut (2006) claimed that computers have permeated nearly every facet of daily life and the phenomena surrounding computers also expanded to include the daily life and psychology well being of computer users. This means a computer nowadays becomes important and outstanding from day to day which later affects the user's daily life and the psychological well-being. Bargh and McKenna (2004) change the idea of computers as proposed by Shklovski to internet. They claimed that studies of internet also indicate that its use enhances online social interactions; helps create and maintain social connections, and improves user psychological well-being. The study of psychological well-being by Diener, Suh and Oishi (1997) founds that psychological well-being refers to global cognitive judgments of the self, which include self-esteem and life satisfaction. This means psychological well-being have something to do with the way of their thinking about certain thing which have connection with their self-esteem and life satisfaction.

Social media has been and continues to be game-changer for communication. It continues to give impact to the human communication either positive or negatively depending on the subjects under study and the type of communication (Edwards, 2011). For the knowledge managers, they used social media knowledge sharing to initiate knowledge management. But, bankers may use it to spread positive knowledge also with negative one. Thus, it becomes the prior concerns of the knowledge managers to make sure there are only positive knowledge is being shared, or else knowledge management initiatives will failed (Ali and Yusof, 2004; Ali and Yusof, 2012). Social media include networks such as Facebook and Twitter allow people to interact with each other and share information (Edwards, 2011). Ali and Yusof (2009) claimed that online technology and tools such as social media provide a new landscape for knowledge sharing activities, where bankers take a more active role as knowledge creator and sharer. As a consequence, bankers have increasingly become the editors of knowledge, empowered by technology to avoid the use of unvalued knowledge (Ali and Yusof, 2011; Ali and Yusof, 2012). Hence, knowledge sharing is not just about the shared knowledge itself but rather offers personal knowledge creation, knowledge storage, and knowledge usage (Ali and Yusof, 2009; Davenport, 1998; Leila, 2005). The study that has been done by Chu (2011) proved that attitudes-related variables may influence Facebook group participation in social media. In order to gain empirical outcomes from this study, Chi (2011) introduced another two variables to know how user response to social media which are trust and global perception of social media and user participation intentions. So, in this paper, the variables to test banker response to social media knowledge sharing will be perception, attitudes and participation intention.

Figure 1 shows the clear framework of this study that in generally to examine two types of banker motivation for online social networking (need for online social capital and banker psychological well-being) on banker response toward social media knowledge sharing. Specifically, it aimed to study whether the need for online social capital (bridging, bonding and maintained) affect the banker response to social media knowledge sharing in terms of perception, attitude and participation intention.

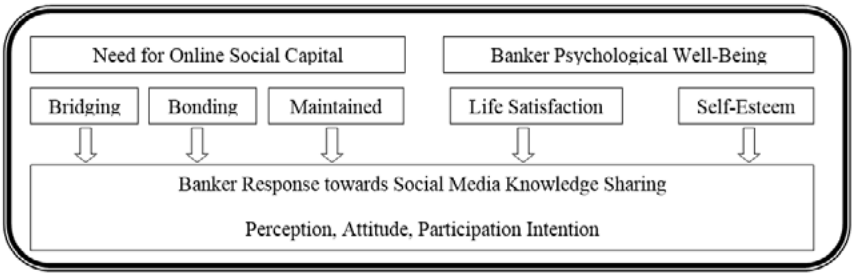

Fig. 1: Research Framework: Banker Motivation for Online Social Networking

Materials and Methods

Research Method

This study was conducted using the survey method. The statistical population consists of 450 bankers from the commercial banks in Malaysia. The sample was selected by Stratified randomized sampling proportional to the volume of 200 bankers. The tools for gathering data was researcher-made questionnaire for Social Media Knowledge Sharing with 70 items based on Likert five-point scale (5= strongly agree and 1= strongly disagree). The collected data was processed using statistical analysis SPSS 18.0 (*Statistical Package for Social Science 18.0*). The statistical analysis technique used was using Alpha Cronbach coefficient.

Statistical Analysis

The researcher used Alpha Cronbach coefficient to test the consistency of the items for independent and dependent variables that are: need for online social capital, banker psychological well-being and banker response towards social media knowledge sharing. Table 1 and 2 below shows the research findings.

	Final Data		Pilot Test	
Variables	Cronbach's Alpha	N of items	Cronbach's Alpha	N of items
Need for Online Social Capital	0.897	17	0.9	17
Bridging	0.905	8	0.915	8
Bonding	0.73	5	0.744	5
Maintained	0.784	4	0.794	4
Banker Psychological Well-Being	0.925	9	0.677	9
Self-Esteem	0.894	4	0.77	4
Life Satisfaction	0.901	5	0.889	5

Tab. 1: Banker Motivation for Online Social Networking

	Final Data		Pilot Test	
Variables	Cronbach‘s Alpha	N of items	Cronbach’s Alpha	N of items
Banker Response	0.946	44	0.941	44
Perception	0.945	32	0.931	32
Trust	0.952	16	0.966	16
Reliability	0.921	6	0.937	6
Willingness to rely on	0.877	4	0.932	4
Usefulness	0.86	3	0.907	3
Affect	0.866	3	0.921	3
Global	0.87	16	0.807	16
Informative	0.88	5	0.893	5
Entertaining	0.847	6	0.87	6
Irritating	0.901	5	0.843	5
Attitude	0.891	7	0.899	7
Participation Intention	0.879	5	0.867	5

Tab. 2: Banker Responses towards Social Media Knowledge Sharing

Results and Discussion

This section deals with the research findings, presented in Table 1 and Table 2.

	Final Data		Pilot Test	
Variables	Cronbach’s Alpha	N of items	Cronbach’s Alpha	N of items
Need for Online Social Capital	0.897	17	0.9	17
Bridging	0.905	8	0.915	8
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Banker Psychological Well-Being	0.925	9	0.677	9
Self-Esteem	0.894	4	0.77	4
Life Satisfaction	0.901	5	0.889	5

Tab. 1: Banker Motivation for Online Social Networking

Table 1 indicated that the need for online social capital and banker psychological well-being variables are reliable with α-score of 0.897 and 0.925 respectively. Both score also shows that the variables reach the good range as it above 0.8. The total of 26 items were combined together which included the sub-variables for need for online social capital and banker psychological well-being in order to get the main value for this independent

variable. To be specific, three types of sub-variables for need for online social capital are bridging, bonding and maintained social capital. For banker psychological well being, two types of variables; self-esteem and life satisfaction were added into the study to gain better results. The pilot test α-score for bridging, bonding and maintained social capital are 0.915, 0.744, and 0.794 respectively. These score also indicates that all variables need for online social networking is reliable. The sub-variables for banker psychological well-being pilot test α-score also shows that self-esteem and life satisfaction are reliable with 0.770 and 0.889 respectively.

	Final Data		Pilot Test	
Variables	Cronbach‘s Alpha	N of items	Cronbach’s Alpha	N of items
Banker Response	0.946	44	0.941	44
Perception	0.945	32	0.931	32
Trust	0.952	16	0.966	16
Reliability	0.921	6	0.937	6
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Irritating	0.901	5	0.843	5
Attitude	0.891	7	0.899	7
Participation Intention	0.879	5	0.867	5

Tab. 2: Banker Responses towards Social Media Knowledge Sharing

Table 2 discuss all of the dependent variables that includes in this study which combined together in order to get the single value. 44 questions were included in this analysis in order to get the value. Both pilot test and the real fieldwork shows reliable results as both of it get the α-score more than 0.6. Moreover, the scores are considered good as it is above 0.8. The α-score for banker responses to social media knowledge sharing is 0.946 while the α-score for the pilot test is 0.941. Both score shows that the dependent variable is good as it is above 0.8 score. There are three sub-variables that included in this study which were perception, attitude and participation intention. For the first variable which is perception, there are two sub-variables for it; trust and global perception. All the sub-variables were tested separately in order to get the precise results. For trust perception, the final α-score is 0.952 while the pilot test score is 0.966, hence this variable is reliable. The final α-score for global perception is 0.807 while the pilot test score is 0.870. This also indicates that the global perception variables are reliable. The last two variables that have been used by the researcher to measure the responses from the banker are attitude and participation intention. Both variables are reliable either for the final data or the pilot test with the α-score of 0.891.

Conclusion

This paper has highlighted relevant aspect to understand on how banker motivation employ in social networking affects the responses of the banker towards social media knowledge sharing. In reality, some of the banker tends to feel that this kind of knowledge sharing strategy is not practical. Thus, the research was conducted to spot this issue. If the result is positive, then they might use this kind of knowledge sharing strategy to increase their corporate knowledge databases.

Based on findings of this study, knowledge manager who decided to use online technology in their knowledge sharing strategy has to make sure that these two aspects of need for online social capital should be tinted in their strategy. Forgone of these two aspects will definitely affects the banker responses to the online databases used in Social Networking Sites (SNS). So, it is suggested to focus more on these two aspects compare to the user self-esteem and life satisfaction. In the future, the researcher suggests for the broadening of the target population to include every employee from banking and finance industry that have Facebook account in order to get different responses. Rather than seeing the issues from the banker's perspective, it is better to view it in more broad ways.

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STUDENTS AND WORK: DIFFERENCES IN GENDER AND STUDY PROGRAMME?

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Abstract

This study examines the particularities of work experience of students towards their study pro-gramme and gender. A descriptive survey research was conducted from March 2013 to April 2013. 332 students in full-time mode of study completed an on-line version of a questionnaire. We used Pearson Chi-square test of independence to test the null hypotheses about independ-ence of the type of study programme and actual work experience of students in our research sample, and also about independence of actual work experience of our students according to their gender, and Cramer´s V to identify the strength of the relationship. Our results show signif-icant – according to Cramer´s V weak - dependence of measured variables.

Keywords

Full-time study, gender differences, university students, work experience

Introduction

Asking questions about priorities in university education, students would probably choose answers in the areas of personality development, disciplinary knowledge and research skills, and also employability and professional skills. Issues of career development, career planning and professional specialisation are actual and important, and every educational institution has to deal with them. Also looking to statistics about unemployment and employability we can state, that university graduates have higher probability to get better-paid job as lower educated population, and also in a situation of job loss lower educated respondents need more time and have more difficulties with finding a new work position (Buchtová et al, 2002; Buchtová and Snopek, 2012). Similarly Jayawardena and Kuruppuge (2012: 116) state that ´success in higher education is an effective way of securing gainful employments, and career development for the youth´. Hall (2010) studied work-study relation in university students over a 15-year episode in a concurrent research design and his results show an increase in part-time work at full-time students, and a steady decrease in hours of study outside normal class time and in time spent in leisure activities. Increasing number of working students in full-time study modes describe also Beerkens, Mägi and Lill (2010) and Bradley (2006). Work during semester reported 85 percent of students in his (Bradley, 2006) research sample.

Creed and Patton (2003) studied the relationship between gender, age and paid work experience towards career maturity in high-school students, in dimensions of Career Development Knowledge and Career Development Attitude. According to their results females at all age levels reported higher levels of career maturity than males, students with paid work experience reported higher level of Career Development Attitude. Career Development Knowledge was not associated with paid work experience.

As was mentioned above, studies show increasing trends in part-time work experience

during university studies (Hall, 2010) and greater proportion of females employed part-time (Creed and Patton, 2003). Our research interest stems from our consulting and teaching activities at Faculty of Economics and Management of the Czech University of Life Sciences Prague (FEM CULS), therefore the main aim of our research and our major research question is, if we can identify some differences in work-experience of students studying in different study programmes, and also if we can find a difference between male and female students in their current work activities. The last question is, if we can find significant differences in self-employment between students in different study programmes at FEM CULS, with the more detailed focus on students of programme Business and Administration. This question stems from the conception of the study programme and we assume that students should be more active and able to provide their own entrepreneurship.

Materials and Methods

Group of respondents

A descriptive survey research was conducted from March 2013 to April 2013. Non-probability convenience sampling was used to create the research sample. After job fair at Faculty of Economics and Management of the Czech University of Life Sciences Prague (FEM CULS) students were asked to complete a questionnaire as a feedback to the job fair. 332 students in full-time mode of study completed an on-line version of a questionnaire in the limit of 7 days after the job fair at FEM CULS was realised. Respondents were students in the first and fourth year of their studies.

The subjects were not paid. Further descriptive characteristics are presented in Tab. 1, below.

	N	%	SP 1 (%)	SP 2 (%)	SP 3 (%)	SP 4 (%)	Other (%)
Male students	105	31.6	6 (1.8)	45 (13.6)	20 (6.0)	24 (7.2)	10 (3.0)
Female students	227	68.4	14 (4.2)	110 (33.1)	79 (23.8)	3 (0.9)	21 (6.3)
Total	332	100	20 (6.0)	155 (46.7)	99 (29.8)	27 (8.1)	31 (9.3)

SP 1 = Study programme Economics and Management, SP 2 = Study programme Business and Administration, SP 3 = Study programme Public Administration and Regional Development, SP 4 = Study programme Informatics; % = % of total N

Tab. 1: Descriptive characteristics of subgroups of respondents.

The method

We used structured on-line questionnaire to collect the data. Information about questionnaire was sent to students via e-learning courses, which they attended at the Department of Psychology FEM CULS. Questionnaire included short introduction, section of demographic questions (gender, study mode, study programme etc.), questions connected to specific employers attending the job fair, and general questions about attitudes and experiences connected to the work experience of students, job fair and similar events organised by FEM CULS.

Statistical Analysis

We used Pearson Chi-square test of independence to test the null hypotheses about independence of the type of study programme and actual work experience of students

in our research sample, and also about independence of actual work experience of our students according to their gender. We formulated and tested two null hypotheses:
H01: type of study programme and actual work experience of our students are independent,
H02: gender and actual work experience of our students are independent.
Tab. 1 shows the distribution of our students in several study programmes. Due to assumptions of chi-square test we had to merge some values in category Study Programme (specifically SP1, SP4 and Other). Merged categories in the variable Study Programme and the variable Actual Work Situation are shown in Tab. 2, bellow.

	N (%)	No time for work (%)	Part-time or full-time employment	Episodic jobs	Self-employment
SP 2	155 (46.7)	33 (9.9)	13 (3.9)	104 (31.3)	5 (1.5)
SP 3	99 (29.8)	16 (4.8)	29 (8.7)	54 (16.3	0 (0.0)
Other	78 (23.5)	13 (3.9)	18 (5.4)	38 (11.4)	9 (2.7)

SP 2 = Study programme Business and Administration, SP 3 = Study programme Public Administration and Regional Development; % = % of total N

Tab. 2: Descriptive characteristics of variables Study Programme and Actual Work Situation.

Second hypothesis assumes independence of other two variables – Gender and Actual Work Situation. Tab. 3 provides descriptive information about counts and percentages in each category.

	N (%)	No time for work (%)	Part-time or full-time employment	Episodic jobs	Self-employment
Male students	105 (31.6)	17 (5.1)	23 (6.9)	56 (16.9)	9 (2.7)
Female students	272 (68.4)	45 (13.6)	37 (11.1)	140 (42.2)	5 (1.5)

% = % of total N

Tab. 3: Descriptive characteristics of variables Gender and Actual Work Situation.

Results and Discussion

Chi-square test is a non-parametric, distribution-free statistics, which enables testing hypothesis about variables measured at the nominal level (McHugh, 2013) and has some basic assumptions. Looking at Tab. 2 we can identify, that there is one subcategory with 0 cases. Due to assumptions of the Chi-square test we had to merge 2 categories - Self-employment and Part-time or Full-time Job. Testing hypothesis 1, Pearson Chi-square has a value 19.944 for N=332, df = 4 and sig. 0.001. To consider the strength of the test we used Cramer´s V – Cramer´s V = 0.173 and is considered as a weak dependence. We can reject the first null-hypothesis on the level of sig. = 0.05.
Testing hypothesis 2, Pearson Chi-square has a value 9.507 for N=332, df = 3 and sig. 0.023. Looking at Tab. 3 we can observe, that 1 cell (12.5%) has expected count less than 5. To consider the strength of the test we used Cramer´s V – Cramer´s V = 0.169 and is considered as a weak dependence. We can reject also the second null-hypothesis on the level of sig. = 0.05.
Our results show that there probably exists a relationship between work experience and gender, and also between work experience and study programme. Chi-square test provides no information about the nature of the relationship (although we considered the

strength of the test) and on this place further, more detailed research measuring variables on interval scales would be appropriate. In our research we focused only on basic level of the examined variables, and it would be interesting to examine in more detail also the time period of the work experience, past experiences in entrepreneurship and in part-time or full-time employment, hours spent in paid work per week and study year etc. Also repeated measures in the same research sample would be an advantage in the further research.

When looking at Tab. 2 and Tab. 3 we can see that our results are similar to Bradley (2006) or Beerkens, Mägi and Lill (2010). Only 18.7% of students have no actual employment, with no time to go to regular employment during their university study. 81.3% of all students in our research sample reported some work activities – irregular jobs as a most common choice (59.0%), part-time or full-time employment (18.1%) and self-employment (4.2%). At this point we can agree with Hall (2010), who states that: ´the absence of any likely moves by governments to provide financial support to students, universities need to recognize the increasing demands placed on full-time students by part-time work and to implement procedures to assist working students.´ Bradley (2006) examined the nature, extent and correlates of paid work amongst university students (with respect to Grade Point Averages and amount of time they spent in paid work) and he concludes that future research should explore the strategies through which students who work long hours manage to perform well academically.

Students at FEM CULS are studying in the study programme Business and Administration and therefore they should be prepared also to create some own business. We assumed that students in this study programme could have more actual experience with entrepreneurship as students in other programmes. Due to low count of students with entrepreneur experience we were not able to test this assumption. This fact may also be interesting in further research work – it would be interesting to explore this situation, probably in more intensive qualitative research design.

On the other hand, in our previous research we examined the concept of self-efficacy in our students (Natovová, Chýlová, 2014) and further analyses of work experience, especially with the entrepreneurship experience in the relation to the self-efficacy in general and specifically entrepreneurial self-efficacy could provide more insight into this area.

Employability of university students is one of important formal aspects for identifying and measuring differences between universities and faculties. Student (and teachers as well) prefer professional training and practical skills, which is regular and valid requirement on the educational institutions. On the other hand, the main aim of university study should not be reduced to the ability of finding a work position. Steur, Jansen and Hofman (2012) point out that university study should lead also to more general intellectual cultivation in the areas of reflexive thinking, moral scholarship and citizenship.

Conclusion

We would like to conclude this paper with the recommendations to the aims of university education and to pedagogical work with students generally: ´...embrace the responsibility for self-management of career; adopt and maintain an employability orientation, in contrast to seeking job security; be prepared to relocate geographically to where the opportunities exist; gain work experience while studying; network and apply for jobs early; and finally, gain initial experience in the traditional areas in their field of interest before branching out into a specialisation´ (Cable, 2013: 11). These general recommendations can be followed not only in psychology courses, although work psychology has an important position in

career planning and development. Together with Hogan (1991) we can summarize that one of the main aims of education should be to prepare students for the challenges of life, including those of work, and a psychology program in contact lesson with students can promote the development of skills and knowledge that apply to work as well as to the growth of personal, civic, and cultural understanding.

The topic of students work during university study is important, and our future work is pointed at more intensive exploration of the time students spend in paid work, time of their study, and effects of these factors on their academic and professional performance. Further research areas are also self-employment of students and more detailed focus on other faculties and study programmes at our university.

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STUDY RESULTS IN NON-MATHEMATICAL ELECTIVE VS. MANDATORY MATHEMATICAL COURSES

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Abstract

The present paper is concerned with the comparison of study results in the courses Mathematical Methods in Economics (I and II), on the one hand, and Agricultural Commodity Quality and Marketing (ACQM) and Agricultural Commodity Quality Analysis (ACQA), on the other hand, which are part of the course programs for Business and Administration and for Economics and Management. All these courses are taught at the Faculty of Economics and Management (FEM) of the Czech University of Life Science in Prague. While Mathematical Methods in Economics I and II are mandatory courses, ACQM and ACQA are voluntary (elective) courses. The paper compares study results linked to gender and field of study, and examines the correlation between the results in individual courses.

Keywords

Agricultural Commodity Quality, bachelor study, Mathematical Methods in Economics, study results

Introduction

Mathematical courses are occasionally considered more difficult to understand, learn, and pass, especially among students who have enrolled in a non-mathematical field of study. However, studying mathematics is of key importance if one wishes to develop the kind of expertise that is indispensable in today's society with its focus on technical skills (Ali et al, 2011). According to a study by Dolton and Vignoles (2002), in the United Kingdom graduates with an advanced mathematics qualification earn 7%-10% more than similarly educated workers without this qualification.

One of the problems of the Czech school system, what is possible to document also by the newest date from PISA-program (Programme for International Student Assessment), is the students´ ability to apply achieved knowledge in practice. Among the best evaluated countries there are namely Finland, Poland, but for examples as well South Korea and Japan (OECD, 2014).

PIAAC (Programme for International Assessment of Adult Competencies) defines numeracy as the ability to access, use, interpret and communicate mathematical information and ideas, in order to engage in and manage the mathematical demands of a range of situations in adult life (OECD, 2012: 34).

Traditionally, life sciences students rarely experience mathematics within the context of their own disciplines (Hester et al, 2014). These attitudes persist, despite mathematics course requirements for most life sciences students, because failure to integrate mathematics in meaningful ways for life sciences majors contributes to the perception that mathematics is irrelevant outside its discipline (Hakkarainen, Holopainen and Savolainen, 2013).

This paper aims to give a brief analysis of dependency of students´ results in two different courses on their field of study. We also show whether there is any difference in the study results between male and female students in subjects requiring mathematical skills compared to course without those requirements.

Materials and Methods

We compared students' academic performance (as measured by their course grades) in the following courses:

Mathematical Methods in Economics I (MME I):

The objective of this course is to provide students with a solid theoretic foundation in selected methods of operations research, which they may then put to practice in the follow-up course Mathematical Methods in Economics II. The core focus of the course is on linear programming models, flow network models, and graph theory models. This course is being taught in the summer semester of the 1st year of the bachelor study fields of Economics and Management (EM), and Business and Administration (BA).

Mathematical Methods in Economics II (MME II):

This course builds upon MME I. It is more geared towards application, putting particular stress on the solution of practical issues and on discussing the manner in which a given solution, once identified, could be implemented. The objective of the course is to deepen the students' understanding of applied mathematical methods in economics, to expand their abilities to solve problems using mathematical modeling, and to acquaint them with the current software standards in the field. This course is being taught in the winter semester of the 2nd year of the bachelor study fields of EM, and BA.

Agricultural Commodity Quality and Marketing (ACQM) and Agricultural Commodity Quality Analysis (ACQA):

The courses deal with the principles, influences, and methods of appraising the quality of individual agricultural commodities in connection with their subsequent marketing. It addresses quality management and food safety management within the context of the Czech Republic and the European Union. Both the courses are taught in the winter semester of the 2nd year of the bachelor study, ACQM in BA and ACQA in EM. These courses differ only in that ACQA put more emphasis on the influence of quality on commodities trade.

We have analyzed the results of students who took their exam in ACQM and ACQA in the academic years 2012/13 and 2013/14. Given the scheduling of the two MME courses in various semesters within the study program, this research includes the study results in MME II of the relevant students also for the academic years 2012/13 and 2013/14, and the study results in MME I for the academic years 2011/12 and 2012/13 - i.e., altogether 348 students classified in ACQM and ACQA, thereof 124 men and 224 women. 111 of these students were classified in MME I and 187 in MME II during the observed study years.

Statistical Means for Study Results Analysis

The contingency table is used for transparent visualization of mutal relations of two statistical variables. The type of the contingency table is given by the number of rows r and the number of columns s, is means $r \times s$ (Hindls, 2007).

Obviously, χ^2 is a measurement of the overall dissimilarity of n_{ij} and m_{ij}. The bigger the difference between observed and expected values, the higher is the test statistic χ^2.

$$m_{ij} = \frac{n_i . n_j}{n} \quad (1)$$

$$\chi^2 = \sum \frac{(frequency\ observed - frequency\ expected)^2}{frequency\ expected} \quad (2)$$

$$\chi^2 = \sum_{i=1}^{r} \sum_{j=1}^{s} (n_{ij} - m_{ij})^2 / m_{ij} \quad (3)$$

i and *j* are indexes of rows and columns, n_{ij} are observed marginal frequencies, n_i and n_j are marginal totals, *n* is grand total of observations, m_{ij} are expected frequencies.

We compare χ^2 to the critical value χ^2 with a chi-square distribution of *(r-1)(s-1)* degrees of freedom at the chosen level of significance. We reject the hypothesis if χ^2 is larger than the table value.

This test is valid asymptotically, and thus can only be applied if there is a sufficient number of observations. All expected values ought to be higher than one (Hendl, 2009); at the same time, the table should not contain more than 20% theoretical incidence rates (frequencies) of less than 5.

Where zero values occur in any of the fields, we proceed to analyze a derived table, created by merging a small number of categories (Hendl, 2009).

Cramér's *V* was used to determine the degree of association between the variables.

H0A: There is no dependency between the gender of a student and their study results:

- a. in Mathematical Methods in Economics I,
- b. in Mathematical Methods in Economics II,
- c. in Agricultural Commodity Quality And Marketing, and Agricultural Commodity Quality Analysis.

H0B: There is no dependency between the respective study results in the fields of study Economics and Management, and Business and Administration:

- a. for Mathematical Methods in Economics I ,
- b. for Mathematical Methods in Economics II,
- c. for Agricultural Commodity Quality And Marketing, and Agricultural Commodity Quality Analysis.

H0C: There is no dependency between the study results in Mathematical Methods in Economics I, on the one hand, and Agricultural Commodity Quality and Marketing and Agricultural Commodity Quality Analysis, on the other hand.

H0D: There is no dependency between the study results in Mathematical Methods in Economics II, on the one hand, and Agricultural Commodity Quality and Marketing and Agricultural Commodity Quality Analysis, on the other hand.

Results and Discussion

Performing a statistical analysis of the below tables, we arrive at the following findings.

Student‘s gender/Course grade	1	2	3	4	Total
Female	12	15	29	15	71
Male	4	6	22	8	40
Total	16	21	51	23	111

Tab. 1: H0Aa Dependency between student’s gender and their study results in MME I

H0Aa: The calculated statistic of 2.48 is smaller than the critical value (7.81), and the null hypothesis thus cannot be rejected.

Student‘s gender/Course grade	1	2	3	4	Total
Female	14	32	48	26	120
Male	6	12	31	18	67
Total	20	44	79	44	187

Tab. 2: H0Ab Dependency between student’s gender and their study results in MME II

H0Ab: The calculated statistic of 2.25 is smaller than the critical value (7.81), and the null hypothesis thus cannot be rejected.

Student‘s gender/Course grade	1	2	3	4	Total
Female	56	73	86	9	224
Male	20	38	51	15	124
Total	76	111	137	24	348

Tab. 3: H0Ac Dependency between student’s gender and their study results in ACQA and ACQM

H0Ac: The calculated statistic of 10.67 is bigger than the critical value (7.81), and the null hypothesis may thus be rejected at the 0.05 level of significance. Cramér’s *V* indicates a degree of association of 0.17 – i.e., the dependency is very weak indeed.
In other words, for the subjects which we examined the study results are entirely independent on students’ gender; at the very least, any such dependency is indiscernible.

Field of study/Course grade	1	2	3	4	Total
Economics and Management	13	18	46	14	91
Business and Administration	3	3	5	9	20
Total	16	21	51	23	111

Tab. 4: H0Ba Value dependence of study results in MME I, for the fields of study (i) Economics and Management and (ii) Business and Administration

H0Ba: The calculated statistic of 9.47 is bigger than the critical value (7.81), and it thus appears at first as if the null hypothesis could be rejected. However, a more detailed analysis shows that the dependency is owed almost entirely to the number of students who received a “failed” (an actual figure of 9, compared to an adjusted 4.15), and we may thus be looking at an error caused by the small number of examined students majoring in Business and Administration.

Field of study/Course grade	1	2	3	4	Total
Economics and Management	58	87	95	19	259
Business and Administration	18	24	42	5	89
Total	76	111	137	24	348

Tab. 5: H0Bb Value dependence of study results in MME II, for the fields of study (i) Economics and Management and (ii) Business and Administration

H0Bb: The calculated statistic of 2.31 is smaller than the critical value (7.81), and the null hypothesis thus cannot be rejected.

Field of study/Course grade	1	2	3	4	Total
Economics and Management	19	39	69	36	163
Business and Administration	1	5	10	8	24
Total	20	44	79	44	187

Tab. 6: H0Bc Value dependence of study results in ACQM and ACQA, for the fields of study (i) Economics and Management and (ii) Business and Administration

H0Bc: The calculated statistic of 3.20 is smaller than the critical value (7.81), and the null hypothesis thus cannot be rejected.

Grade ACQM & ACQA / Grade MME I	1	2	3 & 4	Total
1	4	6	6	16
2	2	4	15	21
3	8	17	26	51
4	3	1	17	21
Total	17	28	64	109

Tab. 7: H0C Dependency between study results in MME I and in ACQM / ACQA

H0C: The calculated statistic of 11.49 is smaller than the critical value (12.59), and the null hypothesis thus cannot be rejected.

Grade ACQM & ACQA / Grade MME II	1	3	3 & 4	Total
1	6	8	6	20
2	12	17	15	44
3	16	23	38	77
4	5	7	31	43
Total	39	55	90	184

Tab. 8: H0D Dependency between study results in MME II and in ACQM / ACQA

H0D: The calculated statistic of 16.00 is bigger than the critical value (12.59), and the null hypothesis may thus be rejected. However, Cramér's V at $V = 0.21$ indicates only a weak dependency.

Overall, then, we find that no strong dependency between study results in (either of the two courses of) MME and the student's gender can be proven; a weak dependency (with women showing better performance) can be found in the case of the ACQM and ACQA courses.

This finding has been corroborated by Kučera, Jindrová and Vostrá Vydrová (2013) examining the sample of all BA students in the former one of the two years observed here.

Correspondingly, the gender has no impact on exam results in the both subjects MME; however, week dependency was proved in case of the Statistics I course (which can be considered to be rather less mathematical than MME), similarly, women reached better results than men.

Nor were we able to show a tangible dependence of study results on the chosen major. The only result in this respect, evidencing a weak dependency in the case of MME I, is fraught with the possibility of statistical error (due to the insufficient number of students in the examined sample).

There is sufficient (if weak) evidence for a dependency between the results in both examined subjects. This is a positive correlation: a better grade in one of the two courses weakly implies a better grade also in the other.

It is striking how many of the students who signed up for ACQM and ACQA (let us recall that their total number is 348 for both examined study years) did not pass (or take) the MME exam. In the case of MME II, 205 of these students (58.91%) have not yet passed the pertinent exam, and 161 (46.26%) have in fact not even once ventured to sit for the exam. In the case of MME I, these numbers of failing students are even higher: 260 (74.71%) have not completed the course, and of these, 237 (68.10%) have not even tried to sit for the exam. These students have made use of the option to postpone the exam until the 2nd year if they lack course credits for no more than two subjects. However, those among them who belong to the earlier of the two years appear to have dropped out of university entirely.

The authors find it prohibitively difficult to determine the total figures for failing students who attended the MME courses, but even so, the above figures already allow by themselves for the conclusion that ACQM and ACQA are the preferred choice of students who are less adept at mathematical and logical thinking. Such data were published only for the case of MME II in the former one of the two observed years (Kučera, Kvasnička and Vostrá Vydrová, 2013); nevertheless, the rate of successful of 76.30% in the sample of all BA and EM students confirms this speculation.

Conclusion

Among students who elect to study ACQM and ACQA, the two genders attain comparable study results in subjects requiring mathematical skills. In contrast, female students enrolled in ACQM and ACQA perform better (by a slight margin) than their male counterparts. Conversely, there is no sufficient evidence for a dependency between academic performance and the chosen field of study.

However, we identified, though very slight, positive correlation between the study results in mathematical and non-mathematical subjects. This fact demonstrates that mathematical and logical skills can help students to understand and pass also non-mathematical courses as in the case of ACQM and ACQA.

Sadly, we find also confirmed one assertion that has been the subject matter of much general debate - namely, that today's students' skills in mathematical and logical thinking are on a poor level, which is particularly noticeable in the case of those students who signed up for the non-mathematical courses ACQM and ACQA. It is presumably for this reason that many students of these particular courses drop out of their B.S. studies.

Based on previous findings, it shows to be a right idea to place mathematical subjects to the beginning of study plans. In this case, in addition, students, who abandon their study because of low talent in mathematical courses, do so earlier and they and their teachers do not waste time studying and teaching of easier non-mathematical courses in vain.

The survey shows results that are largely very balanced. It would be interesting to analyze larger data samples from the university's record over a greater period of time in order to be able to reveal potential trends over time - i.e., to determine whether the said equilibrium is merely a recent phenomenon or instead part of a general trend.

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THE OPPORTUNITY FOR A NEW PROFESSIONAL EDUCATION PROGRAM

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Abstract

In Romania the construction industry, an area with large complex projects, faced with a need for qualified personnel in the field of construction project management. This problem has the effects: long delays, budget overrun, poor quality of works and financial corrections.
This paper presents an analysis based on theoretical and practical studies showing that a large part of the problems in the construction industry in Romania is caused by human resource. The present human resources, it turns out that does not have enough depth knowledge of construction and project management, and the studies show that the current educational system does not provide enough knowledge. Thus arises the opportunity to create new programs of professional education.

Keywords

Professional development, project management, construction, competence

Introduction

Romanian construction companies are under pressure from the European and international construction market and in order to face competition they need to improve organizational and project processes from the initial concept to the execution and implement them within the time and cost budgets.
In this case we may notice that there is a difference between what is required from construction companies and what they can offer through their employees. The technical educational system, in which most employees were trained, has to be updated to the current requirements of the construction market.
Students are encouraged to construct their own knowledge and understanding and to strive towards becoming and independent learner. If university/faculty wants to improve its performance, according to the literature, there are quite a lot of ways how to achieve it. This improvement is mainly focused on new courses profiling innovations, pedagogical/didactical innovations, process innovations, professionalization of teachers' innovations and education chain innovations (Flégl M. et al., 2013).
Employee training is always an investment from the company's point of view. It is an investment of time and consequently always a financial investment too. This investment must have its return rate and efficiency. The responsibility of companies rests in an efficient treatment of financial means invested into the educational process (Staňková and Drdla, 2012).
Association analysis revealed different approaches to employee learning and development. It is possible to find self-motivated (talented) employees and also supportive (learning) organisations which try to develop their employees (Vnoučková, 2013).
The employers of business enterprises and private sphere invest in fewer financial means

determined for training. The reasons may be of economic nature (caused by the economic crisis). However, even they should realize that the investments in their staff training will return in the form of higher competitiveness, work productivity growth and improved image of the company (Varvažovská and Jarkovská, 2012).
The objective of this paper is to present, based on previous studies, the current situation and problems in the construction field in Romania and to propose a solution to improve this situation in a meaningful and sustainable way.
We had made a research for the assessment of the higher educational system, because it has a major impact on the vocational training of the engineers who will work in the construction industry and some of them will become project managers. We have chosen four technical universities from the largest academic centres in Romania and also we have included for comparison a highly rated university from Germany.

Curriculum analysis for existing Bachelor's programs

From the curricula of the universities studied, the following competencies were considered relevant for training in construction project management in Bachelor Programs: Economy and legislation in construction, Management of Construction Works, Project Management, Quality Management in construction, Computer Aided Project Management, Special problems in construction work (Negruţ and Ionescu, 2010).

No.	Technical University – Faculty / Specializations	# Sem.	C	S/P	Total hours	Credits	Total credits	% Credits
1	"Politehnica" University of Timisoara - FMPT / Economic Engineering in constructions	8	119	84	203	15	240	6.3%
2	"Politehnica" University of Timisoara -Faculty of Civil Engineering / Civil Engineering	8	42	42	84	7	240	2.9%
3	"Politehnica" University of Timisoara - Faculty of Civil Engineering / Civil Engineering in German/English language	8	42	42	84	7	240	2.9%
5	Gheorghe Asachi Technical University of Iasi - Faculty of Civil Engineering and Building Services/Civil Engineering	8	98	56	154	11	240	4.6%
6	Gheorghe Asachi Technical University of Iasi - Faculty of Civil Engineering and Building Services / Civil Engineer in English	8	98	56	154	11	240	4.6%
7	Technical University of Cluj-Napoca - Faculty of Civil Engineering / Economic Engineering in constructions	8	182	168	350	30	240	12.5%
8	Technical University of Cluj-Napoca - Faculty of Civil Engineering / Civil Engineering	8	70	56	126	12	240	5.0%
9	Technical University of Cluj-Napoca - Faculty of Civil Engineering / Civil Engineering in English language	8	84	42	126	10	240	4.2%
10	Technical University of Civil Engineering Bucharest - Faculty of Civil , Industrial and Agricultural Buildings / Civil Engineering	8	86	58	144	12	240	5.0%
11	TU München - Faculty of Civil Engineering and Surveying / Civil Engineering	6	168	56	224	19	180	10.6%

Tab. 1: Hours and ETCS-credits for selected lecture from different Technical University for Bachelor degree (Negruţ and Ionescu, 2010)

Table 1 centralized the data collected from the curriculum of the universities studied. These data shows the number of hours for lecture and seminar or project, the total hours completed and credits earned at these disciplines.
For the Civil Engineering specialization the number of hours in the field of Construction Project Management varies between 84 and 224 hours; this is much reduced compared to the specialization Economic Engineering in constructions (Negruţ and Ionescu, 2010). Analysing the education plans, we can see that the training consists mainly of auction documentation for the construction sector, planning methods, law and legislation, and

informatics systems for the management of construction works. These are the basic disciplines for construction management, but they cover only a part of the Project Management area (Negruţ, 2010).

Curriculum analysis for existing Master programs

Master programs in Construction Management include courses that provide advanced knowledge in this field, such as: Project management, Project controlling for construction works, Budget and cost planning, Risk Management in projects, Process optimization in projects, Information systems for project management, etc. Unfortunately, in Romania there are only few Master Programs with such a specialization. Some of these disciplines are distributed in various other Master programs.

For a comparative research of Master Programs it has analyzed three specialized Master Programs in construction management from Romanian universities. First of all, we wanted to analyze and compare Master Programs with specialization in construction management. In this way, we found that not all universities analyzed from Romania offer such Master Programs in civil engineering sector (Negruţ, 2010).

	MASTER PROGRAMS	# Sem	C	S/P	Total hours	Credits	Total credits	% Credits
1	Gheorghe Asachi Technical University of Iasi - Construction Management and Special Technology	3	168	168	336	29	100	29.0%
2	Technical University of Civil Engineering Bucharest - Technology and construction management	4	112	84	196	19	120	15.8%
3	Technical University of Civil Engineering Bucharest - Construction Project Management	4	420	392	812	85	120	70.8%

Tab. 2: Hours and ETCS-credits for selected lectures from different Technical Universities Masters Programs in Romania (Negruţ, 2010)

In Table 2 can be viewed the number of hours of specialization in Construction Project Management Masters for these three programs. It shows a variation between 196 hours and 812 hours (Negruţ and Ionescu, 2010). For increased competitiveness in the Construction field it is required to improve the basic and speciality training in universities.

Materials and Methods

For the substantiation of the decision to create a master's program (M.Sc.) in construction project management, the authors used several research methods based both on theoretical and applied research.

The theoretical research is base on observation. The authors work has started with the presentation of the state of the art of construction management education in Romania in the higher educational system. These researches was conducted a few years ago and presented in different conference paper.

The applied research is based on a questionnaire created for measure the level of knowledge and use of project management processes as a comparison between Romanian and German construction companies. This research is part of a larger doctoral research of Mr. dr. eng. Negruţ Mircea. In the final, all the data and all partial conclusions are gathered to formulate the general conclusions and determine the next steps to follow.

Study on the project management processes in Romanian and German construction companies

The importance of the study is to assess the current competencies of the organization and the employees that have responsibilities in the construction projects, and then to identify the needs of the organizational change and/or educational training of the personnel involved in managing construction projects. This study was designed to be applied in two markets, the market from Romania as a subject of analysis and improvement and the German market as a model. It has designed and developed a questionnaire on the topic: "Status Quo on the use and competencies of project management in construction companies". The questionnaire was designed to be written in two languages and to apply one for a sample of companies in Germany and one in Romania.

We chose to do the market research in the virtual environment because of several reasons: the questionnaire was with anonymous completion, the participants were geographically distributed over a large area in each of the two countries and this environment is faster and much cheaper. It enables faster and easier processing of data because it works with database structures. It is a qualitative research and applied on a directed sample.

Questionnaire design and online implementation

The survey on "Status Quo on the use and competencies of project management in construction companies" aims to assess the application of project management processes within construction firms, and to assess the knowledge of the employees with responsibilities in the project, about project management.

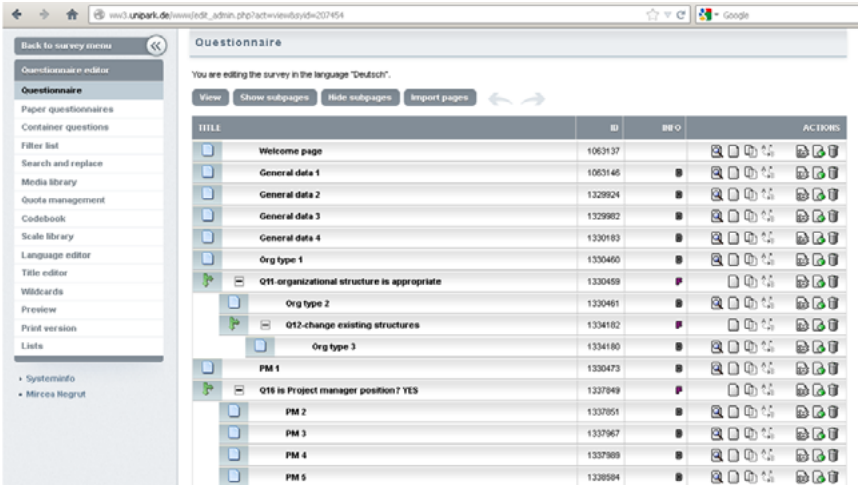

Fig. 1: Structure of pages from the survey [Unipark Screenshot]

For this reason, the questionnaire was developed to include a wide range of issues. It is a general questionnaire rather than one specialized in a narrow area of topics. Figure 1 presents the window in which we can see the structure of the survey pages. Each page contains questions and answers which approximately fit on a window screen.

The survey was applied in Romania and Germany on a directed sample of construction and consulting companies which are involved in medium and large projects. The sample

target was to have 30 representatives of companies that participate in the study, from each country.
Further we will focus on the last part of the questionnaire that assesses the need for continuous training and the training level of the young engineers in project management.

Results and Discussion

Education and vocational training is the last thematic area of the study. This thematic area is important to find out if the organizations are continuously concerned to improve the professional training of human resources and the disposal of investment in this area.
Regarding the importance given by firms of construction management processes, the study revealed that 90.48% of the companies analyzed in Romania, and 64.71% in Germany intend to give greater importance to this sector in the future.
One question asked the respondents to assess if the graduates with Bachelor's and Master's degree in construction field have sufficient theoretical knowledge and skills to be used in the execution of construction works. Both in Romania and in Germany, companies are not satisfied with the quality of Bachelor's graduates, in proportion of over 52%, Figure 2.

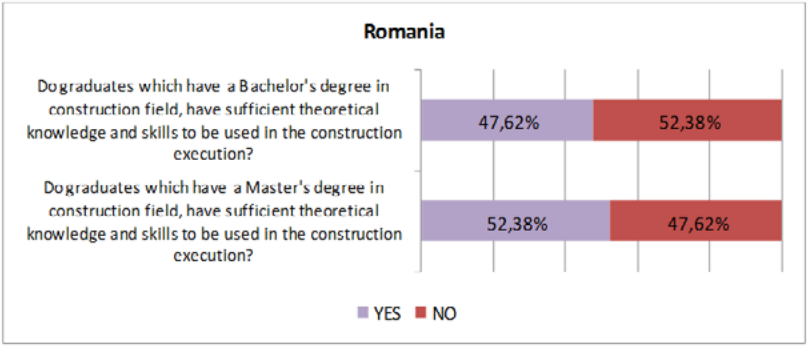

Fig. 2: The degree of satisfaction with graduates of higher education - Bachelor/Master – Romania (Negruț, Mihărtescu and Alan, 2012)

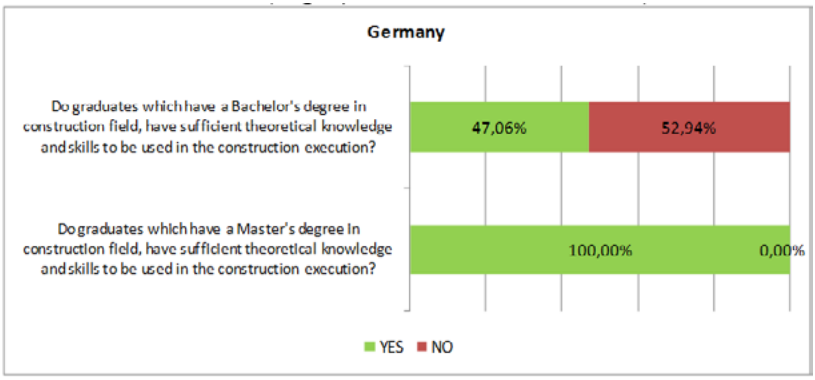

Fig. 3: The degree of satisfaction with graduates of higher education - Bachelor/Master – Germany (Negruț, Mihărtescu and Alan, 2012)

The degree of satisfaction increases for Master's graduates in Romania, at 52.38%, while

in Germany it is of 100%, Figure 3. In Germany, the Master program is perceived by employers as a form of higher education with additional knowledge and skills to graduates. Unfortunately in Romania (the difference between satisfied and dissatisfied is very small), companies cannot say that the Master program provides advanced specialized training, compared to those with a bachelor's degree (Negruț, Mihărtescu and Alan, 2012).
We wanted to assess the implementation of project management processes in the respondents' company. Thus, we asked respondents to evaluate a few statements that could improve the performance in project management, Figure 4. Both companies from Romania and from Germany recognize that additional training is needed at all levels. Also, it can be seen that in approximately 48% of the cases analyzed, the companies raise the issue of lack of qualified personnel (Negruț, Mihărtescu and Alan, 2012).

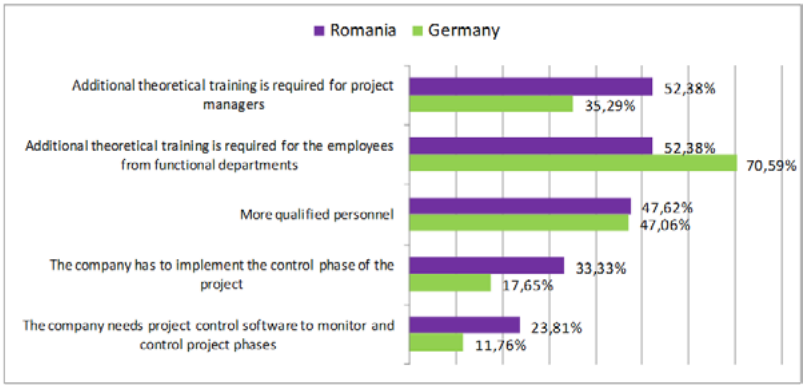

Fig. 4: The factors that could lead to improved of performance in project management (Negruț, Mihărtescu and Alan, 2012)

Both companies from Romania and from Germany recognize that additional training is needed at all levels. Also, it can be seen that in approximately 48% of the cases analyzed, the companies raise the issue of lack of qualified personnel.
Adomssent et al (2014) explored which competencies are needed for tomorrow's business professionals and which concepts and approaches are useful to foster these competencies. Marcelino-Sadaba et al (2014) state a project management methodology designed for small businesses (SMEs), who need to run projects beyond their normal operations. These projects are critical to the survival of these organisations, such as the development of new products to adapt to the market or new legislation, management system implementations, etc. Very frequently, the managers of these projects are not project management professionals, so they need guidance to have autonomy, using minimal time and documentation resources.

Conclusion

These shortcomings of the educational system are evident in construction companies from Romania, in terms of lack of project cost control, achieving a poor control of projects in general. A weakness of the construction companies is the calculation of resource consumption and the unit price of work processes. On this basis we noticed that often times, basic management processes for construction works do not work properly.
The national educational system is one of the main factors that generate long term

efects at the level of professional training of the labor force on the national labor force market. Because of this, we will make a set of suggestions and measures through the implementation of which to lead to a growth in the professional training of graduates and once they are integrated in the companies, they will lead to an increase of competencies and managerial abilities in the long run. As a result of this research and the analysis made, the following improvement proposals for the university educational system can be made:

1. It is necessary to be developed new educational Masters programs dedicated to Project management in the construction industry, or mixed Masters programs that should also contain technical aspects or technologies;
2. This new educational Masters programs will develop new disciplines that are not included in the curriculum of major universities analyzed in Romania, such as advanced cost calculation, project controlling, forecast of project progress;
3. For these Masters programs it is necessary to develop competencies regarding project controlling, cost control and forecasting project;
4. The universities, through their construction faculties, should create and promote short term professional training courses, specialized in construction management and advanced management for the employees of the companies.

The educational system or the professional training has to contribute more to the development of knowledge in this field. It is necessary to increase the competencies and abilities of the graduates in the field of construction project management to obtain long-term effects.

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INFLUENCE OF SOCIAL STEREOTYPES ON PERFORMANCE OF STUDENTS AT SECONDARY SCHOOL

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Abstract

This paper considers the influence of priming and its effects. Priming is an implicit memory effect, in which an exposure to a stimulus influences a response to a later stimulus. It describes priming as a way of activating positive social stereotypes. This research was conducted during informatics lessons (ICT) at a secondary school in Prague. Information technology (IT) teacher and experts were used as social stereotypes. This research was evaluated by means of an analysis of variance, qualitative analysis and correlation coefficient. Questionnaires were filled out by students (n=104) and classified by Cermat according to the theoretical subtest of school leaving exams.

Keywords

Cognitive psychology, education, information and communication technology (ICT), priming, social stereotype, student's influence

Introduction

How to influence a student's performance during teaching is an important question at any time. Priming has been shown to be one of the ways of influencing performance. This was demonstrated in research using the Trivial Pursuit game, conducted by Dijksterhuis and Van Knippenberg (1998), both from the University of Nijmegen. The importance of video-lectures in teaching was confirmed by Houška and Beránková (2011), and many differences between males and females in their evaluations have already been described (Očenášek, Ulman and Vostrá Vydrová, 2013).

Priming is an implicit memory effect in which exposure to one stimulus influences a response to another stimulus. Priming can occur during perceptual, semantic, or conceptual stimulus repetition. In lay terms, it could be said that the human brain automatically assesses some of the information on which decisions are made unconsciously. This process can exist in a modifiable state, in which the entity is located. Each of us has encountered semantic priming (for example Ads) and, therefore, the mechanisms of priming may also play a very important role in education.

One of the important concepts that are closely associated with priming, is perception. Perception according to Sternberg (2002) is defined as a set of mental processes on the basis of which (in the brain) we recognize, sort, merge and attribute importance to the senses obtained from stimuli from the environment.

Perception leads to two other mental processes, namely concluding and decision making. Concluding is defined as a cognitive process of drawing conclusions from empirical findings, observations, or a statement of principles (Sternberg, 2002). According to Hartl, reasoning is defined as a logically correct way of using intellectual operations that enable the creation of assumptions, verification and new cognition (Hartl, 2000). Concluding can be deductive (logical effort of an individual to draw some specific conclusions from

a set of general statements) or inductive (a process aimed at achieving a likely general conclusion based on a number of specific facts or observations) (Sternberg, 2002).

Decision making is described by Nakonečný (1995) as a process of selecting targets and means, which ends with a decision. Decision making and reasoning can often be influenced by various prejudices and stereotypes.

Prejudice or bias is indicated by Hartl (2000) as opinions rigidity.

Stereotype comes from the Greek word "steréos" - tough, stubborn and "typos". It is used to refer to the simplified, schematic and rigid idea, opinion or view, about yourself, your group, the company you keep or other persons and social bodies (companies, class, nation, race, religion, etc.) (Geist, 2000). An important feature of the stereotype is generalization.

"Stereotype threat" is one of the most studied concepts of the last 20 years. The use of the "stereotype threat" is an effort to determine what factors influence the incidence of immediate performance, systematic differences in abilities, and thus the performance of individuals. Interestingly these effects are not confined to academic circles, but also occur in research into organizational behaviour (Inzlicht, Schmader, 2012).

Cognitive psychology, in simple terms, deals with the senses. It deals with perception, learning, reasoning, decision making, etc. It is about processes which are closely related to memory.

Memory can be characterized as a place to store information. The basic task of memory, is to receive information due to the perception of the world around us, or in relationship to us, learning consciously and imparting information for storage and subsequent recall. In literature we can find many ways in defining memory. In this thesis are just a few of them. In terms of time, information storage memory can be divided into short-term and long-term memory. Depending on the perceptions and information storage, memory can be defined as auditory, logical, mechanical, motoric and visual. Furthermore, depending on the type of information stored, there is semantic memory, which stores facts and general knowledge (e.g. grammar rules, mathematical and physical formulas, the spring followed by summer, etc.), and episodic, which includes individual life events (e.g. When was I born? Where do I live? Where and with whom was I on vacation last year?) (Nakonečný, 1995).

Priming is a process through which an initial stimulus activates a specific mental path, thus increasing the ability to process the subsequent stimuli related to the initiative of priming, in a certain way. With priming is the closely related concept of "spreading activation". It is a process in which the stimulus stimulates units (or nodes) in the network, which in turn activate the unit connected thereto (Sternberg, 2002).

Priming will occur even in cases where this kind of stimulus is presented in a way which does not allow its entry into conscious awareness, i.e. a stimulus presentation with a low intensity noise in the background. Priming should take place not only when we are aware of such stimuli (e.g., deliberate reading of this text) (Sternberg, 2002). As already interpreted, priming facilitated two aspects of retrieval from long-term memory: search and recovery (Hopkins and Atkinson, 1968).

The aim of this study is to test the effect of social stereotype form of priming on the performance of a secondary school student. The research was conducted in a classroom and the participants were second year students, from the Secondary school (Gymnasium) in Arabská Street, which is located in Prague 6. The students' performance was influenced by priming during the test of theoretical IT modelled according to the subtest of the new secondary school-leaving exam ("maturita" in Czech) (Cermat, 2010). The students knew

about the testing, but they did not know about the intended priming research. This was also confirmed at a later anonymous questioning.

Materials and Methods

The second year of the secondary school (Gymnasium in Arabská Street) in the academic year of 2011/2012 comprised four classes**.** They took part in this research with the total number of participants being 104 students. Two classes were from the Natural **S**cience branch of the school and the next two classes were from Humanities. They were all second year students. Each class with IT training was divided into two groups of about 15 students approximately 16-17 years old. Thus there were eight groups available.

The theoretical subtest had two purposes, the first one was for the research and the second was to classify the students. The negative priming was omitted for a non-discriminatory reason (so-called "stereotype threat"). Priming was used only in a positive sense, i.e. there was an effort to positively affect the students in comparison with the groups that were not affected. Positive social stereotypes were represented by experts in the IT field, who would ascertain that the tests were completed correctly. They were an IT teacher and professional staff in the IT sector. The results were then compared using an analysis of variance with the other groups, including the group in which no priming was used, i.e. the group without affecting.

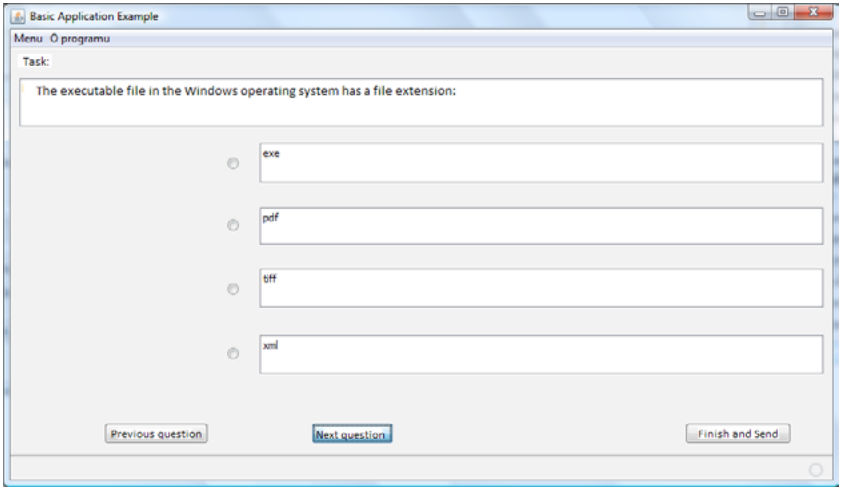

Fig. 1: Application without priming icon Source: author

At the beginning of the research, an instruction test was given as shown above (see Fig. 1), to one group of students which did not receive priming. The test lasted for an hour and was monitored by the teacher. The other group received priming from an IT teacher at the outset of the research and instructions were given in the form of a dialogue - how should an ideal IT teacher look like? This priming was also highlighted in the opening question of the test. The test of this group did not include an icon of an IT teacher.

Another group had the same priming, but during the test the icon that represented an IT teacher was always on display (like the group with priming of the IT expertise – see Fig. 2). It was carried out in order to recall priming continuously during the test of this student group. The aim was to use priming to affect both the male and female students. However,

there could only be one teacher in a class, so it was necessary to choose a male or a female teacher. Finally, the icon of a male teacher was used. The selection was made on the basis of asking a group of random persons which gender they would prefer.
The last group conducted the task of priming for IT expertise (see Fig. 2). The priming research was performed in a similar manner like the previous group. The professional computer specialists were selected in order to eliminate the effects of the stereotype, a teacher who is linked with the school environment. This can affect the past memories of a student, whether consciously or unconsciously. In addition, there were two IT specialists a woman and a man. Priming for women was easier thanks to the icon of a woman.
In this way, four different groups were tested in both a science-based direction and the humanities. The students were told that they would be evenly divided into five groups (five classification groups). All students in the first (best) group would receive a mark of one (excellent), all students in the second best group would receive mark two (very good) etc. This way was done to minimize the risk of transmission of any information or questions to other groups. In addition, students were not allowed to write down questions – to remember exact questions spontaneously are not easy.

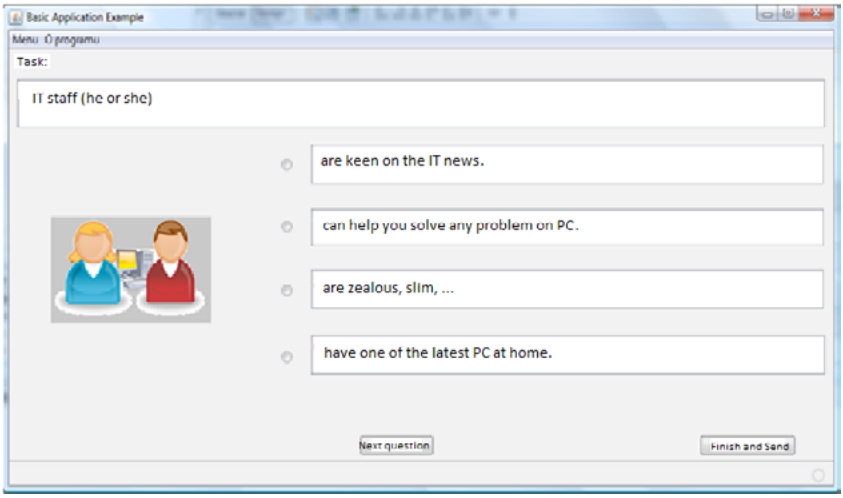

Fig. 2: Application with a priming icon of the IT staff. Source: author

Students could finish the test early. It was also emphasized to the students that the test did not have a fixed deadline by which it should be completed; the teacher could have stayed with the students for a few minutes after the bell had sounded. They were also familiar with marking process, which recognized only answers which had been correctly selected (ie: questions which were left unanswered or were selected incorrectly were not counted as an error). Finally they were also informed that each question had only one correct answer and that all questions should be answered. Of course, the first priming question was omitted from the assessment test.
A random draw of questions might have favoured some students (e.g. 2 questions about graphics in a row could be an advantage), for this reason, all students had the same questions in the same order, except for the first priming question. The group without priming had evaluation questions on the test; therefore the number of questions in all

groups was the same. The students with no priming had the same amount of time to complete the test as the students with priming.

After completing the tests, the students left the classroom and returned later, after the break. The complete exercise (explanation of instructions, priming, filling, and testing) was allocated into one teaching unit, i.e. 45 min. If the student had not finished before the bell, he/she was informed that it is the end of lesson, but part of the break period could be used to complete the test.

Students could use any study materials on the network, but there was no access to the Internet. Some students used the application in full-screen format, and others in reduced form, and some of them tried to crash the application. However, there were no problems in the behaviour of the application. The possibility that some of the students had discovered the source of the test questions was also not detected and in any case, the source of the XML questions did not have the correct answers identified.

Students in a subsequent questionnaire wrote that they knew no questions from other people, and they did not know about priming. Many students also commented on the stress that they had felt during the test. According to Sternberg, this feeling cannot only suppress the influence of priming, but also influence the performance to get good results.

Results and Discussion

There were two possible results – number of points obtained (see Table 1), and the time taken to complete the test (Table 2). These results were analysed by using Excel, and more deeply by using the SAS package. The inspiration and procedures were based on the classic statistics literature (Rupert G. Miller, 1997).

Priming with icon of IT teacher (H)		Without priming (H)		Without priming (N)		Priming with icon of IT teacher (N)		Priming with icon of IT staff (H)		Priming without icon of IT teacher (H)		Priming with icon of IT staff (N)		Priming without icon of IT teacher (N)	
F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M
6			11	11		11		10			7	9		13	
9		12			12	11		7		9			13		9
	10	17		10			10	10			11	8		9	
8		7			13		9	8			14		11	10	
12		6			8	15			8	13		7			7
	11	9		5			9	13			9		19	15	
9		10		15		9			11		13	11			14
9			8		14		16	10		12			11		10
12			7		13		7	10		9			10		10
9			5		6	9		10		11			11		12
13		12			14		12	14			11		11		11
	12	9				10		12		11			15		
15		10					10	13					10		
	10	9					16	11							
		13													

Table 1: Points obtained by individual students of (H)umanities class (without highlighting) and (N)atural science class (highlighting). Every group includes (F)emale and (M)ale students. The groups are listed in the order of taking the test.

After verification of the homogeneity of variances, an analysis of variance was made which showed there was no statistical difference between groups (F 0.491276 < $F_{crit.}$ 2.106465).

The effect of priming was not demonstrated, even if it had been taken instead of point scoring (less detailed resolution). Neither the analysis of male nor female students demonstrated any significant statistical difference, neither were there any significant differences found with male students in comparison to female students anywhere in the experiment.

Other factors were also analysed between the groups, one of which was the processing time (Table 2). There appeared to be a correlation between the time taken to finish the exam and the points received, except in the case of one group, which had a weaker dependence (0.32792). In other words, if the student did not take the opportunity to leave the exam or finish early, then the longer a student took to finish the test, the more points were earned by him or her, i.e. he/she may have selected more correct answers. There are different correlations in different groups, some groups reaching middle correlation, however from previous calculations it is not possible to assume that there is a connection with the influence and priming.

Priming with icon of IT teacher (H)		Without priming (H)		Without priming (N)		Priming with icon of IT teacher (N)		Priming with icon of IT staff (II)		Priming without icon of IT teacher (H)		Priming with icon of IT staff (N)		Priming without icon of IT teacher (N)	
F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M
7			8	-1		17		8			6	5		0	
5		13			0	10		6		6			3		-6
	0	6		0			9	18			-3	7		7	
5		8			0		-1	7			-8		3	2	
6		10			0	11			5	6		7			0
	8	3		-1			8	3			-2		-7	-1	
2		15		-1		4			9		5	-2			-7
0			4		-2		3	5		-10			5		-4
1			18		0		12	17		-2			3		-4
0			19		-2	10		4		-4			6		-5
0		0			-1		7	3			-9		5		1
	3	-1				8		5		2			-7		
0		6					4	4					4		
	6	17					6	4							
		8													

Table 2: Time taken to finish test (positive numbers – unused minutes, negative numbers – used extra minutes during the break). (H)umanities class (without highlighting) and (N)atural science class (highlighting). Every group includes (F)emale and (M)ale students. The groups are listed in the order of taking the test.

After verification of the homogeneity of variances, an analysis of variance was made which showed that there is statistically significant difference between groups (F 11.61074 > F_{crit}. 2.105446) at a level of significance of 0.05. Using the Scheffe method, differences were found between groups, but these differences were not associated with priming. These differences were factored out by an analysis of qualitative characteristics.

Due to the smaller number of students handing in their questionnaires, timing was recorded on a minute by minute basis in intervals of "minutes early", "on time", and "minutes later". Chi-Square value is moderate compared to the value Cramer's V (explanation about 57%), which interprets the correlation coefficient - the groups on different days handed in their work in a designated time. The sample size was greater than 40, but 67% of the expected frequency in the association table was lower than 5, thus Fisher's factorial test had to be used. The values of this final table confirmed previous claims.

To verify the last claim a qualitative test submission was conducted according to the days of the week. In this test, the Chi-Square value was based lower, including Cramer's. Redistribution of students from the groups on the days to achieve greater than expected frequency (only 33% did not meet the value 5), so again Fisher's factorial test had to be used. Here, the values were below a fixed level of significance of 0.05. It can be argued

that we can find dependence between day and time of submission of the test (before the bell is ringing or after ringing). None of these qualitative tests as mentioned above affected the priming on the student.

Conclusion

The author has described the implementation of priming in a real environment, in terms of the impact on secondary school students using social stereotypes, a teacher and IT experts. The primary focus of this experiment was to examine the theory of priming and how it impacts on students' performance when using social stereotypes. An analysis of variance indicated no association between groups with or without priming. There were also no significant differences between male students and their female counterparts. During the experiment there were no simultaneous systematic correlations found with the time of submission in groups, nor with differences between groups with or without priming. It was only discovered that there was a small to medium correlation between the time commitment and the time taken to complete the test.

There was no significant positive effect of priming found during the experiment which was conducted on 104 students, but there was a question of negative priming (stereotype threat), that was not chosen for discriminatory reasons (disadvantaged students in the test). The experiments in this field work demonstrated that during other conditions there was no priming effect, as could be seen in the work of previous authors (Dijksterhuis and Knippenberg, 1998). This might have been caused by laboratory conditions (volunteers, who were not in a normal environment), and by not using negative priming.

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IMPACT OF HEURISTIC STRATEGIES ON PUPILS' ATTITUDES TO PROBLEM SOLVING

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Abstract

The paper describes results of a 4-month experiment whose main aim was to change pupils' culture of problem solving. The experiment involved 11 classes from lower secondary basic schools and upper secondary grammar schools in North Bohemian region: the classes were taught by different mathematics teachers. In these four months the teachers tried to teach the following heuristic strategies in problem solving: Guess – check – revise, Systematic experimentation, Working backwards, Introduction of an auxiliary element, and Omitting a condition. The experiment proved that if pupils are introduced to an environment that supports their creativity, their attitude towards problem solving changes in a positive way already after the period of four months.

Keywords

Problem solving, solving strategies, guess – check – revise, systematic experimentation, working backwards, introduction of an auxiliary element, omitting a condition

Introduction

It is a fact generally agreed on by teachers, mathematics educators and researchers in the field of mathematics education that problem solving is the cornerstone of mathematics taught at all school levels. The posed problems should be more than tasks in which an individual or a group are meant to demonstrate to their teacher how they can apply mastered algorithms. Problems should develop pupils' intellectual activity, simulate work of a mathematician who is facing a problem to be solved, encourage solvers' creativity in the solving process (Brousseau, Novotná, 2008). If problems are to meet these criteria, it is not enough to look for good assignments (although we cannot do without them). It is essential to create suitable environments that influence pupils' relationship to problem solving. We refer to this environment as stimulating learning environment in contrast to Wittmann's (1995) concept substantial learning environment which refers to the context from which mathematics problems arise naturally.

Changes of pupils' attitude to problem solving are one of the phenomena studies in the frame of the GAČR research project *Development of culture of problem solving in mathematics in Czech schools*. The project explores the possible ways of changing pupils' attitudes to problem solving, of making pupils aware that mathematics problems are the means needed for their own personal development. One of the main questions the research team is trying to answer is the question to which extent this attitude positively influences development of pupils' understanding of mathematics, their approach to creative search for solutions to problems, and their behaviour once they encounter a modified or brand new problem.

In (Novotná et al, 2013; Břehovský et al, 2013; Novotná et al, 2014), focus is especially on introduction of heuristic strategies suitable for use in primary and secondary schools

when solving problems differently than with school algorithms. However, most pupils cannot be expected to start using these heuristic strategies unless they are given help, albeit from the teacher or somebody else from outside the school. There are many ways to creation of learning environment to make it more stimulating. One of them is inclusion of problems whose solution is much easier or more convenient if pupils use some (or one) heuristic strategies instead of algorithmic solution typically used in school mathematics.
Creation of a stimulating learning environment in mathematics is not and cannot be a single event. The question is how long a teacher must exert their influence on pupils until it brings positive changes in their attitude to solving of mathematics problems, improves their understanding of mathematics and until their ability to use mathematics in different situations is developed. The paper presents one of the possible approaches to this issue. It reports on a four month teaching experiment in which pupils were repeatedly introduced to the advantages of use of selected heuristic strategies in solving mathematics problems and in which changes in their attitudes to problem solving were studied.

Materials and Methods

11 teaching experiments were conducted in 11 lower and upper secondary schools in North Bohemia in the years 2012 and 2013. 4 experiments were conducted with 12-year-old pupils, 4 experiments with 14-year-old pupils and 3 with 17-year-old students. All the selected schools were ordinary schools without any specialization (basic schools in case of 12 and 14 year old pupils and upper secondary grammar schools in case of 17 year old pupils). The classes were characterized as average or even slightly below average by their teachers.
In the period of four months, teachers of mathematics tried to teach their pupils to use two or three of the bellow listed heuristic strategies when solving mathematics problems:

- ***Guess – check – revise*:** This is a strategy in which we first, drawing from our experience, make a guess about the solution to the given problem. Then we check whether the solution meets the conditions of the assignment. The next guess is made with respect to the previous result. We carry on in this way until we find a solution.
- ***Systematic experimentation*:** Systematic experimentation is a strategy in which we try to find the solution to a problem using several experiments. First we apply some algorithm that we hope will help us solve the problem. Then we proceed in a systematic way and change the input values of the algorithm until we find the correct solution.
- ***Working backwards*:** This is a very common strategy in mathematics. We assume that what we have to find/prove/construct holds/exists. Then we try to deduce from this assumption something we already know or something that is easy to prove/calculate/construct. Thus we in fact try to get from the end to the starting situation as close as possible. The procedure is reverted in the final calculation/proof/construction.
- ***Introduction of an auxiliary element*:** When we use this strategy we try to transform a given problem to a problem we have already managed to solve, or we transform it into a simpler problem we are able to solve. An example of an auxiliary element in problems in geometry is e.g. introduction of straight line or line segment, but it can also be a more complex geometrical figure. In algebra, we often introduce a new variable. We then speak of solution of an equation by substitution method.
- ***Omitting a condition*:** Problem assignment often involves several conditions. If we are not able to fulfil all these conditions when solving the problem at once, we can

ask similarly to Zeitz (2007): What is it that makes the solution of this problem so difficult? If we manage to identify which of the initial conditions is the difficult one, we can try to omit it. If we are then able to solve the simplified problem, we can go back to the omitted condition and try to finish solution of the original problem.

While strategies Introduction of an auxiliary element and Omitting a condition require creative activity from the solver and depend on the solved problem, the first three strategies can be characterized as strategies of algorithmic nature and pupils can use them successfully even if they do not have very good insight into the structure of the problem; use of these strategies does not always ask for very active involvement of pupils' creativity. The participating teachers were provided with a sufficient number of problems that are solved most efficiently using one of the above listed strategies.

The teachers' work was organized as follows. They assigned a problem to their pupils. They let them work and asked the pupil who was the fastest to solve the problem correctly to explain their solution to the others. This was followed by a discussion and explanation of the solving strategy. The teacher then asked other successful solvers to present alternative solutions to the others. If none of the pupils solved the problem with the intended heuristic strategy, it was demonstrated by the teacher. In another, similar problem the teacher then checked to what extent the teacher's solution was actively understood.

Every teacher solved in this way about three problems a week. The pupils sat a written pre-test and post-test at the beginning and the end of the experiment. The problems in the test were the same. Each test consisted of four tasks which were about equally as difficult as problems solved during the teaching experiment. All the problems in the test shared one feature. The selected heuristic strategy was the most efficient way of solving the problem. When evaluating the written tests, attention was paid to success rate but also to the method of solution, i.e. also whether the pupils used some of the strategies shown in the teaching experiment.

Results and Discussion

Research questions

1. Is it possible to achieve any progress in the ability to solve mathematical problems using the above described heuristic strategies for such a short period of time (4 months)?
2. Which strategies allow this progress and which make implantation of these strategies in such a short period of time impossible?
3. Does pupils' attitude to problem solving change? If so, how?

Results

Because of the limited scope of the paper, we have chosen one problem from a test in each age category which we present and comment upon.

Problem 1 - 12-year-old pupils, 98 respondents in total

Assignment: Adam says: "I first lost one half of my glass marbles and then one half of what was left. Now I have 19 glass marbles." How many glass marbles did Adam have in the very beginning?

Efficient solving strategy: Working backwards:

At the end, Adam had 19 marbles. Before the second loss, he had twice as many, i.e. 38 marbles. Analogically before the first loss, he had 76 marbles.

The answer is: At the very beginning, Adam had 76 marbles.

Success rate in pre-test: 32%.
Success rate in post-test: 61%.
Number of pupils who used the strategy Working backwards in the pre-test: 35%.
Number of pupils who used the strategy Working backwards in the post-test: 67%.
Obviously, the number of pupils who used the strategy Working backwards for solution of this problem doubled. All the pupils who used this strategy found the correct solution both at the beginning and at the end of the experiment.

Problem 2 - 14-year-old pupils, 109 respondents in total

Assignment: Find two consecutive natural odd numbers whose product is 1023. (Cihlář, Zelenka, 1998, p. 89/12)
Efficient solving strategy: Systematic experimentation:
We select pairs of odd numbers in Tab. 1 and look for their product.

First odd number	Second odd number	Product of the numbers
1	3	3
3	5	15
5	7	35
7	9	63
9	11	99
11	13	143
13	15	195
15	17	255
17	19	323
19	21	399
21	23	483
23	25	575
25	27	675
27	29	783
29	31	899
31	**33**	**1023**

Tab. 1. Problem 2 – Systematic experimentation

The answer is: The sought numbers are 31 and 33.
Success rate in pre-test: 21%.
Success rate in post-test: 54%.
The number of pupils who used the strategy Systematic experimentation in the pre-test: 0%.
The number of pupils who used the strategy Systematic experimentation in the post-test: 27%.
In the pre-test, the successful pupils solved the problem using the strategy Guess – check

– revise (18%) and using equations (3%). In the post-test there were also pupils who used the strategy Systematic experimentation (all of them successfully). All pupils but two used a computer.

Problem 3 - 17-year-old pupils, 78 respondents in total

Assignment: The perimeter of a rectangular garden is 114 m. One of its sides is 13 m longer than the other. Find the area of this garden.

Efficient solving strategy: Omitting a condition combined with Systematic experimentation: Let us omit the explicitly stated condition that the perimeter of the garden is 114 m. Now we will use the strategy Systematic experimentation. Let us create a table whose first column represent length of side a, second column length of side $b = a + 13$, third column perimeter $P = 2(a + b)$ and fourth column area $S = ab$ (see Tab. 2). The table can be easily made e.g. in Excel, where after setting the formulae the program constructs the table within seconds.

a	*b*	*P*	*S*
1	14	30	14
2	15	34	30
…	…	…	…
21	34	110	714
22	**35**	**114**	**770**
23	36	118	828
…	…	…	…
44	57	202	2508

Tab. 2. Problem 3 – Omitting a condition combined with Systematic experimentation

If we reconsider the omitted condition we easily find the solution (it is highlighted in the table).

The answer is: The area of the garden is 770 m^2.

Success rate in pre-test: 27%.

Success rate in post-test: 45%.

The number of pupils who used the strategies Systematic experimentation and Omitting a condition in the pre-test: 0%.

The number of pupils who used the strategy Systematic experimentation and Omitting a condition in the post-test: 15%.

In the pre-test, successful students solved it exclusively using equations. However, although the problem is quite simple, many students failed to construct the equations correctly. In the post-test the number of successful solvers increased by students who combined strategies Omitting a condition and Systematic experimentation. Most of the pupils using combination of these strategies were successful.

Conclusion

The results of the experiment gained from pre-tests and post-tests as well as from interviews with participating teachers allow us to formulate the following conclusions:

Experimental strategies (Guess – check – revise, Systematic experimentation) and the

strategy Working backwards can be mastered already in shorter period of time, strategies Introduction of an auxiliary element and Omitting a condition require longer time. This is caused by algorithmic nature of the first three above mentioned strategies.
The danger of Systematic experimentation is that its mastery by some pupils makes them use it as first solving procedure instead of e.g. constructing equation or system of equations. On the other hand, more frequent use of the strategy Systematic experimentation develops pupils' sense of effective choice of the initial value.
The short period of time of the experiment was sufficient to change attitudes of some pupils and students to problem solving (this could usually be observed in about one half of the pupils and students in each class). Pupils and students stopped being afraid of solving problems, they stopped laying their solution aside if they were not sure how to solve them in the very beginning. They learned to look for a solution rather than to give up.
Some teachers (about one third) claim that thanks to this experiment the ability to express ideas improved in about one half of their pupils or students. This is confirmed by the fact that pupils and students tend to comment on their solutions in more detail in the post-tests, more of them try to justify the individual steps in their solving procedure.
The presented results are in accordance with Kopka (2010, Foreword) who claims that solving carefully selected problems helps to develop, refine and cultivate pupils' creativity. One of the teacher's tasks at school is to develop his/her pupils' know-how and encourage their creative thinking (Polya, 1973). The approach to problem solving presented in the paper shows one of possible ways to fulfilling this task.
As stated in the introductory part of this paper, the here reported research is a part of an extensive research project focusing on changes in pupils' approaches to problem solving in (not only) mathematics. At this point we are in the phase of finishing a 14-month experiment, which includes problems that require more complex heuristic strategies. The findings of this long-term experiment will allow us to compare effects in both types of experiment. These findings will be useful for further research in pupils' culture of problem solving but also for applications into teaching practice, e.g. for creation of teaching materials and didactical situations for teachers. The results gained in this research will also be valuable for pre-service and in-service teacher training.

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INNOVATIVE APPROACH TO TEACHING BUSINESS – DEVELOPING CASE STUDY METHODOLOGY

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ABSTRACT

The article describes developing and implementing case study method in teaching business within the European project INNOCASE. It presents new trends in pedagogy with the focus on case study method adapted from the RePro methodology that supports knowledge and understanding in the business environment, autonomous learning as well as contributes to personal self-development in terms of teamwork, project management, research skills and negotiation. The output of the project involves case studies prepared in close cooperation with SMEs owners/managers as the basis for the e-learning case study pack consisting of 12 modules, each with a case study and theoretical introduction to the topic of the case. A team of researchers have been involved in an international project INNOCASE since 2012 focusing on the development of the case study method and its application to teaching business.

KEYWORDS

Case study, methodology, teaching business

INTRODUCTION

The article deals with the project INNOCASE, its goals, transfer of RePro methodology, its specifics, and output related to case studies that are based on SMEs in four different European countries. The project focuses on case study method as innovation in teaching different subjects at university level.

The article describes the process of creating the methodology related to case study development in a multicultural team of partners. The team originally put forward the following research questions:

- Is adopting RePro methodology adequate for the goal of the project?
- Are the criteria of SMEs´ selection acceptable for all the partners?
- What kind of information are the researched SMEs able to share?
- Will the target group of the project – SMEs´ staff – be able to use the output of the project – case studies in e-learning – to solve similar problems?

The project addresses two target groups: trainers and teachers specializing in business education and SMEs owners/managers and university graduates willing to start their company or work in SMEs.

MATERIALS AND METHODS

The RePro model was designed to support knowledge and understanding in the current business environment, as well as contribute to personal self development in terms of teamwork, project management, research skills and negotiation. All these products are different from the traditional case study method as they are organized as multidisciplinary

learning modules which can be used in many different study areas and are related to specific problems of leasing tasks.

Definitions of a case study say that it is an account of a situation including enough details to assess the problem and determine possible solutions in a group. Case studies give opportunities to analyze character, context, actions and possible outcomes, which requires the case itself, supporting documentation, and questions (Thomas, 2011). Expected outcomes involve considering options and assessing strategies. Case studies react to a real-world situation and deal with a concrete problem typical for ethnically diverse situations and they can strongly motivate students to learn more about other cultures.The case study method is a kind of research concentrating on one thing, looking at it in detail, without generalizations about it. Case study looks at something in its completeness and provides an analytical insight. It analyzes persons, events, decisions, periods, projects, policies, institutions and other systems studies holistically.The design of a case study involves the following features that have to be interconnected: purpose, conception or question,desk research or literature review,the chosen approach and the design frame, and methods and analysis used in the process of creating a case study (Brannine, 2011). The RePro case material in comparison with the case study method itself entails corporate specific information on the business environment, personnel, production, marketing, logistics, accounting and finance. In INNOCASE project the subjects of case studies will be selected on the basis of companies' analysis – the most crucial areas of SMEs management will be picked up for the case studies (Chlpeková and Koltnerová, 2013, s.220).

The country of origin of the transfer of innovation is Finland, where the RePro[1] project was successfully implemented. The transfer in INNOCASE is based on adapting and developing the case study methodology from the RePro project to the SME environment and making it accessible for a wide range of trainers and educators dealing with business education in partner counties.

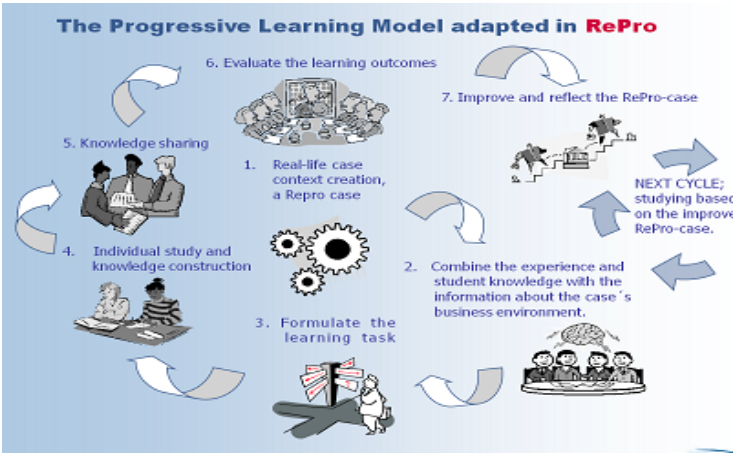

Fig. 1: Learning Model in RePro

[1] The INNOCASE project was based on the results of Real-Life Business RePro aimed at developing an international model for producing, testing and using business-oriented cases and problems in a multicultural learning environment. This was done by combining educational problems with actual business problems.

From a business and educational perspectives, the value of the RePro metodology can be seen in the use of case study in the teaching process with the following elements:

- learning environment – relevant knowledge and information, but also the way of obtaining it as the RePro model integrates professionals, experts, teachers and organizational knowledge
- interactivity of teaching forms – leasing takes place through interactive dialogues and collaborative problem solving
- solving problems in a creative way – active approach, high motivation, a creative form of learning and searching for solutions to the problems
- process approach to learning – a continuous learning process requiring constant monitoring and stimulation as all the educational activities should be reviewed and reflected to enable further developments.[2]

RESULTS AND DISCUSSION

Results

An example of a result - a case study submitted within the project INNOCASE by the Czech team

The creation of case studies within the project INNOCASE has to observe the following structure that was agreed on by all project partners. The presented scheme is obligatory for all partners from Czech Republic, Denmark, Finland, Poland. It consists of:

A – Executive Summary,
B – Basic information about company,
C – Environmental analysis,
D – Definition of problem,
E – Guidance (to solution),
F – Analysis/Discussion/Reflection,
G – and Conclusions/References.

The output of the project –a sample of part of a case study– is presented below:

ARISTA - SUCCESSFUL BRANDING

ARISTA company, founded in 1995 in the North Moravia Region of the Czech Republic, deals with the production of pastry and its delivery to business partners. It has a long and complicated history closely related to political and economic changes that took place in Czechoslovakia in 1989.

In the course of the last 5 years in spite of the economic crisis, demand for ARISTA´s products has not decreased probably due to the long tradition based on an old recipe coming from 1935 using the traditional ray leaven, due to the brand with good reputation because of producing high quality goods, effective investment in the technological equipment (a European Project), and the fact that the firm belongs to the family-owned ones.

However, the company faces some problems related to competition, especially from Polish bakeries, fluctuation of the personnel, and legal and communication ones.

[2] LLP Programme LdV- Innocase – Transfer of innovative case study approach in business education, 2012-PL1-LEO005-27456.

Problems being solved within the project

Arista company, being aware of its problems, has developed a project within the Operational Programme *Enterprising and Innovation* which supports the development of the company by investment in its technological equipment.
The programme focuses on solving the following basic problems:
The need to invest in new equipment to extend the selection of products
The need to renew technological equipment for the following reasons:

- Exchange of outdated equipment
- Following new trends in production
- Taking into consideration changing input - change in the quality of agricultural products
- Increasing demand related to pastry quality
- Ensuring efficient equipment
- Decreasing the physical burden of the staff.

The development of the company including its outlets and ensuring working positions in the region with the high rate of unemployment.

Problems to be solved

A Personnel and its fluctuation

However, the most ardent problem the company has to face is the fluctuation of the personnel. This question is closely related to the type of work agreement). There exist flexible forms of work among SMEs in the Czech Republic. The most frequent types of agreement are the following:

- the main form of employment - the open-ended contract (83% of companies)
- other forms of employment, e.g.
- agreements on performance of work,
- part-time employment or fixed-term contracts,
- temporary workers from job agencies.

B Legal problems

As the company does not have any ambitions to penetrate foreign markets – Polish or Slovak, the main focus is on introducing European norms, like the law related to food, certification, etc. The main problem is related to the application of Czech administration law in the situations when Polish mobile shops where hygienic regulations are not observed, penetrate Czech market, and are not checked by Czech authorities regularly.
In terms of legal problems, the company also faces numerous problems related especially to marketing, accounting, labour-law relations, etc.
It is obvious that big companies employ an expert for each of the mentioned areas, while in SMEs all the problems must be solved by a small number of people.

C Communication problems

Communication problems in SMB, as it has been proved, are the cause of 70% of all the problems in companies. They are related to the following areas:

- The language
- External and internal communication
- The role of IT
- Communication problems
- Intercultural communication problems.

The above presented sample of a case study comprised the description of the situation and outlined the problems. The following analysis, discussion and solution of the situation is the task of the students.

DISCUSSION

At present, it is possible to reply only to some research questions asked at the beginning as the measuring of innovation related to the RePro methodology and its efficiency has just entered the phase of testing. However, the prediction is that the goal, which is the support of autonomous learning and problem solving in SMEs, has been reached. (Benson, 2001, p.19) Specific data obtained from the testing and its evaluation will be the topic of another paper.

After the needs analysis carried out by the coordinator of the project, the partners agreed on the criteria of the SMEs selection, which led to the specific areas in which the SMEs´ owners needed to be educated. The Czech partners were responsible for the problems related to brand creating, support of e-shops and problem solving within communication with customers.

The amount of information available from the SMEs in partner countries was reflected in the depth of the topic covered in the output. There was a big difference between the data gathering procedure in Finland and Denmark, and Poland and the Czech Republic. The owners of SMEs in the post-communist countries were not interested in any education, expansion abroad, and provided information could not be related to any financial area and the know-how they had.

The research question related to the fact whether SMEs´ staff will be able to use the output of the project in the form of case studies in e-learning – to solve similar problems in their companies - can be replied after carrying out testing in four partners´ countries.

CONCLUSION

The article describes the process of creating the methodology related to case study development- transfer of RePro methodology - based on SMEs in four different European countries. It focuses on case study method as innovation in teaching different subjects at university level supporting autonomous learning. The article also presents a sample of a case study created within the project by the Czech team focusing especially on the outline of problems to be solved by potential learners. The added value of the created materials is in the adjustment of RePro results (with regard to content, quality and didactic approach) to target groups needs (trainers/teachers dealing with business education, SMEs owners and managers, graduates willing to start their business), transforming them into a distance learning form and disseminating as well as exploiting within the EU. Using innovated case study method contributes to the quality improvement in business education. It also involves the development of relationship building in the international team of researchers

(Quantanilla and Shawn, 2011). At present, it is possible to reply only to some research questions asked at the beginning of the article as the measuring of innovation related to the RePro methodology and its efficiency has just entered the phase of testing and will be a topic of another article.

ACKNOWLEDGEMENTS

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ANALYSIS OF SCORES FROM MID-TERM AND FINAL TEST BY A CONTINGENCY TABLE

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Abstract

The paper reports and discusses the results of an analysis of scores obtained by students of the basic course in mathematics at the University of Economics in Prague in mid-term test and final test. The dataset contains scores of 900 students who enrolled in the course in the summer semester of the academic year 2012/2013.

At the beginning, descriptive statistics of scores from both tests are reported and then a two-dimensional contingency table is constructed so that the joint frequencies are obtained. The Somer's coefficient is used to find out, whether the score from the final test depends on the score from the mid-term test. Symmetrical measures, mainly the Spearman's rank correlation coefficient, are also used to analyse the dependence of the two variables. Since all measures show that there is a significant dependence between the variables, the results may be used to motivate students to study continuously.

Keywords

Contingency table, Somers' coefficients, Spearman's rank correlation coefficient, test in mathematics

Introduction

Almost all undergraduate students of the University of Economics in Prague have to take a course in mathematics that is taught by the staff of the Department of Mathematics of Faculty of Informatics and Statistics in order to complete their studies. This course provides students with basic knowledge of linear algebra and mathematical analysis. The course's syllabus follows the content of the textbook written by Klůfa (2011), or alternatively (Klůfa and Kaspříková, 2013).

The enrolled students have to sit two tests and an oral examination in order to pass the course. The mid-term test is worth 20% of the final grade and the final test is worth 40% of the grade. The results of these tests provide us with data, which can be analysed by different statistical methods. The dependence of students' performance on their behavioural or demographic traits can be analysed by the means of hypothesis testing (Kaspříková, 2012), correlation between areas covered in the test and the obtained total score may be found in (Kaspříková, 2011), the dependence between performance in particular test items and students' abilities is discussed in (Kaspříková, 2013). The use of probability for analysis of test performance can be found in (Klůfa, 2012), or (Klůfa, 2013).

The aim of this paper is to find out whether the score obtained by a particular student from the final test depends on the score which the student received from the mid-term test. If the dependence is proven, the obtained results may than be used by the lecturers and instructors of the course to motivate students to prepare better for the mid-term test.

Materials and Methods

Data Description

The data come from the summer semester of the 2012/2013 academic year. During that semester, 900 students sat the final test of the course of Mathematics for Economists. The data contain information about the student's score from the mid-term test (out of 20 points) and the score from the final test (out of 40 points). These scores are discrete, i.e. the score cannot have any decimal number. In the following analysis, the score of the final test will be considered as a dependent variable (y) and the score from the mid-term test will be considered as an independent variable (x).

Statistical Analysis

A contingency table, or cross tabulation, is a table that contains the joint frequency of the two, or more, variables. The table is used mainly for categorical variables which can be nominal or ordinal. In our case, the contingency table would have 20 rows and 40 columns, therefore we decided to use intervals, so that dimensions of the contingency table will be reduced to 4x8. The intervals for the mid-term test will be 0-5, 6-10, 11-15, 16-20 and for the final test: 0-5, 6-10, 11-15, 16-20, 21-25, 26-30, 31-35, 36-40.
Afterwards, the measures will be calculated in order to find out, if there is a dependence between the score obtained from the mid-term test and the score from the final test. The measures for two ordinal variables are described in (Pecáková, 2011) and (Řezanková, 2011). In case of ordinal variables we do not speak about dependence, but correlation.
The first important measure that is used to analyse correlation between two ordinal variables is the Spearman's rank correlation coefficient:

$$r_S = 1 - \frac{6 \cdot \delta^2}{n \cdot \left(n^2 - 1\right)} \tag{1}$$

where

$$\delta^2 = \sum_{i=1}^{R} \sum_{j=1}^{S} n_{ij} \left(a_i - b_j\right)^2 \tag{2}$$

$$a_1 = \frac{n_{1+} + 1}{2} \tag{3}$$

$$a_i = \sum_{l=1}^{i-1} n_{l+} + \frac{n_{i+} + 1}{2} \quad \text{for} \quad 2 \le i \le R \tag{4}$$

$$b_1 = \frac{n_{+1} + 1}{2} \tag{5}$$

$$b_j = \sum_{l=1}^{j-1} n_{+l} + \frac{n_{+j} + 1}{2} \quad \text{for} \quad 2 \le j \le S \tag{6}$$

R is number of rows of the contingency table,
S is number of columns of the contingency table,
n_{ij} is joint frequency when dependent variable (y) takes value i and independent variable (x) takes value j,

n_{i+} is marginal total of the i-th row in the table,
n_{+j} is marginal total of the j-th column in the table.
The coefficient ranges from -1 to 1. If the value is positive, there is a positive correlation between the two variables, if the value is negative, there is a negative correlation between the variables, and if the coefficient is equal to zero, the variables are linearly independent. This coefficient gives information about symmetric dependence, not just dependence of score from the final test on the score from the mid-term test, but also about the opposite dependence.
Apart from the Spearman's rank correlation coefficient, there is a group of measures that are based on comparing pairs of objects, i.e. students in this case. This group of measures include: Goodman and Kruskal's gamma, Kendall's Tau-b, Kendall's Tau-c and Somers' coefficients. The formulas can be found in (Pecáková, 2011) or (Řezanková, 2011). However, we will be focused on one of the Somers' coefficients, which will provide us with information about dependence of score from the final test on the score from the mid-term test. The rest of the measures are symmetric ones, like Spearman's rank correlation coefficient. The Somer's coefficient may be calculated as follows:

$$d_{yx} = \frac{C - D}{C + D + T_Y} \tag{7}$$

where
C is number of concordance pairs (where one object, has both values of variables x and y lower than the second object),
D is number of discordant pairs (where one object has the value of variable x lower than the second object and the value of variable y higher than the second one, or vice versa),
T_Y is number of pairs, which have the same value of variable y and different value of variable x.
For all the measures, the null hypothesis states that the variables are independent and we will perform the tests at the level of significance of 5%.
IBM SPSS software was used to construct the contingency table and calculate the measures.

Results and Discussion

Descriptive Statistics

Firstly, we will describe the two variables by descriptive statistics and histograms.
Concerning the mid-term test, we can observe, that 50% of the students have 15 and more points from this test (see median in Table 1) and the mean is 14.06 points (out of 20). The other interesting thing is that the mode is the maximum, i.e. 20 points (see Figure 1). From the histogram and from the table, it is noticeable that the score is skewed to the left, or there is a negative skew, therefore we may conclude that most of the students were well prepared for the mid-term test.

		Statistic	Std. Error
Score from mid-term test	Mean	14,06	,166
	Median	15,00	
	Variance	24,908	
	Std. Deviation	4,991	
	Interquartile Range	7	
	Skewness	-,812	,082
	Kurtosis	-,075	,163

Tab. 1: Descriptive statistics for the mid-term test score

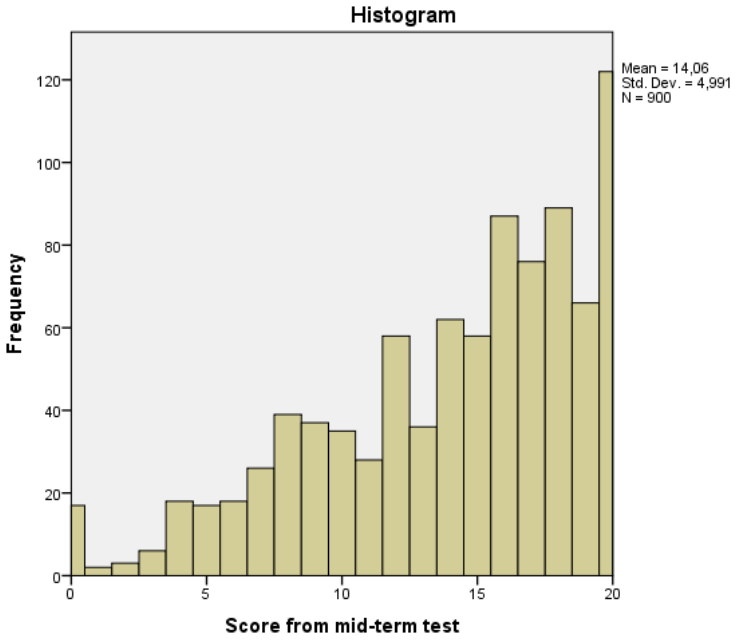

Fig. 1: Histogram for the mid-term test score

The descriptive statistics for the final test score are similar. The median and the mean show us that more than 50% of the students obtained more than 20 points from the test and a negative skew is present again. However, the skew is smaller and variance is greater. The mode is the maximum as well, i.e. 40 points, although, it is not as clear as in the Figure 1. The greater variance may be caused by the fact that students sit this test during examination period and since they obviously have other exams during this period, they are not as well prepared as for the mid-term test. On the other hand, greater variance may also be caused by the fact that the last chapters of the textbook (Klůfa, 2011), which are taught after the mid-term test, such as differential equations or functions of two variables, pose more problems to students.

		Statistic	Std. Error
Score from final test	Mean	26,41	,310
	Median	28,00	
	Variance	86,413	
	Std. Deviation	9,296	
	Interquartile Range	14	
	Skewness	-,555	,082
	Kurtosis	-,417	,163

Tab. 2: Descriptive statistics for the final test score

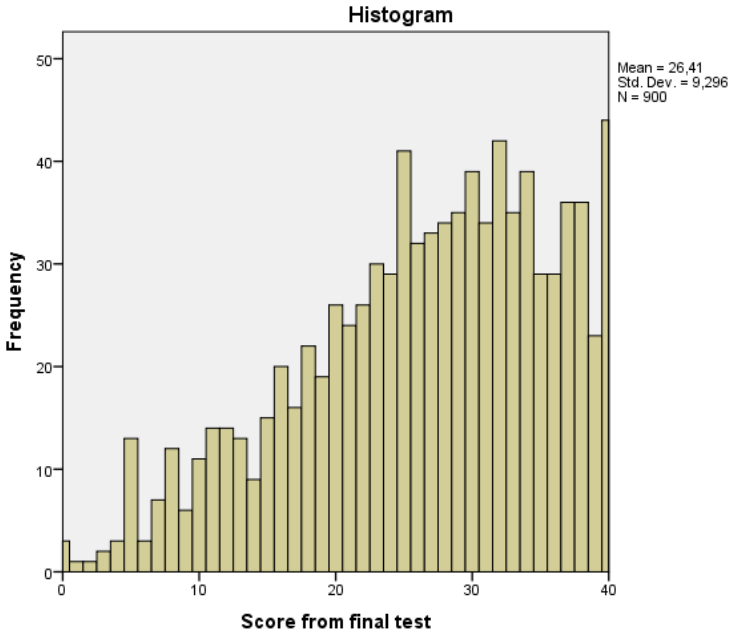

Fig. 2: Histogram for the final test score

Contingency Table and Dependence

From the contingency table (see Table 3) we can observe that there is some dependence, or correlation, between the variables, since the joint frequency of the two variables is much higher along the main diagonal and there are not many students who obtain many points from one of the tests and nothing from the second one. The following results in Table 4 prove this assumption. The third Somer's coefficient is 0.334, which shows some small correlation. The second Somer's coefficient is 0.260, therefore we may conclude that the score from the final test depends on the score from the mid-term test more than the mid-term test score on the final test score. This can be seen from the contingency table as well, since there are no students who received 0-5 points in the mid-term test and 36-40 points in the final test while there are 128 students who received 16-20 points from the mid-term test and 36-40 from the final test.

		Score from final test								Total
		0-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	
Score from mid-term test	0-5	7	10	6	11	8	13	8	0	63
	6-10	5	14	23	17	29	30	22	15	155
	11-15	5	8	20	41	49	49	45	25	242
	16-20	6	7	16	34	64	81	104	128	440
Total		23	39	65	103	150	173	179	168	900

Tab. 3: Contingency table

			Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Ordinal by Ordinal	Somers' d	Symmetric	,293	,025	11,519	,000
		Score from mid-term test Dependent	,260	,022	11,519	,000
		Score from final test Dependent	,334	,029	11,519	,000

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Tab. 4: Directional measures (Somers' coefficients)

The symmetric measures are all greater than zero and the Spearman's rank correlation coefficient is equal to 0.354 (see Table 5), therefore there is obviously a positive correlation between the two variables and since p-values of all measures in Tables 4 and 5 are all smaller than the level of significance of 5%, therefore we have to reject the null hypothesis, which is another proof of the dependence between variables.

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Ordinal by Ordinal	Kendall's tau-b	,295	,025	11,519	,000
	Kendall's tau-c	,292	,025	11,519	,000
	Gamma	,391	,032	11,519	,000
	Spearman Correlation	,354	,030	11,340	,000
N of Valid Cases		900			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Tab. 5: Symmetric measures

Conclusion

Results presented in this paper show us that dependence exists between a score from the mid-term test and a score from the final test. These results may be used to encourage students to prepare better for the mid-term test and study continuously throughout the semester.

Since Figure 2 and Table 2 show greater variability in the final test scores. In the future,

we might try to analyse whether there were some differences among the variants of final tests and we may also try to analyse differences in scores obtained by the students of different study programmes.

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REAL ECONOMY - UNIVERSITIES INFORMATIONAL ASYMMETRIES

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Abstract

The paper's aim is to present the actual relation regarding the three entities - the labor market (W), the education market (E) and the job market (S) and to try to answer a question if the Bologna education system, implemented in Romanian education, is good or is bad regarding the education market in relation with labor market and job market. Next are presented the Romanian higher educational system particularities followed by a review of weaknesses regarding the three actors corresponding to entities enumerated above: universities, students and employers (labor market). Finally, a set of possible ideas, solutions that can be considered in order to improve and help remodelling the actual higher educational system in Romania are presented.

Keywords

Education market, higher education, labour market, students

Introduction

Normally labour market should be fully complemented by the education requirements for all grades, whose essential purpose is to meet society's needs for present and the future. Students motivated by a specific demand/need in the labour market should find the educational market everything they need to access the own goal. Viewed through the prism of these goals all the government' and specialists' documents in the areas listed agree that between the three markets should be a very close connection, mutual conditioning and overlapping interests. Specialists or not, active politicians or simple economic reality, social life or every day's culture commentators are all agreed (with multiple variations but not changes the problem's matter) with such a vision on the trio of the three entities-the labour market (W), the education market (E) and the job market (S)-see Fig. 1. Murgescu (2000) pointed out that the relationship between education and economy is dual but not rigid and univocally, it has to be seen in its social dynamics. Soukup and Šrédl (2009) remark that the education also has a signal role and a filter factor in labour market. There will always be trades for which education and learning is not ready and also, education for jobs that are disappearing or will not find an outlet on a labour market – labour market that is in a rapidly and increasingly changing to areas unstructured yet or areas that education did not predicted yet. Exceptions always exist everywhere and we do not theorize or conclude on this basis but we are happy that their existence is a strong signal of "life and hope". Although the existence of Europe Community hastened often facilitated the rendering compatible process in all social areas regarding the education multiple conferences and resolutions led to tests that not only cleared the each state's social culture but also in some cases have not validated the proposed systems. The Bologna process is pointed out in

other works, of Komárek (2011) that shows that it is not fully satisfactory regarding other EU country. This education system, implemented in 2004/2005 in Romania, is good, is bad? The Romanian higher educational system particularities followed by a review of weaknesses regarding the three actors corresponding to entities: universities, students and employers (labour market) are presented next and a set of possible ideas, solutions that can be considered in order to improve and help remodelling the actual higher educational system in Romania are drawn in our paper.

Materials and Methods

In order to develop the aims stated in paper's abstract were inventoried and used a series of works, reports and also the author's personal experience in higher education as teacher for more than 30 years. Also, his previous/actual work as an ARACIS (The Romanian Agency for Quality Assurance in Higher Education) evaluator and long or short term expert in university programs accreditation deployed under HDR/POSDRU (Startegic operational sectorial Human Resources Development Projects) projects was used.

Review Stage

Romanian education has undergone major changes over the past 65 years, including 2 traumatizing changes for the system and with latter negative effects but on long term. Abolition, mergers and reducing the universities number in the 70's culminated in massive inventions decreases, losses of academic autonomy and excessive growth of engineering education from the 80's. All this turned the Romanian higher education into a rigid one, with fewer specializations, dominated by technical ones, including also the schooling number decrease (students' number). Stated motivation was the adapting to the Romanian economy needs that was supposed to pay "debts" and to assure its own economical, science and technological progress. At the university level things were just; moreover, it was given credit and investment addressable to bankrupt economic sectors or at least unproductive. Privileges were granted to majors in expense of others, all generating effects on the higher education and industry in the Romanian society level.

Perţ (2000) pointed out that disappointment, failure to meet satisfaction, uselessness, jamming system, the emergence and the increase of imbalances in labour market, imbalances, surpluses in some sectorial areas, professional territorial, deficits in others, and consequently over occupancy of employed labour force. Another change in good this time, even if sometimes only on the intention and ideal levels, occurred in the early 90's of last century along with the post-communist "thaw". Characteristics of the last 20 years for Romanian higher education are high degree of correlation and synchronization for higher education worldwide; rejuvenation of dialogue and the relationship between education, economic and social environment and the emergence of private education in certain areas, except that on the technical engineering and military.

Actual Stage

Clear fall off the idea that the education system has not changed radically - the conservative feature of any system of education was respected- but only disconnected from the communist centralized system and more closely related to social needs, through the liberalization of labour market and connected the European and international space requirements.

Changes are still observable through effects: increased specializations number (Sora 2011:38) and the redistribution of weights (Sora 2011:58), reconfiguration of education

cycles and planes, redistribution of higher university education studies from student's perspectives options (NSI 2009:448), emphasis on skills training, learner centred education, funding per capita, increasing the decision-making system transparency and the Romanian higher education qualifications integration in European community space. However, not all visible effects are bringing long-term real benefits. This is because not all effects have one cause and not all actions require univocal reactions, not to bring into discussion the human factor (hidden intentions), unpredictable directions of successful economic development, social appetite and labour for specific skills or careers.

To give endorsement authenticity to the assertions stated above we illustrate it with few technical academia issues but not only. Universities bring in study programs as diverse and as many following criteria that they create themselves and then evaluate them. Beneficiaries are usually "barons" of academics and their political, central/local administration cronies. The labour market makes it difficult to capitalize on some of the universities offer, more part-level different disciplines from a study programs. It is certain, however, that any study program is not the direct result of the Romanian labour market request and they rarely respond to local labour market demand, and then only by a few subjects included in some master programs that are with the payment regime. The above noted are the effect of a very small degree of coincidence between the labour market and the university. That is why most times and most of the time, the three actors: the labour market (W), University market (U) and students (S) working in almost parallel worlds Fig. 2.

Gist of perceptible characteristic features in the Romanian society is: U - Mainly wants a curricula areas multiplication / diversification / flexibilisation and they cover it with the teaching activities in expense of in applied and practice activities; W - Primarily wants qualifications in narrow technical fields but already established - education, medicine - and the vast labour market wishes especially the transversal competencies (professional skills) development molded in required specialties general competencies; S - Follows the minimum effort to get more money using a diploma attesting to a job that they do not know at all at the time that make an admission option and they don't know at all during school time and very little after. Let's detail the three actors weaknesses and document aspects of Romanian reality with statistics and data sources from (NSI 2009;2014) questionnaires and reports from Voicu et al. (2010) of HRD (Human Resources Development/POSDRU projects in the last 10 years (e.g. over 5500 graduates and nearly 4000 employers surveyed - Voicu et al (2010:18-20).

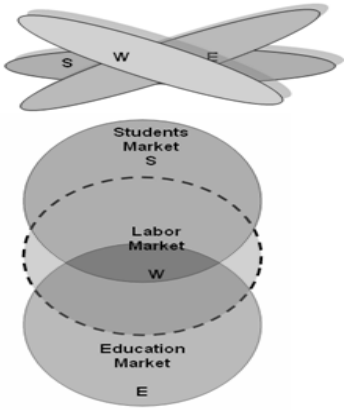

Fig. 1: A vision about the three Entities - the Labour Market (W), the Education Market (E) and the Job Market (S)

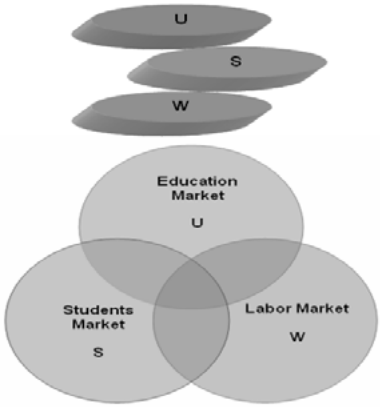

Fig. 2: The three actors: the labour market (W), University market (U) and students (S) working in almost parallel worlds

Results and discussions

Higher education

The tendency of communist era centralization and consolidation had as a response in post-communism a centrifugal movement whose effect was the explosion in the number of higher education institutions. (In terms of private education we appreciate that its appearance was a natural thing and the way of granting authorization, structure, etc. are not discussed in this paper). This phenomenon was characterized by a number of deficiencies. Their essence, but without a classification and a hierarchy by chronology or importance, remember the following: subunits which have become independent units and competing the parent institution in the same market (e.g. western Romania has six technical universities within a radius of 250 km, in the past being only one);

- Lack of a country-level perspective on the labour market needs, nor the number or qualifications structure;
- Mismatches on density of geographical area education units in the country, mismatch of annual admissions number and specializations: needs, the number of high school graduates, the birth rate etc.
- Waiving compulsory internship of graduates;
- Phenomenon occurrence time is in contradiction with resources; allocated budget is about 6% of GDP and reaches 3% of GDP as a result of execution.
- Strong division between the higher education institutions allocated budget; strong dissipation investment efforts in the field
- Pronounced increase of investment efforts and of the education sector with diminishing its coverage;
- Inadequate and disproportionate remuneration relative to the tasks' amount (the same tasks but salaries up to 3 times);

Among the weaknesses in the education process enumerated, the most severe according to the authors are:

- Study programs not correlated with local labour market and the disciplines do not have necessary perennially to editing support materials, competitive courses;
- Inconsistent and unstable curriculum volume and structure, theoretical teaching activities not correlated with the teaching practice ;teachers with educational, pedagogic and specialized precarious training, the courses become tormenting and fade; teaching skills does not evolve and does not develop, they are left to TIC;
- The disappearance of "hierarchical pyramid" and subordination relationships between teachers and upsetting hierarchies between internal organizational structures;
- The research directions and opportunities of interest grinded at the individual level; decrease of the research and scientific staff of the departments' role until disappearance;
- Individual democratic criteria vote, unique, free and secret for competent candidate transposed in practice became the "gang vote" for the future "umbrella man" of the "yes-man "group;
- Human character, professional integrity, dignity, academia tend to become only intentions without actually coverage;
- Giving up at the admission exam opened the "gates" and diluted quality in a dramatically way; candidates' "weak" knowledge is increasing and don't provide a quality graduate; students assessment has a strong subjective component mainly related to the need to constitute the study formations (students number);
- Portfolios, projects, papers undergraduate dissertation and doctoral theses are day by day ' electronically bibliographical documentation' to a given topic, most often without being recent or serve someone in the future;
- Transversal skills share to the graduates' professional luggage is reduced;
- Professional skills are far from market needs.

Labour market

Is growing by business rules without responding to national headquarters on short or very long term - which otherwise are outlined only at the intentions level in political speeches. Among the consequences mentioned:

- At national level is not known the qualifications needs and graduates number and about trends and forecasts cannot be it;
- 'Both employers and graduates believe that, at present, the higher education system fails to provide graduates the practical skills they need, but does not fail with the theoretical knowledge' (Voicu et al 2010:16);
- 'Only about a quarter of employers (27%) and recruiters (23%) believe that the main responsibility should belong to employers. The remaining three quarters of respondents dividing responsibility between faculty and students, a slightly higher proportion (especially for the recruiters) view that faculties should have the responsibility to prepare students to correlate with job requirements' (Voicu et al 2010:17);
- 'For 76% of employers do not care if a potential employee has only a bachelor's degree or master's degree (Voicu et al 2010:19)
- Firms remember the education system only when they need their products and respond in a little extent to the questionnaires issued by government entities
- Interest granted by employers to certain skills acquired by graduates in college is different from that covered by the universities – see Table 1 which is done on data from (Voicu et al 2010:28-29);emphasize (50%) on the students practical training but delayed or disproportionately respond to requests from higher education needs in this respect;
- The number of scholarships is very small, a drop in the ocean, masters pay regime, established at the company's request have limited lifetime, so the effort becomes ineffective;
- 'To find a first job, transversal skills are more important than specific ones. Both for the graduates and recruiters, specific skills acquired in the study programs are important but took a backseat to those transversal' (Voicu et al 2010:11);

Components	Very important percentage [%] Actors	
	Recruiters	Employers
1. Manner of presentation at interview	18	12
2. Personality	18	18
3. Field of study	30	5
4. Specialization	35	11
5. Recommendations from the third parties	44	12
6. Computer use	45	22
7. Knowledge of foreign languages	46	32
8. Work experience during university	48	48
9. License exam results	47	38
10. Internships	58	47
11. Previous faculty work experience	68	30
12. Reputation of the university	70	27
13. Study abroad experience	61	70

Tab. 1: Labour market perception of the importance given to the different skills, first job (Voicu et al 2010)

Students

If in the last 20 years, the whole Romanian indicator number of students/1000 inhabitants increased, to all other specific indicators were noted decreases and reported deficiencies prevail against the benefits. Here are some examples:

- Downstream skills acquired are insufficient to upstream access during the studies;
- Candidates are committed to university without knowing anything about the upcoming qualification nor any content path; the students number interested in "job" by many universities fell below the critical number needed to carry out the teaching process;
- The student understands the school as something optional, not as a means to improve and make use of their mental faculties;
- Largeness of disciplines in universities, subjective and "flexible" evaluation etc., negatively shapes the future character and amplify the graduate temptation - natural otherwise -to laziness, sufficiency, lack of combativeness and competitiveness etc.;
- The student calls practice work activities but is not willing to practice and execute with his mind or his own hands;
- Admission on the basis of the "dossier" is not motivated for the candidate throughout his higher education study and totally irrelevant to the choice of "future qualification";
- Only half of the graduates surveyed consider that they had the necessary skills for future job and to learn to work, 85% of them learnt to work in the workplace (Voicu et al 2010:13);
- 'For the whole graduates sample consider that more than half (55%) of the knowledge and skills they need in the workplace were really learned in the workplace around one third (32%) were learned in college and 14% have been learned in other circumstances (Voicu et al 2010:14);
- Graduate undertakes where can or where is specialized, the time elapsed until the first job in the specialization field is over three months (Voicu et al 201:27);
- 'Reasons invoked by graduates, about a position in a different specialization than that one of the graduate are related mostly to the lack of availability of a post in its specialization field' (Voicu et al 2010:26);
- 'According to the recruiters, the main reason for changing the workplaces in the first 5 years after graduation is to find a job better paid (Voicu et al 2010:29); the gap between expectations and achievements, desires and possible, between the time of onset and completion of studies has negative repercussions on overall physical condition graduates.

Presenting especially negative things with a very critical tone and sometimes directly, the author don't wants the defamation Romanian higher education system but on the contrary wants to correct the deficiencies, system's improving and modernizing through the clear identification of places and moments in which, if the three players acts decisively and with joint efforts, expected results can be obtained soon. Signals that the system cannot be "patched" became apparent and causing unwanted effects. Therefore we have to change the "bag" not the "rags" and to fill it with content that on the one hand to respect conservatism beneficial the education system continuity and on the other hand that assure viability and development of modern and effective education goals needed in fulfilling tasks set by society. Without claiming that the ideas presented below are solutions to all

the problems, nor the originality of the formulation or as staging logic, we propose taking into consideration the following:

- Designing a pragmatic document on the triple problem of education, labour, economics, to be proposed to a public debate which then forms the basis for long-term planning (25 years) of concerted actions of two of the three entities (education and labour market);
- Organization higher education in regional university poles; - Linking schooling numbers to the specialization repertoire on medium term labour market requirements, NSI programs and long-term government reports;
- Revitalization / construction of professional orientation cabinets in secondary education cycle (high school) so that students are informed about the qualifications from the peoples that are approved of the job market;
- Widespread use of National Higher Education Registry (NHER, 2014) the platform for academic and labour market information;
- Considering the practical works hours as hours that are part of didactic personnel hours and conduct their teaching hours in calendar condensed regime in industrial units offered by the labour market; establishing compulsory internship in their specialty and subsidizing the employers who ante-called graduates in certain specialties;
- Reinstatement university admission exam and revision the specializations nomenclature in order to correlate them with the labour market, recognizing the obsolete unsustainable ones;
- Withdrawal of accreditation for underperforming or that have deviated from the original study programs, reduction of education planes curricula based on strict adherence to chronology of disciplines and rules emitted by ARACIS - The Romanian Agency for Quality Assurance in Higher Education;
- Restriction on the number of disciplines, there are many disciplines that have chapters which became independent disciplines and judicious distribution of workload between classroom activities, seminar, lab, seminar and practice;
- Review the basic disciplines content, removing ballast information, overlapping elements and depth specialization; reconsidering graduating works and dissertations regarding the topic, volume, content, and implementation according to potential employers;
- Stopping inflationary trend of thesis with topics and resolving that do not find their utility in the real economy and the fundamental theories;
- Restoration of real and functional hierarchical pyramid in higher education;
- Remove that criteria needed to promote for which the institution or system did not previously created conditions and also they do not fulfilled them; Stimulating creativity in individual research by facilitating access to profile grants or scholarships.

Conclusion

All analysis materials, research reports and statistical data from various surveys or INS have noticed in the last decade many of the shortcomings outlined in this paper. No one took care of finding solutions or action plans and this are existent even the Bologna system is applied from several years, but only the educational system cannot repair all the problems. If at least some of the previous measures listed would find a counterpart in governmental and institutional measures we believe that parallelism damaging indicated in Fig. 2 could be shaken and the three actors involved would become tangible each other

for a restoration of the natural links that should exist between them and which alone can ensure the harmonious development of any society as a whole and final aim: healthy adults who work with joy and trained to fulfill their dreams.

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EDUCATION PRODUCTION FUNCTION - CONTRIBUTION OF FACTORS TO EFFICIENCY MEASUREMENT

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Abstract

Formulated and regressed on the base of observed data sample a production function allows for efficiency computations evaluating all units of the sample. Creating thus an inequality index, a question of influence of input factors arises. The Shapley value decomposition generalized by Sorrocks represents a regression based approach to decompose any inequality index.

Production function explaining grade by the help of preliminary tests score is estimated distinguishing between public and private school students. An eventual influence of the type of property on the student performance is studied. Further, a contribution of the property factor to efficiency measurement is computed. While the grade itself in our sample does not depend on the type of property, a contribution of this factor to efficiency is apparent. The interpretation of results is that the private school students from the sample are less willing to move from worse introductory results to a successful grade.

Keywords

Production function, corrected OLS, efficiency measurement, Shapley decomposition

Introduction

An education production function is an application of the economic concept of a production function to the field of education. Directing attention to the distribution of student performance -- the outputs as opposed to the inputs, production functions started to enter some American analyses in the second half of 20ties. One of the pioneering studies appeared at Harvard University delivered by S. Bowles (1970). Education production functions also are in focus of the professional carrier of E. Hanushek (e.g. 1979, 2007). In 1979 he described in details discrepancy between conceptual production functions and educational reality dealt in previous analyses. Pritchett and Filmer (1997) stress financial aspects of education in their education production function study; after all they prepared their text for the World Bank. Other authors mention various features of not explicitly economic nature as families, peers, neighborhoods, labor market success, college attendance, graduation rates, and, most frequently, standardized test scores. Besides, differences in teacher quality have been shown to be very important (Hanushek, 2007).

The Shapley value decomposition was first applied in 1953 as a solution for estimating the power of any given voter in a coalition voting game; then Sorrocks (1982) proposed a regression based approach to decompose any inequality index. Inequality always is a common concern, often strongly perceived by people. In case of economic inequalities, governments which redistribute resources through taxation and public expenditure, and also international authorities, care to get information about the underlying factors. As an example, let us mention recent study of Celidoni et al. (2011). Non – economic inequalities may be connected with different ways of personal evaluation and social

status. Inequalities in study results usually bring also economic consequences, thought it is not always a straightforward process.
The objective of the paper is to analyse performance differences between public and private schools students. Production function explaining grade with the help of current tests results and the type of property. Further, the efficiency of students´ results is computed representing an inequality index. The Shapley decomposition being applied, the contribution of the type of property is quantified.

Materials and Methods

Education production functions

Suppose the production function to be in the Cobb – Douglas form

$$Y = AX_1^{\alpha_1} X_2^{\alpha_2} \ldots X_k^{\alpha_k}. \quad (1)$$

After estimating the parameters by the help of OLS we can compute efficiency (generally called technical efficiency) of each unit in the data sample.

$$TE_i = \exp(\hat{u}_i - \max_j \{\hat{u}_j\}) \quad (2)$$

whith $\hat{u}_i, \hat{u}_j$ being residuals of the regression, $i = 1, 2, \ldots, n$ where n is a number of observations. Estimated parameters α_i explain a contribution of X_i to Y. If we need to quantify a contribution of factor X_i to TE_i index, the Shapley decomposition may be useful.

Shapley decomposition

Let us describe briefly a mechanism of Shapley decomposition in general. Suppose a level of inequality to be represented by an index $E = E(x_1, x_2, \ldots, x_k)$ explained by the factors $x_1, x_2, \ldots, x_k$ (in our case we have *TE*). The contribution of the factor x_i to the total inequality is computed removing it from the basic regression (relation (1) in our case) and measuring the extent to which the index *E* (*TE*) has changed. If we imagine scenarios in which some or all of the factors are eliminated, the value of the contribution of any given factor may depend on the order in which the factors appear in the elimination sequence. Let $E/pr(x_i)$ be the value of *E* when *p* factors have been dropped, *r* denotes the rank of elimination of x_i. We formally define also $E/kk(x_i)$ what is the value of *E* when all variables have been dropped, x_i as a last one. Together, there are *k*! possible elimination sequences. Common contribution of factor x_i is then given as

$$C(x_i) = \frac{1}{k!} \sum_{r=1}^{k} C_r(x_i) \quad (3)$$

where $C_r(x_i) = E(x_1,\ldots,x_i,\ldots,x_k) - \sum E/p\ (x_i)$ is a contribution of x_i when *r* is the rank of elimination. For further details see Sorrocks (1982 and 1999). According to this formula, the contribution of any given factor can be interpreted as the expected marginal impact of the factor when the expectation is taken over all the possible elimination sequences.

Data sample

The data file was created comprising 100 persons from two different schools; 60 students from a public school free of charge, 40 are the students of a private school with all study programs subjected to a charge. Unifying features are: the same subject, the same teacher and the same requirements; as for the students, comparable preliminary experience and knowledge of related subjects. In both cases, current tests - used below as one of explanatory variables - are announced before, in a written form, without an

offer of possible answers. Eventual differences in students´ motivation, approach and performance were considered only as a subject of speculations and became a reason for the following analysis.

Results and Discussion

As explaining factors we use the type of property *prop* equal to 1 if the item relates to the private school and 0 in the other case, and *score* reached by current testing. *Grade* given by the examination is an output. Relation is given as a Cobb – Douglas production function in the form

$$grade = A * score^{\alpha} * \exp^{\beta * prop} \tag{4}$$

what after rearranging gives an econometric model

$$\log(grade) = \log A + \alpha \log(score) + \beta\ prop + u \tag{5}$$

with *prop* as a dummy variable and u a disturbance term. Scores are measured in per cents of successfulness, grades are modified with the help of percentage form, too. Hence grade 1 equals 100 % and further proportionally to grade 4 as 1 % (= 0 after applying logarithms).

After estimating with the help of OLS, parameters α and β give a basic information: increasing / decreasing score by 1 % implies increasing / decreasing of grade by α %; β measures a change in *grade* value according to the type of property.

To compare all the students as individuals, the concept of efficiency is known. Following general rules described e.g. in Pankova (2012) and using COLS (corrected OLS) we can compute the so called technical efficiency TE_i of the *i*-th unit according to (2). Individual evaluation by TE_i represents inequalities which further may be treated by using the principle of Shapley decomposition. Due to the low number of factors, comprising resp. non-comprising of a variable into relevant calculations will of course be sufficient here.

After estimating by the help of OLS we have the results as given in Table 1.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SCORE	0.305503	0.113383	2.694436	0.0083
PROP	0.048395	0.090426	0.535194	0.5937
Log(A)	2.683343	0.499723	5.369663	0.0000

Tab. 1: Regression of (1), source: own computation

Having $\hat{\alpha} = 0.306$ we conclude that increasing of *score* by 1 % brings increasing of grade by 0.306 %. Parameter $\hat{\beta}$ relating to type of property is positive (private school exhibits grade better by 0.048 %) but according to *t* - statistic (see Table 1.) $\hat{\beta}$ equals zero. Constant (= 2.683) has no straightforward interpretation.

Further we compute *TE* values following (2). To explain an eventual influence of type of property, we re-estimate (4) with $\exp^{\beta * prop}$ factor dropped and on the base of newly found residuals we express TE_{NEW}. Impact of type of property on the student´s performance is then found as $IMPOFPROP = TE - TE_{NEW}$. The results are represented by the Figure 1.

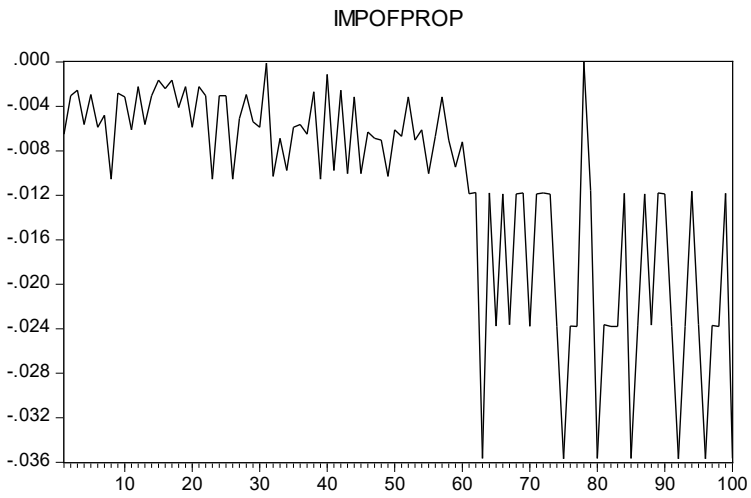

Fig. 1: Impact of type of property on the student´s performance, source: own computations

Commentary: In fact, technical efficiency means reaching of an output by minimal amount of inputs. In the light of this definition, *TE*, resp. TE_{NEW}, computed above, speaks in favour of minimising intra – semestral tests results what of course has no justification. On the other hand, the influence of type of property separated by Shapley decomposition principle brings a meaningful information. In the data sample, as well as in the Figure 1, observations from 1 to 60 relate to public school, 61 to 100 corresponds with private school students. The shape of the *IMPOFPROP* curve means that the private school students from the sample are less willing to move from worse introductory results to a successful grade.

Conclusion

There was no preliminary intuition about a result. The teacher did not mention significant differences in attendance, activity, knowledge, creativity and diligence. The overall impression is confirmed by the results of estimated education production function. While there is a positive relation between semestral tests score and the final grade, an influence of type of school status is insignificant in the aggregate. Seeing in details and creating an inequality index as an individual performance, the type of property shows a difference: to turn an unfavourable start into a grade is much more successful process in case of public school students. The result of course relates to the sample in question, only.

A possible generalization should be supported by a larger panel data set over different schools, subjects and also time periods. For future studies and more general conclusions not only a larger data sample will be necessary. To profit from all subtle details of Shapley decomposition technique, a multi – factorial education production function should stay in the base of an analysis.

Acknowledgements

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STARTERS OF PROBLEM POSING

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Abstract

In the process of posing mathematical problems without any topic restrictions four types of initial ideas (starters) were identified: Mathematical topic, Process of problem solving, Variation of the known problem and Context. (All four starters can be divided into sub-types.)
The respondents at three levels of experience in problem posing took part in the research. (Groups of novices, specialists and experts.) The self-reflections of their problem posing process were analyzed. The results are: With increasing level of experience the ratio of Mathematical topic decreases, the ratio of Process of solving increases and the ratio of Variation of the known problem increases.
There is a difference in Context as well. Novices usually glance around themselves hoping to find inspiration for their problem. The specialists and experts usually notice the interesting situation in their surroundings and afterwards they realize that it is a good basis for the problem.

Keywords

Expert – specialist – novice comparison, problem posing, problem posing process, starters, self-reflection

Introduction

Before we start talking about problem posing, we should specify the term "problem". Henderson and Pingry (1953) define a problem as a question which is prepared in order to be solved. Stehlíková (2000) describes the difference between an exercise and a problem: "*An exercise is a task which can be solved by using the strategies known to the pupil. The exercise becomes a problem if the solving strategy is not immediately clear to the solver, if he/she must search for the way how to solve the task.*"
The study deals with free problem posing. Free problem posing situation – according to Stoyanova and Ellerton (1996) – is such a situation where the poser is not limited by any restrictions. He/she can choose freely what his/her problem will be about. In these free situations it is interesting to observe what kind of initial idea the poser uses at the beginning of his/her work.
If we view the problem posing process as a creative action, we can use model form the theory of creativity to describe the process. E.g. Osborn model (as cited in Žák 2004) presents that the phase of discovering appropriate information and defining the problem is the first step of creative action.
Zhouf (2010) talks about the very beginning of problem posing more specifically:
"The problem posing process starts by making clear what Mathematical issues the problem will regard. (Nearly all issues can be related to different Mathematical disciplines.) Then we think more in detail – what specific Mathematical terms the problem will be about (or

what are the other possibilities).”
The study will regard to further specifications – how the initial idea or the source of inspiration of problem posing can look like.

Material and Methods

The study is a part of wider research on problem posing (see e.g. Patáková 2013a or b). The main goal is to describe differences between problem posing process of novices (beginners in problem posing), specialists (teachers who pose the problem for their class but not more than their profession requires) and experts (very experienced problem posers posing the problems for Mathematical competitions, writing textbooks, ...). The aim of the research is to get better insight into the problem posing process especially of the skilled problem posers. The results are meant to be integrated into various courses of problem posing for the teachers or future teachers.
75 participants took part at the research (25 experts, 27 specialists, 23 novices). They were asked to pose the original and difficult mathematical problem which could be used as a competition problem for approximately 15-year-old students. (This age of students was chosen because it is the age when students leave lower secondary school and start the upper secondary school. So the specialists and experts specialized on both types of schools could be involved.) In addition they were asked to write a detailed self-reflection of their problem posing process and fill in a questionnaire. All these materials were processed in Atlas.ti software and methods derived from the grounded theory were used for their interpretation.
The main questions of the presented part of the research were:

- What can be identified as a starter of problem posing process?
- What are the differences between the three groups of participants with respect to starters of problem posing?

Qualitative description of the identified starters

Four different ways what to start problem posing with were identified:

1. **Mathematical topic**

In this way of problem posing the poser decides first what topic the problem should regard. The choice of the topic can be done by two different ways:
a. The topic can be chosen generally. The problem posing process may then continue by the choice of another – more specific initial idea. An example:
“I chose the graph theory as a topic of my problem...”
b. The topic may be chosen more specifically. This way of the beginning of problem posing is usually connected with a picture of a geometrical shape, with a written mathematical expression or something like this. The poser watches what he / she has drawn / written and tries to find some property he / she could develop to form a problem. An example:
“I tried to draw an equilateral triangle. I inscribed its heights inside and I realized these were its medians at the same time. Having looked at the shape, I came to the idea of inscribing some shape inside – the question could be on the area of this shape. So I tried to cut the medians into three equal parts. I realized that three of these points formed an equilateral triangle again...”

2. **Process of problem solving**

Within this type the poser knows how he / she wants the student to solve the problem. There are two types of initial ideas of this type:
a. The poser thinks about the general mathematical apparatus (e. g. system of equations)

or the specific mathematical theorem (e. g. the Pythagorean theorem) which will form the basis of the problem's solution process. An example:
"I wanted to pose a problem based on a system of linear equations, ideally three linear equations..."
b. The poser doesn't think on a specific apparatus or theorem but on a specific way of thinking the problem should require. An example:
"I like difficult geometrical problems that require only elementary considerations as means of argumentation..."

3. Variation of a known problem

Variation of a known problem means an intentional inspiration by an existing problem or some mathematical situation which is known to the poser. It doesn't mean trying to remember and reconstruct the existing problem. (This "strategy" is not described in this study which deals with posing new problems only.) Contrarily, recalling the existing problem is just the start of the work. The poser uses the known problem as a background for the new one which may be totally different from it. So the old problem serves only as an initial idea, the initial point where the poser starts his / her work. There are two types of using the known problem as an initial idea of the work:
a. The poser recalls a specific problem he / she likes and wants to work with. An example:
"I remembered an old problem from Mathematical Olympics from 9th grade category. The core of the problem lied in central angles and inscribed angles. The area of the inscribed hexagon was to be computed. I started experimenting with an octagon..."
b. The poser goes through the old problems and intentionally searches for a source of inspiration. An example:
"I opened the old booklet of Mathematical Olympics. My attention was attracted by the following problem. (I don't know why just this one, I've simply read several problems and this one made me think about.) ..."

4. Context of the problem

If beginning with the context, the poser doesn't start with any typically mathematical thoughts. The first idea is what non-mathematical topic the problem should regard. There are three ways the participants used:
a. The poser wants the specific non-mathematical topic, no matter what mathematics will be finally involved. An example:
"I decided to pose a problem about the topic I like – the railway transport. At first I thought of railroad switches but I haven't found any way how to use it to form a problem. For sure it is possible to do this but it eluded me. Having left this I started thinking about the shape of the trains..."
b. The poser starts with a glance around himself / herself. He / she doesn't know what to start with at all so he / she tries to find inspiration in his / her surroundings. An example:
"I glanced around myself and looked for the inspiration – we need to paint the room..., how many tins of paint, ... Oh no, this is not original at all. Something else, e.g. a cup... A cup, a cup... Good idea, I'll prepare tea for myself... Ready... What else is in the room? A bike! ... I like cycling, especially with my friends. Wee watch the speedometers and count how far it is to our goal. ... Interesting is that we don't usually reach an agreement. ..."
c. The poser takes inspiration from its surroundings as in the previous case. But there are some important differences. Firstly, he / she doesn't intentionally glance around himself / herself. He / she just notices something interesting somewhere around himself / herself and he / she starts to see a mathematical problem in the situation. Secondly, such an inspiration is compact. It is not an isolated idea – e.g. the idea of a bike as in the previous

case. The poser sees the whole situation which is in fact the first version of the problem. (Of course there is still much to do with the idea to form a problem but even the first idea is quite elaborated.) An example:

"... We wanted to come to the pond in the forest. There were two possible ways – to follow the path, than turn left and reach the pond – or to follow the roadway, than turn right and reach the pond. Both ways seemed to be equally long. We joked about dividing into two groups and taking the different ways... Here came an idea to arrange the situation to form a problem..."

Results

The ways of the beginning of the problem posing process were identified within the self-reflections. The corresponding ratios within the three groups of respondents are shown in the Fig. 1.

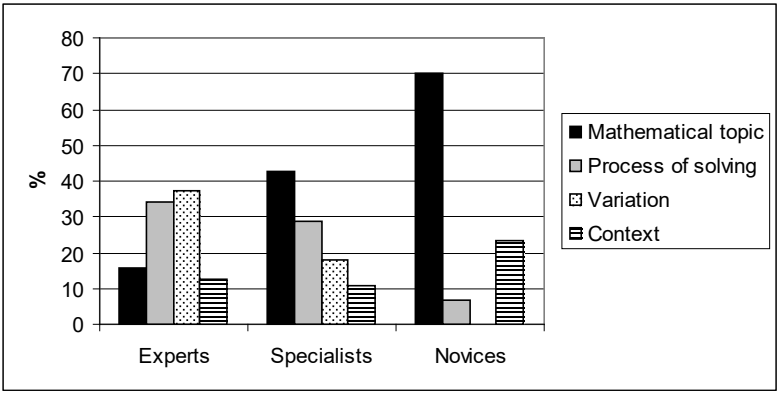

Fig. 1: Ways to begin the problem posing process within the three groups of participants

Discussion

Whilst experts and specialist perform variety of ways what to start problem posing with, the majority of novices' problem posing starts with the choice of mathematical topic.

Looking at mathematical topic as an initial idea of problem posing, we find that the novices use this very often and with the increasing level of experience in problem posing the ratio of this initial idea decreases. The reason is probably that this way how to start problem posing is quite general. Experienced problem posers more often start with something more specific – e.g. a theorem – which moves their initial idea from the general level to a level of intended problem posing process. The expertness lies in the awareness that the more specific the initial idea is, the more pleasant and less random orientated the problem posing is.

There is another interesting thing about this initial idea. Whilst experts and specialists used equally both sub-types of this initial idea, the majority of novices worked according to type b. They e.g. drew a picture and waited for the inspiration while looking at it. This way corresponds a little with the initial idea of Context b. (glance around) which is present most in novices' case as well. The similarity is in the fact that the poser looks at something (no matter whether it is his surroundings or a picture he / she randomly drew) and wants it to help him / her to start.

Intended process of solving is quite a frequent way how to start problem posing in experts' and specialists' case. Sub-type a. (specific theorem or mathematical apparatus) is more frequent within all three groups.

It is worth noticing that this is a common way how teachers pose problems within their classes – choose a specific issue they want to practice with the students. Note that the context of work was a little bit different within the research – the participants were asked to pose an original and difficult problem. But while talking with teachers, this is the most common way how they start problem posing in their usual work. This aspect – that teachers are used to this problem posing type – may be the cause why the frequency of "process of solving" initial idea is not in the middle between experts and novices as it approximately is in the case of mathematical topic and the variation of an old problem.

Variation of an old problem is the aspect whose ratio increases with increasing level of expertness. Having talked with several novices and experts, it was found that the novices don't feel it as a correct way to pose an original problem. Whilst the experts have lots of experience with this way of thinking and they know that they are able to pose a problem totally different from the initial one and that it is only a comfortable and effective way to start for them.

Another observation has the same reason. Whilst the novices' participants did not use this initial idea at all, the specialists used sub-type a. (recall of the specific problem) only. Some experts used the sub-type a. – they intentionally went through some old problems and searched for inspiration.

All of these remarks are in correspondence with Kontorovich and Koichu (2012). They say that the expert problem poser knows a lot of problems which are organized into structures (called nesting ideas). These structures often form a background for his / her problem posing work. The experts are driven by a desire to achieve the feel of innovation which means that they need to pose a problem that they feel to be different form the problems they know.

There are differences in the context initial idea as well. All three groups use this. But the more experienced problem posers identify the compact problem situation around themselves whilst the novices just glance around themselves.

Conclusions

Four starters of problem posing were identified: Mathematical topic, Process of problem solving, Variation of the known problem and Context. There are some sub-types identified within each of the starters.

It was found that with increasing level of experience:

- The ratio of Mathematical topic decreases.
- The ratio of Process of solving increases.
- The ratio of Variation of the known problem increases.

The more skilled problem posers want some specific point to start their work with. They use e.g. a specific theorem, specific type of computation, specific problem they know from the past,... The less experienced posers often start with something more general – e.g. a topic. They also often rely on external inspiration – e.g. a glance around themselves.

The experienced problem posers also more often use a known problem as an inspiration because they know they are perfectly able to pose the totally different problem on that basis.

Acknowledgements

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BUSINESS GAMES POWERED BY ARTIFICIAL INTELLIGENCE IN EDUCATION

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Abstract

The business games are a useful tool for the education of management. These games can be helpful in training of decision making and strategic planning. Each game can be understood as a simulation of real business conditions in the strategic management area. These business conditions must be effectively solved by the manager. This exercise helps student gain skills, which can be applied to the real problems in the future. The quality of the simulation closely correlates with the skills student gains. In general, the more realistic the game simulation is, the more realistic decision making must be applied by the participant. Defining the mechanisms for recording games, learning and adaptation of the intelligent computer system is the goal of the team. At the Czech University of Life Sciences we will have the "Athena" named artificial intelligence with the ability to simulate human beings behaviour during playing managerial games. To describe, how to adapt the artificial intelligence based system into the business games is main goal of this paper.

Keywords

Business game, game strategy, game interface, artificial intelligence, training set, adaptation, intelligent agent, E-Learning

Introduction

The ability to adapt to the business environment, to choose and follow an appropriate strategy, to critically assess the market situation, to minimize loss or maximize profit - every graduate of management courses should possess the ability to handle. Jarošová (2005) defines two main approaches which she calls experiential and academic (based on the theoretical knowledge.)

By Jarošová (2005), we can understand the academic approach to learning as a process of acquiring the highly formalized objective scientific knowledge, the capability development process of critical review, and skills to apply knowledge in practice. Experiential approach is represented by the experiential learning. According to Kolb (1984: 37) we can understand the experimental learning as 'process whereby knowledge is created through the transformation of experience'. Managerial simulation games (in general Business Games) can serve as an effective supporting tool in acquiring the essential managerial skills. According to Wawer et al (2010) the individual games can be perceived as scenarios describing possible market situations, which are very likely to be encountered in the real world. Managerial games offer an entertaining way to hone these crucial skills in a virtual environment, thus without impacts on the real world. It can be assumed the more realistic the game conditions are, the more realistic the decision making procedure must be applied.

The game must be played up until the end, in order to evaluate the full impact of strategies

implemented. To assess these, the steps each player took should be carefully recorded. The rules of the game also must be followed; otherwise the game can yield unwanted conclusions. The time-consuming characteristics of the vast majority of these games also mean the possibility to record the current state of the game and continue later could be highly beneficial. All these conditions can be realized with basic software. The key determinant of each game success is, however the set of quality opponents, which is not always available. The authors combine the modern technology and possibilities of artificial intelligence to realistically imitate the behaviour of a human game adversary. By the term "Artificial intelligence" we understand the machine which is able to think similar to human beings (Russell and Norvig, 2009). This artificial intelligence is based on the perceptron neural networks technology with backpropagation learning algorithm (Tettamanzi and Tomassini, 2001). The illusion of playing against a human being should be as credible as possible. The software will also enable a game of human players only, serving just as a virtual game board and rule maintainer. Each time a player makes a turn; our solution represents it in the form of turn-vectors, which are stored, and consequently used for training the artificial intelligence. By connecting the gathered data with qualitative survey at the end of the game, we can get a complex understanding of the strategies used. This can be used in directing further education efforts to address the areas of managerial skill responsible for a wrong strategy choice and eventual loss. We develop the students' knowledge by a controlled polling and at the same time, we can modify the game parameters in a way, which can help them in so needed managerial skills.

Defining the mechanisms for recording games, learning and adaptation of the intelligent computer system is the goal of the team. At the Czech University of Life Sciences we will have "Athena" named artificial intelligence, with the ability to simulate human beings behaviour during playing managerial games. To describe, how to adapt the artificial intelligence based system (sometimes called as intelligent agent) into the business games is the main goal of this paper.

Materials and Methods

In the introduction, the general issues associated with ability to simulate human beings behaviour during business games strategy developing has been discuses. Via disused problems we decided to formalized business games general rules and join them with the artificial intelligence based solution.

We suppose, for each business game exist some general rules. According to them the players optimize the strategy utilized. We suppose business games are in general created around following ideas:

- Gather resources
- Develop an industry
- Ensure continual growth (develop strategic units – population, houses, factories etc.)
- Limit competitors (block resources, conquer a competing unit)

Unfortunately, the state space of conventional managerial games is usually quite limited. When keeping the game in a purely deterministic way, the players can soon get an understanding of the game principles and employ a collection of "hard coded" strategies that work only in the limited game domain. Therefore, the practical relationship with the real world scenarios would be negligible. To overcome this issue, the authors include various elements of chance in their games (rolling a dice, picking a random card, etc.). Certain games also incorporate the elements of bluffing and bidding. This makes the

outcomes less predictable and the illusion of the game taking place in the real world much stronger.

The deterministic software utilizes for such tactics only pseudo-random algorithmic mechanisms. Human players are usually capable to learn how such functions work after several iterations. The intelligent system in comparison, imitates the behaviour of human beings, and acts in a nondeterministic way. Moreover, the game intelligence adjusts its settings based on the varying initializing conditions. It is thus close to impossible for a player to learn anything more than basic game rules. The system behaviour is much closer to the human being behaviour and the illusion of playing against a real player is more realistic. We decided to use Power Grid game (Friese, 2004) as practical example of business games. This game can be played by students or volunteers. Thanks to recording players´ decisions during the game, we received data describing player's strategy. This data is used as training set for our artificial intelligence.

Power Grid game short description

Power Grid game is a classical business board game for 2 – 6 players, developed by Friese (2004). In the case of the Power Grid game, the players aim to supply the given count of cities with electricity. The rules govern the possibilities of purchasing, storing, consuming, and renewing the scarce resources, and limit the possibilities of purchasing new power plants. Similar set of rules also limit the construction of wiring network among cities.

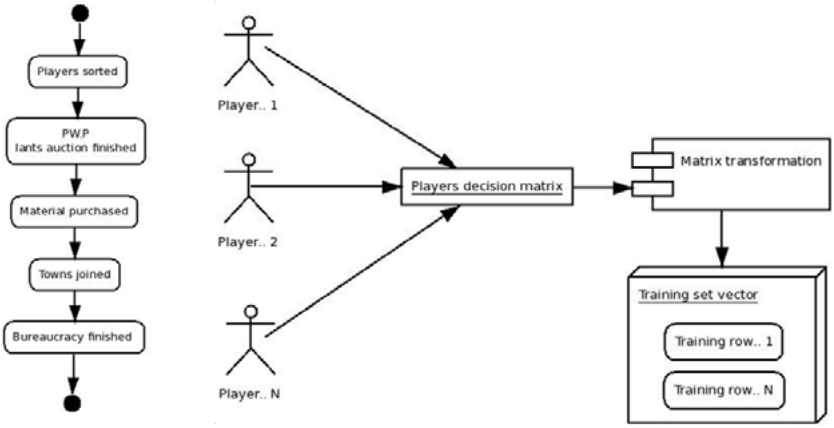

Fig. 1: Power Grid game State Chart and Players decision matrix transformation

The Power Grid game can be elementary described as a three epoch based game. Each epoch is typical by a different offer of power plants and resources (materials). During the first epoch, only the resource consuming (coal, oil etc.) power plants exist. During next two epochs are new power plants developed. The player can buy new power plants as solar based and resources consuming power plant can be rejected. Prices and number of power plants and resources available are changing. To win the game, each player thus must find the optimal balance between the expenditures for resources and revenues from the supplied cities.

Each epoch has five laps as described by Fig. 1 (left). During these laps the players can interact and make the business. Firstly players define playing order, next they start Power

Plants auction, next start buy resources, next start join towns and finally they gained money (Fig. 1, left side).
Each game epoch is stored as the matrix of players' decisions. Data into this matrix can be stored directly by player using prepared form (it consumes energy and time) or automatically. The players' decision matrix must be transformed into game strategy vector as described Fig. 1. Set of these vectors can be used as a training set for the artificial intelligence (Fig. 1, right side).

Game strategy use for Artificial intelligence

Following Thompson (2010) we can propose that the game strategy is the key point of the whole solution. It evolves dynamically. The implemented strategies differ according to the resources and the power stations available. While in the classical game scenario, students get the understanding of the available types of power plants, and structure of the game world, the intelligent software solution flexibly generates these values. The "technological development" of the power plants can also have varying pace, be slower or faster, depending on the required situation. Therefore, students are forced to abandon trivial strategies, and modify their plan gradually. When the intelligent agent acts in a human-like way, it can choose the optimal strategy depending on the game round and development. In that case, students would have an ideal educational tool at hand. The aim of this project is to create an artificial solution that will not be differentiable from a human being in a game play.
While in one epoch, it can be beneficial to save money and invest them after several game rounds; in other epochs can such a strategy lead to the loss of important power plants and inevitable defeat. From the game strategy point of view, it may be important to save money and focus on purchasing the power plants, which in turn enables the player to store plenty of resources and thus sell out the game market. This can force the opponents to restructure the portfolio of the power plants owned. Another possible strategy relies on early purchase of the short and thus cheap wiring between cities, without actually supplying them with energy. Such investment into infrastructure means a financial disadvantage for the game adversaries in the later stages of the game. By Becker (2011) we suppose the player can also rely on the 'eager finish', when the last turn means a complete consumption of resources, which would normally affect players' performance in further rounds, but is irrelevant because of the actual victory. This idea is relevant for "Power Plants" game too. Each of these strategies and their combinations lead to various scenarios of bidding and bluffing during the power plant purchasing stage. Such intentional manipulation of game adversaries introduces a real world situation for the students, where the decision making is dependent on the environment (Nemerow, 1996), where the available information influences our reasoning.
We understand that possible ways of addressing these situations are countless, and each of them represents a feasible study variant, and thus a beneficial educational game. We now stand upon a verge of a complex issue – designing a software solution capable of replacing a human player.
Let's go to focus onto very specific part of the game: Power plant auction (Fig. 2). This game lap is typical for "clever" human decision. Each player must calculate with a lot of unknown variables. "How will change my adversary's strategy, if I try to buy a better power plant?", "Start auction?", "How much money can I spend?", "Can I bluff and manipulate with them to by Power plant, which I really don't want?"

Thanks to this example it is visible that for realistic behavior the system must use something more than the randomness Fig: 2.

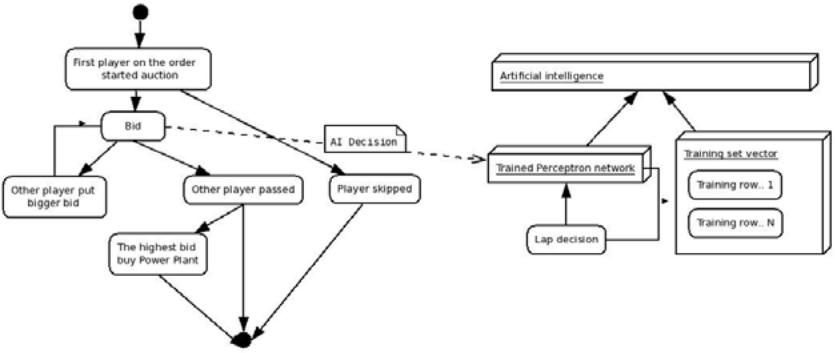

Fig. 2: Artificial intelligence decision mechanism implemented for the auction

Figure 2 shows the Artificial intelligence decision mechanism implemented into the Power plant auction. The system makes decision via internal strategy. This strategy should be de facto optimal solution for game.

Results and Discussion

The previously described methods of artificial intelligence adaptation for business games purpose have real results. These results we can split into four parts, which we call business game architecture. These parts are designed at the CULS:

- Game application interface
- Game message server
- Game intelligence
- Game client (Graphical interface)

Game application Interface

This is standardized by the SOA architecture. The Enterprise Application coded in the Java Enterprise edition runs on the GlassFish 4.0 application server. It distributes the WSDL description of the interface. The desktop application coded by the CULS team connects through this interface. Thanks to the open standard, the web application or mobile application can be easily designed as well, which is another benefit of the proposed solution. When a request for a different game or a better GUI arises, it can be realized without limiting the actual game service.

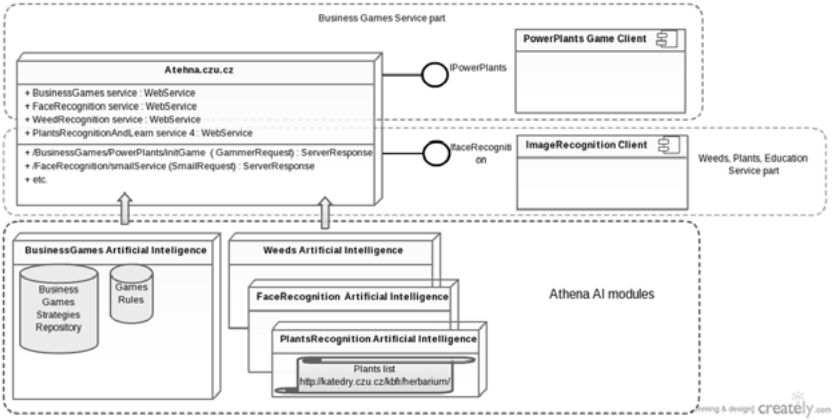

Fig. 3: Business Games Service is a small part of the multi-purpose AI project on the CULS. This paper talks about the Business Games Service placed on top of the picture.

Game message server

The message server is in fact a simple timer-driven application. From the moment of its launch on the application server, it awaits the connection requests from players. When the game GUI is launched and connected to the server, the server assigns each player a unique identifier and generates a game board setting. The game board is set up at the beginning of each game and remains unchanged until the end of the on-going game epoch. The server also ensures the basic game rules and settings, including:

- Amount and distribution of resources.
- Generation of power stations and random set up of their properties:
  - The power plant generation follows the price rule. The "technologically worst" and hence cheapest are the power stations burning the fossil fuels.
  - Power plants operating on two different commodities (excluding wind) are always available for purchase.
  - The wind power stations require no additional resources for their operation. This type or power plants cannot store resources.
- Game plan set up, and placing a player at a random location on the game board.
- Dynamic game board refreshing

The random generation of the game board and player's starting location can naturally put a certain player into disadvantageous starting position. This is also desirable from the educational point of view, because in such situation a different set of strategies must be applied. After creating the game world, the solution consequently prompts individual players to make their turns. It ensures the game is played according to the rules, manages the consumption of resources, their availability and prices on the market. It also updates the list of available power stations, and governs the auctions.

Without seeing the actual game adversary, we cannot perceive the facial expressions of our opponents. This naturally highly reduces the space for bluffing, which is currently one of the key disadvantages of such computer game. Our research team considered scanning the facial expression of the individual players. This however goes against the idea of replacing the game adversary with the artificial intelligence. Naturally up to the point when a computer would be capable of efficiently imitating human mimics. This

possibility is however on the theoretical level only.
The decision each player makes must be stored in the form of a vector, also called the vector of solution, to the solution database (Fig. 3). The winning strategy is consequently presented to the intelligent agent, which uses it for learning (Fig. 3). Such empirically gathered data are valuable, because the player can retrospectively follow the strategy utilized in game, and find out the important breakthroughs in the game. This function is priceless from the educational point of view.

Game Intelligence

The game intelligence is formed by the perceptron neural network with one hidden layer, which adapts itself based on the gathered learning sets from winning strategies. The aim of this research is to make the network capable of replacing a human player, and become fully independent. From the technical point of view, this is a standard artificial intelligence task. Porter (1990), Mitchell et al (2000), Baker, Gedajlovic and Lubatkin (2005) and many other authors describe various strategies companies utilize. Based on these findings a classical optimization algorithm can be designed, but the complex nature of the game mechanisms makes such a solution inappropriate. The behaviour of artificial neural network is highly unpredictable, because of the ability to predict as well as make mistakes. The student should thus feel like playing against a human adversary. This is the main goal of the entire research project, which is yet in its opening phase. We have however found out the machine can learn, which is a crucial determinant of future success.

Game Client

The Figure 4 shows user interface design of the game client. This client is the "java desktop" based application. We developed it for experimental gaming. The player can play game with other players. During the game are current data stored into Business Games Strategy storage (Fig 3.). These data are used as teaching vector for our Athena Artificial Intelligence server shown by Figure 3.

Fig. 4: Power plant game client

The Game Client is only experimental tool, which helps to record players decisions. We developed it by our team and we can change it according to our needs.

Discussion

Becker (2011) has described the impact of business games as a tool of experiential learning. In comparison with their approach, we do not rely on the predesigned set of game strategies, but instead propose a solution capable of learning from the recorded games. By adapting the methods of artificial intelligence, the solution can evolve together with the players and thus better support their professional development similar to Wawer et al (2010), Wolfe (2000) or Hawtrey (2007). This way the game keeps its dynamic character, which is difficult to predict, and players thus must gradually work on their strategy. The future stages of the project are to gain big number of game strategies. According to these strategies we suppose to improve our intelligent agent adaptation (to play better and be cleverer than current agent). Beside of that we can quantify benefits from playing business games by conducting a survey among the students of the management courses. This game can be available as an e-learning tool for future managers.

Conclusion

The business games based on the artificial intelligence solution can be used in the education of students of management courses. The nondeterministic character of the game generated using such an agent can further approximate the real market situation, and thus support the players in acquiring the important managerial skills and insights into the practical work of managers. The authors have introduced software capable of eliminating the key disadvantages of the algorithmic game system, including the game adversary intelligence problem.

This solution can be used as an E-learning tool which helps the student to gain managerial skills. Students can apply these skills to the real problems in the future. The quality of simulation will be improved by our team according to our growing knowledge. Thanks to open architecture and Web Services based technology, the solution open for other teams is presented. We suppose to develop a community of contributors. Thanks to the community contribution, we can improve the quality of simulation, quality and availability of the game client (for tables and mobiles for example) and other game aspects. The Power Grid solution can be presented during the ERIE conference time for the audience.

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THE RESPONSIBILITY OF THE TEACHERS FOR VALUE ORIENTATION OF THE STUDENTS

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Abstract

The aim of the paper is to assess the value orientation of the students with stress on the teachers' responsibility for its formulation. We acknowledge the teachers' role as one of the important persons influencing the values formulation process. In primary research, there were 82 students and 14 teachers questioned. The value ranking differs between teachers and students, although the correlation is strong implying an important role of teachers in value formulation process. However, teachers perceive their influence more important than students. Regarding the way by which can teachers contribute to the value formulation process, the highest impact has according to the students "the way of subject explanation" and according to the teachers "own example". Most of the teachers admit that they try to influence the students' value orientation in a positive way to the high extent.

Keywords

Responsibility, value orientation, quantitative research, questioning method

Introduction

The importance of the value orientation is in its determination of the person's behaviour. "All goal-oriented behaviour requires providing means with regard to the aim pursued and value preferences formulated" (Dorotíková, 1999). Value orientation fulfils individual and social roles. From the point of view of an individual, the values help the individual to adapt on physical and cultural conditions in the society and help to orient in new situations. Values help the individual to integrate into the society and to take a position there. On the other hand, from the perspective of the society, the value orientation serves as a prevention of deviant behaviour and as a social control. A person takes up values acknowledged by the society and learns to behave accordingly.

Value system and orientation of a student is formed in the assessment process. Resulting behaviour and manner are influenced by the value orientation. Therefore, it is necessary to make it a part of students' education. The process of formulation of the value orientation is influenced not only by the educational process and its organisation, but also by the interior of the school and overall climate and atmosphere. For the students of the high school between 15 and 18 years is typical the willingness to select norms and values by themselves. They do not want automatically accept the values which are served to them by the society. They want to act according to their own decisions based on the values they accepted. "Current youngsters are rather intensively but realistically concerned by the questions of conscience, responsibility and guilt, justice and evil. They reject cheap sentimentalism and formal conformism" (Říčan, 2004). This aspect is especially important for the work of teachers and educators.

The teachers should positively influence the students, but should not expect that young

people will adopt the values without critical thinking and assessment of their thinking and value orientation. The problem for adolescents is not the lack of values, but rather the overabundance of them. They are not yet able to coordinate them. They expect from the society (respectively from teachers) a stable value hierarchy, which would help them to create their own hierarchy. According to Kučerová (2005) the role of the teacher "stretches out to the superhuman performance – to introduce the student via cultural transmission to the world of the adult and mature, to be responsible for him or her at this way, and at the same time take him or her as not only equivalent but also as an equal partner.

Hence, also the value orientation of the teacher themselves should be examined. "Each person seeks professional contexts that correspond to his/her own value system and tends to emphasize certain aspects of the work and to prefer some activities to other ones" (De Caroli and Sagone, 2013). This suggests that being a teacher presume certain value orientation. Among the values that a teacher confesses and that determine his or her behaviour should be included: honesty, fairness, responsibility and truthfulness, sense of fairness, diligence, discretion, determination, kindness, friendliness and accessibility. The values are described in detail in research of Suditu (2012).

In the teaching context, Jewett, Bain and Ennise (1985) constructed five structured set of value orientations as follows: Disciplinary Mastery (DM), Learning Process (LP), Self-actualization (SA), Social Responsibility (SR and Ecological Integration (IE). This classification was used for example by Sisman and Ok (2012) in their study regarding the orientation of the perspective teachers in Turkey. They found out that "the teachers were more oriented toward Ecological Integration and Self Actualization. That is; participants of the study seemed to demonstrate tendency toward integrating natural and social environment, and emphasizing personal liberation." Also Banville (2002) utilized this methodology to examine the differences in value orientation of Quebec and American teachers.

Teachers are viewed as bearers of education and ethical values. Teachers' professional morale can be divided in two groups (Lorenzová, 1999): professional virtues (characteristics which are manifested in the profession) and professional obligations (norms for the profession performance and for the relationship with the students). Teachers must be aware of that young person is opened to positive but also negative effects. "Many teachers are more inclined to spend time helping students acquire academic content and relevant skills than allocating time for discussing value topics." (Frydaki and Mamoura, 2008) A teacher should understand his or her profession as a mission and realize that his or her educational influence is not negligible. The responsibility of teachers in relation to the students lays in the fact that students are not yet biologically, emotionally, cognitively and fully socially developed. Positive social orientation, responsiveness, openness, kindness, empathy, understanding and partnership, generosity, interest in students etc. contribute to creating a favourable image of the teacher.

The aim of the research is to examine the responsibility of a teacher in the value formulation process of the students. The structure of the paper is as follows. Section Materials and Methods describe the research design and the sample of respondents. Results of the primary research are presented next. They are discussed and compared to the results of other surveys. Last section concludes.

Materials and Methods

We assume that teachers should affect the value orientation of the students in a positive way and should be aware of their responsibility in this process. A primary quantitative

research was done in September 2011 at certain business high school in Prague. The issue was examined from the point of view of students and teachers.

There were 82 students questioned (32 boys and 50 girls) in age from 15 to 19 years (16.5 years in average). We chose this sample for several reasons. Lower boundary of this period means important social bound as obligatory schooling is finished and young person has to decide about his or her future direction. Higher age marks the end of the high school. Also moral and personality character tend to stabilize in higher age and are rather developed than significantly changed. Hence, our sample contains the most important period of value formulation process. Besides, former high school students are at the university nowadays. Therefore, the sample is relevant for the university environment.

There were also 14 teachers (3 men, 11 women) questioned. The age was not important for the analysis of the respondents. We examined rather the length of teaching experienced, which ranged between one to thirteen years.

Two questionnaires – for students and teachers separately – contained analogical questions, in order to confront different points of view. Most of the answers were on a scale from 1 (the least) to 5 (the most). To describe the results standard descriptive statistics were used. To test the correlation between students' and teachers' value rank, a Spearman rank correlation coefficient (1) was calculated. It is a statistical measure of the strength of a monotonic relationship between paired data. It ranges from -1 to 1 where the value closer to |1| implies stronger linear relation.

$$r_S = \frac{\sum_i (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\left(\sum_i (x_i - \bar{x})^2 \sum_i (y_i - \bar{y})^2\right)}}, \quad (1)$$

where r_s stays for Spearman rank coefficient, x_i is the rank of a particular value given by students and y_i is the rank given by the teachers. Next, the significance of the Spearman rank coefficient was tested. The calculations were done in MS Excel 2007 and Stata 11.2.

Value orientation

Kilian et al. (2010) distinguished in their research only two type of value orientation: well-being and achievement – both based on the statements of the students. Another scale used for example by Yılmaz et al. (2010) is Schwartz Value Survey. The methodology contains 57 Items which represent 10 value types on individual level. Respondents rate the importance of each value as a guiding principle in his or her life. Score 1 implies that the value is opposed to the respondents' principle and 7 that it is a supreme principle. The analysis in this paper utilizes modified value classification according to Sak (1998). In his longitudinal study he distinguishes following value orientations: (1) global (expresses the interests of the human race – health, peace, environment), (2) reproductive (orientation on family and children), (3) hedonistic (focus on interests, hobbies, friendship), (4) professional development, (5) liberal (appreciating especially freedom, democracy), (6) material-egoistic and (7) social-value (being useful to others, community work, social activity). We slightly modified the orientation, so there were three values in each type. Friendship was included into social-value orientation. Also religion was added in this category. Material-egoistic orientation was supplemented by focus on money and assets, desire for power and influence, and the desire for recognition in a group (family, peers or teachers).

Results and Discussion

Firstly, we asked the respondents to assess the degree of importance of the 21 values on a scale from 1 (the least) to 5 (the most). Each answer was valued by points. The sum of points generated the prevailing value orientation. Than the question who (or what) is influencing the value formulation process is examined. Finally the role of the teacher is analyzed in detail. We assess the degree to which teachers really influence the students and the degree to which they should. Also the ways how the teachers can influence the process are considered.

Value orientation of the students and the teachers

The research reviled the differences between the value orientation of young and adults. The values ranking differs. As it can be seen from Tab. 1, the most frequented orientation of students was "global". It was due to the fact that especially one value ("health") was highly appreciated (second after the "friendship"). Despite that "friendship" was the first, other values from the group of social-value orientation were not that appreciated, hence it was at the last position for the students. Liberal orientation was only at fifth position implying that it was not that important for the students. The formulation of opinions on the democracy and political situation concerned Ekström and Östman (2013). They examined the role of civic talk with family and peers in young people's development of political knowledge, democratic values and different forms of civic practices.

The most important for teachers was "health", "family" and "children". Hence, reproductive orientation predominated. Also values related to the liberal orientation (e. g. "freedom") were important. Our results could have been confronted with the research of Frydaki and Mamoura (2008). They examined the value orientation of the teachers and found out that "the taught subject seems to affect the displayed value orientations". However, we asked only about the years of pedagogical practice. Hence, we examined the value orientation in relation to this indicator. For all teachers is on the first place "reproductive value orientation". The teachers with less than 10 years of practice than prefer "professional development", while teachers with more than 10 years of practice are "globally" oriented. At the third place, there is "liberal" orientation common for both groups. Value orientation of the teachers concerned also Yılmaz et al. (2010). They examined the value preferences of teacher candidates in Turkey. There were found out statistically significant differences in value orientation with respect to the gender, type of the high school attended and the branch studied there.

The values ranked by students and teachers were assessed by Spearman rank coefficient. The Spearman's rho = 0.6 implies strong correlation. Test of hypothesis H_0*: Ranks of students and teachers are independent* revealed that the relation is statistically significant (Prob > |t| = 0.0043). This might show that the teachers have certain influence on the students' value hierarchy.

Value orientation	Values	Students	Teachers
Global	health, world peace, live ecologically	15.5%	14.9%
Reproductive	family, children, love	15.4%	17.4%
Hedonistic	enjoy the life, free time activities (interests, hobbies), good looking	15.3%	12.7%
Professional development	education, profession, success at school	14.7%	15.1%
Liberal	freedom, democracy, privacy	13.6%	15.3%
Material-egoistic	money and assets, power and influence, recognition of the others (family, peers)	13.2%	11.2%
Social-value	being useful to others, friendship, religion	12.3%	13.5%

Tab. 1: The value orientation of students and teachers; Source: own elaboration

Determinants of the value orientation

The students and teachers were asked to what extent is students' value orientation influenced by family, peers, teachers, famous persons and characters from book or PC games. The respondents answered on the scale from 1 (the least) to 5 (the most). From the results presented at Fig. 1 can be seen that the teachers do not play significant role in the value formulation process. Students stated that the most influence on their value orientation had their family, than peers (25 %), and teachers (18 %). Famous persons and characters from book or PC games gained both 14 % of answers (Fig. 1 on the left side).
On the other hand, teachers think that the students are influenced by peers at the first place (28 %), than by family, teachers, famous persons and again the least by characters from books or PC games (Fig. 1 on the right side).
Detailed question examined the role of the teachers further. Answers to the normative question "To what extent should teacher influence the value orientation" corresponded to the previous ones. The results are shown at Fig. 2 on the left side. Most of the students stated that to the medium extent (42 students). On the other hand, the teachers perceive that their role should be stronger (high influence marked 10 teachers and medium 4 teachers).

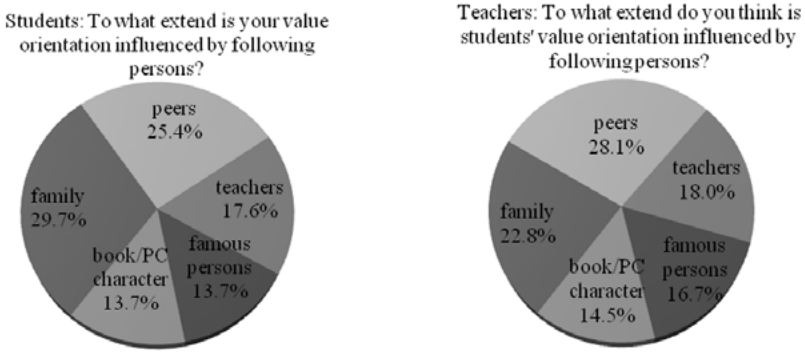

Fig. 1: Influence of persons on student s' value orientation, Source: Own elaboration

Acknowledging the responsibility of the teachers for value orientation forming process, we asked about the way how they fulfil their role. We questioned the students to what extent can teachers influence their value orientation by three ways. The results are

presented at Fig. 2 on the right side. The most frequented answer was by "the way of explanation of the subject". Than follows "the presentation of own opinions" and the third was "own behaviour example". This order applies on girls, boys has the first and second places switched.

Regarding the degree to which teachers can influence the value orientation, the students mostly think that the way of explanation of the subject can influence them highly or intermediately. Similarly the presentation of own opinions has high or medium impact. Own example, on the other hand, has only medium influence.

The way, how the curriculum is thought revealed to have an important influence of the students' value orientation. This is in line with the declaration of Ennis and Chen (1993). They stated that "Value orientations represent theoretical belief systems that guide teachers' curricular decision making."

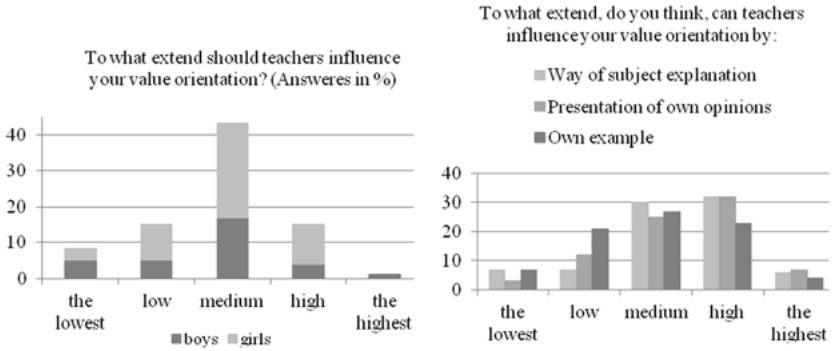

Fig. 2: Influence of teacher on student's value orientation, Source: Own elaboration

The same question was also given to the teachers. According to them, they can influence the value orientation of the students mostly by "own example" and than by "the way of explanation of the subject". "The presentation of own opinions" is at the third place. Teachers could also suggest another way of positive influence on students' value orientation. Their recommendations can be categorized into two groups. Firstly: "friendly encouragement", "friendly attitude", "love for people", requires the right behaviour of a teacher as a person. Second category: "consistency in the enforcement of established rules", "stating the examples from practice", "discussion", and "topic selection" are closer to the fulfilment of the role of a teacher.

Related question asked about the degree to which teachers try to influence the value orientation of their students in a positive way. The most frequent answer was to the "high" (8 teachers) and "medium" extent (3 teachers). Suditu (2012) examined the values which are important for future teachers in relation to the profession. She found out that to create supervisory relationship with students was essential.

Those answers suggest that teachers are aware of their responsibility in the value formulation process of the students. Our results can be confronted with the study of De Caroli and Sagone (2013). Their research showed that „teachers attributed importance to acting honestly and responsibly, to achieve the established goals in collaboration with other colleagues for the success of individual and group, to operate in an innovative manner in the development of their profession and to all that is useful to grow and improve professionally and personally."

However, we must be aware that the evaluation of the topic is strongly subjective. Replies might be biased by teachers trying to respond according to what they believe would have been correct behaviour (i.e. according to what is expected of them) and not according to their actual behaviour.

Conclusion

The aim of the research was to assess the value orientation of the students with stress on the teachers' responsibility for its formulation. The teachers are one of the important persons (besides family and peers) influencing the value formulation process. In a primary research 82 students and 14 teachers from business high school were questioned about the value orientation.

The value ranking differs between teachers and students, although the correlation is strong and statistically significant. While teachers think that the most important role in students' formulation process play the peers, the students assume that it is a family. Teachers perceive their influence on value formulation process of the students more important than students (10 teachers answered that their influence should be high and 4 medium). Students prefer medium role of the teachers.

Regarding the manner in which teachers can contribute to the value formulation process, the highest impact has the way of presentation of the curriculum. Than follows "the presentation of own opinions" and the third was "own behaviour example". Teachers, on the other hand, think that their "own example" is more powerful. Most of the teachers are trying to influence the students' value orientation in a positive way to the high or medium extent.

We may conclude that the role of the teachers in students' value formulation process is important and that teachers are aware of that. However, the answers might be influenced by personal by the norms and expected behaviour. Students and teachers may rather respond according to the expectation than to the real situation. This behaviour can be limited to certain degree by the question formulation and linking the questions in a questionnaire, so it can be recognized whether the answers are consistent. We also have to keep in mind that the research was done so far only at a limited sample. The respondents were from one high school and its certain characteristics may have also influenced the results.

As the "own example" way of influencing the students' value orientation by a teacher is seen as relatively important by the teachers, the challenge for future research is to examine in detail the way how teachers influence the students' value formulation process not only intentionally (by prior stated ways), but also non-intentionally.

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USING ASSIGNMENT MODELS TO ANALYZE PROGRAMMING APTITUDE

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Abstract

Dehnadi et al. developed a programming aptitude test, which aims to predict, without requiring any prior programming experience, whether a person can become a programmer. The test results, however, do not seem to have the promised predictive power. Various authors have shown that the test cannot be used to predict programming aptitude with sufficient precision. This article analyses Dehnadi's test from a different perspective – we use the same set of questions and answers and try to devise an alternative evaluation method based on statistical methods.

Keywords

Algorithmic thinking, programming skills, Dehnadi's test, mental models, programming aptitude prediction

Introduction

Successfully predicting aptitude for programming can have important consequences for both teachers and companies in the IT sector. Teachers could use this information to better adapt their courses and companies that try to find programmers might use the prediction to quickly screen candidates during an interview. Because of the possibly large implications, many authors tried to analyse programming aptitude and create a test which would successfully separate programmers from non-programmers (Cross, 1970; Mayer and Stalnaker, 1968; Murnane, 1993). Despite these efforts, no sufficiently exact method for predicting programming aptitude was found. Other authors tried to link programming aptitude with mathematical and logical thinking following the fact that many programming concepts have their mathematical counterparts (Milková, 2011; Van Someren, 1990; Hubálovský and Milková, 2010). However, even strong mathematical skills do not seem to predict programming capabilities well (Wilson and Shrock, 2001).

The topic was revived recently by (Dehnadi, 2006) who claimed to have found a test that can accurately predict programming aptitude even before the person is exposed to any programming concepts. The test consists of 12 questions based on the assignment operator. The evaluation of the test is based on mental model consistency, particularly whether the student was able to keep a single mental model of assignment throughout the whole test. Despite the initial claims of predictive power of the test, criticism from other authors has shown that the test cannot predict programming aptitude well and that the original promising results might have been caused by other factors (Bennedsen and Caspersen, 2007; Petránek et al., 2013; Milková and Kořínek, 2013; Vaněk and Ježek, 2013).

This paper focuses on further analysis of Dehnadi's test and its relevance to programming aptitude. The aim of the paper is to analyse whether there is any dependency between the answers novice programmers fill in the test and their results in a subsequent introductory

programming course. We use standard statistics and machine learning methods to discover dependencies and correlations in the answers. We collected data from 343 students who participated both in Dehnadi's test and our introductory programming course.
To make this paper more self-contained, the following section briefly discusses Dehnadi's test. We then follow with details on the collected data, used methods and present our results.

Materials and Methods

Dehnadi's test

The test created by S. Dehnadi (Dehnadi, 2006; Bornat and Dehnadi, 2008; Dehnadi et al., 2009) consists of 12 questions that contain two or more trivial operations denoted by the symbol "=". See Figure 1 for an example of a question from the test. The students are asked to choose one or more of the predefined answers or supply their own answer. There are no incorrect answers; the evaluation is instead based on mental model consistency. The evaluation process tracks whether the student interprets the "equals" symbol consistently throughout the whole test.

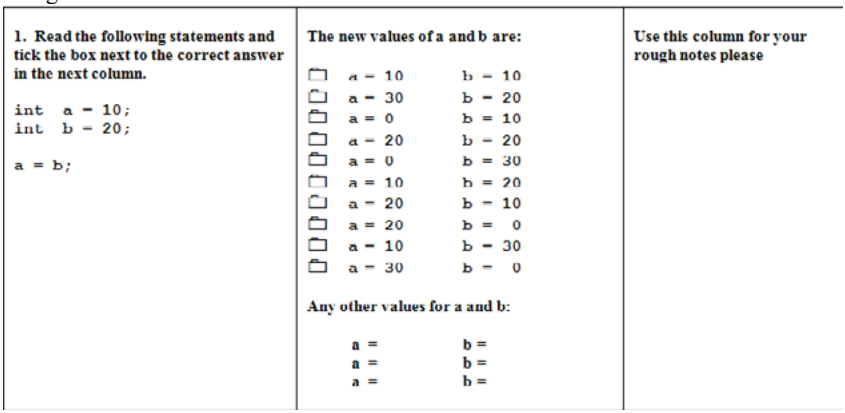

Figure 1: An example question from Dehnadi's test. (Dehnadi, 2006)

Dehnadi concluded that students with 8 or more answers corresponding to a single mental model of the "equals" symbol have a significantly higher chance to become good programmers.
While the test nicely separates the students in Dehnadi's research, independent groups reported mixed results in their own experiments (Bennedsen and Caspersen, 2007; Petránek et al., 2013; Milková and Kořínek, 2013).

Input data

We collected data about 343 students who both filled Dehnadi's test and participated in the introductory programming course. We represent each possible answer in Dehnadi's test as a binary variable denoting whether the student has selected that answer or not. We group these variables into a binary vector of 165 dimensions as there are 165 answers on the answer sheet. The result from the introductory programming course was also represented as a binary number as passed/failed.

To compare our results to Dehnadi's evaluation we computed the original Dehnadi's score for each student according to the mark sheet in (Dehnadi, 2006) and converted the score to a pass/fail variable by thresholding it at 8 points.

Altogether, 71 % of the students passed the introductory programming course and 74 % passed Dehnadi's test (scored 8 or more points). Dehnadi's test was able to successfully predict the success or failure in the introductory course in 63 % of the cases – only slightly better than a random guess (50 %) and worse than a trivial classifier that would predict "success" all the time (71 %, equal to the percentage of students who passed the course). This confirms the criticisms stated in (Bennedsen and Caspersen, 2007; Petránek et al., 2013).

We further grouped the data according to student answers – students who checked the same answers were grouped into one bin. This gives an idea of how common certain patterns in solving the test are. There were 166 different answer combinations for the 343 answer sheets. The number of students belonging to each combination is very unevenly distributed – the most occurring category has 157 students (45 % of all), second most only 10 students, three categories have 3 students, six categories 2 students and the rest of the categories (155) only 1 student (see Figure 2).

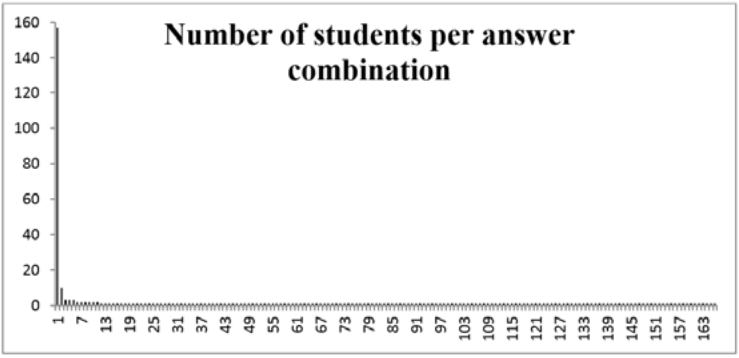

Figure 2: Distribution of students into the 166 different answer combinations that appeared in the results.

The course success rates in these groups show that even though many students had the same answers, some of them passed the programming course while others did not. This indicates that the association between the answers and a corresponding success in the course is weak, if any. Table 1 shows the top 5 combinations of answers and the corresponding course passing rate of the students for these combinations. Other combinations have too few students to give a meaningful number; in total the success rate among the remaining combinations is 64 %.

Combination nr.	Number of students	Passed course (in %)
1	157	78.9 %
2	10	60.0 %
3	3	100 %
4	3	66.7 %
5	3	33.3 %

Table 1: Course success rate for the top 5 common answer combinations.

Interestingly, the most common combination corresponds to the standard way programming languages use assignment – this suggests that many students already have met the concept of assignment in high school math or programming classes and also explains the higher success rate compared to other groups.

Results and analysis

Predicting success using statistical classifiers

To find out whether there is any dependency between the answers and the course success we trained standard classifiers on the data with the aim to predict course success or failure based only on the answers from Dehnadi's test. We compared the results with Dehnadi's evaluation and with a naïve classifier that predicts "success" for each student. By definition, the naïve classifier has a fixed success rate equal to the percentage of students who successfully passed our introductory programming course (71.1 %).

We used three different classifiers that work well with binary inputs – Random Forests and AdaBoost from the Python scikit-learn library (Pedregosa et al., 2011) and a custom implementation of a neural network classifier based on the Cuda Neural Network library (Pyrevenant, 2008). Table 2 shows parameters used for each of the classifiers. The optimal classifier parameters for the task were found using a 20 % cross-validation set and verified on a 20 % test set.

Classifier	Parameters
Random Forest	n_estimators = 20, max_features = 18
AdaBoost	n_estimators = 100
Neural Network	layer_sizes = {162, 50, 20, 10, 1}, activation_function = sigmoid, learning_rate = 0.1, epochs = 20000

Table 2: Parameters used for individual classifiers, listed are only the parameters that differ from the defaults in the corresponding libraries.

We aimed to choose the parameters to ensure the classifier has the possibility to represent all the significant variations in the data. Over-fitting was avoided using the cross validation set.

Each classifier was able to outperform Dehnadi's evaluation method in predicting whether the student will succeed or fail the programming course but they all failed to outperform the naïve classifier that predicts success all the time. The prediction rate is computed as the number of correctly predicted successes plus the number of correctly predicted failures, divided by the total number of students. The neural network classifier was able to match the score of the naïve classifier by learning to predict success all the time, basically degrading itself to the naïve classifier.

Classifier	Prediction rate
Random Forest	70.2 %
AdaBoost	65.0 %
Neural Network	71.1 %
Dehnadi (reference)	62.7 %
Naïve classifier (reference)	71.1 %

Table 3: Comparison of classifier results. All classifiers were better at predicting success than Dehnadi's evaluation, yet worse than the naïve classifier.

The results demonstrate that Dehnadi's test cannot be used to reliably predict programming success – programming aptitude is likely a set of skills that work together and a simple assignment operator test cannot comprehend all these skills. This conclusion agrees with the previous criticisms of Dehnadi's test in (Bennedsen and Caspersen, 2007; Petránek et al., 2013; Milková and Kořínek, 2013).

Conclusion

Predicting future programming skills of novice programmers is a difficult task. We analysed a data set of 343 students who took an introductory programming course and examined a promising programming aptitude test from S. Dehnadi. We used standard machine learning algorithms to predict success or failure of students in the introductory programming course based on their answers in Dehnadi's test. Even though there seems to be a link between the success in Dehnadi's test and success in our programming course, the connection is too weak to yield any useful predictions. We concluded that the best way to predict is to say "success" for each student which is useless for real-world applications. However, this naïve classifier outperformed every other classifier we have tested, including Dehnadi's reference evaluation method. According to this analysis we conclude that Dehnadi's test in its current form cannot predict programming aptitude and that a different test needs to be developed for this purpose.

Programming aptitude is a complicated set of skills that likely cannot be predicted using a simple test focused on one particular operation. The aim of future research should be to focus on various different skillsets and verify which ones positively correlate with programming aptitude.

Ackowledgement

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APPLICATION OF THE PREDICTION MARKET INSTRUMENTS IN HIGHER EDUCATION

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Abstract

The contribution deals with specific problems of the implementation and operation of a prediction market in the environment of a university institution. It shows a prediction market as a tool of self-fulfilment of students. Unlike a number of similar markets this market can be ranked in experimental markets with specific starting conditions which influence namely the motivation and incentive system of the market. The contribution deals with the settings of this motivation system and, at the same time, it shows some problems connected with the factor of over motivation of the market participants resulting in attempts to manipulate the market. In the next part particular outputs of the experimental prediction market at the University of West Bohemia in Pilsen, Faculty of Economics are shown as they document the students´ abilities of self-assessing and predicting the results of the official assessment of their performance.

Keywords

Electronic virtual market; prediction market; motivation and incentive system; market manipulation

Introduction

Electronic virtual markets have been used for more than two decades with the aim of collecting information that is spread among more experts in the given field. These markets are perceived as alternative tools of collecting information and they complement the classic statistical method of survey research and data processing. Electronic virtual markets are used to assess the success rate of the assigned forecasts – predictions. Hence the term prediction market comes (hereinafter referred to as PM). In case of the prediction markets these are speculative markets simulating the activities of the stock exchange on which the traded titles are tied to a particular prediction of a particular event (e.g. political party XY will get to parliament in the next elections) or with a prediction of an evaluated parameter (e.g. the percentage of the votes won by a given party). The value of the titles is given by the amount of trust of the buyers and sellers in the given event or the value of the parameter. The current market price of the title can be interpreted as an estimate (prediction) of the probability of the event or the anticipated value of the parameters.

The process of trading on PMs identifies and aggregates the true assessment of an event by the market participants that is reflected in the price of the share. While an individual trader may be biased or can come to a wrong conclusion, the aggregation based on the market mechanism can detect such mistakes and set the "correct" price. This ability of PMs is based on the hypothesis of effective markets, when all the available information is at any moment fully reflected in the price of the share (Fama, 1991). With regard to this hypothesis the market mechanism on the competitive markets is the most effective tool for the aggregation of any asymmetrically distributed information among the market

participants (Hayek, 1945).

PMs can be applied successfully also in teaching. In such case the role of the study subject as a teaching aid (meant to explain the basics of the functioning of the financial markets) can also be added to the main role of the market, i.e. collecting and identifying information among the participants of the teaching process. More studies about the application of PMs in teaching have been written only recently. For example the work of Ellis and Sami (2012) can be mentioned in this relation, in which the authors explore the connection of the active participation in PMs, students´ activity in the course and the gained knowledge in courses of Political Science. In Damnjanovic et al (2013) the authors mention a case study of engaging a PM called Educational Predict Market in courses of Project Management with all its advantages and disadvantages as described by students. Buckley, Garvey and McGrath (2011) use the PM principle in teaching subjects in the field of social science and economics for the development of orientation and decision making in a wide range of issues. Passmore and Cebeci (2004) use PMs for solving problems related to the development and introduction of innovations in the teaching technology. All these studies, however, take over the ready-made universal applications of the prediction market and they concentrate mainly on the practical application of the market in teaching. But the implementation itself and mainly the operation of the PM system in the specific school environment has not been dealt with at all.

Unlike the real prediction markets the experimental markets applied in the school environment have their specifics influencing mainly the motivation and incentive system of the market. A specific goal of this contribution is to describe and to discuss the problems related to motivation system implementation and other consequences. The other publications concerning the school environment mentioned above do not deal with the implementation itself and with the trade process in school environment as well. In this contribution we will describe some of these specifics and illustrate their influence on the market functioning. We are going to deal with the settings of the motivation system and, at the same time, we are going to illustrate some problems related, on the contrary, with too much motivation of the market participants which may result in attempts to manipulate the market. The presented findings shall be documented by the particular outputs of an experimental prediction market called FreeMarket at the University of West Bohemia in Pilsen, Faculty of Economics. At the same time the possibilities are described to demonstrate the market behaviour as well as the individual trader behaviour in courses focused on issues of financial products and markets. Further, a potential to use the market to student's self-evaluation is shown, as well as to the ongoing teacher's evaluation.

Materials and Methods

With all the prediction markets the **motivation and incentive system** is one of their key attributes. The purpose of this system is to initiate the activity of the market participants, to increase the volume of trading and the market liquidity, all of which have a direct impact on the quality and accuracy of the gained predictions. Not all the tools can be used in all PMs, though. In the following we are going to deal with the settings of the incentive system. Generally, two different motivational systems may be applied:

1. *The winner takes it all* – a high level appraisal can only be gained by the best, the others get noting;
2. *Blanket appraisal* – a large part of the participants gets a lower level appraisal in relation to the activity and gained results when trading on the market.

So as to secure the main market functionality, i.e. to gain the most accurate predictions

and aggregations of the information from as many participants as possible, ***not only a high volume of trading*** but also the activity spread among ***as many traders as possible*** is desirable. A high volume of trading is supported by the first suggested system, while the second system supports the evenly distributed activity. In Gangur (2014) an experiment is described examining the given statements for a prediction market implemented in the university environment. The market participants were divided into two groups: in the first group only three best of them were awarded a prize (they immediately received their academic credit), the others gained nothing. In the second group the participants were awarded according to the balance of their accounts. All the participants could transfer their earned money into the points that contributed to the overall point assessment in the course.

The results of the experiment showed a greater activity of the participants of the first group in case of the volume of trading, but a greater activity with regard to the number of the implemented trades was not proved. Therefore it seems that the motivation system used in the first group supports mainly the market activities with regard to the amount of the invested funds and this way it also influences setting the price of the asset. On the other hand, the tests of the homogeneity of the transaction number dispersions in the individual groups showed a more even distribution of transactions among the market participants in the second group. In the first group the results indicated activity of just a small group of traders. The motivation system of the first group may put off a larger part of the participants who do not believe they might belong to the narrow group of the best from further trading. Like this it may limit evenly aggregated information collected from all the market participants.

The effort of the market organizer consists more in applying the blanket system of awarding participants (the system of the second group) and in increasing the motivation of the participants of this group by other tools. If the applied motivation tools are successful, it is necessary to identify if they are not too motivational. This "over motivation" may lead to attempts to manipulate the market. Any manipulation has a big influence on the other market participants who respect the given rules and are informed about the unfair behaviour of some competitors. These participants lose trust in the whole market system and this way their interest in contributing their information with the aim of setting the value of a chosen asset decreases. This behaviour is, however, undesirable also from the point of the main purpose of the market, i.e. gaining quality and accurate predictions. In further parts of this contribution some types of the market manipulation are described that have been detected over a long term period of using the *FreeMarket* at the University of West Bohemia, Faculty of Economics.

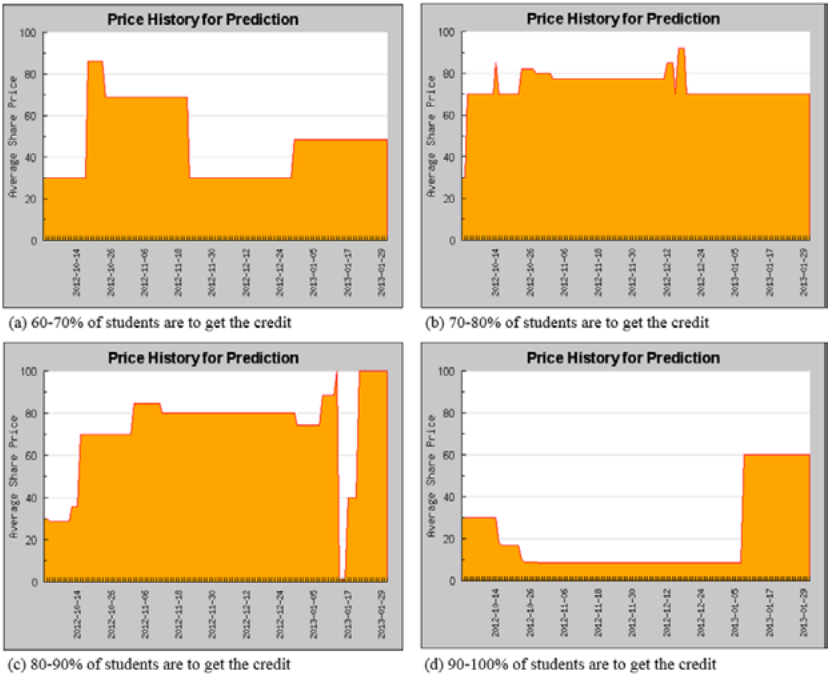
Results and Discussion

Prediction markets, as well as other financial markets, often become the target of fraudulent activities of the participants. It is, for example, manipulation with the price of some selected assets, non-ethical influencing of some selected accounts and unfair transfers of financial sums between the individual accounts. In other parts of this chapter various forms of this fraudulent behaviour are shown. Attention will be paid mainly to **market manipulations and their detection**. Several possibilities of manipulation will be classified; various models of non-ethical and unfair behaviour, ways of detection of such behaviour and some possible ways of minimizing or eliminating the occurrence of such phenomena will be indicated.

Unfair trading detection

Let us first give an example of simple manipulations on a prediction market on a particular example of the *FreeMarket*. The aim of such research was a prediction of the success rate percentage of students enrolled in the course "Financial and Insurance Calculations" in the academic year 2012/2013. The success rate here is represented by gaining/non-gaining the academic credit in this course. In the prediction students assessed themselves as a whole.

Several titles were issued with a different success rate percentage so that the possible success rate could be covered from 0 to 100%. Most trades were executed with the forecast: "*60-70% of students are to get the academic credit*" and: "*80-90% of students are to get the academic credit*". The figures 1(a) - 1(d) show the development of the prices of the selected titles in the range 0 - 100 of the virtual currency units (hereinafter referred to as VCU). Finally 89.29% of students got the academic credit. The period of the beginning of the second week in January, i.e. around January 8th, 2013 can be taken as a date of closing trades, when the credit retests took place as the last awarded activity for gaining the academic credit. Figures 1 (b) and 1(c) show that as of this date most students predicted the success rate to be at around 80%. The interval of the success rate 80-90% deserved more confidence (a higher price of the shares related to this prediction). It can be said that the students' estimate of the credit success rate was correct.



(a) 60-70% of students are to get the credit

(b) 70-80% of students are to get the credit

(c) 80-90% of students are to get the credit

(d) 90-100% of students are to get the credit

Fig. 1: Prices of some selected events of the academic credit success rate

Some interesting facts are obvious from the Figures above. After the first date of the credit tests in the third and fourth week in December the success rate published was 67.41%. The students´ confidence in the final result was not significantly affected by this, as is obvious

from Figures 1(a), 1(b) a 1(c). After the results of the first credit tests were published, there was an increase in trading of the title 60-70% success rate and a moderate increase of the price of the given title as well as a moderate decrease of the prices of the two titles in question in Figures 1(b) a 1(c). But these changes were not as significant as to influence the final estimate. Similarly, publishing the final results of the credit retest in the second week of January led to an increase in students' belief in possible exceeding the 90% success rate and in bigger confidence in the success rate reaching 90-100%.

Unfair behaviour can be detected by means of the price development. The example of Fig. 1(c) is an apparent case of simple manipulation. A big slump of the price is obvious here after publishing the final results of the retests as well as the overall success rate of the tests when it was quite simple to estimate the interval of the final success rate regardless of the individuals who were still allowed to take the retest later. At this moment some students, who did not need the bonus points to gain the academic credit or to benefit from the bonus points in the exam, began to sell a given title for a zero value or a very low value to other participants (who needed the bonus points) with whom they created a coalition. These students, after the title was closed, gained maximum appraisal for each share item, i.e. 100 VCU.

It is not always possible to reveal manipulation by this simple analysis of the price development. Transfers of financial amounts between accounts can take place in a less obvious ways and also in smaller quantities. These transactions do not differ from fair transactions at first sight and deeper analyses as well as other tools are necessary to detect them. The following parts describe various possibilities of manipulation with funds and ways of unfair transfers of money or shares between accounts including detection of such behaviour.

The Ping-Pong strategy

The aim of the so called "Ping-Pong" strategy (Blume et al, 2010) is to transfer money from one account to another one by means of a few mutual trades between two accounts with one share and significantly different prices, or, as the case may be, even a big amount of trades with a small difference in prices. Table 1 shows the Ping-Pong strategy on a real list of transactions with one title as they were identified in the *FreeMarket* system.

Seller ID	Buyer ID	Quantity (pc)	Price/pc	Transaction time
1340	1351	9	100	2012-12-30 14:41:28
1318	1319	10	99	2013-01-03 16:07:45
1351	1438	9	100	2013-01-21 16:40:08
1438	1351	9	1	2013-01-21 16:55:57
1351	1438	9	100	2013-01-21 16:56:32
1438	1351	9	1	2013-01-21 16:58:16
1351	1438	9	100	2013-01-21 16:59:03
1438	1351	9	1	2013-01-21 17:00:06
1351	1438	9	100	2013-01-21 17:02:29
1438	1351	7	1	2013-01-21 17:03:25
1351	1438	6	50	2013-01-21 17:04:04

Tab. 1: An example of the ping-pong strategy transactions

In Table 1 all transactions with the described share are recorded. As is obvious from the figures, the use of the Ping-Pong strategy between traders 1438 and 1351 is apparent when trader 1438 ruins his/her account in favour of trader 1351. The preparation for the transfer is obvious as early as on December 30th, 2012 when trader 1351 buys the share for the price 100, which is the maximum price for a share, and such a transaction is useless and illogical. The Ping-Pong itself takes place on January 21st, 2013 and takes only 8 minutes. In the first transaction trader 1438 buys 9 shares from trader 1351 for the maximum price of VCU 100 and like this he/she nullifies this investment for the position of trader 1351. The Ping-Pong starts 15 minutes later when 1351 buys a share from trader 1438 for VCU 1 and sells it immediately for VCU 100 and like this he/she earns VCU 99 for one share. Such exchanges, first with 9 shares and then with 6 shares, take place 3 more times, the last one only for VCU 50 because 1438 has not got cash enough anymore and he/she ruined his/her account completely. This way, if we don´t consider the introductory transfer of VCU 900 to the account of trader 1351 who had nullified the former investment of trader 1351, the amount of VCU 2,936 was transferred from the account of trader 1438 to the account of trader 1351 within 8 minutes.

Prominent trader

The core of the "Prominent trader" strategy (Blume et al, 2010) is the transfer of money from several accounts to the account of one prominent trader by means of transactions with various prices which are advantageous for a prominent trader. Table 2 shows, on a real list of transactions with one title from the *FreeMarket* system, a pattern of the behaviour of a prominent trader.

The date and time of the decision about a possible non-fulfilment of the event was November 23rd, 2013 at 10:00 p.m. This title predicted the victory of a given couple in the dance competition StarDance. Each week one couple was eliminated from the competition and so it was possible to close the shares of the finishing couples before December 20th. These were the shares with which it is not possible to set the date and time of trading with regard to the fact that the date when the event may possibly be fulfilled is well known but the date and time when the event may not be possibly fulfilled is not clear. With other types of actions it is mostly one well known moment in which it is possible to decide if the event was or was not fulfilled and it is also possible, as of a given date and time, to close trading with a given title automatically without the administrator´s intervention.

It was possible to close with zero value the given share tied to the victory of a selected couple as early as on November 23rd after 10:00 p.m. when the viewers of the StarDance show decided that this particular couple would finish their presence in the competition. The share was not closed though because the system does not close it automatically with regard to the final date of closing the title in December and also because of the fact that further trading for the purpose of a risk free profit resulting from the knowledge of the results is not assumed any more either.

In Table 2 all the transactions with the above share are recorded. The record of the transaction contains ID of the seller (0 represents the issuer, i.e. the FM system administrator), ID of the buyer, number of shares, the price of one share, and the date and time of the transaction execution.

Seller ID	Buyer ID	Quantity (pc)	Price/pc	Transaction time
0	1505	10	36	2013-11-12 18:16:57
0	1505	20	36	2013-11-12 18:17:23
0	1477	70	22	2013-11-26 09:19:24
1505	1506	15	60	2013-11-26 09:29:37
1505	1506	15	75	2013-11-26 09:29:37
1477	1506	15	99	2013-11-26 09:29:37
1477	1506	5	99	2013-11-26 09:31:29
1477	1506	4	99	2013-11-26 09:32:12
1477	1506	1	99	2013-11-26 09:33:00
1477	1472	44	99	2013-11-26 10:00:10

Table 2: An example of the transactions of a prominent trader

The shares were first bought by buyer 1505 in the amount of 30 pieces for the price of VCU 36. Then nobody traded the share up to the decision made on November 23rd at 10:00 p.m. Then, on November 26th, buyer 1477 buys all the remaining 70 shares for the price of VCU 22, and after that trader 1506 starts helping sellers 1505 and 1477 by buying worthless shares from them. First, for the price of VCU 60 or 75 he/she buys all the shares held by trader 1505 and then, for the price of VCU 99 he/she buys 10 shares from seller 1477. This support of trader 1477 is then finished by buyer 1472 who buys further 44 shares for the price of VCU 99 from seller 1477. This way the donators 1506 and 1472 practically ruin themselves in favour of the prominent traders 1477 and 1505.

The detection of transactions of the type "Prominent trader" can be facilitated by introducing another attribute into the characteristics of the issued title. By completing the date and time of the possible decision about the non-fulfilment of the event tied to the share it is possible to detect and analyze all trades implemented after this date. The new attribute and the comparison of its value with the time of potentially suspicious transactions does not, however, reveal trading implemented before the time of the decision. Generally, it is possible to apply this pattern of behaviour to any share which is offered for a low price. This may happen when one of the holders wants to get rid of the share to obtain free funds, both for another investment or for the transfer of money from the system. The shares that nobody is interested in are another possibility and these are offered by the issuer-administrator of the system by means of the Dutch auction. The price of such shares decreases linearly in course of time and in case traders are not interested in them their price may fall to the minimum value set. Then they are an ideal target for the prominent traders who buy them in for a low price and then they sell them further to their "sponsors". Setting the parameters influencing the permeability of the filter detecting potentially suspicious transactions is seen as the key factor when using the system of detecting suspicious behaviour. On the basis of our findings from the long-term operations of the *FreeMarket* system these parameters are namely as follows:

- time period between the purchasing and selling transactions;
- differences between prices;
- date and time of the transaction with regard to the date and time of the decision and the event.

Influencing the price

Manipulations of the type "Influencing the price" of a selected title are motivated by the

interest of some market participants in influencing the event connected with the title. Research surveys on this topic show that any liquid market with sufficient turnover of titles that traders are interested in will adjust the price in the right direction (see Hanson and Oprea (2009)). Another situation may occur when there is no interest in the given title and the market participants are motivated by the size of their portfolio.
In the *FreeMarket* system this situation was caused by the motivation conditions which rewarded one group of participants by the size of their portfolios, while the participants of the other group were awarded by the amounts of their account balances. Under the conditions set this way and in the process of the continuous trading, when the final appraisal of the participants may take place before closing all the traded titles, the transactions stated in the following Table 3 were detected.

Title ID	Seller ID	Buyer ID	Quantity (pc)	Price/pc
2200	0	1457	100	4
2200	1457	1517	92	100
2200	1517	1457	45	100

Table 3: An example of the portfolio increasing transactions

Table 3 shows, for example, a purchase of 100 shares with ID 2200 for a low price of VCU 4 by trader 1457 and the following sale of the majority of shares to trader 1517 for the maximum price. By this operation the price of the title was increased to VCU 100. Trader 1517 subsequently sold approximately one half of these shares with the newly set price of VCU 100. Here even the inexperience of these traders is apparent. In fact it would be enough if owner 1457 sold only 50 shares for VCU 100 to trader 1517 and like this he/she would set the price of all these shares to VCU 100. Because both the owners own all these shares and they do not offer them on the market, these shares are non-marketable and unless the title 2200 is closed, the portfolio value of both the traders 1457 and 1517 will increase by VCU 5,000 and will stay on that level.
The described transactions may be prevented by the change in the motivation settings and, at the same time, by participants being appraised according to the amounts of their account balance only from the closed titles, or by organizing the testing period in such a way that the final appraisal takes place after closing all the titles.

Summary notes

The mentioned manipulations can be identified on real-money markets especially, where the stock price also determinate the player's resulting financial payment. The play-money market manipulation is described in literature particularly in connection with the manipulation aimed to event decision influence, to which the share is joined (Hansen et al, 2004), or as an attempt to influence the event itself with a view to make profit from the influenced event final state regarding the appropriate item price (Ottaviani and Sorensen, 2007).
In this case we described several examples of manipulating behaviour detected also in the specific play-money experimental market in the school environment, and we showed the significant influence of the correct and careful setting of the motivation system to the market participant's behaviour.

Educational benefit

A practical experience in trading on stock market and namely a daily monitoring possibility of the price development and inflation influence is an advisable supplement

to the education courses focused on financial engineering, monetary and capital markets, especially in following areas:

- The double auction system and individual item price development effected by it shows students the practical impact of the share price volatility on student's portfolio value and illustrate the risk associated with the financial market trading.
- Students are clearly aware of difference in the portfolio value and the cash value.
- Students can try out in practice the capital market trading as brokers.
- Students are aware of the narrow link between the title price and the real world events (analogically, the link between the stock price and the company operating results according to the fundamental analysis).
- Students perceive inflation influence and its negative impact on their portfolio state; they keep watching their money and try as soon as possible to transfer theirs financial resources to the course credits and put the inflation influence aside.
- With reference to adjusted motivation system the students are aware of the difference in big profit "romantic" fiction and the reality. In the spring semester 2013/2014 about 20 out of 195 participants only achieve the portfolio value which exceeded the starting value of VCU 10000 i. e. they realized a gain, and only 2 participants exceeded VCU 20000.
- Last but not least the FreeMarket functions as a student's self-evaluating tool where students independently evaluates themselves as a group and, at the same time, they may continuously view the whole group evaluation aggregated into a single actual stock price. This information influences their future behaviour and their approach to learning.

Conclusion

The authors of the contribution deal with the issue of the motivation of the participants of an experimental prediction market in the environment of an educational institution. The results of the experiments with various motivation and incentive systems are presented here and namely the consequences of the over motivation of the market participants – the manipulative transactions are described. On a practical example of predictions on the experimental market *FreeMarket* in which students evaluate themselves, instances of various kinds of manipulations are shown. Further, on a detailed listing of transactions revealing market manipulations, some basic principles of the individual types of manipulation are described and basic procedures are derived for detecting such behaviour together with identifying the key parameters for the settings of simple filters revealing potentially suspicious transactions. Some precautions in the settings of the motivation and incentive system aiming at preventing the manipulation are also given.

Further research shall be aimed at proposing and developing more sophisticated tools of detecting manipulative behaviour by means of statistical methods or methods of artificial intelligence along with the proposal and implementation of precautions against such behaviour. In the area of applying the prediction markets for the purpose of self-assessment it is also possible to examine the influence of the continuous decisions that affect the final appraisals of the participants as far as the development of the prices of the relevant titles is concerned.

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A PROPOSED APPROACH FOR THE INTERCULTURAL COMPETENCES ASSESSMENT

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Abstract

The article proposed a possible approach to assess intercultural competences of students studying in culturally diverse groups. The assessment is based on a set of tests measuring socio-cultural intelligence and group behaviour. The sample was formed by 68 subjects (experimental group) and the research investigation was made before and after an international experience. Students obtained higher scores after an international experience. For evaluating the group performance was taken into account the investigation results and the educational performance of the group (shown by their partial transcript of records).

Keywords

Intercultural competences, intercultural training, battery tests

Introduction

The article purpose is to propose a possible approach to assess intercultural competences of students studying in culturally diverse groups. The assessment is based on a set of tests measuring socio-cultural intelligence and group behaviour. The sample was formed by 68 subjects (experimental group) and the research investigation was made before and after an international experience. Students obtained higher scores after an international experience. For evaluating the group performance, the investigation results and the educational performance of the group were taken into account (shown by their partial transcript of records).

Fantini (2009) considered interculturality as being a process in which people from different cultures interact in the working or learning processes. It is linked with the ability to experience the other person's culture, open-mindedness, curiosity, and interest shown to that person and her/his culture. For Kuman-Tan et al. (2007) and Fantini (2009) intercultural competences are related to the ability to manage the communication challenges with people from different cultural backgrounds. Regarding the communication process, two aspects must be taken into consideration: *appropriateness* (valued rules, norms, and expectations of the relationship) and *effectiveness* (valued goals or rewards relative to costs and accomplished alternatives).

Intercultural competencies are defined by a set of skills, knowledge and attitudes, which are employed during interactions with culturally diverse team members (Lloyd and Härtel, 2010). Sometimes, intercultural competences allow understanding different social norms and practices, integrating culturally diverse employees into one organizational system (Singh, Merchant and Skudrzyk, 2012). Diversity may increase the group efficiency only when its members are capable to understand each other and to combine and create new ideas (Maznevski, 1994; Houška and Beránková, 2010; Rauchová and Houška, 2013).

The proposed research methodology is based on a set of tests, measuring socio-cultural intelligence and group behaviour.

The intercultural competences assessment

According to Fantini research (2009), there are about 86 instruments for evaluating the intercultural competences. The most popular quantitative tools used for assessing intercultural competences are the Inter-cultural Development Inventory, the Cultural Intelligence Scale and the Multicultural Personality Questionnaire. In the case of the qualitative tools, the scenario-based assessment seems to be useful for evaluating the intercultural competence. Messner and Schafer (2012) provide guidance for personal improvement based upon the identification of personal traits, strengths, and weaknesses.
Matsumoto and Hwang (2013) states that, in recent years, has witnessed the emergence of a large number of tests that measure the intercultural or multicultural competences. The field research focused on the analysis of cross-cultural competences (3C) involves the development and validation of performed tests. Creating these types of tests starts by identifying the predicted desirable outcomes, the target culture of this competence will be compared with, and the factors needed to demonstrate this competence: skills, abilities and required knowledge. In the literature, the results refer only to two elements: adaptation and adjustment. Adaptation is the process of changing one's behaviour in response to environmental conditions or social pressures. Adaptation was evaluated through the following criteria: management style, manager's behaviour, cultural performance of different groups, professional interests, international orientation and, interactive behaviors'. Adjustment refers to subjective experiences associated with adaptation and can result in self-esteem, self-awareness, physical health, stress, psychological and psychosomatic concerns, communication problems, cultural shock, anxiety, reduced work performance and interpersonal difficulties. Matsumoto and Hwang (2013) considered that the most relevant tools for assessing the cross-cultural competences (3C) are: Cultural Intelligence Scale (CQ), Intercultural Adjustement Potential Scale (ICAPS) and Multicultural Personality Questionnaire (MPQ). All those investigation tools are summaried in Table 1.

Investigation tool	Creator(s)	Description
Cultural Intelligence Scale (CQ)	Ang, Van Dyne and Koh (2006) based on the researches made by Earley and Ang (2003)	Has 40 items comprising four components: meta-cognitive, cognitive, motivational and behavioural.
Intercultural Adjustment Potential Scale (ICAPS)	Matsumoto et al. (2001)	Has 193 items, with eight levels to assess: emotional regulation, critical thinking, openness, flexibility, security, emotional commitment to traditional ways of thinking, tolerance for ambiguity, and empathy.
Multicultural Personality Questionnaire (MPQ)	Van der Zee and Van Oudenhoven (2000)	Has 91 items, classified in five categories: Cultural Empathy (CE), Open-mindedness (O), Social Initiative (SI), Emotional Stability (ES) and Flexibility (F).

Tab. 1: Instruments used in the investigation of the behaviour cultural dimensions

CQ predicts cognitive processes of decision making and leadership behaviors. ICAP predict psychological adjustment, such as culture shock, depression and anxiety. MPQ is used to identify the professional interests of international and intercultural and international orientation.
All these tools can predict outcomes of intercultural investigation beyond standard

personality and intelligence (Matsumoto and Hwang, 2013). Numerous studies have shown that CQ and ICAPS can predict outcomes beyond emotional intelligence or emotional skills (Groves and Feyerherm, 2011; Moon, 2010; Yoo et al., 2006) and only a few studies have provided negative results (Ward, 2008). The intercultural adjustment is considered to be an emotional process, and the investigative tool for assessing the intercultural competence overlaps sometimes aspects related to emotional abilities (Matsumoto and Hwang, 2013).

Description of the Proposed Model for Assessing Group Efficiency

Figure 1 shows a general overview of the proposed model. The model was structured on three levels: inputs, the elements taken into account**,** and the outputs. The inputs included: the characteristics of human personality, international studies experience, intercultural relationships and interactions and intercultural programs. The three elements taken into account were: Social intelligence (SQ), Cultural intelligence (CQ) and Group behaviour. The outputs included cognitive results, psychological results, behavioural results, and performance results.

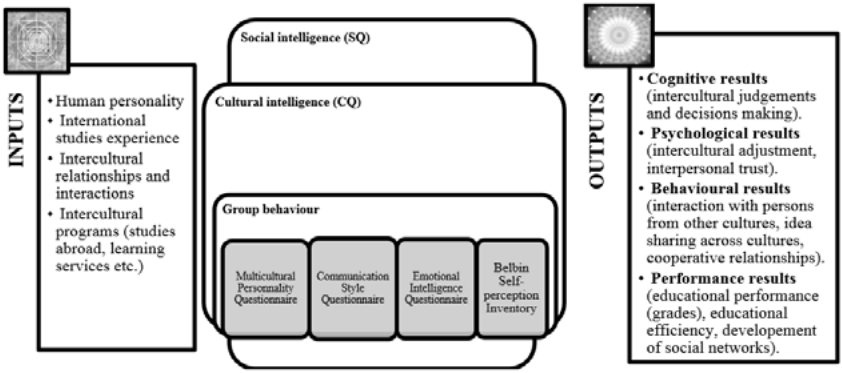

Fig. 1: The Proposed Model for Assessing the Group Efficiency

Several authors have examined the effects of cultural intelligence (CQ) on cognitive and psychological results (Ang et al., 2007; Ward, 2008). Ang et al. (2007) considered that *cultural judgement and decision making* (CJDM), which refers to the decisions quality based on intercultural interactions, is being a very important cognitive result. Intercultural adjustment refers to the general well-being when living and interacting with persons from another culture (Ang et al., 2007).

Materials and Methods

The proposed research methodology is based on a set of tests measuring socio-cultural intelligence and group behaviour. The first test used was the Multicultural Personality Questionnaire (MPQ). The MPQ questionnaire validity was revealed by measuring the behavioral features (Van Oudenhoven and Van der Zee, 2002; Van der Zee et al., 2003), individuals self-efficacy analysis (Van Oudenhoven and Van der Zee, 2002), analysis of students in an exchange program and students at undergraduate level (Leong, 2007). The second test used was the communication style questionnaire, having the purpose to identify the main communication styles within an organization: action-oriented communication style, process-oriented communication style, people-oriented communication style and

ideas oriented communication style. The third test used, the emotional intelligence questionnaire, identifies the importance of the basic skills that determine the success of an organization.

The last test used, *the Belbin Team Role Inventory*, also called the Belbin Self-Perception Inventory, and is a personality test developed by Meredith Belbin in 1970 to measure the preference for nine Team Roles (Coordinator, Shaper, Monitor Evaluator, Team worker, Implementer, Plant, Resource Investigator, Finisher, and the Specialist – a Team Role added by Belbin in 1993).

Results and Discussion

The sample group consists of the 68 students with the average age of 21 years old (mean M = 20.5; standard deviation SD = 2.82). 78% of students were male and 22% were female. The research variables were: age, gender, nationality, residence (urban/rural), and college school profile. In the sample group, the students profile was varied. Students' nationality in the research group was Romanian, Slovak, Hungarian, Serbian, German, Tunisian, Moroccans, and Cameroons.

At the beginning of the research study the following hypotheses were formulated:

Hypothesis 1.The five factors of the multicultural personality (Cultural Empathy, Open-Mindedness, Social Initiative, Emotional Stability, and Flexibility) are positively associated with the international experience.

Hypothesis 2. Using the communication style questionnaire in the experimental group, most of the students will have an action-oriented communication style.

Hypothesis 3. The emotional intelligence results will show us increased personal skills and increased social skills.

Hypothesis 4. Using the Belbin Team Inventory in the experimental group, most of the students will be Team workers.

For the MPQ questionnaire there were compared the average scores for each dimension of intercultural competence in two stages: before and after an international experience (Figure 2). It was identified higher average scores after an international experience. The hypothesis 1 formulated at the beginning of the study was confirmed.

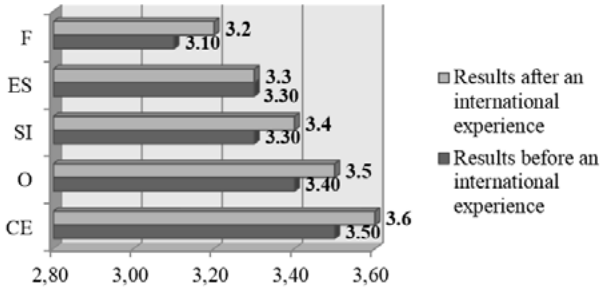

Fig. 2 MPQ results before and after an international experience

Using the communication style questionnaire was identified that 27 subjects had a process-oriented communication style, and after an international experience 23 subjects had an action-oriented communication style. The hypothesis 2 formulated at beginning of the research study was not confirmed.

Communication style questionnaire	Communication style results before an international experience	Communication style results after an international experience
Action-oriented communication style (S1)	11	23
Process-oriented communication style (S2)	27	18
People-oriented communication style (S3)	19	12
Ideas-oriented communication style (S4)	11	15

Tab. 2: Communication style before and after an international experience

By assessing the level of emotional intelligence, the research study tried to identify the importance of the basic skills that determine the success of an organization: personal and social skills of the individuals. In the experimental group were identified higher percentage scores after an international experience (Table 3). The hypothesis 3 was confirmed; most of the subjects had increased personal skills and increased social skills (96% before an international experience and 98% after an international experience). In the same time, were idenified: low personal skills - increased social skills and increased personal skills - low social skills (Tabel 3).

Skills	Results before an international experience	Results after an international experience
Low personal skills - Low social skills	0%	0%
Low personal skills - Increased social skills	1%	1%
Increased personal skills - low social skills	3%	1%
Increased personal skills - Increased social skills	96%	98%

Tab. 3: The emotional intelligence results before and after an international experience

The Belbin Team Inventory was used to measure the group performance before and after an international experience (Table 4). The hypothesis 4 formulated at the beginning of the study was not confirmed. During the research study made before and after an international experience and using the Belbin Team Inventory were identified also several roles (Table 4).

Belbin Team Inventory	Belbin roles before an international experience	Belbin roles after an international experience
Coordinators	16	11
Shapers	8	6
Plants	4	3
Monitor Evaluators	7	6
Resource investigators	3	4
Team workers	3	5
Implementers	6	7
Finishers	4	5
Combination between several styles	The rest of the subjects	The rest of the subjects

Tab. 4: Belbin Team Inventory - a comparative study: before and after an international experience

Conclusion

Management of a diversified learning group in the organizations (due to age, culture, ethnic identity, or religious beliefs) is posing an increasing challenge for teachers. At the same time, diversity poses unique requirements to students themselves. While implementing educational tasks, students need to cooperate with others in an effective manner. Based on the research results, an increase in value for each dimension was identified as a result of international experience that subjects had abroad. It was identified a higher educational performance for the students with high scores for emotional stability (44.44 %). From a more practical perspective, this research offers a new way to indirectly understand the intercultural skills. In the future, the proposed model for monitoring the group efficiency will prove to be a useful tool for empirical researchers.

Acknowledgements

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DISCRETE DYNAMIC ECONOMIC MODELS IN MS EXCEL

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Abstract

Students of university economic studies often do not accept the fact that in modern economics the position of mathematics is quite significant. This leads to their negative approach where they presume that mathematics is useless for their studies. If we want to show the students how interesting and useful mathematic models in economic processes can be, we can when teaching the topic difference equations for instance show some simple models and right at the beginning offer instead of precise solution the MS Excel "solution". Moreover when using such software we can follow changes when values in some parameters in the given model are modified. In our paper we present some motivation models and also graphical interpretation of the solution to derived difference equations. The present text may be considered as an innovative methodological approach how to present either traditional or more demanding economics problems with the help of ICT. Particularly MS Excel has been chosen since it is very current and accessible software.

Keywords

Absolute and relative address, compound interest, MS Excel, neoclassical growth model, recursively given sequence, sequences

Introduction

Recursively given sequences

Secondary school leavers know that sequence is given either by a functional formula for its n-th term or recursively, which means that the previous values of terms of the sequence are used to generate the value of the next term of the sequence. This means that for determining the n-th term of the recursively given sequence it is necessary to know the previous values of terms of the given sequence. This additional necessity knowledge leads to the fact that the functional rule for the n-th term is preferred very often. Secondary school mathematics shows particularly how arithmetic and geometric sequences can be characterised by recursively rule and how to derive the functional formula for the n-th term as well, see e.g. Stewart, Redlin and Watson (2002). Secondary school mathematics does not deal with the general instructions how to find a formula for the n-th term of the sequence from a recurrent rule. Such problems are related to the so called difference equations and students can get acquainted with them in courses of mathematics at some types of universities, se e.g. Gavalcová and Pražák (2004). Let us briefly remind a basic mathematical formulation of recursively defined sequences. Given a real function f: $N_0 \times R \rightarrow R$ and an initial value $x_0 \in R$, we can compute an arbitrary term of sequence x_n, where $n \in N_0$ according to the relation

$$x_{n+1} = f(n, x_n). \tag{1}$$

This relation, together with the initial value x_0 is called the first order recurrence equation.

The solution to this equation is any sequence $\{x_n\}$ generated by this equation.
In the present paper we show how to work with recursively given sequences when one do not know the formula for the *n*-th term. Such an approach is necessary when we work with a nonlinear recurrence equations and can be widely used for modelling of dynamic phenomenon in economic and management. We use Microsoft Excel (MS Excel) tables since modelling economics and management problems with MS Excel is quite actual and frequently used. Our approach can be considered as an extension of the approaches given in Balakrishnan, Render and Stair (2007) which mainly considers only static problems. Other applications of MS Excel in economics and management can be found in literature. Findley (2013) introduced the simple guide on how to solve and simulate a discrete-time specification of the Life-Cycle/Permanent-Income model of consumption and saving. Briand and Hill (2012) described an implementation of Mote Carlo method. In Husinec et al (2008) a stochastic model can be found and Palocsay, Markham and Markham (2010) use MS Excel as a tool for business intelligence and decision support system.
The paper is organized as follows: First we introduce a general approach how to model a dynamic phenomenon with recurrence equations. Then two MS Excel applications are introduced - we start with a description of the process of compound interest, which is at basic courses for economists and managers taught on the base of geometric sequence, then we demonstrate neoclassical growth model, which helped the economists to partially understand phenomenon connected with economic growth in some countries in the world.

The use of recursively given sequences in issues on economic topics

Dynamics economics processes in discrete time can be studied with the following general procedure:
1) We find a recurrent relation between terms of the time sequence or a recurrence equation for given terms of a time series. This part of analysis is not very often used in economic literature and instead of that one can find graphs that represent the given problem. However if we want to understand the real dynamics of an economic phenomenon, the finding of the recurrence equation is necessary and crucial step. Having the recurrence equation with function f: $N_0 \times R \rightarrow R$ and initial value x_0, we can use iterative process to find (or predict) following terms of the sequence:

$$\begin{aligned} & x_0, \\ & x_1 = f(0, x_0), \\ & x_2 = f(1, x_1), \\ & x_3 = f(2, x_2), \\ & \ldots \end{aligned} \tag{2}$$

2) With the help of MS Excel we determine values of terms of the recursively given sequence (to be more precise - only a finite number of terms of the given sequence). At first we put the initial value x_0 to a selected cell. Then we write the function formula f into another selected cell. Finally we copy this formula to the selected area of cells.
Let us demonstrate the use of this procedure in two following examples.

Compound interest

The first problem deals with calculation of compound interest and focus on the question how to count the value of the deposit with the value CZK A for N years provided that the interest is charged n times a year. It is an easy and well known problem therefore it can be used to clearly present the above mentioned general approach. Instead of a traditional approach in economical courses when students only get the formula for the value of the

account in time t we prefer to develop a recurrence equation for this problem. Details of the derivation of the equation can be found in Pražák (2013).
For the calculation we need the following notations: the initial value of the deposit A, the length of time for the savings N years, the number of n interest periods for one year and the interest rate r, $r \in (0, 1)$. It is obvious that the interest rate for one interest period is given by the fraction r/n. Let t, $t \in \{0, 1, \ldots, T\}$, denotes a time period, where $T=N.n$ is the total number of interest periods, and B_t denotes the value of the account in time t. The value of the account in time period $t+1$ can be described by the following relation

$$B_{t+1} = \left(1 + \frac{r}{n}\right) B_t, B_0 = A. \tag{3}$$

Note: It is not difficult to see that the given formula forms a geometric sequence. This approach, however mathematically a more correct one, will not be discussed here.

Owing the simplicity of the present model we can briefly describe details of its implementation in MS Excel. We introduce how to use this tool to make a table of terms of the given sequence. First we set the values of exogenous parameters and the initial deposit.

Parameters	Cell address
Annual interest rate, r	F4
Number of interest periods, n	F5
Initial value of the deposit, A	F6

Tab. 1: Parameters specification

Then we prepare formulas for computing terms of the sequence that is given by the latter recurrence equation. The sequence will be formed in columns **I** and **J**. In column **I** we insert the order of the terms of the sequence and in the column **J** we successively find values of the sequence.

Description	Cell address	Formula
Initial time	I4	=0
Next time period	I5	=I4+1
Initial value of the deposit	J4	=F6
Next value of the account	J5	=(1+$F$4/$F$5)*J4

Tab. 2: Formulas specification

Now the formulas given in cells **I5** and **J5** can be copied into the cells in columns **I** and **J** starting with line **6**. The number of lines formed by copying depends on the total amount of our interest, see fig 1. Adding sliders (also known as scroll bars) to the sheet enable us to change easily values of the given parameters and the initial value of the deposit. This way we get a tool through which the influence of the parameter change on the final value of the deposit can be demonstrated:

- Provided that we set one interest period of one year, we get a relation for simple interest.
- Provided that we put B_0=1, r=1 a n=365, we can model how the value of the deposit of CZK 1,- increases in one year if the interests are paid daily (banks usually do not do that, but why not to explore such situation). This way we find the value of CZK 2,71, i.e. the value of CZK 1,- deposit in one year would make about CZK

2,7. Provided that we keep increasing the number *n* of the interest period, let´s say we would pay the interest several times a day, the value of the known Euler number *e*=2,718…. can be approximately achieved.

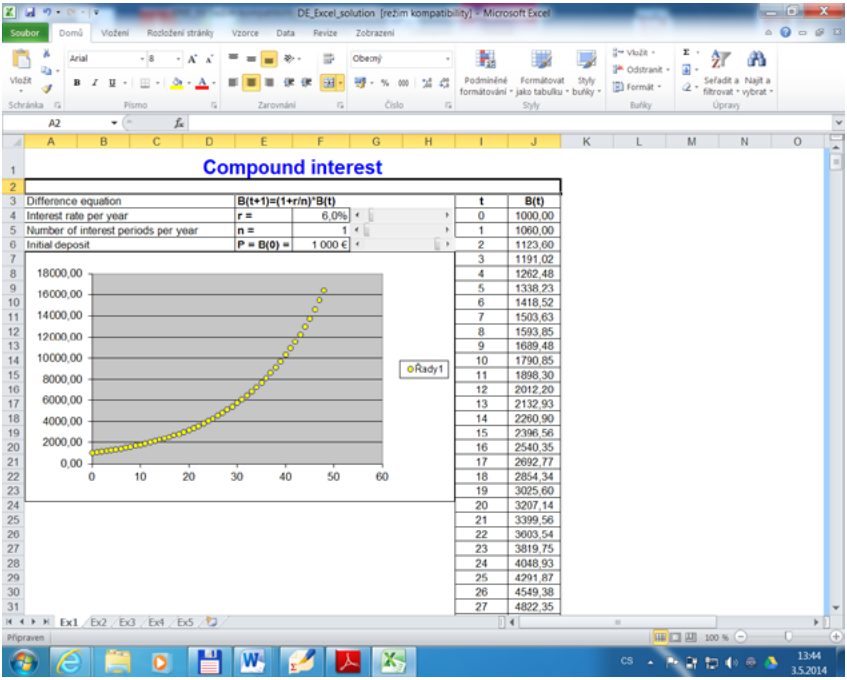

Fig. 1: Compound interest in MS Excel

Neoclassical growth model

Neoclassical growth model was described in Solow (1956). It is considered as the fundamental model in the theory of economic growth. Let's give a brief description of this model, for more details see e.g. Blanchard (2000) or Holman (2004). The given model deals with two essential relations between output *Y* and capital *K*: the amount of capital determines the amount of output and the amount of output determines the amount of saving and investment, which further determines the amount of accumulated capital.

We assume that output *Y* is dependent on capital *K* (it represents all means which we do not consume but use them for generating a profit, i.e. buildings, machines) and labour L (that is understood as a production tool). This relation can be expressed with the neoclassical aggregate production function *F,* that can be formally written as $Y=F(K, L)$. Consider a theoretical experiment in which we doubled both the amount of capital and the amount of labour then it is possible to consider that the output is doubled as well, for details see Blanchard (2000). This phenomenon is called constant returns of scale and for λ, $\lambda>0$, it can be written as $\lambda Y=F(\lambda K, \lambda L)$, which is a property of homogenous functions of degree one, see Hoy et al (2001). Putting $\lambda=1/L$, we get $Y/L=F(K/L,1)$. To simplify notation we introduce the intensive production function *f*, that can be represented as $f(K/L)=F(K/L, 1)$. This notation allow us to write

$$\frac{Y}{L} = f\left(\frac{K}{L}\right) \tag{4}$$

Within the model prepared in MS Excel we use the intensive production function of Coob-Douglass form $f(x)=x^{\alpha}$, where $\alpha \in (0,1)$. The evolution of the capital stock can be described as the following difference equations, for all details of derivation see Blanchard (2000),

$$\frac{K_{t+1}}{L} = (1-\delta)\frac{K_t}{L} + sf\left(\frac{K_t}{L}\right) \tag{5}$$

The parameter δ, $\delta \in (0,1)$, represents the depreciation rate of capital per year. If we introduce the initial value of capital K_0 the latter recurrence relation can be used to prepare MS Excel table. Unlike the previous problem, details of the implementation are not given here. As soon as the MS Excel model is prepared, we can study different effects of the change of the initial value or the values of parameters of the given model. One of the screens of the prepared model is given in fig. 2.

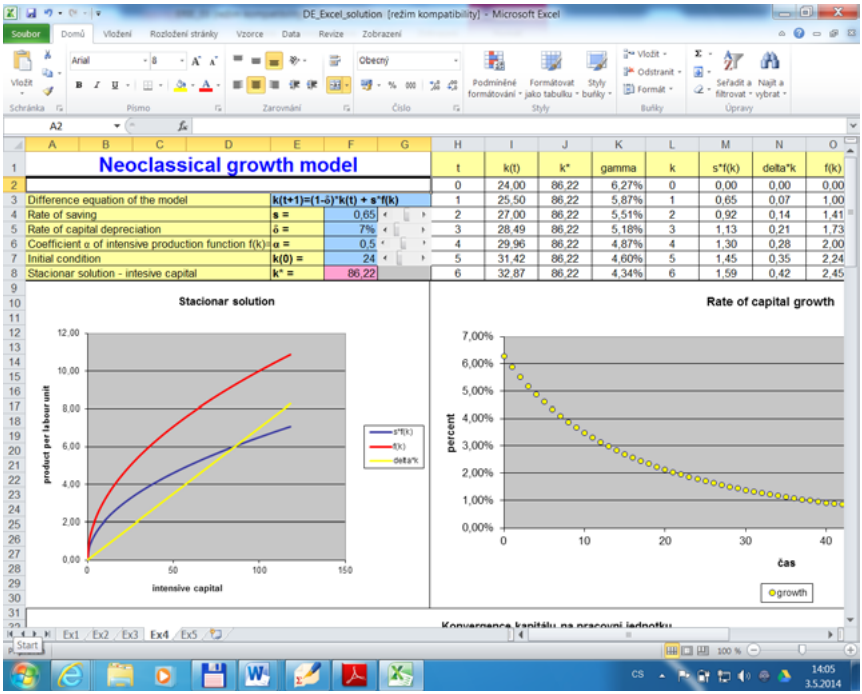

Fig. 2: Neoclassical growth model in MS Excel

Let us add that the relative growth rate of capital is defined as

$$\gamma_t = \frac{K_{t+1} - K_t}{K_t} \tag{6}$$

This relation can be used to enrich the model and to study how this quantity evolves in time depending on the change of exogenous parameters of the given model. The prepared MS Excel model allows us to demonstrate and confirm some conclusions connected with the phenomenon of economic growth:

- The amount of savings determines the stationary value of capital Ko. The stationary value or equilibrium is usually understood as a constant sequence that represents the solution to the derived equation. Since the value of capital determines the value of output, it is possible to conclude that the savings rate determines the equilibrium value of output Yo. If we consider two comparable economies then the one with the higher saving rate has also a higher equilibrium of its output.
- The saving rate has no influence on the long-term growth rate of output per labour unit, i.e. the output converges to the constant value, which means that in the long run the rate of product growth is zero.
- The increase of the size of savings leads in the short term to higher growth of output per labour unit, however, it is only a temporary growth.

On the base of the formed MS Excel application we can also explain why after World War II there was a significant economic growth in some European countries, cf. Blanchard (2000). Consider e.g. France, which suffered big losses in World War II. Out of 42 million people 550 000 died. However the losses on capital equipment were much bigger. If there is a higher destruction of capital than labour force, the capital equipment K/L rapidly decreases. And this happened in France. In 1946-1950 France showed rapid growth, the average value of which was 9,6% per year. This rapid movement can be explained as follows: with the initial value $K_0 < K^o$ there was a significant convergence to the equilibrium, i.e. to the long-term capital equipment K^o/L as can be predicted according to the neoclassical growth model, cf. the graph on the right hand side of fig. 2.

Conclusion

We showed that if we want to work and experiment with recursively given sequences, we can effectively use tables of MS Excel. We presented a general approach how to deal with dynamics economics problems: firstly find a recurrence formula for the given (economic) problem and secondly use MS Excel tables to find a solution to the given mathematical model. This approach can be considered as an extension of the existing approaches to modelling different economic and management problems given in Balakrishnan, Render and Stair (2007), Findley (2013), Briand and Hill (2012), Husinec et al (2008) or Palocsay, Markham and Markham (2010). We believe that the usage of the described innovative approach to the modelling of dynamic economic phenomenon can enrich the explanation of both classical economic dynamic models (theory of firm, growth models or business cycles) and the more recent economic results (the theory of economics growth as an optimal control problem), cf. Gandolfo (2009). In our future research we would like to find a method how to implement a solution to optimal control problems in MS Excel that can be used either by students to experiment and deeply understand these problems or by instructors to present recent economic results and theories.

The given examples show that it is relatively easy to find recurrence formulas and implement them in MS Excel and moreover by sliders one can easily change the initial values and parameters. This feature of the described approach can be considered as the biggest bonus – it is possible to study the influence of changes in parameters on the quality of solutions without going through detailed calculations. Further hypothesis can be formulated or known facts from relevant theories demonstrated. As the graphic output can be easily obtained, we can demonstrate the basic aspects of solutions also by the means of a graph. The described models give possibilities to tackle also other recursively given sequences except for the arithmetic and geometric ones and thus to enhance the knowledge of university students focused on economic studies.

The described approach to the study of dynamical problems in economics has been successfully implemented into both the mathematical courses and economics courses in our university. The further research will deal with the exploration of efficiency of this general approach in a different study groups and compare it with the approach that do not use MS Excel.

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MASSACHUSETTS EDUCATION REFORM

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Abstract

This paper uses Tobit regression methodology to estimate educational, economic, and demographic variables which determine Massachusetts Comprehensive Assessment System (MCAS) test scores in English, Mathematics, and Science by school district for the years 2000 and 2013. The research has important implications for education policy. If policy makers continue reform, information about how educational inputs and demographic variables influence educational scores is needed. This paper suggests that per pupil expenditure, teacher salary, and attendance rates, increase MCAS scores. More students per teacher, more students per computer, more special education students, and more students eligible for reduced price lunch reduce scores. While MCAS scores rose from 2000 to 2013, the latter set of regressions suggests that demographic variables still influence scores greatly. Overall, Massachusetts students are scoring better but low income students still lag behind. This has implications for ongoing Massachusetts educational reform.

Keywords

Accountability, education reform, education resource efficiency, high stakes testing, TIMSS, Massachusetts comprehensive assessment system

Introduction

US President George W. Bush's first action upon taking office in 2001 was to promote education reform including (1) increased federal funding for elementary and secondary education, (2) consolidation of federal education spending programs, (3) annual tests of student achievement, and (4) vouchers for students attending failing public schools (The Economist, 2001). Before Bush and 'no child left behind' known as NCLB, many states undertook their own reform. In 1993, Massachusetts implemented education reform and the Massachusetts Educational Reform Act established the Massachusetts Comprehensive Assessment System (MCAS) in 1998. The federal and state reforms were similar. (Massachusetts Department of Education, 2014).

Critics of US education (Kronholz, 2000) had pointed to tests showing that the US was not at the top of the countries in the International Mathematics and Science Study (TIMSS) in 1999 when Singapore scored highest with 604, Czech Republic scored 520, and US scored 502, just above the average of 487. By 2011, US moved up to the top quartile and Massachusetts moved up to scores similar to the top East Asian countries. Table 1 shows the scores. Reform in Massachusetts seems to be working. Over time, the results show an increase for the US although not to the very top tier.

Year	United States	Massachusetts
2011	509	561
2007	508	547
2003	504	n/a
1999	502	513
1995	492	n/a

Tab. 1: Grade 8 TIMSS Math Results– US, and Massachusetts (Kronholz, 2000)

In Massachusetts, substantial state education assistance funding was allocated to public schools. Total local and state funding for primary and secondary public education rose from $3.5 billion in 1992 to over $5 billion in 1999, yet while state aid rose in the early days of reform, Figure 1 shows real funding has leveled off and even decreased in recent years. (Massachusetts Department of Education, 2014)

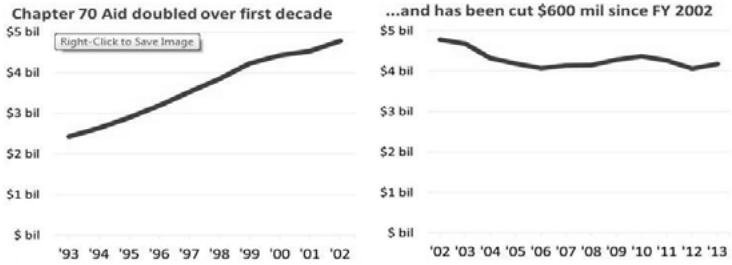

Fig.1: Inflation Adjusted Massachusetts Education Aid 1998-2013 (Massachusetts Department of Education, 2014)

As part of the reform, charter schools were created to foster competition. Public school principals were awarded contracts which were not renewed if their school failed to meet goals. The state established a uniform curriculum. Public school teachers would have to pass a teacher certification test. Lastly, to graduate from high school, public and charter school students would have to pass MCAS tests in English, Mathematics, and Science by scoring above 220, on a 200-280 range, on the 10th grade test. Students who failed the test would not earn a diploma thus the tests were dubbed 'high-stakes testing." (Massachusetts Department of Education, 2014). Legislators and voters expected results, from principals, teachers, and students. The MCAS test generated controversy. The initial 2000 results, the first year tests counted, shown in Table 2, were poor. Average scores fell into the Needs Improvement category. In 2000, 34% failed English, while 45% failed mathematics, and 37% failed Science.

Subject	Average. Score	Advanced 261-280	Proficient 241-260	Needs Imp. 221-240	Failing <= 220
English Language Arts	229	7	29	30	34
Mathematics	228	15	18	22	45
Science/Technology	226	3	23	37	37

Tab.2 : Year 2000 MCAS Test Results: Percentage of Grade 10 Students at Each Level (Massachusetts Department of Education, 2014)

Students from cities generally scored lower than students from suburbs and minority student failure rates were nearly 80%. For Hispanics, the failure rate was 66% for English, 79% for Math, and 74% for Science. For blacks, the failure rate was 60% for English, 77% for Math, and 70% for Science. And while the same groups underperformed in both 2000 and 2013, Figure 2 shows that the percentages of students scoring *Proficient* or *Advanced* in English Language and Mathematics rose from 1998 to 2013. (Cite, year) Still, MCAS scores have improved over time. (Massachusetts Department of Education, 2014)

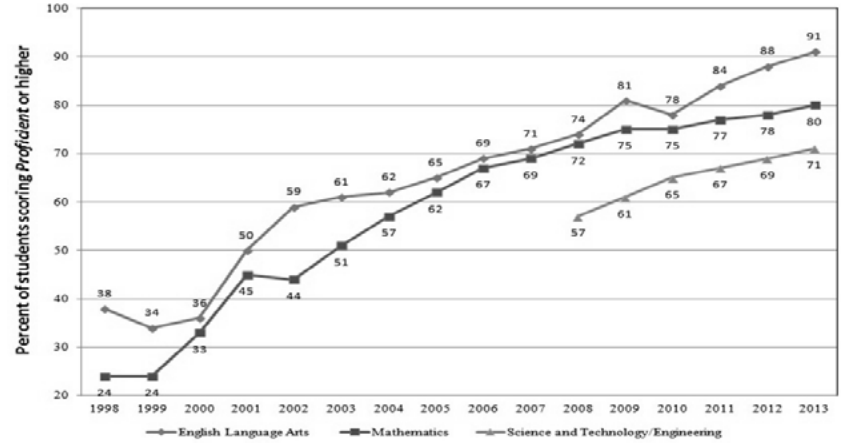

Fig. 2: MCAS Scores 1998-2013 (Massachusetts Department of Education, 2014)

Hanushek's (1986, 1996) historic works on the economics of education survey the voluminous literature. Glewwe et al. (2011) collaborated with Hanushek to include developing countries and Hanushek and Woessmann's (2010) work covered international outcomes. The empirical research still has not reached a consensus. Hanushek's (1996) work summarizes 377 empirical estimates published to yield the results found in Table 3. In short, while the empirical research still has not reached a consensus, almost six times as many studies suggest that teacher experience leads to better student performance as do teacher experience, teacher salaries, and expenditure per pupil. Teacher-pupil ratios don't seem to matter as much, nor do teacher education and facilities.

Resource	Number of Estimates	Positive Statistically Significant	Positive Statistically Insignificant	Unknown Sign	Negative Statistically Insignificant	Negative Statistically Significant
Teacher-Pupil Ratio	277	15%	27%	20%	25%	13%
Teacher Education	171	9%	33%	26%	27%	5%
Teacher Experience	207	29%	30%	12%	24%	5%
Teacher Salary	119	20%	25%	28%	20%	7%
Per Pupil Expenditure	163	27%	34%	13%	19%	7%
Administra-tive Inputs	75	12%	23%	32%	28%	5%
Facilities	91	9%	44%	23%	19%	5%

Tab. 3: Effects of Key Resources on Student Performance (Hanushek, 1996)

In early work, Coleman et al. (1966) estimated the relationship between spending and outcomes and found that differences in education resources were not related to differences in educational outcomes, contradicting the consensus. Hanushek (1992) asserted that family size directly affected children‘s achievement. Fitzpatrick and Yoels (1992) suggested that state fiscal resources can improve retention. Total educational expenditures per students‘ average daily attendance reduce dropout rates, while the percentage of female-headed families with children is found to increase dropout rates. In a study of Massachusetts student scores, Jaggia and Kelly (1996) found that ‘socioeconomic factors play a large role in determining student performance. Median income, the percentage of professionals and managers, the percentage of single mothers, the percentage of renter occupied units, and the crime rate within a community generate significant results. Jaggia and Kelly (1996) overwhelmingly rejected the position that spending leads to greater learning. In another study, the Educational Testing Service estimated that ‘about 90% of the differences among the proficiency of public schools can be explained by five variables: number of parents in the home, days absent from school, hours spent watching television, quantity and quality of reading material in the home, and amount of homework done. Schools can only influence the last.” (National Center for Education Statistics, 1990)

Materials and Methods

This paper investigates the relationship between MCAS scores and the educational, economic, and demographic variables. A simple ordinary least squares (OLS) regression model could estimate the determinants of the average MCAS score of 4th, 8th, and 10th grade students in 2000 and 2013. But because the lowest possible score a student can receive is 200 and the top score is 280, OLS estimation is not appropriate as it assumes that a linear relationship exists between the independent variables and the dependent variable, thus OLS allows predictions that lie outside of the possible 200-280 range. To remedy this problem, we use a Tobit model to assess the importance of the included independent variables.

Using 2000 data, the dependent variables are the average MCAS scores for 4th, 8th, and 10th

grade students in English, Mathematics, and Science. Data are reported for: all students, regular day students, and students with disabilities. Thus 27 regression estimations are run using the 2000 data (3 grades * 3 subjects * 3 groups of students). The econometric specification is:

$$\text{MCAS Score} = \beta_0 + \beta_1 * \text{PPT} + \beta_2 * \text{TCHSAL} + \beta_3 * \text{STUPTCH} + \beta_4 * \text{STUPCOM} + \beta_5 * \text{COMPINT} + \beta_6 * \text{ATTEND} + \beta_7 * \text{LIMENG} + \beta_8 * \text{SPECED} + \beta_9 * \text{REDLCH} + \beta_{10} * \text{CHOICE} + u \quad (1)$$

where PPT = per pupil spending, measured in thousands of dollars, TCHSAL = teacher salary, measured in thousands of dollars, STUPTCH = students per teacher, STUPCOM = students per computer, COMPINT = percentage of computers on internet, ATTEND = attendance rate, LIMENG = percentage of students with limited English proficiency, SPECED = percentage of students in special education, REDLCH = percentage of students eligible for reduced price lunch, CHOICE = a dummy variable equal to 1 if school choice exists in the district, 0 otherwise, and u = error term. We expect positive relationships between MCAS scores and (1) per pupil spending, (2) teacher salary, (3) percentage of computers on the Internet, (4) attendance rate, and (5) choice. We expect negative relationships between MCAS scores and (1) students per teacher, (2) students per computer, (3) percentage of students with limited English proficiency, (4) percentage of students in special education, and (5) percentage of students eligible for reduced price lunches.

Because of recent data collection changes by Massachusetts Department of Education, the 2013 regression specification had to change. Computers were in every school and almost all were on the internet. This seems to be obvious as importance of information systems steadily grows (Dařena, 2011). Massachusetts no longer published teacher experience, but they published teacher age which the authors decided not to use as they thought it did not indicate teacher quality. Also available was the percentage of students with Low Income, LOWINC, which was used instead of the percentage of students eligible for a reduced price lunch. A new variable, STABILE, was added which measured the stability of the student population which was expected to be positively related to MCAS scores. Students from families who move around a lot are not stable and less likely to score well on MCAS.

$$\text{MCAS Score} = \beta_0 + \beta_1 * \text{PPT} + \beta_2 * \text{TCHSAL} + \beta_3 * \text{STUPTCH} + \beta_4 * \text{ATTEND} + \beta_5 * \text{STABILE} + \beta_6 \text{LOWINC} + u \quad (2)$$

The independent variables are expected to have the same relationships with the dependent variables as in Equation (1). Per pupil spending, teacher salary, attendance, and stability are expected to be positively related to MCAS scores while students per teacher and percentage of students with low income are expected to be negatively related to MCAS scores. A problem with the 2013 specification is that the Department of Education no longer published breakouts by type of student and not all tests were taken in each grade thus only eight regressions were estimated, for Grade 4 – English and Mat, and for Grades 8 and 10, all three English, Math and science MCAS scores were used as the dependent variable.

Results and Discussion

A summary of the estimation results is shown in Table 4. Many results conform to previous work. Per pupil spending is mostly positively related to MCAS scores. For 2000, 14 of 27 estimates of per pupil spending are positive and statistically significant, while

12 are positive and statistically insignificant. This seems to be fairly consistent evidence that money matters. Also in 2013, seven of eight estimated PPT coefficients are positive and significant. Teacher salary is shown to increase MCAS scores, but more so for 2000 than 2013. The attendance rate, computers on the internet and the percentage of students with limited English proficiency also increases MCAS scores. Class size is negatively related to MCAS scores in 2000 but not to a huge extent and the result is the same for 2013. Also, the higher the percentage of students identified as special education students and the higher the percentage of students eligible for reduced price lunch; the lower are MCAS scores.

2000 Results	Positive Stat. Signif.	Positive Stat. Insignif.	Negative Stat. Insignif.	Negative Stat. Signif.	2013 Results	Positive Stat. Signif.	Positive Stat. Insignif.	Negative Stat. Insignif.	Negative Stat. Signif.
PPT	14	12	1	0	PPT	7	1	0	0
TCHSAL	18	9	0	0	TCHSAL	2	6	0	0
STUPTCH	0	5	15	7	STUPTCH	0	0	6	2
ATTEND	16	11	0	0	ATTEND	4	4	0	0
REDLCH	0	0	0	27	LOWINC	0	0	0	8
COMPINT	8	19	0	0	STABILE	1	6	1	0
STUPCOM	0	5	19	3					
SPECED	1	7	9	10					
LIMENG	15	9	2	1					
CHOICE	1	14	12	0					

Tab. 4: Summary Results for Years 2000 and 2013

Of all the year 2000 variables, REDLCH has the most negative and statistically significant estimates. Every single estimated coefficient, all 27 regressions, is negative and statistically significant. The same thing happens when low income student percentages are estimated via the 2013 regressions. This is good evidence that poverty and income highly influence MCAS test scores. Contrary to expectations, LIMENG is positively related to MCAS scores. Perhaps students who do not speak English as a native language get extra academic help and thus score higher, all else equal. While multicollinearity may exist, tests done by the authors show low variance inflation factors.

In looking at the data in Table 4 using 2013 data, the results are the same. Expenditure per pupil is positively related to test scores as is the attendance rate, teacher salary, and stability, a measure of how frequently students change schools. High stability means high scores. And finally, the higher is the percentage of low income families, the lower are the scores. The scores may be better but still there are different educational outcomes and they seem to depend on income levels.

Conclusion

The empirical results have important public policy implications. The United States has relied on its public school system for over two-hundred years. This paper suggests that school systems can allocate resources efficiently. Teacher salary is important where higher teacher salaries will attract better teachers. Class size is not overly important. Computers are nice to have especially in the early grades, but not a panacea, and are now ubiquitous. High school students need Internet access but with virtually all computers on the internet today, this is no longer a problem. Attendance is vital especially in the upper grades. Overall, Massachusetts education reform seems to be improving standardized test scores when looking at both MCAS scores and National Assessment of Educational Progress

(NAEP) scores where Massachusetts has been the top scoring state for the past four years and rivals the TIMSS scores of the top East Asian countries. (National Center for Education Statistics, 2013). Yet funding has been falling in Massachusetts and that has ominous overtones for continued improvement in education. While the results of the model are based upon socioeconomic characteristics of the Massachusetts educational system, the results can be generalized and implemented into a different system as well.

Acknowledgements

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USEFULNESS OF SHARED CLIL LESSON PLANS

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Abstract

In the era of immense possibilities of digital sharing, there is a need for reflecting on the limitations of shared materials. Within the context of Content and Language Integrated Learning, this paper focuses on the usefulness of shared lesson plans, as perceived by mathematics teacher-trainees at the end of their CLIL methodology training. An online questionnaire is complemented by an open-question survey to establish the benefits and pitfalls, the data is being related to CLIL theory and methodology and compared to lesson plans that the students created at the end of their CLIL methodology training during their Mathematics teacher training at the Faculty of Education. The research shows significant discrepancies among the sets of data, draws implications for designing a CLIL-lesson plan analytical tool, and future areas of investigation are suggested.

Keywords

CLIL, lesson plan, mathematics, scaffolding, teacher training

Introduction

CLIL (Content and Language Integrated Learning) is a dual-focused educational approach in which an additional language is used for the learning and teaching of both content and language (Coyle, Hood and Marsh 2010:1). Promoted by European Commission (2003) as 'nurturing self-confidence in young learners and those who have not responded well to formal language instruction', it is seen as not only a trend in language teaching, but as a self-contained methodological approach; Dalton-Puffer (2013) published an updated CLIL research agenda. In the context of the Czech republic, CLIL is employed typically in a school that teaches most subjects in the teachers' and students' mother tongue (L1). In our study we focus on Mathematics taught through a foreign language (L2) at a secondary-school level. Sedlačík, Čechová and Doudová (2013) provide an indirect support for this type of integrated learning, when they disprove the myth that people are typically gifted in Mathematics or a language, but seldom both.

Coyle's (1999) theoretical 4C's framework illustrates the interconnectedness of the four aspects necessarily present in every CLIL implementation: Content, Communication, Cognition, and Culture. As far as the specifics of CLIL methodology are concerned, there are two key principles: dual objectives of each teaching unit (present in all the phases of the teaching process, from planning to evaluation), and systematic scaffolding, that is, facilitating and enabling the students overcome the obstacles that learning through L2 might present. Novotná, Hadj-moussová and Hofmannová (2001) sum up: 'in order to help the learners succeed, it is of the utmost importance for the teacher to examine and analyse possible barriers that might have a negative impact on learning. The CLIL teacher should be able to suggest ways how these could be minimized.' The topic of CLIL has yet not been covered in the ERIE events, even if Koteková's work on the role of confidence

in language learning (2013) and thinking skills (2010) follow the line of interaction of cognition and communication.

This paper presents partial results from a larger ongoing research looks into the limitations of sharing CLIL lesson plans. The aims of the overall research are to create an analytical tool for CLIL lesson plans, specifically in Mathematics, and to investigate the concordance between teachers' and teacher-trainees' perception of useful features of a lesson plan, and their actual lesson plan purposefully adapted for sharing. Academic materials on lesson planning and on tools for lesson plan analysis are scarce. Meyer (2010) offers a flexible CLIL-lesson planning tool, and establishes quality criteria for successful and sustainable CLIL; nevertheless, he does not offer a tool for a lesson plan analysis. Nováková (2013) presents a thoroughly documented template for analyzing mathematics lesson plans based on Theory of Didactical Situations, and Panasuk and Todd (2005) use factor analysis to assess the effectiveness of lesson planning; these two models, though, fail to reflect the duality of CLIL classrooms.

The aims of the presented part of the research are the following:

- research teacher-trainees' views on the benefits and pitfalls of using a lesson plan from a public database;
- to create a descriptive tool for CLIL-lesson plans and test it for teacher-trainees' input;
- to compare the teacher-trainees' theoretical claims to their lesson plans.

Besides, since our sample consists of teacher trainees who underwent the same CLIL training programme, we wanted to verify whether their responses in the survey and lesson plans reflect the intended impact of the CLIL course, and draw implications for the CLIL-course design.

Data from closed-ended online questionnaire and open-ended pen-and-paper survey are compared to data retrieved from lesson plans; a descriptive tool designed for the purpose of the research is employed to identify the items to be analyzed.

Materials and Methods

24 students who enrolled in a CLIL course at Department of Mathematics and Didactics of Mathematics, Faculty of Education, Charles University in Prague provided the sample for this study. Their training was completed by creating a CLIL lesson plan (for details on the course and its conceptual development, see Novotná and Tejkalová 2010).

Based on a detailed study of over 50 CLIL mathematics lesson plans, 27 individual items featured in a CLIL lesson plan were identified. The items were presented in an online questionnaire study among the 24 students at the end of their CLIL training; the students were asked to identify the 5 most useful features in a CLIL lesson plan and were allowed to add any further comments. The questionnaire was specifically designed for the purpose of the study; it offered the list of 27 items identified by the authors and asked the respondents to select the five most useful items from the list. The wording of the items and the question was pre-researched with three teachers and two teacher-trainees and reviewed based on both written and oral feedback. A month later, the students were required to answer two open-ended questions to supplement the online survey, to establish which features of a lesson plan they considered to be the most useful in a lesson plan, and which aspects were the pitfalls of using a downloaded lesson plan.

To complete this perspective of future teachers' perception of CLIL lesson plans, six of the students' lesson plans were analyzed. We opted to choose a minor but largely homogeneous group: all of the students (3 male, 3 female) were of the same age (23-24

years), after their bachelor teacher-training programme in Mathematics, with no teaching practice, no direct experience with learning a content subject in a foreign language at any level of their education, and their level of English according to CEFR definitions (as evaluated by themselves) was B1/B2. The students' lesson plans were created before the students filled in either of the questionnaires.

Results and Discussion

In the two bar charts below, the most frequently selected items are presented. The first chart shows the top ten items from the 27 items featured in the online questionnaire, organized by frequency of occurence. The full categories are

- Specific mathematical tasks in L2,
- scaffolding techniques to help students work in L2,
- ready-made worksheet for the students,
- detailed instructions for the teacher,
- lesson clearly structured in a series of activities,
- list of vocabulary with translation,
- explicitly stated prerequisites in L2 an MA,
- links to further online activities and/or worksheets,
- timeline of the lesson,
- solutions to the tasks.

In the open-question survey, only 11 different items were identified as the most useful in all of the 24 students' replies. The bar chart below presents them organized by frequency of appearance. Even though the respondents used several synonymical expressions, these could be unambiguously summarized using the formulations we proposed in the questionnaire survey, that is, the students did not identify a new item. The 11 items, ordered by frequency of occurence, are:

- Specific mathematical tasks in both L1 and L2,
- ready-made worksheet for the students,
- list of vocabulary with translation,
- timeline of the lesson,
- solutions to the tasks,
- explicit phrasing of the sentences in L2 that the teacher is supposed to used in the classroom (instructions etc.),
- sims formulated both for MA and L2,
- ready-made presentation to use in classroom,
- explicitly stated prerequisites in L2 an MA,
- detailed instructions for the teacher,
- lesson clearly structured in a series of activities.

It is to be noted that never more than 50% of the students agreed on any item in the open-question survey. This shows less consistence than the questionnaire survey, where the highest ranking feature was identified by 92% of the students. For further research, we suggest to complement the two approaches with interviews with the respondents to shed light on this phenomenon.

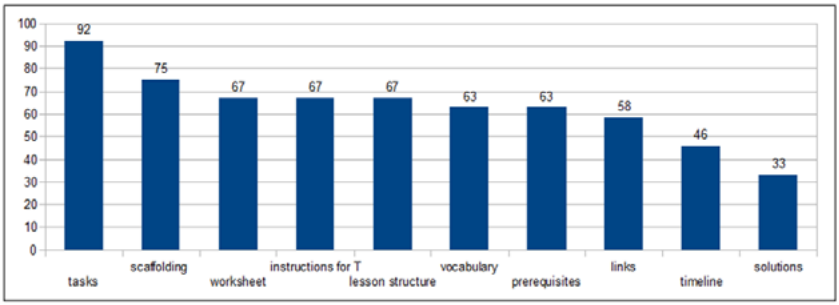

Fig 1.: 10 most useful items selected out of 27 in the questionnaire (in %)

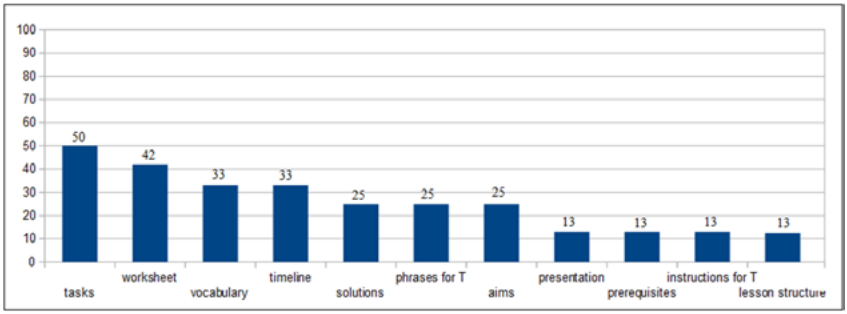

Fig 2.: Items identified in the open-question survey (in %)

The comparison shows that there were two items selected in the online questionnaire and omitted in the open-question survey: Links, and Scaffolding techniques. We attribute the fact of links missing from the second survey to the fact that it was done in pen and paper and thus online resources were not such an obvious choice, and we do not attribute any significant relevance to this omission. On the other hand, since scaffolding is one of the CLIL methodology aspects, we find its omission in students' open answers alarming. We attribute it to the fact that the term „scaffolding" and the concept itself are new to the students. Nonetheless, it is something that should be dealt with when adapting the CLIL course.

In the open-question survey, three features arose that did not rank top ten in the questionnaires. The students called for the explicit formulation of the phrases that the teacher is supposed to use during the lesson (13% in the online questionnaire). We are convinced that the realization of own linguistic competence limitations is the key factor in this choice; perhaps the students chose a more subjective perspective during the second survey. They mentioned a ready-made presentantion, which amounted to only 8% in the online questionnaire, and explicit formulation of the dual aims of the lesson, which achieved 13% in the online survey. Again, we suggest to complement the two approaches with interviews with the respondents.

The students consistently see the tasks and a ready-made worksheet as the most useful features; there is no pattern in the following items.

Further on, we shall discuss the results we obtained from the comparison of the features that appeared in the surveys, and those featured in the lesson plans. We reviewed the

lesson plans specifically for thirteen items: the eleven items identified in the open-question survey (we selected this survey as the starting point of the comparison since it provided us with a more condensed view; furthermore, all of the items from this survey were present in the questionnaire and identifiable in the lesson plans), and the two top-ten-ranking items from the questionnaire results: Scaffolding, and Links (see full wording of the categories above).

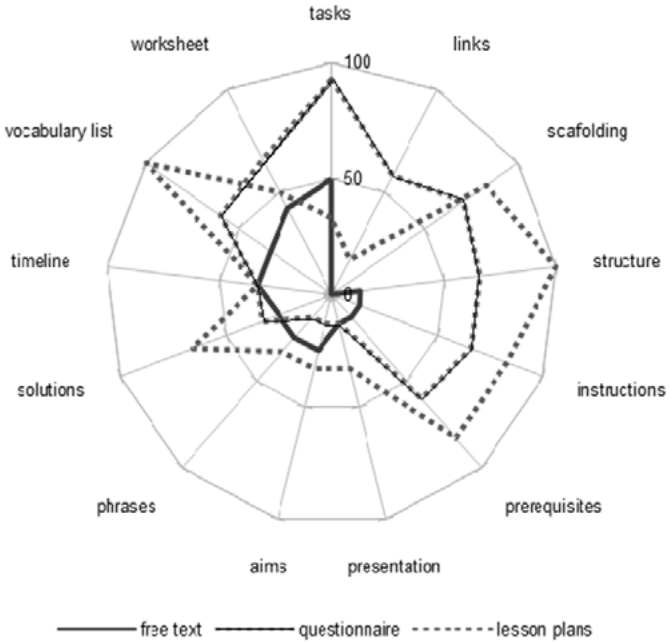

Fig 3.: Occurence of items in the surveys and the lesson plans compared (in %)

The students were specifically asked to design the plans for the purpose of sharing them within the CLIL community. Given this instruction, we expected the items featured in the lesson plans to at least partially reflect the claims in the questionnaires. The net diagram below illustrates the percentage to which the individual items amounted, in both surveys and the lesson plans.

We can see that in some instances there is correspondence between the perception proclaimed in the questionnaire and actual appearence in the lesson plans. Nevertheless, in other items there is wide discrepancy between the theoretically proclaimed perception of usefulness and actual appearance in the plans.

The data from the lesson plans are particularly optimistic in case of scaffolding: even though scaffolding did not arise as a spontaneous reply in the survey, there is evidence of most of the students consciously scaffolding their CLIL activities in their lesson plans. All in all, attention needs to be paid to this aspect when updating the course design for next academic year.

On the contrary, dual aims both ranked low in the surveys and are seldom featured in students' lesson plan. This phenomenon prompts serious reconsiderations for the CLIL

course design adaptation, since the duality of aims is a key concept for successful CLIL implementation.

There is another pool of data to consider. When asked to identify the most problematic or risky apects of using a shared lesson plan, the students mentioned the following items:

- language mistakes,
- localization inconsistence,
- missing aims,
- missing prerequisites,
- missing timeline,
- lack of visual support,
- lack of translation to L1,
- lack of translation to L2,
- unrealistic tasks,
- lack of a ready-made worksheet,
- inadequate difficulty of mathematical tasks,
- lack of an introductory overview of the lesson,
- disorganized vocabulary list.

While some of these items mirror the demands proclaimed in the surveys (such as prerequisites, timeline, visual support, worksheet etc.), there are three more areas that are identifiable in a lesson plan: one being the language-switching aspect (that is, which parts of the plan are in L1/L2 and whether the author provides translation), the other two of evaluative character: language mistakes and localization issues, and problems with the content aspect of the tasks presented. This triggered an important shift for the CLIL lesson plan descriptive tool that is being created: after the collection of both closed-reply and open-ended question questionnaires, and based also on the reflection of the students' lesson plans, the categories in the descriptive tool were extended to include a more detailed view of the mathematical tasks elaboration in the plans, the language employed, and two evaluative categories, which focus on linguistic accuracy and adequacy.

Conclusion

In the era of immense possibilities of digital sharing, there is a need for reflecting on the limitations of shared materials. Within the context of Content and Language Integrated Learning, this paper focuses on the usefulness of shared lesson plans, as perceived by mathematics teacher-trainees at the end of their CLIL methodology training. Data obtained from two complementary surveys were compared to the hard evidence from trainees' lesson plans, and related to CLIL theory and methodology.

The data provided by this survey helped to adapt the descriptive tool to cater not only to the perceived benefits of the lesson plans, but to the pitfalls, too. Immediate future steps within a wider research project include applying the tool to the rest of the teacher-trainees' lesson plans, looking for trends, and verifying the tool for use with experienced teachers, who underwent some type of CLIL training.

The implications for future CLIL teacher training are that while the actual lesson plans complied with most of the key aspects of CLIL and saw the students employ numerous CLIL strategies and techniques (and thus confirming that the main aim of the methodological course was accomplished), the importance of dual aims in CLIL provisions needs to be put forward on both theoretical and practical level.

The comparison showed that the trainees perception of useful items in a shared lesson plan does not reflect in their own plans intended for sharing; however, the sample on

which this comparison was made is so limited that it would be untimely to draw any final conclusions. Even if it might be tempting to explain the discrepancies by the lack of respondents' teaching practice, such a view would be simplicistic. Further data need to be analyzed, especially input by further trainees, and by experienced teachers.

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FEED BACK IN THE EDUCATION DEVELOPMENT PROGRAMME

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Abstract

The paper is engaged in description of education development programme and using the TOPSIS method and the output oriented DEA model for feed-back. The case study stated in the paper is a part of a commercial firm's performed order. The solution stated therein had a positive impact on the course of education development programme and brought to the firm a competitive advantage. The education development programme is defined in form of a development centre, training blocks and a closing certification of participants. Both the development centre and the certification were targeted on an input and output analysis. Obtained data on the participants were used to make calculations in the DEA model and by the TOPSIS method. Achieved results enabled to split the participants group better and to evaluate the education programme from the efficiency point of view in a better way.

Keywords

DEA model, development centre, feed-back, education programme, TOPSIS method

Introduction

A long-term and favourable effect with an education process can be achieved only if education process is continual and provided a feed-back. Wiener (1948) has defined and implemented basic element and principle of management as well as feed-back. Feed-back has been crucial (Armstrong, 2006) for the Human Resource Management (HRM). A repeated and efficient application of the feed-back evokes any effectiveness growth. The process which would allow to operate effectively and to measure the efficiency of education of adults, i.e. life-long learning is described by e.g. Kolman (2008) or Vnoučková (2013). Kolman (2008) states that feed-back at providing education or selecting talented employees/ students is practicable thanks to implementation of procedural knowledge. Kolman (2008) describes the procedural knowledge by help of K-maps and proposes it on the base of education process: 'Trust, interest and goodwill - step-wise teaching/learning - implementing and testing knowledge - personal development and growth - development and establishment of new knowledge'. The described procedural knowledge for the purpose of selection of talents has got following components: a selection procedure; selection outsourcing; development; decision procedure. Education, development and talent hunting programmes in order to obtain feed-back have introduced quantification of input for the assessment/selection part and quantification of output for the development part. While Vnoučková (2013) links the human resource management with measuring of efficiency directly and uses quantitative approaches. Vnoučková (2013) takes for the key factor of organizational efficiency: employee education, talent management and the necessity to retain skilled employees. Without any quantification and repeated measuring the sustainable development of human resources isn't feasible.

Feed-back and appropriate quantification thereof happens if the education process is structuralized in a suitable way. Structure and progress of the education process are described by Staňková and Drdla (2012) who, further on, compare the efficiency of education programmes and tools thereof in commercial sphere. A diverse process, the process of human resource development, is being described by Sorasak et al. (2014) in real practice of the Thailand Manufacturing Industry. Again the quantified feed-back is emphasized here, without which it would be impossible to carry out the controlled company development from the human resource point of view. The objective of the paper is to present a new way of using mathematical methods in such a branch as personal development. The combination of mathematic models in HR management is very rare but on the other hand it can bring interesting result.

Materials and Methods

Human Resource Management

Since 19th century the Human Resource Management (HRM) whose title wasn't used primarily at all passed through a large evolution gradually. The HRM was arisen from scientific management at the beginning of 20th century whose representatives are Frederick Winslow Taylor and Henri Fayol. Later, the approach of purely scientific management was relinquished step by step. Firm's objective hasn't been only aimed at the productivity that can be reached by a standardized approach to work however it shall be moved towards satisfied employees.

Armstrong (2006) or Mathis and Jackson (2008) state that the HRM is a strategic and logically sophisticated approach to management, who are working in the company and participate in the company goals either individually or collectively. At present, an integration of strategy for HRM development within the whole company strategy is implemented. The development of people in the company is treated actively and every partial company strategy is penetrated by the HRM.

Assessment and Development Centre

According to Hroník (2002), methods of both the assessment centre (AC) and the development centre (DC) are used in large extent nowadays. Though both titles are often mistaken one for another there is a principal difference between those approaches. The assessment centre is a method that helps with selection of new employees. The development centre helps with identification of any development needs for the existing staff.

Within the assessment and development centres two methods are basically used, i.e. group and individual trainings completed by psycho-diagnostic tests. Thanks to the well set measuring of development potential in the subsequent development plan, it is possible to make use of various teaching methods. The most frequent ones are group trainings, workshops, individual consultations as well as various on-job methods supporting an easier implementation of gained knowledge in practice.

System of Mg Consulting s.r.o. development programme

The company Mg Consulting s.r.o. was founded by executive directresses Martina Jandečková and Magdaléna Prunerová in the Czech Republic in 2008. Since the very beginning, the company has been engaged in education and consultancy activities in the human resource range. Its predominant clients are national and international companies. For its education and consultancy activity the company uses development programmes

that are structured as follows:

1. Development Centre - The development centre provides benefit of any findings of the level of assessed competencies of each development programme participant. Pursuant to outputs from the development centre a more precise content specification of particular training blocks happens. The content thereof will be all the more focussed on the participants' weaknesses and development points. The development centre acts as an input analysis here. Aggregate indicators of a participant being in the development programme are monitored e. g.: communication, target orientation and a customer orientation.
2. Workshop and training blocks - The workshop sense is to get ready the participants for the development programme system in which they won't be only passive attendants however they will be actively involved in, e.g. in form of exercises, case studies and homework. Any contents and orientation of particular training blocks are adequately focussed on abilities, knowledge and skills that were shown in the development centre as weaknesses. The trainings provide the participants the chance for their knowledge evolution and progress. Individual training blocks of the development programme go ahead in the same way, simulate the participants their work load, assignment and elemental operations.
3. Certification of the participants - The development programme conclusion is finalized by the participants' certification. This is an analogy of the development centre when the same competencies are assessed for the second time. The participants' certification as an output analysis is aimed at practised topics from past training blocks. There is again a team of internal and external reviewers engaged in the certification. The certification benefit represents again the data on participants evidencing a change. Herewith a comprehensive file of input and output data is obtained concerning each participant of the development programme.

A case study was carried out with an order of the company Mg Consulting s.r.o. Subject matter of the case study was evaluation of development programmes in the automotive area. The programme was running in three waves in between 2010 and 2012. All waves as components of the development programme structure and contents of the individual trainings were compiled identically and different participants took part in each wave. The total participant number was 49 (6 women and 43 men) in all three waves.

Multi-criterion analysis of variants - the TOPSIS method

The Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) method evaluates any variants in a file according to their relative distance from the ideal variety and the nadir one. Varieties in a file may be also job seekers or existing employees who are going to be assessed. At using the TOPSIS method it has to be calculated a standardized criterion matrix first. Then a standardized weighted criterion matrix will be calculated thereof. For the standardized weighted criterion matrix there is a distance calculation of individual variants from the ideal and nadir ones, as stated below:

where w_{ij} is a value of standardized weighted criterion matrix, h_j is a value of ideal variant of the given characteristic, d_i^+ is a value of distance between the variants and ideal variant.

$$d_i^+ = \sqrt{\sum_{j=1}^{k} \left(w_j - h_j\right)^2}$$
$$k = 1, 2, ..., n \quad (1)$$
$$i = 1, 2, ..., m$$
$$j = 1, 2, ..., n$$

$$d_i^- = \sqrt{\sum_{j=1}^{k} \left(w_j - d_j\right)^2} \quad (2)$$

where w_{ij} is a value of standardized weighted criterion matrix, d_j is a value of nadir variant of the given characteristic, d_i^- is a value of distance between the variants and nadir variant.

The resulting value, according to which the rank of particular variants, the relative distance indicator shall be set, is calculated as follows:

$$c_i = \frac{d_i^-}{d_i^+ + d_i^-} \quad (3)$$

where c_i is value of relative distance measurement.

Based on the value of relative distance indicator, particular variants shall be ranked from the highest to the lowest one. Hereby the rank of employee selection or assessment may be obtained.

Efficiency Evaluation - Data Envelopment Analysis Method

Data Envelopment Analysis (DEA) serves for evaluation of units against the best unit. The DEA is a non-linear programming model for the estimation of an efficiency of units, based on the relationship between multiple outputs and multiple inputs. The DEA measures of an efficiency of any Decision-making unit (DMU) is obtained as the maximum of a ratio of weighted outputs to weighted inputs, subject to the condition that the similar ratio for every units is less than or equal to 1. The simplest DEA model assumes constant returns to scale; this model is called the CCR model, according to its authors, Charnes, Cooper, and Rhodes (1978). DEA models were used in education for example in Flégl et al. (2013). Output orientated model is:

$$\Phi_H = \sum_{i=1}^{n} v_{iH} x_{iH} \rightarrow MIN \quad (4)$$

Subject to:

$$\sum_{j=1}^{n} u_{jH} y_{jH} = 1 \quad (5)$$

$$\sum_{i=1}^{m} v_{iH} x_{ik} - \sum_{j=1}^{n} u_{jH} y_{jk} \geq 0, \mathrm{k} = 1, 2, ..., \mathrm{p}$$
$$u_{jH} \geq 0, \mathrm{j} = 1, 2, ..., \mathrm{n} \quad (6)$$
$$v_{iH} \geq 0, i = 1, 2, ..., m$$

where Φ_H is efficiency score of the DMU_H, x_{iH} is the *i-th* input of the DMU_H, y_{jH} is the *j-th* output of the DMU_H, v_{iH} is a weight assigned to the input x_{iH}, u_{jH} is a weight assigned to the output y_{jH}.

The relative efficiencies of the output orientated DEA model generally show how much an output must increase to achieve the efficient level. The DEA model may be used to differentiate groups of employees according to efficiency. The DEA model with employees, who were designated as inefficient, offers a specific recommendation for improvement and correction/remedy further on.

Results and Discussion

For purposes of this paper, results of only 2nd wave of the development programme are displayed below i.e. the most attended by participants (1st and 3rd waves are not mentioned in this paper due to the limited space). The results are stated illustratively to demonstrate procedures and benefits. The second wave was running in the period from 11/2011 to 06/2012 with participant number 21. The obtained data on participants in the development centre (DC) and at the participant certification (certification) are shown in Table 1. Data was used in TOPSIS and DEA model.

	DC / INPUTS			Certification / OUTPUTS			Difference		
	TO	C	CO	TO	C	CO	TO	C	CO
IIP1	3	3	2	3	4	3	0	1	1
IIP2	3	4	3	4	5	3	1	1	0
IIP3	2	2	2	3	2	3	1	0	1
IIP4	4	4	4	4	4	4	0	0	0
IIP5	4	2	3	4	3	3	0	1	0
IIP6	1	1	2	3	3	3	2	2	1
IIP7	2	2	0	3	3	3	1	1	3
IIP8	2	2	2	2	1	1	0	-1	-1
IIP9	2	3	3	2	2	2	0	-1	-1
IIP10	2	2	2	3	3	3	1	1	1
IIP11	2	2	1	3	3	3	1	1	2
IIP12	3	3	3	4	4	3	1	1	0
IIP13	4	4	3	4	5	5	0	1	2
IIP14	4	3	3	4	3	4	0	0	1
IIP15	4	4	4	5	4	5	1	0	1
IIP16	3	3	2	4	3	3	1	0	1
IIP17	3	4	4	3	3	3	0	-1	-1
IIP18	1	2	1	3	3	3	2	1	2

Tab. 1: Input and output data on participants of the development programme

During the development centre as well as the certification three competencies were assessed – target orientation (TO), communication (C) and customer orientation (CO). The values for each competence are chosen from the Mg Consulting s.r.o. internal 0-5 scale: where 0 is unacceptable performance and 5 represents absolutely excellent performance. The same scale was used during the development centre and the certification.

First, the TOPSIS method was used for the data from the development centre (column 1 to 3 of table 1) and then for the data from the certification (column 4 to 6 of table 1). Weights of all three competencies were the same (1/3) according to the client's decision for whom all of them had the same importance. A couple of relative distances from ideal

and nadir variant in the given data file was gained with each participant. Difference of those distances (see Table 2) sets a participant's progress from the development centre to the certification and an impact of performed training blocks and workshop.
Further, the output oriented DEA model was used to calculate the participants' efficiencies in the development programme. In this case, the CCR model was used for result calculations. The reason was an assumption that all the participants went through the same development program and they had the same conditions for personal development, so the results should increase in a constant way. Inputs for DEA model represent an evaluation of each participant during the development centre. Abbreviations of the DMU were created because it was not possible to use participants' names. In front of *P* that represent Participant is the number of the wave (2 in this case). After *P* comes the number of the participant in the selected wave. Data from the development centre (column 1 to 3 of table 1) were marked as the inputs and data from the certification (column 4 to 6 of table 1) were marked as the outputs. The obtained efficiency rates are shown in Table 2.

		TOPSIS method results (difference of relative indicators Distance between DC and Certification)	**Model DEA result** (efficiency rate)
IIP20	improvement	0.231	Efficient (1)
IIP7		0.224	Efficient (1)
IIP18		0.216	Efficient (1)
IIP11		0.131	Inefficient (1.5)
IIP6		0.071	Efficient (1)
IIP16		0.02	Inefficient (1.9)
IIP1		0.003	Inefficient (1.9)
IIP10	Impairment	-0.02	Inefficient (2)
IIP13		-0.037	Inefficient (2.1)
IIP3		-0.055	Inefficient (2)
IIP19		-0.055	Inefficient (2)
IIP2		-0.085	Inefficient (1.8)
IIP15		-0.09	Inefficient (2.4)
IIP12		-0.096	Inefficient (2.2)
IIP14		-0.135	Inefficient (2.3)
IIP21		-0.162	Inefficient (2)
IIP5		-0.185	Inefficient (1.5)
IIP4		-0.295	Inefficient (3)
IIP17		-0.407	Inefficient (3)
IIP9		-0.426	Inefficient (3)

Tab. 2: Result comparison of the TOPSIS method and the DEA model

In the 2nd wave, those became efficient whose difference between DC and Certification achieved in total evaluation at least 5 points (see Table 1). For example, participant IIP11 gained only 4 points and falls according to the DEA model results among inefficient units. The results of TOPSIS method can be added at valuation of the development programme fruitfulness by the DEA model results. Using both approaches the participant group can be divided in three groups (see Table 2): efficient improvement (4 participants, marked in grey, above the line), inefficient improvement (3 participants, unmarked, above the line), and inefficient impairment (14 participants, under the line). For example: Unit IIP10 improved, but is inefficient (see Table 1), because the improvement is insufficient comparing the other participants.
The benefit of this approach is the identification of 'inefficient improvement' group, i.e. those who obtained insufficient improvement. Therefore, the client can focus on a further

development of this group, i.e. it is still suitable to work on in order to develop their competencies and skills. The identical approach was applied in the 1st and 3rd waves as well. The company Mg Consulting s.r.o. obtained herewith a competitive advantage in the market of consultancy and educational services.

Conclusion

It was the objective of the paper and case study to set who of the participants became efficient or inefficient and who of them got better or worse in particular waves of the development education programme. The set goal was reached by using the system of the Mg Consulting s.r.o. development programme within which the input and output data on participants were gained and by applying the TOPSIS method and DEA model. The combination of using the both mathematic approaches became a very strong argument at feed-back and evaluation of the development programme against customers.

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PROPERTIES OF PROBLEM SOLVING STRATEGIES

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Abstract

The paper describes fundamental properties of eleven selected heuristic strategies and shows how these can affect the ability to master these strategies. We defined five fundamental properties of discussed heuristic strategies: the demands on knowledge prerequisite to the use of the strategy, the demands on experience prerequisite to the use of the strategy, the possibility of teaching the strategy to pupils by repetition and drill, the potential risk of misuse of the strategy and the success rate of the use of the strategy. For each strategy we assigned degree of above-mentioned properties. This evaluation has been verified by research within an experiment, in which ca 250 pupils and 12 elementary as well as secondary school teachers in the Czech Republic took place.

Keywords

Heuristic strategies, problem solving, characteristics, mathematics education, lower and upper secondary school education

Introduction

This paper describes one partial outcome of work on solution of the project Development of culture of problem solving in mathematics in Czech schools.

It is a universally accepted truth that problem solving forms the basis for successful mathematics education. Solution of carefully selected problems helps to develop, refine and cultivate creativity (Kopka, 2010, Foreword).

"In traditional conception of school mathematics teachers use problems mostly as tools for testing, helping the teacher to classify the pupils to those who "have grasped" the subject matter and who have failed. In consequence pupils predominantly perceive problems as tools for assessment." (Brousseau and Novotná, 2008). But problem solving is an indicator of the state of comprehension of concepts that pupils are taught. They help their solvers realize what former knowledge is applicable in the new situation, what role this knowledge plays in it, what knowledge turns out to be useless or even erroneous and becomes an obstacle to further development of mathematical knowledge and pupils' skills.

The existing work focusing on the culture of problem solving can be divided into three groups. The first stream is constituted by works whose aim is description of pupils' attitude to problems and problem solving in dependence on different variables influencing these attitudes (Nesher, Hershkovitz and Novotná, 2003). The second group is formed by works whose goal is to bring about change in these attitudes by various methods; the consequence should be a change in the culture of problem solving both in case of an individual and in case of groups of pupils, and build-up of pupils' motivation to problem solving (Bureš and Hrabáková, 2008; Bureš and Nováková, 2010; Bureš, Nováková and Novotná, 2010; Bureš, Novotná and Tichá, 2009). The third trend encompasses works

focusing on complex projects in problem solving, such as clusters of problems (Kopka, 2010; Bureš, 2010), mathematics rallies (Brousseau, 2001; Růžičková and Novotná, 2010). Within the frame of these complex projects pupils work with sets of problems, solve them individually and in groups and then swap their experience and knowledge from the solving process and discuss it.

In our research we focus on a number of different aspects that influence problem solving in mathematics. One of these aspects is the "inner structure" of a heuristic strategy. This structure is made of several properties. We explore the relationship between these properties and a pupil's problem solving process.

There are three perspectives from which active problem solving can be viewed.

Fig. 1: Ways of problem solving

The first way is referred to as **trial.** It is the most primitive way of dealing with a problem. The only thing prerequisite is a solver's external motivation. The solver does not ask himself/herself whether the problem was solved correctly. His/her only aim is to "solve the problem".

The second way is referred to as **direct way** and is based on application of learnt knowledge. The pupil is familiar with the required solving procedure, is aware it must be used in the situation and applies it.

The third way is called **solution using a heuristic strategy**. This solving procedure arisesin the situation when the pupil does not have the needed knowledge or has it only on the level of isolated pieces of knowledge. Either the pupil is motivated to solving the problem or has internalized external motivation and wants to solve the problem either with objective or subjective feedback on correctness of the solution.

Polya (1973) lists a number of strategies out of which we chose those strategies we find useful in mathematics education at lower and upper secondary school level. We modified a number of these strategies. The result of our work is analysed in the following text.

Heuristic strategies

Guess – check – revise – is one of experimental strategies. The principle of this strategy is drawing nearer and nearer to the solution. In the first attempt, the solver makes a random choice. In the second step he/she checks whether the original guess was correct or considers how wrong he/she was. In the third step he/she revises, corrects, which generates a new guess. The whole process starts from the beginning. The objective is to reach the goal, using a finite number of guided iterations.

Systematic experimentation – is another experimental strategy. The principle of this strategy is the process of drawing nearer and nearer to the solution. The solver starts by selecting some value (either the first possible or some closer to the solution) and then works systematically. After each carried out experiment the solver checks whether the result is the sought solution. If not, he/she continues. The value for the next experiment depends on a given order (not the solver's decision). This strategy is based on the fact that the solver is aware that the sought solution is in a chain of values with an underlying

system and if this chain is gone through, the solution will be discovered. In this case the solver often uses information technology.

Use of false assumption – is another experimental strategy. The solver estimates the result but is aware it is probably wrong (false). He/she checks the result to verify that his/her value meets the conditions of the assignment but also to see how far it is from the required value. Or, strictly speaking how many times the required value is different from the gained value. Based on this discovery the solver corrects the expected result. What is important is the nature of this correction, which must be based on a calculation leading to the right result. This strategy is suitable for problems of linear nature.

Working backward – a very frequently used strategy in mathematics when we know the final state, the initial state and try to proceed from the end to the beginning. To solve the problem we turn the found solution round. The strategy is well applicable in geometry construction problems. A specific type of these are problems in which we know the way (e.g. arithmetical operations) and final state and our task is to find the initial state. These problems are based on discovery of operations inverse to operations assigned. In our view it is a "pseudo" way back.

Introduction of an auxiliary element – the basic idea of this strategy is that introduction of an auxiliary element makes the solution much more easily accessible to the solver. We define an auxiliary element as an object which is not included in the problem assignment originally. We insert it into the problem with the hope it will make the solving procedure easier.

Generalization and specification – the basic idea of this strategy is based on the fact that in some type of problems it is better to focus on a more general case than is presented in the assignment. Simplification by generalization can be used in numerically demanding problems. Generalization can also offer better insight into the studied issue. Having solved the generalized case we select more specific values in such a way they meet the criteria of the original assignment.

Specification and generalization – the basic idea of this strategy is based on the following: if we have a problem assigned with parameters, or indefinitely, in the first stage we choose a specific value or position, or we select a specific case. In some cases this will have to be repeated several times. Either because the solver is not convinced about arbitrariness of his/her selection of a particular value or because he/she does not grasp the idea of the solution after only one selection. In the second stage the solver returns to the original problem by generalizing the gained results. We do not generalize the problem but the obtained results.

Analogy – use of this strategy is based on the fact that solution of a problem "analogical" to the original problem is simpler. The solver "discovers" the way to (method of) solution and then applies it on the original problem. The principle of this strategy is that the solver poses this analogical problem on his/her own. This is usually done by substituting objects in the problem by other objects (more "user-friendly") but leaving the context of the assignment.

Problem reformulation – the basic idea of this strategy is based on "translation" of the problem into another problem. This translation can be done through a change of the context, substitution of objects or by mathematizing the problem in an innovative way. Having solved the reformulated problem, the solver has a result which is at the same time solution to the original problem. The act of reformulation is the solver's initiative.

Decomposition into simpler cases – the basic idea of the strategy is based on decomposition of the assigned problem into several simpler cases that we solve one by

one. If we then connect all the solved simpler problems, we get solution to the original difficult problem.

Omitting a condition – the basic idea if this strategy is based on presupposition that we are able to distinguish different "limiting" conditions. If we are not able to meet all the conditions from the assignment at once, we can ask, similarly to Zeitz (2007): "What is it that makes this problem so difficult?". If we are able to pinpoint the initial condition that makes it so hard, we can omit it. If we are able to solve thus simplified problem, we can return to the omitted condition later and can try to finish solving the problem.

Materials and Methods

The results presented in this paper are based on findings from experiments conducted in 2012 – 2014 on 12 lower and upper secondary schools in the Czech Republic. The aim of the experiment was to develop problems and pilot them at schools and study their potential to change culture of pupils' problem solving using heuristic strategies. There were two different experiments: a short term experiment (4 months) and a long term experiment (17 months). In these periods pupils were introduced to the above described heuristic strategies with the aim of being taught how to use these strategies when solving mathematics problems.

During the experiments the teachers presented to their pupils and students prepared problems that could be solved efficiently using the above described heuristic strategies. Very often the problems were such that the use of one of the strategies results in a faster, more efficient or elegant solution to the given problem.

The teachers kept an updated record of spontaneous use of any of the discussed strategies by their pupils and noted their reactions to the expected solution reached with the help of this heuristic strategy. Problem solving always had a constructive form. There was always a pupil or a student who demonstrated their solving procedure and explained it to others . The teachers encouraged their pupils to search for more solving procedures. This approach to solving was used both in cases of problems from the lessons targeted at the current subject matter and in cases of short problems used as warm-up activities in the beginnings of lessons.

There were 252 pupils and students and 12 lower and upper secondary school teachers from Northern Bohemian Region and Prague involved in the experiment (for details see e.g. (Novotná et al, 2013), (Břehovský et al, 2013)).

Age characteristics of pupils and students (at the begining of the experiments):

- 13 years of age – 138
- 15 years of age – 62
- 17 years of age – 52

The gender of the pupils was not taken into account. No specialized classes were involved in the experiment (e.g. schools with extra mathematics or language lessons).

This paper is based on analysis of:

- pupils' tests and written production
- transcripts of interviews with pupils
- ideas of participating teachers

Within the frame of this experiment we defined five properties of strategies (described below) and tried to state the degree or level of this property. In some cases the classification is based on results of other already published research. E.g. use of the strategy Analogy is described by Silver (1981, p.55) as follows: "Exploiting related problems is much more complex than it first appeals". The strategy Systematic experimentation is described by

Elia, van den Heuvel-Panhuizen and Kolovou (2009) as having a lot of potential to lead to success. Stacey (1991) characterizes the strategy Guess – check – revise as an intuitive strategy that can be used by anybody. However, in most cases the statement of the degree or level of a property was based on our estimation. The table was later amended with respect to findings from the experiment. Conclusions follow in the last part of the paper.

Results and Discussion

Properties of heuristic strategies

As stated above, the following properties of heuristic strategies were defined.

The demands on knowledge prerequisite to the use of the strategy – the degree of this property describes how much knowledge is prerequisite to successful use of this strategy. (Knowledge is what the solver learns intentionally, experience is acquired.) It is not only knowledge from the area of the problem, but knowledge in general. Higher degree of knowledge allows the solver to use strategies such as Analogy or Problem Reformulation.

The demands on experience prerequisite to the use of the strategy – as mentioned above, experience is gained through practice. In our case this experience may be positive and negative. A higher value means the solver needs more experience in order to use the strategy successfully. This property includes strategies as well as methods, namely graphical.

The possibility of teaching the strategy to pupils by repetition and drill – the values give the chance of success of teaching the strategy by regular repetition or drill. This is typical for algorithmic strategies such as Guess – Check – Revise or Systematic experimentation, but also Working backward. The advantage is a certain level of automatization of the solving procedure that usually leads to success.

The potential risk of misuse of the strategy– the value describes the risk of misuse of a strategy, i.e. using it to solve a problem where it is not applicable. This risk is very low for some strategies, especially algorithmic strategies, because regular repetition does not only increase the ability to apply a selected strategy but also to discern whether it is possible to solve the problem using the selected strategy (Use of false assumption). The risk cannot be stated in relation to an individual solver (it is different for everybody). The value should give the "absolute" level of the risk of misuse.

The success rate of the use of the strategy– the scale describes probability of finding the correct solution if the strategy is not misused (see above). I.e. if the solver uses the right strategy, what danger is there he/she will not reach the right solution. E.g. strategies Guess – Check – Revise have high success rate in contrast to e.g. Problem reformulation.

The table below shows results of our work. The values given in the table have been reached by iterative procedure from the originally estimated values. This procedure was based on discussion in the research team using experience and knowledge gained from pupils' written production and from interviews with participating pupils and teachers.

The numbers state the degree of the given property. Key numbers are:

1 ... little, least;
3 ... average;
5 ... much, most.

Example: Guess – Check – Revise: little knowledge, little experience are needed to learn the strategy, the risk of its misuse is low, it can be taught by repeating easily and success rate of the strategy if used at the right moment is very high.

	Knowledge	Experience	Learn by repeating	Misuse of strategy	Success rate
Analogy	3	3	4	3	4
Working backward	2	3	4	3	4
Guess – Check – Revise	1	1	5	1	5
Problem reformulation	5	5	1	5	4
Decomposition to simpler cases	3	4	3	2	4
Systematic experimentation	1	2	5	1	5
Use of false assumption	2	2	5	2	5
Omitting a condition	3	3	2	4	4
Auxiliary elements	3	4	2	1	5
Generalization and specification	5	4	2	1	5
Specification and generalization	3	3	3	2	4

Tab. 1: Rating of properties

In the beginning we described each value for each property of strategy and what it means for us. For example – Analogy, property: knowledge: 1 – no knowledge is required (common sense suffice), 3 – required knowledge corresponds with age and pupil´s ability, 5 – required knowledge is specific or refers to other areas).

After obtaining data from our respondents (pupils' tests), we worked out comparative analysis of the expected and factual values for each property of strategy. We performed interviews with selected pupils and teachers (transcripts of interviews with pupils and teachers) afterwards. We made changes of values compared them with our experience.

For example – Analogy is the most divergent from our assumption (3 – 4 – 3 – 4 – 3). The changes made are based on the analysis of pupils' tests and written production, transcripts of interviews with pupils and teachers and our own experience.

Conclusion

The paper presents partial results that were confirmed by experiments based on pupils' tests and written production and on interviews with pupils and teachers.

1. Strategies based on experimenting, i.e. Guess – Check – Revise, Systematic experimentation and Use of false assumption can, in comparison to other strategies, be mastered more easily by repetition and do not require much prerequisite knowledge and experience. At the same time they have the highest success rate.
2. Strategies that require much knowledge and experience, i.e. Problem reformulation and

Generalization and specification, are hard to be learnt by repetition.
3. The strategy Problem reformulation seems to be the most difficult. The amount of prerequisite knowledge and experience and the risk of its misuse are largest. The chance to teach the strategy is minimal. However, the success rate is very high.
4. The strategy Analogy, Working backward, Decomposition into simpler cases, Omitting a condition, Introduction of an auxiliary element and Specification and generalization are comparable as far as the amount of prerequisite knowledge and experience and chance to learn the strategy by repetition are concerned.
5. When compared to other strategies, strategies Problem reformulation, Analogy and Omitting a condition bear a high risk of misuse.
6. In contrast, strategies Generalization and specification, Introduction of an auxiliary element, Systematic experimenting, Guess-check-revise bear minimal risk of misuse.
The description and overview presented in this paper show educators and teachers how these strategies differ and how they are related and form groups. It makes no sense e.g. to present strategies requiring a lot of prerequisite knowledge and experience to younger children. The nature and characteristics of strategies presented in the paper will allow teachers to make thought-out decisions about how and when to include them in lessons. The original aim of inquiring into this aspect was to state the relationship between type of pupil and a selected strategy. This involves grasping a strategy, mastering the strategy and ability to use it successfully. By now we have succeeded in defining relationships between strategies and a group of pupils globally. We will now focus on a more refined classification of strategies with respect to different types of pupils according to Myers-Briggs Type Indicator (Miková and Stang, 2010).

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RESEARCH FINDINGS ON TEACHERS OF INFORMATICS SUBJECTS IN ELEMENTARY SCHOOLS

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Abstract

The paper briefly reports on the concept, application and results of the survey for teachers of informatics subjects used as one of the research methods within the "Children's Information Technology Competencies and Their Development in Primary and Lower-secondary Schools" research project. The research project focused on a complex issue of curricular, process and organisational aspects of informatics, or information technology education. The project ran in more than 1000 primary and lower-secondary schools in the Czech Republic in 2013. The questionnaire method was applied in the final phase of the project. Electronic questionnaire was given to those interested in broader participation in the research in 167 schools. The questionnaire consisted of nine questions in five fields. The questionnaire was completed by 84 teachers of informatics subjects, who expressed their experience and opinions on the development of pupils' information technology competencies in primary and lower-secondary schools.

Keywords

Education, ICT literacy education, pupil's ICT skills, development of ICT competencies

Introduction

Among key competencies seen as a specific combination of knowledge, skills and attitudes, which people should acquire for their personal fulfilment and development, active citizenship, social cohesion and working life (European Parliament and the Council, 2006), information technology competencies have a significant place and are a foundation for broadly understood information, or information technology literacy (Ala-Mutka, et al, 2008; Anderson, 2008; European Commission, 2010).

Within formal and initial education, primary and lower-secondary schools have undoubtedly a particularly significant role in providing information technology education and targeted development of information technology competencies, or individual cognitive and operational skills and attitudes necessary for the effective use of information and communication technologies. Informatics or information technology education as a standard part of the primary and lower-secondary school curriculum is a feature of school systems of developed countries (Ala-Mutka, 2011).

However, the approach to teaching thereof is not uniform. On the one hand, there is a wide range of approaches characterized by reducing informatics education to practising the use of specific software tools mainly for searching and processing text information; on the other hand, there are approaches emphasizing the development of pupils' digital literacy, critical, creative and informatics thinking (Ferrari, 2012).

The above stated facts underline the importance of modern, competence-orientated information technology education provided within elementary education. Yet, they also stress the need for research activities seeking to explore the current state and approach of

the development of pupils' information technology competencies in primary and lower-secondary schools. In this context, in 2012 and 2013 researchers from the Faculty of Education, Charles University in Prague realized P407-12-1541 ''Pupils' Information Technology Competencies and Their Development in Primary and Lower-secondary Schools'', a research project supported by the Czech Science Foundation grant.

The research focused on the issue of informatics, or information technology education in Czech primary (ISCED 1) and lower-secondary (ISCED 2) schools and its target group included both the teachers of informatics subjects and their pupils. 1183 primary and lower-secondary schools from all regions of the Czech Republic joined the project through their teachers and pupils (Rambousek, Štípek, Wildová, 2012).

The issue of informatics, or information technology education in Czech primary and lower-secondary schools seen from the viewpoint of curricular, process and organisational aspects was the subject of the research activity within the project. Five main areas of interest representing key dimensions of a coherent survey were identified within the subject thus broadly defined. They were the following dimensions: characteristics of informatics educational activities, the content of educational activities, the current state and concept of the development of pupils' information technology competencies, the structure of teachers' ICT competencies and the implementation of information technology competencies development into the educational activities and school educational environment. The primary aim of the project was defined as the identification of the current state, structure and orientation of the development of pupils' information technology competencies in terms of building the level of their information technology literacy (Štípek, Rambousek, Procházka, 2013a; Štípek, Rambousek, Procházka, 2013b).

Material and Methods

During the project, within an extensive exploratory survey, both empirical quantitative and qualitative methods were used in addition to theoretical methods. The questionnaire method was used as a primary empirical research method. It was based on an interactive graphic questionnaire for teachers of informatics subjects, in which research data were obtained from 1183 teachers representing individual primary and lower-secondary schools.

The questionnaire for teachers included also an invitation to participate in the second empirical phase of the research based on a survey for teachers, a questionnaire for pupils and case studies. 167 teachers of informatics subjects, 52 % of whom were women, 48 % men, representing 167 primary and lower secondary schools accepted the invitation and registered into the system.

The interested teachers were consequently asked through an electronic mail to complete a survey available on the enclosed website address, in which they could express their opinions and experience with curricular, process and organisation aspects of information technology education and primary and lower secondary school pupils' information technology competencies development.

The survey included five thematic fields, three of which included sub-questions. There were all together nine questions in the survey:

The first thematic area focused on the evaluation of the approach of the Framework Educational Programme for Elementary Education (FEP EE) in the educational field of Information and Communication Technologies. It included two questions:

1.a) What is your assessment of the current FEP EE in the educational field of Information and Communication Technologies?

1.b) How would you modify this document in the given field?

The second thematic area of the survey focused on the findings as to how the respondents modified the educational field of Information and Communication Technologies when defining their School Educational Programme. It included one question:

2) How did you extend or modify the given field in your School Educational Programme, or what is specific in your SEP compared to the FEP EE approach?

The third thematic area of the survey sought to find out how the respondents perceive the compulsory informatics subject in terms of its inclusion in the school curriculum, mainly in terms of its time allocation. It included one question:

3) How do you perceive the compulsory informatics subject in terms of its inclusion and time allocation?

The fourth field of the survey focused on the evaluation of the results of information technology competencies development and on the definition of the conditions for successful educational impact. It included three questions:

4.a) How do you manage to achieve the goals and intentions of SEP in terms of building and developing pupils' information technology competencies and how do other subjects and school environment contribute to that?

4.b) What do you consider a necessary condition for achieving the goals and intentions of SEP in terms of building and developing pupils' information technology competencies?

4.c) What do you consider the main obstacle to achieving the goals and intentions of SEP in terms of building and developing pupils' information technology competencies?

The fifth thematic field focused on the methods and organisation of teaching informatics subjects. It included two questions:

5.a) What is the usual course of the lesson of the compulsory informatics subject from the viewpoint of teaching methods and organisation of education?

5.b) What has proved successful in developing pupils' information technology competencies and could provide an inspiration for others?

The survey was electronically assigned to the teachers interested in the participation in the second phase of the research, into which 167 schools registered. 84 teachers of informatics subjects (48 % women and 52 % men), which corresponds to a response rate of 50.3 %, expressed their opinions and experience concerning information technology education and the development of pupils' information technology competencies in primary and lower-secondary schools.

Within individual questions and sub-questions, the obtained qualitative data were prepared for the analysis by the reduction technique and highlighting the key words in the text. The data thus in-vivo coded were consequently analyzed through the method of cluster analysis, during which the respondents' statements were grouped by their similarity. In this phase of analysis, one respondent's answer could be evaluated as a source of more than one statement. In individual questions, the clusters of similar statements were identified covering the same opinion. The clusters of statements were categorized and given a provisional name. It was not possible to group all the statements, or respondents' answers. There were only a few of such answers, though.

The answers to individual questions, or sub-questions were divided into 4 to 6 clusters following the above described method. Each cluster can provide a number of respondents' statements (n_v) pointing at what is expressed by the given cluster. We may show n_v, the relative value, expressed percentually based on the total of all the statements of the given

question (sub-question). n_v value cannot be directly related to the significance of the given cluster compared to the others, though.

Results and Discussion

In the following parts, we present the results of the analysis of respondents' answers to the survey questions. In each question (sub-question) we show obtained clusters of statements given a provisional name and n_v value and its relative value (Rambousek et al, 2013).
In the answers to question 1.a) the following clusters of statements were indicated:

1.a1)	I am fine with it	$n_v = 25 = 41.7$ %
1.a2)	Appropriately general	$n_v = 6 = 10.0$ %
1.a3)	Too general	$n_v = 8 = 13.3$ %
1.a4)	Insufficient in content	$n_v = 14 = 23.3$ %
1.a5)	Insufficient in concept	$n_v = 7 = 11.7$ %

For sub-question 1.a) surprisingly a great number of respondents'' statements (41.7 %) in cluster 1.a1) expressed agreement with the concept and content of the document. Moreover, in the same sense 10 % of statements approve of the general (unrestrictive) concept of the document. Unlike the previous statements, 13.3 % of statements of cluster 1.a3) consider the document content as too general, brief and unclear. Besides, two more clusters of statements were formulated considering the concept of the document as insufficient. The first cluster 1.a4) (23.3 %) emphasizes the insufficient content of the document not reflecting the current state of ICT field and requirements for pupils' information technology competencies development. The statements of the second cluster 1.a5) (11.7 %) are even more critical and they find the whole concept of the document inadequate.
In the answers to 1.b) question the following clusters of statements were indicated:

1.b1)	Increase time allocation	nv = 17 = 27.4 %
1.b2)	Develop into standards	nv = 16 = 25.8 %
1.b3)	Content extension	nv = 14 = 22.6 %
1.b4)	Content innovation	nv = 9 = 14.5 %
1.b5)	No modifications	nv = 6 = 9.7 %

In relation to sub-question 1.b) the respondents' statements requiring the increase of the current time allocation appeared most often in cluster 1.b1) (27.4 %). The second biggest number of statements (25.8 %) in cluster 1.b2) suggest the content be better specified and elaborated into binding standards for individual thematic units. In the context with cluster 1.a4) 22.6 % of statements of cluster 1.b3) perceive the need to extend the document content primarily in the direction of algorithmic thinking development, basics of programming, mobile technologies, working in the cloud and technological support of the cooperation. 14.5 % of statements point out the necessity to innovate the current document content (1.b4) and 9.7 % do not require any modifications.

In the answers to 2) question the following clusters of statements were indicated:

2.1) Enriching the curriculum	$n_v = 32 = 39.0\ \%$
2.2) New topics	$n_v = 7 = 8.5\ \%$
2.3) More lessons	$n_v = 22 = 26.8\ \%$
2.4) More details	$n_v = 5 = 6.1\ \%$
2.5) No specifics	$n_v = 16 = 19.5\ \%$

The statements (39.0 %) declaring extending and enriching the curriculum constituted the biggest cluster 2.1) in question 2). The topics such as algorithmization and programming, graphics editing, digital photography and videos, but also typing with all ten fingers appear most often. 8.5 % of statements (2.2) support this direction and they encourage introducing new topics, such as cloud solutions, social networks and the use of mobile devices. The request for a time allocation increase included in cluster 1.b1) became evident in the frequency of statements constituting cluster 2.3), in which 26.8 % of statements tell that there have been an increase in the time allocation for informatics subjects and topics by means of cross-subject links and optional subjects. Some of the respondents tried to meet the requirement of the development of the content into topics and outcomes 1.b2) within SEP, which is shown by 6.1 % of statements. The remaining 19.8 % of statements do not state any specifics in this question.

In the answers to question 3) the following clusters of statements were indicated:

In question 3, most statements (47.5 %) in cluster 3.1) reflect the opinion that the time

3.1 Insufficient time allocation	$n_v = 47 = 47.5\ \%$
3.2 Extended time allocation	$n_v = 21 = 21.2\ \%$
3.3 Sufficient time allocation	$n_v = 14 = 14.1\ \%$
3.4 Subject necessary	$n_v = 17 = 17.2\ \%$

allocation for a compulsory subject is too low and it does not reflect the rapid development in the field of information technologies and new requirements for the development of pupils' information technology competencies. 21.2 % of statements in 3.2) cluster express the same opinion, in which respondents state that they extended the low time allocation by means of extra lessons or merging informatics topics with other subjects. Only 14.1 % of statements in 3.3) cluster hold the opinion that the time allocation is sufficient. 17.2 % of statements in 3.4) cluster commented on the issue of the existence of a compulsory informatics subject in the school curriculum. All these statements point out the importance of the subject as the base for information technology literacy development. They encourage and at the same time demand a wider interconnection between application informatics topics and other subjects.

In the answers to question 4.a) the following clusters of statements were indicated:

In sub-question 4.a) the respondents' statements formed 5 clusters. The biggest cluster 4.a1) contains 51.1 % of statements declaring that they manage to achieve the given goals

4.a1) I do manage	$n_v = 46 = 51.1\ \%$
4.a2) I manage satisfactorily	$n_v = 11 = 12.2\ \%$
4.a3) Other subjects help	$n_v = 23 = 25.6\ \%$
4.a4) Other subjects do not help	$n_v = 7 = 7.8\ \%$
4.a5) Cannot say	$n_v = 3 = 3.3\ \%$

and intentions. 12.2 % of statements in cluster 4.a2) support this statement though less definitely. The statements in cluster 4.a3) emphasize (25.6 %) a significant influence

of other subjects on the development of pupils' information technology competencies, whereas the statements of cluster 4.a4) express the opposite evaluation (7.8 %). Several statements emphasized that due to the lack of criteria it is not possible to successfully evaluate the achievement of goals (3.3 %).

In the answers to question 4.b) the following clusters of statements were indicated:

4.b1) Adequate equipment	$n_v = 38 = 39.2\ \%$
4.b2) Qualified teachers	$n_v = 31 = 32.0\ \%$
4.b3) Sufficient time allocation	$n_v = 11 = 11.3\ \%$
4.b4) Pupils' interest	$n_v = 10 = 10.3\ \%$
4.b5) Colleagues' and leadership support	$n_v = 7 = 7.2\ \%$

In sub-question 4b) the clusters of statements indicated a necessary condition for achieving the goals and intentions of SEP from the viewpoint of building and developing pupils' information technology competencies. The available, functional and efficient technical equipment reflecting the development in the field of information technologies is the most often stated condition (4.b1, 39.2 %). 4.b2) is the second cluster of statements with the highest frequency, in which 32.0 % of statements consider high-quality, qualified teachers with a high level of expertise as a necessary condition. In the context with the previous questions, surprisingly only 11.3 % of statements consider an adequate time allocation (4.b3) a necessary condition and 10.3 % of statements consider pupils' interest and openness (4.b4) a necessary condition. The last cluster 4.b5) formed by 7.2 % of statements points out the necessity of support and helpfulness from the school leaders and whole teaching staff.

In the answers to question 4.c) the following clusters of statements were indicated:

4.c1) Little funding, bad equipment	$n_v = 31 = 36.9\ \%$
4.c2) Low teachers' competencies	$n_v = 17 = 20.2\ \%$
4.c3) Low time allocation and importance	$n_v = 13 = 15.5\ \%$
4.c4) Pupils' lack of interest	$n_v = 13 = 15.5\ \%$
4.c5) Weak support from the colleagues and leadership	$n_v = 10 = 11.9\ \%$

The respondents' statements in sub-question 4.c) formed actually the same clusters as in sub-question 4.b), though expressed in the opposite way. From the viewpoint of the number of statements (36.9 %) cluster 4.c1) takes the first place here, in which the respondents consider bad and obsolete equipment and the lack of funds for its renovation or innovation as the main obstacle. Statements (20.2 %) of 4.c2) cluster consider low teachers' competencies, their insufficient qualification, but also insufficient commitment and zeal for teaching as an obstacle. From the viewpoint of the number of statements (15.5 %) cluster 4.c3) indicates a low time allocation and low interest in the given field of FEP as the third obstacle. The same number of statements (15.5 %) also point out in 4.c4) pupils' lack of interest, passivity and reluctance to acquire a wider spectrum of information technology competencies. 11.9 % of statements in cluster 4.c5) consider weak support and unhelpfulness from the leadership and colleagues as yet another obstacle.

In the answers to question 5.a) the following clusters of statements were indicated:

5.a1) Combination of methods and forms	$n_v = 28 = 34.1\ \%$
5.a2) Introducing practical work	$n_v = 23 = 28.0\ \%$
5.a3) Emphasis on outcome	$n_v = 18 = 22.0\ \%$
5.a4) Emphasis on technology	$n_v = 13 = 15.9\ \%$

Respondents' statements formed in sub-question 5.a) 4 clusters. In cluster 5.a1), there were 34.1 % of statements, in which respondents characterize their teaching as a combination of various methods and forms, often in terms of traditionally taught lesson. By means of statements in cluster 5.a2) (28.0 %) respondents say that they try to encourage pupils' practical work, or explain the rules and assign the task which the pupils do individually. 22.0 % of statements of cluster 5.a3) moreover emphasize the significance of the outcomes of practical work, which should be familiar, interesting and useful in practice for the pupil. The fourth cluster 5.a4) includes statements (15.9 %), in which respondents accent the importance of technical equipment for their teaching, mainly for classroom work, where each pupil has his or her computer and where a digital projector is available, or interactive whiteboard.

In the answers to question 5.b) the following clusters of statements were identified:

5.b1) Individual work and approach	$n_v = 17 = 27.4\ \%$
5.b2) Pupils' interest and outcomes for practice	$n_v = 13 = 21.0\ \%$
5.b3) Cooperation and projects	$n_v = 9 = 14.5\ \%$
5.b4) Materials for pupils	$n_v = 8 = 12.9\ \%$
5.b5) Technologies	$n_v = 8 = 12.9\ \%$
5.b6) Update of the content	$n_v = 7 = 11.3\ \%$

In the last sub-question 5.b) a greater variability of the statements was apparent than in the previous sub-question. According to the statements in cluster 5.b1 (27.4%) respondents welcome implementing pupils' individual practical work and individual approach to them. By means of the statements in cluster 5.b2) (21.0%), the respondents say that they had good results when encouraging pupils' interest by implementing pupils' familiar and in practice useful topics as outcomes of practical work. 14.5% of statements of cluster 5.b3) underline the use of cooperative work and realization of projects, whereas 12.9% of statements of cluster 5.b4) provide positive experience with creating materials for pupils in the form of electronic manuals, video tutorials and worksheets. The same amount of statements (12.9%) form cluster 5.b5); respondents say in them that including specific technologies, mainly virtual educational environment, cloud environment, interactive whiteboard, but also spatial visualization and augmented reality in the lessons have proved successful (Prokýšek and Rambousek, 2012; Jeřábek, Prokýšek, Rambousek, 2013). The last cluster 5.b6) contains 11.3% of statements declaring good experience with an ongoing update of the educational content of the given field and reflection of the development in the ICT field.

Finally, it is necessary to emphasize that the numbers of the statements in individual clusters do not indicate directly the level of significance or importance of particular clusters. It is also necessary to emphasize the fact that due to the voluntary principle of the survey it was not possible to ensure the full representativeness of the sample comparable with a random selection since the selection of the respondents was primarily based on the teachers interested in the participation in the survey. The above presented findings cannot

be therefore considered generally true. We may only relate them to the respondents of the survey and any generalization warrants caution.

Conclusion

The findings of the survey complemented the results of other methods applied in the research primarily from the viewpoint of the evaluation of curricular materials and conditions for the effective provision of ICT literacy in primary and lower-secondary schools. Most of the respondents consider the content of FEP EE in the educational field of Information and Communication Technologies as too general and half of them criticize its concept due to the lack of current content or overall inadequacy of the concept. Above all, the document should be modified in terms of the increase of a time allocation, better specification of the content and in terms of its extension and innovation.

In the area of Information Communication Technologies, SEPs are supplemented or modified primarily in terms of extension, enrichment and innovation of the curriculum. SEPs are also modified with the aim to provide informatics subjects and topics more time considering their importance for the development of particular pupils' competencies. Generally, respondents consider the time allocation for the compulsory informatics subject in the school curriculum as insufficient and at the same time they do not support its merging with other subjects.

Respondents declare that they manage to achieve the goals and intentions of SEP to build and develop pupils' information technology competencies, in many cases also with the help of other subjects. Above all, they see adequate technical equipment and teachers' qualification and their level of expertise as necessary conditions for achieving goals and intentions of SEP from the standpoint of building and developing pupils' information technology competencies. In contrast, they identify insufficient technical equipment and a lack of finances for its development and teachers' low qualification and their level of expertise as the main obstacles.

As other obstacles they identify a low time allocation for the informatics subject, pupils' lack of interest and reluctance and colleagues' and leadership's weak support. In the lessons of a compulsory informatics subject, respondents usually apply a combination of methods and teaching techniques, or they encourage pupils' practical work if possible with outcomes interesting for pupils, or useful in practice. Individual practical work, individual approach to pupils, supporting pupils' interest in learning and creating practical outcomes have proved successful.

Acknowledgements

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FUTURE MATHEMATICS TEACHERS AND THE IDENTIFICATION OF SPECIFIC SKILLS FOR WORK WITH GEOGEBRA

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Abstract

Using the framework of Technological Pedagogical Content Knowledge, the authors look into ways to develop this knowledge in future mathematics teachers for secondary schools. The first stage of research is presented. First, tasks were designed in which specific skills which pupils must master in order to work with ICT effectively are needed. These tasks were assigned to 19 student teachers whose work was observed by capturing their solving processes in GeoGebra by Camtasia, collecting their written work and recording their discussions. Finally, it was investigated to what extent the tasks contribute to the students' ability to plan teaching with dynamic geometry software. Similarly to related research, it transpired that individual work on problems contributes to enacting elements of TPACK in a very limited way and that discussions are essential. The second stage of research will thus include reflections on the solutions of problems and students' proposals of projects.

Keywords

Future mathematics teachers, GeoGebra, specific skills for work with ICT, TPACK

Introduction

ICT tools are being increasingly used in teaching (not only) mathematics which affects the most important agent in the teaching of mathematics, that is, the teacher and his/her education. In this paper, we will use Mishra and Koehler's framework (2006) of a teacher's knowledge which builds on Shulman's work (1986) and his idea of pedagogical content knowledge. Mishra and Koehler claim that in order for the teacher to teach successfully with technology, he/she has to have knowledge about content (C), pedagogy (P), and technology (T). Their model expresses mutual relationships between and among these three phenomena.

Technological Content Knowledge (TCK) is knowledge about the manner in which technology and content are related, i.e., how the content can be changed by the application of technology. Technology enables, for example, new forms of representation. Thus technology can change the subject matter.

Technological Pedagogical Knowledge (TPK) is knowledge about the existence, components and capabilities of various technologies to serve solving a particular task in the process of teaching and learning mathematics. Technology changes the nature of learning – e.g., proofs by construction were not available before.

The central part of the model is Technological Pedagogical Content Knowledge (TPCK, later TPACK) which is "the basis of good teaching with technology and requires an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face; knowledge of students' prior knowledge and theories

of epistemology; and knowledge of how technologies can be used to build on existing knowledge and to develop new epistemologies or strengthen old ones." (Mishra and Koehler, 2006: 1029)

Since its introduction, the above model has been devoted a lot of research attention especially abroad (for the Czech context, see, e.g., Carbová and Betáková, 2013; Jančařík, 2013). Some studies look into the enactment of TPACK (e.g., Jang and Tsai, 2012), others into its development in (future) teachers (e.g., Bowers and Stephens, 2011) or both (e.g., Polly, 2011). Comprehensive reviews of literature in this area have been published (Chai, Koh and Tsai, 2013; Abbitt, 2011). The authors of the former view TPACK, among others, as an important agent against "overemphasis on technological knowledge in many ICT courses that are conducted in isolation from teachers' subject matter learning and pedagogical training" (Chai, Koh and Tsai, 2013: 31). The latter review points to the enormous complexity of uncovering the causes of the TPACK development.

In our previous research (Robová, 2013), we have identified some *specific skills* which pupils must develop in order to overcome problems which they face and which prevent them from using the ICT tools to best advantage. The skills (pertinent to dynamic geometry software with which we deal in this text) include, e.g., the interpretation of graphs with discontinuities, scaling in order to see the most appropriate part of the graph (to be able to 'read' its properties), rounding and estimating results and checking the validity of numerical and graphic outputs, understanding the differences between computer and paper geometry, etc. Naturally, teachers must be aware of these skills: "[…] the skills are, at the same time, part of the teachers' TPCK as they should devise ways in which these skills can be developed in their pupils" (Robová, 2013: 100). Thus, we decided to structure the preparation of future mathematics teachers (within a mathematics education course) for the use of ICT along these skills.

The general *goal* of our research is to find efficient ways to develop *aspects* of student teachers' TPACK which would help them to use ICT tools (namely GeoGebra) in their future teaching practice effectively. This can be done in different ways both by special longitudinal teacher development programmes (e.g., Polly, 2011; Hardy, 2010), including programmes with an online part (e.g., Kramarski and Michalsky, 2010), and by integrating elements of ICT into regular mathematics education courses. A more detailed review of different ways to develop TPACK is given in (Hofer and Grandgenett, 2012).

We use the latter approach and as a starting point, we use Bowers and Stephens' claim that "the best we can do is engage prospective teachers in technology-enhanced mathematical explorations with the explicit goal of discussing the ways in which technology enabled them to describe relationships among objects on the screen that could not have been developed without the tools employed" (Bowers and Stephen, 2011: 291).

Thus, our *aims* are:

1. Develop mathematical tasks within the topics of a) Functions, and b) Geometry in which the above specific skills play an important role.
2. Find out to what extent student teachers are aware of the skills already (based on their previous experience as learners of mathematics) and to what extent the proposed tasks contribute to this awareness.
3. Find out to what extent the tasks contribute to the student teachers' ability to plan such teaching which effectively implements dynamic geometry software.

While questions 1 and 2 look into the interplay of TK and CK (TCK), the third question concerns the participants' TPK and possibly TPACK. Notice, however, that we do not claim that in the procedure described here students' TPACK in all its complexity will

be developed. We are looking into one of its many aspects (the above specific skills connected to the use of ICT). This article concentrates on the first stage of our research in which the research tool was trialled and only includes the results for the Functions part of our research.

Materials and Methods

Tasks to diagnose and possibly develop student teachers' awareness of the above specific skills in the area of functions were developed and divided into two worksheets. We decided to concentrate on GeoGebra (GG) only as this software is constantly being developed and can now be used not only for geometry, but also for algebra, functions and even statistics. *Worksheet 1* (or WS1) comprises problems on determining the domain and range of functions, their monotony, zero points and x and y-intercepts. WS1 problems are quite easy to solve and each of them includes some of the above specific skills. The aim is to make the students aware of these skills without concentrating too much on the solutions to the problems. *Worksheet 2* (WS2) problems also refer to the specific skills but they are mathematically more demanding. The aim is to put the students in the role of pupils, that is, they have to concentrate on the theoretical mathematical solution, too. To some extent, the problems are to disturb the student teachers' image of ICT tools solving all the problems by themselves. The worksheets include space for writing results and comments. The students were asked to record any specific skills the problems in their opinion require. Some examples of problems follow. Specific skills needed for their solution are given in square brackets.

WS1_P3: Graph function $f: y = \sqrt{x + 20.25}$. Using the graph, determine: a) domain D_f, b) range H_f, c) zero points of f, d) x-intercept P_x, e) y-intercept P_y, f) $f(-4.25)$. [Input of the function equation; adjusting the range of coordinates.]

WS1_P4: Graph function $f: y = \frac{x^2 + x - 2}{x - 1}$ and determine a) type of the function, b) domain, c) range, d) $f(1)$ and $f(7)$. [Input of the function equation, using the equation of the function to critically appraise the graph – finding the point of discontinuity which is not seen on the graph.]

WS2_P1: Solve the equation in R in a graphic way: $2x^2 + x = 3x + x^2 + 3$. [Input of equations; change of the range of coordinates – the second intercept is outside the displayed area.]

WS2_P2: Solve the equation $|2x - 3| = |x + 7|$ with the unknown $x \in R$ in a graphic way. Write down a set of roots. [Input of the equations; adjusting the range of coordinates; zooming; using graphs to find roots; combining algebraic and graphic solutions, including recognising that the result shown by GG –1.33 is in fact - 4/3.]

WS2_P5: Graph function $f: y = \sqrt{3x - x^3}$. Using the graph, determine a) domain D_f, b) range H_f, c) zero points, d) y-intercept P_y, e) $f(-2)$. [Input of the equation; recognising an irrational number of $\sqrt{3}$.]

Participants of the study are 19 future mathematics teachers: 9 full-time students and 10 combined-study students. Prior to the study in 2013, they had completed nearly all their university mathematics courses and a course on GG and other mathematics software. In the course, they mostly played the role of mathematics learners (their TK and TCK

was developed). As for other experience pertinent to ICT, unlike in some other countries, graphic calculators are not encouraged at Czech schools and thus we can presume that the student teachers did not use them extensively. Combined-study students had some years of teaching experience – they worked as unqualified teachers. However, none of them had taught with technology.

The *full-time student version* of the two worksheets comprised 6 (WS1), resp. 8 problems (WS2). The students worked on them during two sessions each of which lasted four 45 minute lessons. Both authors were present, one leading the sessions and the second making notes and observing students. Each student had his/her laptop with GG and worked independently (but they could discuss things). Their work on the laptop screen was captured by Camtasia and they were also asked to write down their solution as well as any comments they might have. Thus for each student, the data consist of a videorecording of his/her work in GG and filled-in WS1 and WS2. At the end of each session, there was a short discussion about the worksheets which was videorecorded. Finally, the students were asked to submit a Project: a written material for secondary teachers comprising a plan for at least two mathematics lessons in which each pupil is equipped with a laptop with GG and other software. The Project was to include problems in which pupils independently develop some mathematical concepts. The suggested implementation of the problems in class was to be described in detail. The Project was prepared by the students at home after the sessions and submitted later in writing. The teacher provided them with the feedback via e-mail but otherwise the Projects were not discussed among the students.

Each *combined-study student worksheet* comprised 5 problems, selected from the worksheets for full-time students. As combined-study students have less than one third of contact time than full-time students, they only worked on the worksheets for 2 lessons and then continued at home. Another two lesson seminar was devoted to the discussion of their solutions and questions. Thus, their work was not captured by Camtasia and we only have their written solutions and comments. No Project was assigned to them. One of the authors was present at the seminars.

The above data were *analysed* using qualitative methods, i.e., we looked for such phenomena in the students' written work or recordings which show their awareness (or lack of it) of the skills and to what extent they are able to use them. Camtasia recordings were used when we were in doubt as to the students' solution or when we found an interesting phenomenon. For the Projects, we followed not only the quality of the proposed problems and whether they would benefit from being solved via ICT but also to what extent the students incorporated the above skills into them.

Results and Discussion

In terms of the student teachers' TK, we can say that they could work with GG tools satisfactorily. They only had small problems, such as not knowing how to input the absolute value function. They used the help line of GG when they did not know some command (e.g., to input a function with a given domain).

Student teachers showed a good level of *the skill to input the equations of functions* into GG. In this respect, there was a good link between their TK and CK; e.g., some did not know the command sqrt and thus used the power of ½, or they used $1/(\tan x)$ instead of cotan x. One student expressed his belief that "pupils could learn to understand in GG the logical structure of an algebraic expression" (by realising that brackets must be used in a certain way when the equation is inserted in the algebra windows in GG) (TCK). The majority of students mastered *the adjustment of the range of coordinates* for graphs in

order to see important properties of functions – they also used zooming and moving the figure along the visible part of the screen.

On the other hand, many students had problems with *determining properties of functions via graphs*, namely, domain, range and zero points. Some of the functions from the worksheets are devised in such a way that the points cannot simply be read from the graph no matter how far we zoom. Moreover, the students often do not connect their TK and CK; they read the properties from the graph without realising that it is only a hypothesis which must be proved by their CK: "I do not know how to find the range and domain in the way other than by estimation."

Most problems require that the students *connect their CK and TK*. For WS1_P4, most of the students used their CK to point to the fact that while the function has a point of discontinuity at $x = 1$, GG appears to have plotted it (which is due to the insufficient resolution). Full-time students' Camtasia recordings showed that they were trying to justify this fact by technology – by looking for the intercept of line $x = 1$ and the given function. Half of the distance-study students correctly wrote that the domain was R–{1} but incorrectly stated that the range was R. The correct domain might be the result of seeing at first sight that there cannot be 1 in the denominator (using their CK). They seem to have used TK for the range – the graph seems to be continuous. Similarly to WS1_P4, WS2_P1 requires that the students are able to *appraise the graphs critically* using their CK – two parabolas are graphed, however, it is necessary to zoom out carefully to see both intercepts. All of the students solved it, however, only one specifically commented on this skill.

As for the skill to realise that GG *rounds the numbers off* and even though it shows decimal results, they are, in fact, irrational numbers, nearly all students recognised that the number 0.333 should be 1/3, they did not do so for 0.16667 as 1/6 (even when adjusting the number of decimal places to get a „more precise" number). Some made mistakes caused by an inappropriate choice of the number of decimal places. For example, one of the students put down the (incorrect) roots of + 2 a –2 and then wrote: "The results should be $\pm\sqrt{3}$. I have only later realised that there was a rounding off error." Another student used his CK to reason that the solution produced by GG could not be correct but was unable to change the software behaviour – that is, he lacks TK to change the number of decimal places in results. He solved the problem by using the function 'Object properties' where the numbers are shown correctly. The problem of GG rounding off the numbers was met several times in the worksheets. This inspired one of the students to experiment with it. For example, in WS2_P1 where the results are whole numbers, he increased the number of decimal places to 15 and commented that the result was $x = 2.999999999999999$ instead of $x = 3$ and that mathematical reasoning must be used in order to overcome the software deficiency.

Similarly to WS1_P3, for WS2_P5 GeoGebra does not show the end-points of the domain. Most of the students calculated them by hand (getting the correct results which include irrational numbers $\pm\sqrt{3}$), however, three students wrote: "It is not possible to determine the domain as GG says that the x-intercept does not exist." It might be caused by their conviction that they should solve the problem only by GG. In the same problem, about half of the full-time students wrote that $f(-2) = 1.41$ (instead of $\sqrt{2}$) as they found it by looking for the intercept of the given graph and line $x = -2$. One of the students estimated that the result might be $\sqrt{2}$ and he used GG to verify it – by line y = sqrt 2 and the command 'Relationship between two objects'. His TCK is advanced.

As stated above, we wanted the student teachers to realise which skills they were using when solving the problems and asked them to write them down. However, it transpired that many of them were either not aware of using any skills specific to ICT or did not consider them to be anything worth mentioning. Thus, e.g., they correctly put down an irrational number as a solution rather than an imprecise decimal result produced by GG but did not express this fact in writing. The combined-study students included more detailed skills needed for individual problems which might be attributed to their teaching experience – they are more aware of problems their pupils might have.

We also looked into what kind of topics the worksheets led the students to discuss publicly. The most important issue concerned the realisation that even though technology is powerful, without "good knowledge of mathematics" it will not help learners. By that, they meant, e.g., knowing the decimal expansion of common fractions and square roots, being able to find the domain and range of the function by manipulating with its equation, etc. They also discussed the danger of a non-critical acceptance of results produced by technology – teachers, they said, should lead pupils to a critical appraisal of the results and to realising that GG does not show precise numerical results and is not able to show "a complete graph of the function". On the other hand, the students liked the idea of scroll bars which enables us "to see all different cases of a function". If we compare this to what was written in the students' worksheets, then we can see that the discussions played an important role in their awareness of the specific skills.

Finally, we analysed the full-time student teachers' Projects mainly from the point of view of their incorporation of the development of specific skills into the proposed problems.

All but one students used such problems for which GG is beneficial (e.g., they include a dynamic aspect, make use of scroll bars, etc.). They were mostly able to grade problems according to their difficulty. However, the situation in the Projects was similar to that in the worksheets. The student teachers' expected that pupils need to have certain skills in order to solve problems in GG, however, they did not express them explicitly neither described (except for a few notes in some Projects) how they will lead the pupils towards mastering the skills. To an extent it is surprising as during the common discussion some students suggested "giving pupils such problems in which they will notice the limiting features of the software themselves". Only one student teacher included a problem in a Project (on exponential functions and their properties) which led to the irrational result and commented that the pupils have to notice it.

Conclusion

Research showed that sometimes when we say to pupils explicitly what they should notice, it is not didactically effective. It is more efficient when we put them into situations in which they are learners and meet the challenges themselves (e.g., Bowers and Stephens, 2011). This was our intention with the worksheets. We were aware of the fact that within such a limited time frame one cannot expect that student teachers master technology (or in this case GG) on such a level as to be able to use it to its full potential and to their pupils' advantage. However, we believed that what it could do is to make them aware of limitation and merits of the software and hopefully, use this knowledge for improving their teaching. This expectation was not fully met.

First, it seems that the awareness of the specific skills is dependent on the type of the problem or, more specifically, on the solving strategy it encourages. If it leads the students towards using technology (that is, on the surface the solution via software seems to be obvious), then they might forget to check the appropriateness of the solution by mathematical

reasoning. If the technology fails, then they are "forced" to reason mathematically. A good example is WS2_P5 and the awareness (or lack of it) of the irrational result. Second, the discussion phase of the worksheets seemed to be essential for at least some student teachers' awareness of specific skills. The independent work on problems was not enough. Finally, the proposed Projects did not make full use of the skills in question. We have reached the same conclusion as Bowers and Stephens (2011: 301): "Even though constructs were debated by the students and posted as a guide, the data seemed to indicate that it remained relatively elusive in some of the students' final projects."

We consider the above study as the pilot one for the main study to be organised in 2014. The worksheets will be modified. Some of the problems which did not contribute to the already identified specific skills will be omitted. Some problems will be specified. Moreover, the pilot study uncovered that we underestimated the importance of discussing the emerging issues. Some students only became aware of them when they were brought out by their colleagues. Bowers and Stephens' study (2011) is important for us in another respect as it showed that the final Projects as written by the student teachers should be subject to class discussion and the basis for bringing out their own metacognitive processes (e.g., by asking them to speak about the way they developed their Projects). The importance of the metacognitive instruction was also confirmed by Kramarski and Michalsky (2010). This stage will be appended to our work with student teachers in the main stage. Finally, for the distance-study students an online course will be improved so that the discussions about the issues can be organised and the disadvantage of little contact time is reduced.

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THE CORRELATION OF TWO METRICS FOR EVALUATION OF STUDENTS MANAGERIAL COMPETENCES

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Abstract

Many organisations are interested in such employees, who are able to offer various knowledge and competences needed for scope of employment. At the present time, the accent is put on modern education systems and their teachers have an effort to prepare future candidates within labour market. At schools, modern methods are used to develop competences, in the other words, competence-based learning process should be used to get more competent students. That was the reason to evaluate managerial competences on the research sample of 140 students that study the management branch. For the evaluation, we used two metrics - the first was problem-solving, the second was verbal and mathematical competences. The theoretical part of this paper contains competences that were measured. In the other part, there are described the results of strong positive relationship between mentioned metrics, what was our determined main aim of this research.

Keywords

Education, managerial competences, positive correlation, problem-solving, students

Introduction

The main problem of the presence is that the students do not achieve the success in their life after graduation. This can be caused by the three reasons. *The first reason* is that the educational system tries to implement in the subjects the new type of education which is called "competence-based education". There are still subjects where the main role of the learners is to drill the theoretical knowledge, and the competences are developed in no way. *The second problem* can be the fact that the schools are focused mostly on the development of one type of competences, not on other types (not according to the field of study, to which the school is focused on). *The third reaso*n may be the fact, that there are too many unemployed graduates. The companies protect themselves in the way that the interviews are more and more complicated and are very frequently realized by "assessment centers" in order to select the best applicants. Several countries and organizations have participated in measurement of such performance. For example - Collegiate Learning Assessment, Assessment of Higher Education Learning Outcomes, Collegiate Assessment of Academic Proficiency, Programme for International Student Assessment, Maryland Performance Assessment Program, Criterion-Referenced Evaluation Systém, Kentucky Instructional Results Information System, Vermont's portfolio system, Prince William County Public Schools' Standards of Quality, Measure of Academic Proficiency and Progress, Critical Thinking Assessment Test (Khattri, 2000, Minedu, 2012, OECD, 2004). Their objective was to find out, whether and how the students are prepared for the practise. Each study measured not the same type of students´ performance – different competences. They subsequently processed gained results in the final reports. These "organizations" have developed a series of tests, studies, and others. I was inspired by them and as a result,

I have created my own methodology of competences evaluation, which is consisted of two metrics. To mentioned methodology, I have involved the variation of tests and tasks, which the graduates are required to master for working experience of the field they had studied. I have been investigating that economical positions in the "big 4" type companies – outsorcing economy (where most students are looking for a job after their studies) apply a combination of comparable tests to those that I have applied in my research. From this perspective, I have set the goal, to determine whether the students have developed the competences of two groups – problem solving and managerial assumptions. Therefore, my hypothesis was a thought to assume that there exists a relationship, which means that students who obtained more points from one metric, should have gained also more points from other metrics, if their competences are developed equally to be prepared enough for the labor market from each sphere in the way that employers require (I have been inspired by the research, which examined the number of required competences of the job portal in Slovakia – competence "problem-solving" according to the Bašistová, Ferencová, 2011). Their research was performed with the aim to find out what competencies employers demand the most frequently. The results verify that an enterprise requested from candidates is the managerial competence – problem-solving. This competence was requested 3753 times.

We were inspired by the issue, therefore our purpose was to evaluate competence problem solving, whether the students have assumed to be good managers, when they have been studying managerial discipline for four years. Tested students of The Faculty of Business Economics studied management branch. It means that they graduated within education program the subjects that should develop skills and competencies needed in management. For example, it is concerned with communication, verbal and mathematical skills, creativity, problem-solving, trouble shooting, etc.

The aim of the research was to find out how managerial competence problem-solving is linked with the sum of verbal and mathematical competences and whether the relation between the two variables can be proved. In other words, our aim was to find out if both the types of competencies are developed equally.

Material and Methods

Research sample

The sample was composed of the second year students studying an engineering degree of The Faculty of Business Economics in Kosice, which is one of the seven faculties of the University of Economics in Bratislava (Slovakia). Out of the total students, our tested sample contained 80%. Overall, 140 records were analyzed; it means 140 students, from whom we gained the test results. The student performance was provided by a competent person. After jointing the data with the student performance, the identifier was made anonymous in order not to identify and specify a person (student), forasmuch as it was not the aim of the research. The data were obtained continuously in the 2012 summer term.

We can consider our sample relevant, because only the small number of records is not available. Regarding gender, 72% of women and 38% of men were tested. This was not planned; it was the structure of the sample. The following picture represents the matter.

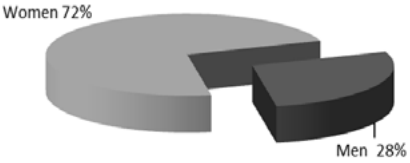

Fig. 1: Percentage decomposition of the research members

The average age of men is 23,56 years old, and women´s average age is lower, it is 23,37 years old. The difference between the two averages is minimal, that is why the inclination of a line connecting the averages shows, whose average is higher. The research was realized at the beginning of the year 2012.

What was tested

The structure of competences and their division needed for this research is shown in the my own following scheme:

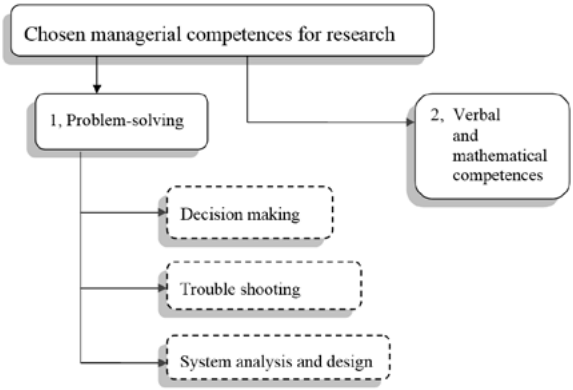

Fig. 2: Own scheme.

In the figure 2, we can see what metrics for evaluating of the students competency we used. We were inspired by a big project, The Programme for International Student Assessment, which has arisen by OECD, where experts developed three types of tests for measuring the managerial competence „problem-solving“. To the second part of measured competences, belong verbal and mathematical competences. It is concerned with a set of tests, which was published by NFER-NELSON publisher in England. They are specialized especially on the identification of managerial competences for various leading positions. *Making decision, system analysis and design, and trouble shooting* are generic problem solving structures that capture important aspects of everyday and real personal life, analytical reasoning that will assess in the assessment programme. To what degree is a student able to confront a particular problem and begin to move towards a solution? What evidence does the student offer to understand the nature of a problem, characterise the problem through the identification of variables and relationships, select and adjust representations of a problem, move to a solution, reflect on the work or communicate the results? OECD raised these questions, when it has started to realize a big project, called „the Programme for International Student Assessment“ in 1997. *Problem-solving* is an educational aim in the frame of all school curricula in more countries (Klepáková, 2011).

Verbal competences are not unitary constructs. Verbal abilities apply to all the components of language usage, including skills like word fluency, grammar, spelling, reading, vocabulary, verbal analogies, and language comprehension (Mesárošová, Mesároš, 2012). According to Balaji and Somashekar (2009) verbal skills help expressing information to individuals or groups effectively, whereas the audience and the nature of information are taken into account. Berry (2007) reports that speech is a more spontaneous process, whereas writing tends to be more deliberate. *Mathematical competence* is an individual's capacity to identify and understand the role that mathematics plays in the world, to make well-founded judgements and to use and engage with mathematics in ways that meet the needs of that individual's life as a constructive, concerned and reflective citizen (OECD, 2006).

The research, as we have mentioned, was realized among students by means of *tests.* We evaluated two variables: problem-solving and verbal with mathematical competences. Each test was focused on different type of competence problem-solving.

We used *Pearson´s correlation coeficient* for statistical processing, which shows us the power of the relationship of two number variables. It is a statistical measure of the strength of a linear relationship between paired data. In this research, we use the Cohen's (1988) interpretation of effect size. A correlation coefficient of .10 is representing a weak or small association; a correlation coefficient of .30 is considered a moderate or medium correlation; a correlation coefficient of .50 or larger is thought to represent a strong or large correlation.

The hypothesis

The aim of the research is specified in within introduction. Based on aim presumption we derived our basic research hypothesis:

H1: We assume that direct linear relationship exists between problem-solving and verbal/ mathematical competences of students.

Results and discussion

In this chapter, we present results gained by data processing in statistical program SAS. This chapter is comprised of two parts. The first part contains the presentation of the results of correlation analysis which contains whole sample (n=140) and in the second part we can see scatter plot generated by mentioned program SAS.

Correlation analysis

In the next table (table 1), there are presented the data being obtained by means of calculation of the Pearson Correlation Coefficients. We can see that the medium positive correlation exists (0.36468). P-value <.0001 means that when we have the random sample from our population, the relationship between these factors should be significant. In this case, we asked for all member of our population, so we used the significance of correlation coefficient as the way how to differ the stronger coefficients from weaker (in our research was tested more competences, but this paper contains results of two metrics).

<.0001 means the value is less then 0,0001 and the SAS software do not write the exact value or round it to the zero.

Pearson Correlation Coefficients, N = 140, Prob > |r| under H0: Rho=0		
	Points (verbal and mathematical)	Points (problem-solving)
Points (verbal and mathematical)	1.00000	0.36468 <.0001
Points (problem-solving)	0.36468 <.0001	1.00000

Tab 1: Pearson Correlation Coefficients

Figure 3 demonstrates not strong correlation (0.36468). We can see a increasing trend, it means correlation is positive. On the y-axis, there is the sum of points from verbal and mathematical competences; on the x-axis, there are points from problem-solving.

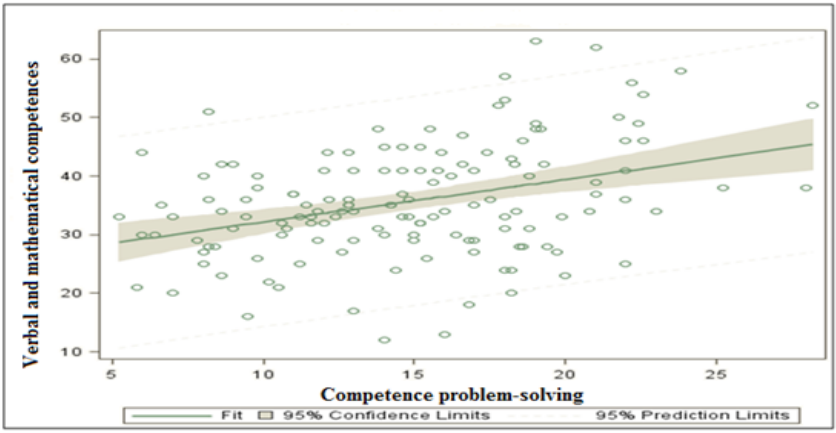

Fig. 3: Scatter plot between two variables

Both the types of competencies would be developed concurrently during the educational process, because they are equally important for employers. Therefore the aim of the research was to find out, whether the correlation between student´s points from two metrics (managerial competence problem-solving and from the sum verbal and numerical competence) exists. Our results are that here is not proven strong correlation, but only medium positive relationship was validated (0.36468). It is not true that those students, who acquired more points from the managerial competence problem-solving, also acquired more points from the sum of verbal and mathematical competences. We can not be sure that our results point out to the concurrent development of competencies during studies. Students did not obtain such high score as we was expecting from the our used metrics.

The next figure (4) displays that students presented the ability in verbal and mathematical communication while suggesting new solutions and solving different problems etc. However, we are depressingly surprised in the fact that the students did not obtain the adequate number of points from each one test (metric).

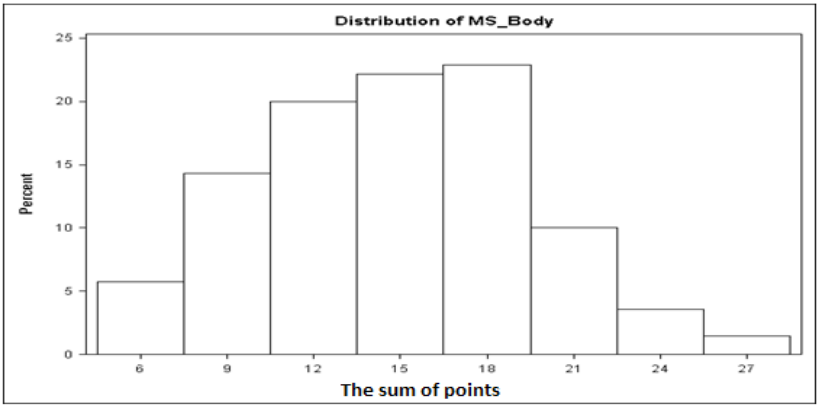

Fig. 4. Percentage display of total score (problem-solving).

The students could reach together 41 points. The total sum of points was 28,2, and the minimal number was 5,2 points. More than 20% and less than 25% of the students gained from 12 to 18 points. The similiar situation occurred in the results from verbal and numerical tests. The final conclusion of the research is that tested competences are not developed in so much that we had expected.

All the students being tested were studying the engineering degree of the faculty, that is why we had expected considerable better results. At the same time we had expected that learning process as a whole is a set for evolving the competences which are mostly required by the market these days. It is not sufficient that the students are focused mostly on theoretical knowledge when they study several subjects related to management and its branches. Nowadays, most examinations are realized in the way that the students must learn a quantum of information, which will be eventually forgotten. It is not a problem of university itself in which the research was conducted. It is a problem of how the education system is realized. Unemployment in the country is always increasing, and most students are forced to travel abroad, where it is not actually easy to find a job also for the reason that the students of other types of schools in different countries (with a focus on based - learning process) are prepared to practice with a higher quality, they are more creative and communicative in interviews at assessment centers, which are currently focused on monitoring various competences. These are the competences which were tested in the research and which were not selected randomly. On the basis of studies we have come to such metrics that are even used by large outsourcing multinational companies while selecting the staff for economical and managerial positions. Therefore, it was the place to ask, from which the following hypothesis was deduced “if several competences are being developed during university studies in parallel”, or in other words “whether students have achieved proportional points from one metric (proposed by OECD) as well other metrics that are commonly used in interviews to the economic position of outsourcing character.

To summarize the results of the research, two weaknesses were shown – we had expected a higher number of test points (histogram), and at the same time we had expected that the university develops the competences simultaneously. Therefore, the performance of changes should be developed by the highest bodies (in the government), to take into consideration that the theoretical examinations should be excluded, and the learning

process should have a duty to be improved to the way that the schools should mirror the interviews itself. We suggest to use more modern practices in education, such as simulations, case studies and discussions to boost students to communicate more between themselves, to encourage them to the critical discussion, expressing opinions and finally to increase their competences by suggesting solutions to problems working in pairs or groups. According to Pčolinská (2012) the most modern methods are simulation games. It is modern methods of teaching process. Students are able better applied theoretical knowledge directly in a simulated environment.

Conclusion

The increased use of standardized testing to measure student and teacher success has caused a shift in the way teachers approach students and learning. Students in regular education classrooms, particularly those from lower socio-economic backgrounds, may not receive the highest quality instruction due to the testing needs of the school or other students. However, educators must find ways to include all learners in the highest quality instruction while meeting district testing needs (Salemi, 2010). According to Urbancová (2013) it is needed because students who are holders of competences, thanks to their knowledge, skills and abilities it is possible to generate new innovative ideas that will help organisations to achieve a competitive advantage.

The partial aim of our research was to evaluate managerial competencies on the students, how they are developed. The first type that we have chosen was problem-solving for testing which we pick over the metrics of OECD (2004,2003) (institution has tested competences on chosen schools from 1997 in similar a way as we did in our research) which has classified this competency as necessary "attribute" of individuals to be successful within labour market. We examined this competence on each student and we found out that results are not expected. In the aggregate, students gained lower points. To the second part of measured competences, belong verbal and mathematical competences. It is concerned with a set of tests, which was published by NFER-NELSON publisher in England. They are specialized especially on the identification of managerial competences Regarding to the results, in the aggregate students gained lower points too. The positive correlation between student´s points from two metrics exists, but it isn´t strong. We had expected that the university develops the competences simultaneously. The performance of changes should be developed by the highest bodies (in the government), to take into consideration that the theoretical examinations should be excluded, and the learning process should have a duty to be improved to the way that the schools should mirror the interviews itself. Maybe, the next reason of this fact is that there is not adequate time to develop the competences in the highest quality in universites. Therefore, we recommend to pedagogues to have positive approach to utilise the modern methods into educational processes and participate in the balance development of both the types of competencies – problem solving, verbal and mathematical competencies.

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STUDENTS CREATIVITY AND THEIR TYPES OF COMMUNICATION – STUDY FROM SLOVAKIA

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Abstract

Communication skills are observed as very important managerial competences. The purpose of our study was to measure selected competences among students preparing for their future profession. The research aimed at the impact of creativity (such as thinking competence) on communication skills of the last year students studying at the Faculty of Business Economics in Slovakia. The research was based on students´ seminar works written for their "Sales and Vending Strategy of a Company" course. We focused on students´ presentation and discussion skills, and their creativity. In the relationship of creativity and presentation, weak direct linear correlation was proven. The research of creativity and discussion proved trivial direct linear relationship.

Keywords

Creativity, discussion, presentation, students

Introduction

Interest in creativity research began to grow somewhat in the 1950s and a few research institutes concerned with creativity were founded. However, several indicators of work on creativity show that it remained a relatively marginal topic in psychology, at least until recently (Sternberg, 2003). Creativity is something what makes us humans. It is also needed to solve pressing social problems. The European Union dubbed 2009 "The European Year of Creativity and Innovation," pronouncing in its manifesto that "Europe's future depends on the imagination and creativity of its people". Asian countries such as Singapore and China announced major initiatives in creativity (Sawyer, 2012). Creativity is an enormously important resource for speeding up economic growth and human development (Khandwalla, 2014). According Finnish authors, creativity is the activity (both mental and physical) that occurs in a specific time-space, social and cultural framework and leads to a tangible or intangible outcome(s) that is original, useful, ethical and desirable, at least to the creator(s) (Kampylis et al, 2009). Creativity is the combination or recombination of what we already have, and "what we already have" is usually seen as a set of atomic elements. We shall call this "combinationism" (Dartnall, 2002). Creativity is a topic of wide scope that is important at both the individual and societal levels for a wide range of task domains. At an individual level, creativity is relevant, for example, when one is solving problem on the job and in daily life. At a societal level, creativity can lead to new scientific findings, new movements in art, etc. The economic importance of creativity is clear because new products or services create jobs. Furthermore, individuals, organizations, and societies must adapt existing resources to changing task demands to remain competitive (Sternberg, 1998). According Sawyer et al (2003), explaining creativity can help also educators teach more effectively. Educational psychologists are increasingly discovering the role that creativity plays in development

and learning. Creativity is risk taking, initiative, and the ability to see new combinations of knowledge. Creativity is what gives pupils the opportunity to become innovative, enterprising, and capable of leadership, all qualities that are ultimately defined by the entrepreneur (Andersson, 2010). Creativity uses imagination to develop new insights into situations and applies innovative solutions to problems. This skill is helpful in designing and developing new methods where the established ones are inappropriate or unavailable (Balaji and Somashekar, 2009). According to Plucker et al (2004) creativity represents interplay between ability and process by which an individual or a group produces an outcome or a product that is both new and useful as defined within some social context.
Due to the need of the research of this article, we need to think about chosen soft skills – oral communication, presentation and listening skills of individuals and reaction on questions presented in their responses. *Oral communication skills* help expressing information to individuals or groups effectively, whereas the audience and the nature of information are taken into account. *Presentation skills* have become the hallmark of successful managers. *Listening skills* help knowing and understanding problems better (Balaji and Somashekar, 2009). Thanks to personal creativity of people it is possible to generate new innovative ideas that will help organisations to achieve a competitive advantage too (Urbancová, 2013).
Creativity can create new opportunities and drive the communication in the right sense. Crisis somehow becomes a daily part of our life and because of that competent managers should communicate with taking into the mind conditions of crisis communication, especially in the business sector. Therefore schools are trying hard to implement more educational forms focused on creativity and communication skills with regards to pressure and decision making in risk conditions. It is interesting to research, how is creativity developing during the study and whether is linked with two types of communication competences. The aim of this study is to find out how managerial competences - discussion and presentation are developed and linked (independently) with the creativity of students and whether the relationship between mentioned variables will be proved.

Materials and Methods

Research sample

The research sample consisted of the last year students studying at the Faculty of Business Economy at the University of Economics with the seat in Košice, Slovakia, including branch in Michalovce. Totally 113 records (students) were analysed, from the total number of 199 daily students of the last year. The data were obtained continuously in the 2011 winter term. The research was carried out in 2012.

Methods

As the tool of the measure we selected seminar works that students should work on in the last year of their studies at the course „Sales and Vending Strategy of the Company“. Only those works were selected which were performed individually, i.e. not in pairs or groups. Elaboration of the seminar work was the condition of obtaining credit points at the course „Sales and Vending Strategy of the Company“. Three competences were measured during the research – presentation, discussion and creativity. Competences were connected with the work. Students could obtain 15 points for the seminar work. For the needs of the course, seminar works were evaluated in 5 fields: Introduction + conclusion, Theory + references, Application of the theory in the real conditions of business, Presentation

of their work at the courses and Discussion about the solved problem. Each field was evaluated with 3 points, together 15 points for the seminar work.
Demands of the syllabus of the given subject for working-out the assignment were as follows: essay must solve some of the problems – theses of the course. It consists of the student's own introduction to the problem being solved, generalization of current situation, own elaboration of the problem with clear conclusion and literature – sources of knowledge and information. The students finish the essays with summary or conclusion, in which they formulate findings and results clearly and the opportunities for the next work can be described there as well (Curriculum of the course "Sales and Vending Strategy of the Company", 2011).
The worked out seminar work reflects mainly the creativity competence. The amount of information provided in the theoretical part was up to every student. Not only were we interested in how students understood and analysed a problem in a selected company but also how they introduced solutions to those problems. Furthermore, the nature and number of proposed solutions was in students´ hands. Evaluation of the seminar works for the course was up on the 2 teachers done according the previous description. In cooperation with another researcher we changed evaluation for the needs of our research in the sense of creativity. Measurement of the creativity was up on the two researchers – authors of the paper (one was also the teacher of the course).
Creativity was evaluated on the base of fixed structure although it was not a part of the points for the seminar work. It was done mainly because of our research needs. Creativity consisted of 4 competences: fluency, sensibility, originality and elaboration (Oihus et al, 2013). Creativity was researched mainly in the second part of the work – the analytical one (Application part evaluated with 3 points during the course). For the research of the creativity students could obtain 11 points in total but they achieved 10 maximally. For the fluency, students could obtain 4 points. Another parts of creativity were evaluated with 3 points. In researching sensitivity, we examined whether students could find a problem to which suggestions were provided. Interesting thing was that most of the students suggested purchase of machinery, better promotion, decreasing prices without indication "why?". In assessment of elaboration, we evaluated suggestions and solutions. Some of the students introduced one suggestion, others more. We monitored who was and how was a student able to find and suggest solutions. We chose three students out of all whose works were original and distinguished from others. In the end we counted the points what was critical for the evaluation of the creativity for each student.
With connection to the measurement of another variable – communication, we used points from course evaluation. We aimed on two levels: student presentation and discussion. During the presentation, we evaluated the ability of students to present the topic solved in the work, student's ability to express themselves correctly and eruditely, the ability of composition the presentation in a suitable way and the ability to catch the attention of other students by the speech. During discussion we have evaluated student's ability to answer questions from the audience in a professional manner. We aimed at student's response to questions, the ability to think in context and students' approach to work on a problem – whether they really solved the problem, knew well the environment of the company and whether they could reflect the problem. For presentation students could obtain 3 points, the same within discussion – 3 points maximum. Students could obtain 6 points altogether (these 6 points were the part of the 15 points that students could gain together for the term work).
Works were evaluated with the pointing system, adding numeral characters to the students

work in each category/competence. The more points students obtained, the better skills were shown in each observed competence.
In the following chapter "Results and discussion" we present results gained by data processing in statistical program SAS. We used *Pearson´s correlation coeficient* for statistical processing, which shows us the power of the relationship of two number variables. It is a statistical measure of the strength of a linear relationship between paired data. In this research, we use the Cohen's (1988) interpretation of effect size. A correlation coefficient of .10 is representing a weak or small association; a correlation coefficient of .30 is considered a moderate or medium correlation; a correlation coefficient of .50 or larger is thought to represent a strong or large correlation.

The main aim and hypothesis

The research, as we have mentioned, was realized among students during the course "Sales and Vending Strategy of the Company". We evaluated these variables: creativity to discussion, creativity to presentation. Variables were presented in the seminar works of individual students based on the conditions for working out the seminar work.
The aim of the research was to find out how managerial competences - discussion and presentation are developed and linked (independently) with the creativity of students and whether the relationship between mentioned variables will be proved.
Based on this presumption we derived our research hypothesis:
H1: We assume that direct linear relationship does not exist between creativity and presentation.
H2: We assume that direct linear relationship does not exist between creativity and discussion of student.

Results and Discussion

We have measured these variants of variables: creativity and presentation, and creativity and discussion. Results are presented by using tables and graphs. These are the outputs of the program SAS. First, we proved the existence of direct linear relationship between creativity of students and their presentation skills, then we proved the impact of creativity on their skills in communication within discussion.

Creativity/Presentation

In Table 1 we can see basic descriptive statistics, where we have 113 student observations, averages of points for each variable, standard deviation and minimum and maximum values that students achieved in each variable. Students could obtain 3 points maximum for presentation and 11 points maximum for creativity. In a presentation minimum value was 0.5 point, in creativity the maximum value reached 10 points.

Simple Statistics							
Variable	N	Mean	Std Dev	Sum	Minimum	Maximum	Label
Presentation	113	2.81	0.44	317.50	0.5	3.0	Presentation
Creativity	113	3.7	1.91	418.00	0	10.0	Creativity

Tab. 1: The values of Simple Statistics of variables Presentation and Creativity

Relationship or dependence between two variables – creativity and presentation we have researched by Pearson correlation coefficient. The value of the coefficient was in this case 0.14 what indicates ***small direct linear relationship***. Although the result is approaching

zero and relationship seems really low, we can presume that with increasing points for creativity, points achieved in communication criterion – presentation increase too.

Pearson Correlation Coefficients, N = 113 Prob > |r| under H0: Rho=0	
	Creativity
Presentation	0.14
Presentation	0.14

Tab. 2: The relationship between Presentation and Creativity expressed by Pearson Correlation Coefficients

So we can also presume that those students who achieved better results in creativity, have better presentation skills, they have ability to present the topic of the term work suitably, they are able express themselves correctly and erudite, they know how to prepare a presentation and have ability to interest their audience. We can state that hypothesis H1 was not proved. As the correlation was too low, there should be done another research. This result relates only to the chosen group of students.

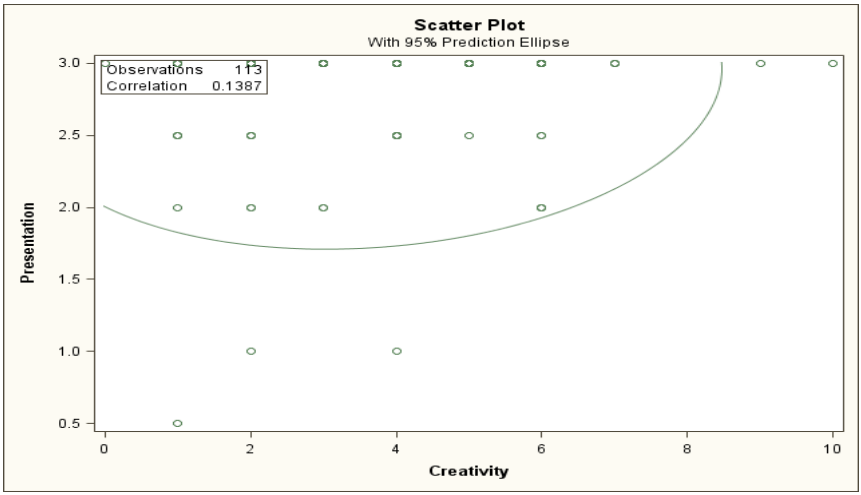

Fig. 1: The scatter Plot of relationship between presentation and creativity

Creativity/Discussion

In the second hypothesis H2 we assumed that direct linear relationship does not exist between creativity and discussion. It means that students, who achieve higher score within creativity, do not achieve higher score for discussion. In other words, students who are more creative and have creative thinking are not able to react to questions, show knowledge of the problem being solved, provide interesting solutions as well as quick and logical answers to questions during a discussion.

Table 3 shows descriptive statistical indicators. Minimum values are changing in discussion, where students obtained minimum 1 point.

Simple Statistics							
Variable	N	Mean	Std Dev	Sum	Minimum	Maximum	Label
Discussion	113	2.81	0.39	317.50	1.0	3.0	Discussion
Creativity	113	3.7	1.91	418.00	0	10.0	Creativity

Tab. 3: The values of simple Statistics of variables Discussion and Creativity

Table 4 presents the result of the Pearson correlation coefficient that indicates ***direct linear relationship*** between creativity and discussion. This dependence is ***low or trivial*** because result of 0.096 is approaching to zero and it is lower than 0.1.

Pearson Correlation Coefficients, N = 113 Prob > |r| under H0: Rho=0	
	Creativity
Discussion	0.096
Discussion	0.31

Tab. 4: The relationship between Discussion and Creativity expressed by Pearson Correlation Coefficients

In verifying hypothesis H2, measuring the relationship between creativity and discussion, we can say that even though there is proven a direct linear relationship, we cannot clearly state that the more students are more creative, the better communication skills they have; they are familiar with the problem being talking about and they logically react to the posed questions and vice versa. This result is again related only to the group of researched and valuated students.

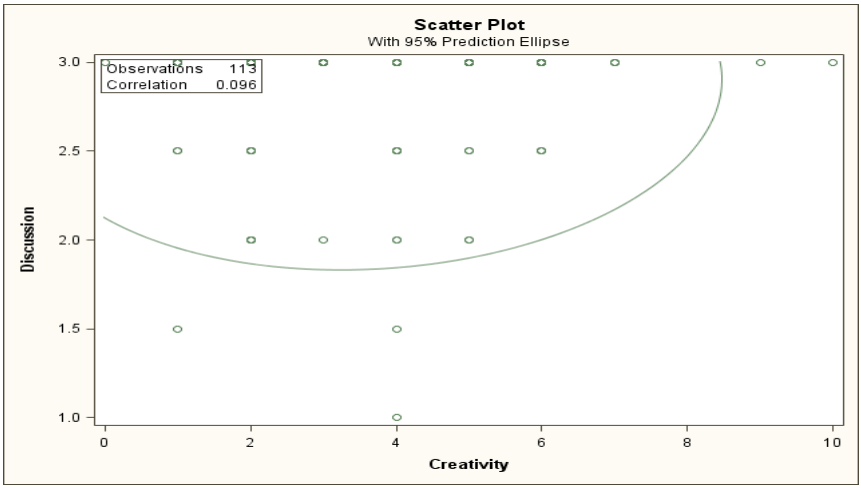

Fig. 2: The Scatter Plot of relationship between Discussion and Creativity

Conclusion

Sternberg in Handbook of creativity (1998) states that creativity helps to the new scientific findings that can occur also in economic field - creation of new ideas, new products and services, new process of production. It can be also seen in the preparation of young

people for professional life, how creative they are and what their creativity can bring in the specific problems solutions. The way of creativeness we could also observe during evaluation of students term works. Aim of our research was to find how creative they are and if there was proven relationship between creativity and their communication skills.
The aim of the article was to measure selected types of managerial competences among the last year students who are preparing for their professional life. We were interested in how they are creative and if the creativity influences their communication skills – discussion and presentation. Our research has been realized during the course "Sales and Vending Strategy of the Company", at the Faculty of Business Economy in Košice. We measured the relationship between creativity, presentation and discussion. The relationship between creativity and presentation was indicated as *small direct linear relationship*. The relationship between creativity and discussion was *trivial.* In the first hypothesis, we can state that it was not proven. We can conclude that the more students creative are, the better they can present themselves and explain the topic to audience. But in the statistical result there is not proven so strong relationship to state it mandatory. Same situation is in the second hypothesis, where direct linear relationship between creativity and discussion was observed, but the correlation was weaker than in the first hypothesis. Again we can't state surely that the more students creative are, the better they can discuss about topic.
In generally, we can conclude, that relationship between variables expressed by the results was direct linear and we could say that the more students dispose with creativity, the better they can understand and talk about the topic of their work and possible solutions. Moreover, they are more able to provide answer to posed questions. As we take in the mind statistical results, they proved low relationship. For rejection hypothesis we should find out stronger significance. Although relationship is weak, we can suggest include more practical tools for soft skills and competences into the educational process while students are being taught and prepared at school. Students should be given more opportunities to practice their creativity and communication skills as they also represent a significant part of their future career. According to Klepáková and Ivančová (2013) it is especially in jobs positions that require creative thinking.
As we stated in the introduction, creativity is important in society. To the more national structures as European Union and Asian countries creativity is something what impels the innovation forward. Creativity is important as thinking skill and according its importance (lightly seen in our results) it is desirable to educate people and lead mostly students to the creative thinking, that can be manifested in the communication, presentation skills, responding skills and innovative thoughts. Sawyer and Andersson see the creativity as an important part of education system and the base of the innovative approach in solving problems. Therefore, we suggest to use more modern practices in education, such as simulations, case studies and discussions to boost students to discuss more between themselves, to encourage them to the critical discussion, expressing opinions and finally to increase their creativity by suggesting solutions to problems working in pairs or groups. As the results showed low and trivial relationship between creativity and next variables (presentation and discussion) there should be done another researches to measure the relationship in other groups of students, if there is also connection between the ability of creative work and creative thinking expressed in communication skills (presentation and discussion).

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IDENTIFICATION OF CONTEXT SPECIFIC KNOWLEDGE AS TOOL FOR FACILITATORS AND THEIR QUALITY INVOLVEMENT

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Abstract

Energy is an indispensable part of daily life, but to the each technology unarguably belongs proper maintenance and management by local actors. Small-scale biogas technology can cover increasing energy consumption in rural areas of central Vietnam, if managed well. The survey was conducted in two districts of the Thua Thien Hue province in central Vietnam from July to September 2012 at the level of randomly selected owners of biogas plants (n=141) and facilitators (n=9). Methods of data collection included focus group discussions, semi-structured personal interviews, questionnaire survey and observation. Collected data were categorized, coded and analyzed in a statistical programme Statistica 10. Based on our findings Context Specific Knowledge for facilitators (from the commune, district or province level) and their quality involvement was identified. More research in terms of facilitator's impacts on knowledge transition process to the beneficiaries should be done to prove the sustainability of the extension services.

Keywords

Central Vietnam, context specific knowledge, facilitators, biogas technology

Introduction

Energy is an indispensable part of daily life and with environmental issues has become the most important problem of common concern. Increasing energy consumption in rural areas of central Vietnam can be covered by use of family-size biogas technology and can lead to healthier and more sustainable way of living. Biogas technology is considered as a technology significantly improving the environment, as it solves waste management problems, produces biogas and digestate at the same time (Muller, 2007; Molino et al., 2012). To the each technology unarguably belongs proper maintenance and management by local actors. The two key actors in the extension performance in case of central Vietnam and our study are biogas technology owners and facilitators, as the immediate providers of advices and services. In Vietnam all 63 provinces and cities have their own Extension Centres. At the district level 585 of total 648 have Extension Station, which are directly under control of the provincial Extension Centres, or the District People Committees. Vietnamese agriculture is mainly crop focused, facilitators' experience with husbandry is lower, as well as in the case of biogas technology, where main feedstock is pig manure. The topic of information transmission is showing its importance through positive effects on small-scale householders in Africa and Asia. With proper extension services is coming increase of poverty reduction and household income improvement in the long-term period (Buadi et al., 2013; Hu et al., 2012). This paper aims at identification of the current state of extension services in Central Vietnam and creating proper recommendations and comments for further process of trainings in target area.

Materials and Methods

The survey was conducted in Huong Tra and Phong Dien districts, the Thua Thien Hue province in central Vietnam from July to September 2012 at the level of randomly selected owners of biogas plants (*n=141)* and facilitators (*n=9*). Methods of data collection included focus group discussions (*n=41*), semi-structured personal interviews (*n=100*), questionnaire survey (*n=100*) and observation. Biogas plant (BGP) owners and facilitators were interviewed through a semi-structured interview; each interview took around one hour. Results of participatory methods were compared with the results of own observation of target groups. The questionnaire was piloted tested; based on the results adjusted and approved by the experts from Agricultural Forestry Fishery Extension Centre (AFFEC) before final distribution. Collected data were categorized, coded and analyzed in a statistical programme Statistica 10. Due to the nature of data Spearmen´s correlation coefficient (ρ) was used to detect possible relations between average diameter of knowledge at the level of BGP owners and their commune facilitators.

Results and Discussion

Characteristics of biogas technology facilitators

The purpose of the inquiry was to identify Context Specific Knowledge (CSK) for facilitators and their quality involvement. Local facilitators are from the commune, district or province level. Commune facilitators are employees of commune. The summary of commune characteristics of facilitators is presented in Table 1. In average facilitators have 5.3 (±2.43) years of experience in the field of maintaining biogas technology. Facilitators have in average 10 (±1.91) villages under administration with 122.17 (±65.48) biogas plants (BGPs) under supervision, from which are in average 61.81 (±21.74) built by Czech University of Life Sciences Prague (CULS) as project implementer. In the extension service hierarchy commune facilitators are subordinated to district facilitators; facilitator α from Huong Tra district Agricultural Forestry Fishery Extension Service (AFFES) with 10 years of experience, 60 villages under administration and 4 commune facilitators under administration, then facilitator β from Phong Dien AFFES with 7 years of experience, 70 villages under administration and 4 commune facilitators under administration. Technical management of the whole province, connected with the issue of biogas technology, is up to facilitator γ who is a provincial technician from Agricultural Forestry Fishery Extension Centre (AFFEC). Facilitator γ has got 6 years of experience with biogas technology and he has the deepest education background in the field of biogas technology and has all 150 villages in the province under administration with all 40 facilitators in charge. As presented in Table 2 all of newly built BGPs in the province are under administration of facilitator γ.

Knowledge of biogas technology by facilitators

Knowledge about specific issues connected with biogas technology is presented in Table 3 (commune facilitators) and Table 4 (district and provincial facilitators). Knowledge about issues of biogas technology, biogas and digestate (as by-product) are quite satisfying; however, knowledge about digestate management and its handling is poor. This is more obvious in case of district and province facilitators, who are more realistic in this issue and who are aware of their deficits.

Characteristics of BGP owners and their knowledge related to biogas technology

The second target group surveyed involved BGP owners. Education of respondents,

taken by the highest educational attainment in household is tertiary (34% of respondents), secondary (55%), primary (10%) and without education (1%). There is an expectation that with deeper education there is growing ease to adapt to the new possibilities (Behrman and King, 1999) that could be connected to the better maintenance of the BGPs. Respondents (BGP owners) in our survey attended at least one training in 79% of cases and in average they attended 1.9 trainings with their satisfaction in 61 cases (48.19%). Education is often viewed as the principal route out of poverty in developing countries (Glewwe and Jacoby, 2004) so there is obvious substantiation for improvement and proper maintenance of the trainings. The BGP owner's knowledge about specific issues connected with biogas technology is summarized in Table 5. The highest knowledge is about technology in general, which is coming from trainings and from practice. However, there is low knowledge about digestate management. This is caused by recent arise of the problem with digestate issue and so far minimal information provided from facilitators to the BGP owners.

Relationship between knowledge of facilitators and beneficiaries (BGP owners)

In order to identify/define the relationship between knowledge of facilitators and knowledge of BGP owners Pearson´s correlation was calculated. It showed us the positive correlation between examined factors (ρ=0.45). Pearson's correlation was done through average diameter of knowledge at the level of BGP owners and knowledge of their commune facilitators at the critical value of 5 %. It confirms importance of proper education and proper maintain of the trainings. The reverse effect from growth to education, and this the possibility of endogeneity is crucial (Seetanah, 2009), as evidenced in case of 40 African states. An association at examined knowledge transmission confirms our hypothesis and shows the importance of proper education and correct maintain of the trainings. Recently there has been a wave of decentralization of educational systems in many countries, these reforms are downsizing the bureaucracy and modifying its functions (Behrman and King, 2001), and this can lead as well to dilution of the function. There is also importance of teacher´s role (Mahini et al., 2012). The issues of causality and dynamics have been largely ignored until recently (Seetanah, 2009). Due to the above mentioned facts there were designed comments and recommendations on the training process.

Recommendations for further trainings

According to famous Edgar Dale´s extensively cited "Cone of learning" (Rodrigez-Hernandéz et al., 2012); it must be noticed importance of non-formal education (NFE). Even if so called: "Cone of learning" and its authenticity was criticised (Molenda, 2003). Through "Cone of learnign is shown importance of active approach to the learning process. BGP owners were showing higher involvement during focus group discussions (FGD) with the use of NFE than with conventional methods. As one of the respondents (farmer from Duong Son Village) said: "*Trainings are sometimes very long and tiring. I am losing my attention. Trainings should be more focused on practical information*". This led us to an assumption that NFE is an important part educational and training process and should be more involved in conditions of Vietnamese Extension Service procedures, because currently there is strict top-down approach. Long-term impact on knowledge must be examined in further studies. Research results also have shown us the importance of continuously repeating training, because with delays in time respondents report decrease of specific knowledge about the topic. With this is in conformity study of Steyn (2013), who points to the need of continuous education and submits criticism of traditional approaches using one-day trainings. This was supported as well by studies Hunzicker (2011) and

Chappuis et al. (2009), because these trainings may raise awareness of specific topic and create a foundation of knowledge, but do not lead to sustained continuing professional development or fundamentally improved practice (Hunzicker, 2011; Chappuis et al., 2009). There is need to involve methods of learning which includes deeper participation of the trained people. This is showing importance of demonstration BGP and active participation of the people during the training process. Trainers must use as many relevant real life examples as possible (Dichaba, 2013). According to Dale´s research, the least effective method at the top, involves learning from information presented through verbal symbols (listening to spoken word). The further you progress down to the bottom of the Cone of learning; there is higher impact of used methods. The most effective method is at the bottom, it involves direct, purposeful learning experiences, such as field experience. The discussions should be guided and modelled, and facilitators should encourage their listeners (BGP owners) to respond in an assertive manner (Rodrigez-Hernandes et al., 2012). The success of extension services is based on the performance of extension agents. Only qualified, enthusiastic and self-confident extension agent can minister to improve farmers' livelihood (Mazancova and Havrland, 2010). The pedagogy is bound with purpose of meditating the methods and educational process (Rodrigez-Hernandes et al., 2012). It demands from facilitators to be able to answer questions while keeping an eye on BGP owners during training process in order to empower them to reflect more otherwise there is a danger of participants easily loosing the interest. The Facilitator's role should be not only to teach, but as well become designer of a learning scenario, encouraging listeners to participate and learn, according to their social and psychological characteristics. Similar conclusions were reached also by Rodrigez-Hernandes et al. (2012). Based on our findings below is visible so called "Set for facilitators and their quality involvement" (Figure 1) was developed. Context specific knowledge (CSK), which is the main indicator of proper educational impact during trainings shall consist from following topics: Knowledge of the topic (provided by AFFEC and through experiences), Pedagogical knowledge (for proper behaviour and teaching methods, taught by AFFEC, BPAHS, or state educational centres), Beliefs and enthusiasm (trainers belief is important, because of the way of knowledge and trust into technology transmitting) and Knowledge of the respondents (every rural area in developing countries can be very specific and that is why is this specific knowledge very important as well). The importance of respondent's attitude was also evaluated in the study by Mazancova and Havrland, (2010), where it was considered for a crucial factor in successful information transfer process. Whole educational process shall be controlled through several aspects, as they are: AFFEC, Commune, BPAHS and training participants through their feedback.

Commune facilitators (N=6)				
	Years of experience	Number of villages under administration	Number of BGPs under administration	CULS BGPs
Mean	5.3	10	122.17	61.83
St. dev.	2.43	1.91	65.48	21.74
Min	2	7	76	34
Max	10	12	264	94

Tab. 1: Characteristics of commune facilitators

District and province facilitators				
Name	District	Employer	Number of BGPs under administration	CULS BGPs
Facilitator α	Huong Tra district	Huong Tra AFFES	340	242
Facilitator β	Phong Dien district	Phong Dien AFFES	380	250
Facilitator γ	province technician	AFFEC	1000	500

Tab. 2: Number of BGPs under administration of district and province facilitators

	Mean*	Min	Max	Sr. dev.
Knowledge about BGP technology	1.33	1	2	0.47
Knowledge about biogas	2	1	3	0.82
Knowledge about digestate	2.33	1	4	1.1
Knowledge about digestate management	2.75	1	3	0.89

*the five point scale: 1-very good, 2-good, 3-moderate, 4-low, 5-very low

Tab. 3: Knowledge about specific issues connected with biogas technology – commune facilitators

	Mean*	Min	Max	St. dev.
Knowledge about BGP technology	1.33	1	2	0.47
Knowledge about biogas	1.33	1	2	0.47
Knowledge about digestate	2.33	2	3	0.47
Knowledge about digestate management	5	5	5	0

*the five point scale: 1-very good, 2-good, 3-moderate, 4-low, 5-very low

Tab. 4: Knowledge about specific issues connected with biogas technology – district and province facilitators

	Mean	Min	Max	St. Dev.
Knowledge about BGP technology*	1.66	1	5	0.85
Knowledge about biogas*	3.01	1	5	1.07
Knowledge about digestate*	1.81	1	5	1.04
Knowledge about digestate management*	3.16	1	5	1.15
Counted knowledge mean	2.41	1	5	0.89

*the five point scale: 1-very good, 2-good, 3-moderate, 4-low, 5-very low

Tab. 5: BGP owner's knowledge about specific issues connected with biogas technology

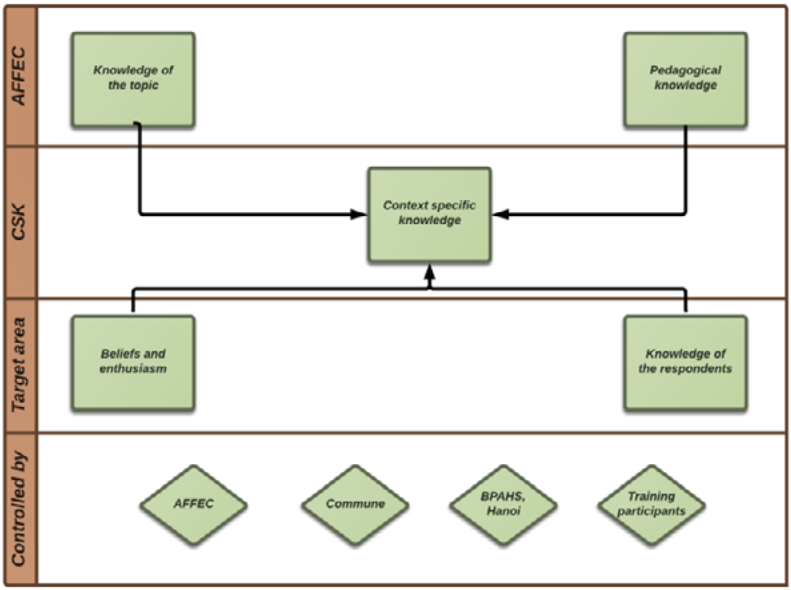

Fig. 1: Set for facilitators and their quality involvement

Conclusion

The level of knowledge at the level of facilitators and BGP owners was assessed in two districts of province Thua Thien Hue, Vietnam. This assessment was based on random sampling of BGP owners and all local facilitators. Based on Cone of Learning CSK (Context Specific Knowledge) for facilitators and their quality involvement were created. CSK shall consist of following topics: Knowledge of the topic, Pedagogical knowledge, Beliefs and enthusiasm and Knowledge of the respondents. Also further trainings of facilitators are needed, especially in case of improving knowledge about digestate and its management.

More research in terms of facilitator's impacts on knowledge transition process to the BGP owners and findings of further limitations should be done to prove the sustainability of the extension services.

Acknowledgment

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STUDYING AT THE VIRTUAL UNIVERSITY OF THIRD AGE

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Abstract

The article deals with aging and quality of life mainly within the context of lifelong education. It points to the growing need to deal with issues related to educating seniors not only with respect to the specific needs that higher age poses on the learning process, but also with respect to social exclusion or spatial seclusion. It is focused on making use of e-learning within courses that form a part of the University of Third Age (U3A) programmes. Part of the article is further formed by a brief description of the main characteristic features of a virtual form of education as it is conducted by the FEM CULS Prague in regions that are further away from university campuses. It also provides information on the characteristics of Virtual University of Third Age (VU3A) students, it maps their demographic characteristics, social background, their ICT experience, and also their perspective on virtual education and their experience with it.

Keywords

E-learning, lifelong education, senior students, Virtual University of Third Age

Introduction

We can consider the manner in which a given society takes care of its older citizens, supporting their integration and maintaining the quality and meaning of their life, to be one of the manifestations of a functioning society. The issue of quality of life and the meaning of life becomes important even at a very advanced age as the human lifespan keeps expanding. At this point, especially when our interests are one sided and lie in financial security and having basic life necessities fulfilled, without focusing on being useful to others and without having sufficient amount of communication and enjoying common everyday pleasures, the sense of having a purpose in life can be significantly shaken (Kalvach, 2005) and the possible risk of depression increases. (Ondrušová and Dragomirecká, 2012). When we take into account reduced participation within society, spatial segregation and institutional disengagement, older people also risk social exclusion (Scharf et al, 2001).

Education further belongs among things that affect the quality of life (the term itself is quite wide and ambiguous) (Vives Barceló, Orte Socías and Macías Gonzáles, 2012), and it should be accessible to individuals regardless of their age. People of all ages should have the opportunity to continue studying within a society that supports lifelong education (Escuder-Mollon, 2012). Nillson (2010) indicates that lifelong learning programmes can have impact on the increase of social inclusion.

The text is focused on the subject of educating elderly students. This group of students is not usually motivated to study on account of work related ambitions, however, they are motivated by their interests. Educational institutions usually try to offer educational programmes that deepen current knowledge (economics, art, history, ICT, etc.), as well

as other programmes that maintain or encourage senior citizens to be active (supporting volunteer or possible cross-generation activities). Some programmes are also dedicated to increasing citizen competences of senior citizens, e.g. increasing awareness of their legal rights. One reason for the success of these programmes may be that their goals include improving seniors' physical, mental and social health and their quality of life in general (Vives Barceló, Orte Socías and Macías Gonzáles, 2012).

Currently most public schools and universities and even some private academic institutions offer senior citizens further education in the form of University of Third Age. The main problem of the regularly offered learning programmes is that they are tied to the place where the given educational institution is located. The increasing age of population and at the same time the younger generation's move from the country to urban centres is characteristic for the current situation in the Czech Republic. It is necessary to provide such form of courses that would be able to secure the learning needs of senior citizens even in remote regions. Viewed from this perspective, e-learning seems to be an optimum (convenient) solution with regard to the need to overcome distances. The student does not have to travel far to attend university courses, but the courses are available within the student's reach. Technology is playing an increasing role in education. As technology advances, it is used for the benefit of students and people of all ages that take part in the learning processes (Gudănescu Nicolau and Popescu, 2013).

The article's goal is to present several outcomes resulting from a survey, which was conducted among a group of seniors - students of the Virtual University of Third Age (VU3A) at the Czech University of Life Sciences Prague, Faculty of Economics and Management.

Materials and Methods

Virtual University of Third Age was created at the FEM CULS Prague in 2008. Its aim is to make accessible general interest college courses in a long-distance form even to those seniors that cannot attend full-time studies of University of Third Age (U3A) at university campuses chiefly on account of the distance. Virtual U3A is used mainly by smaller groups of seniors in regions all across the Republic.

The system of the courses is based on e-learning. The lessons' facilities are created using LMS Moodle with an internet application. The courses are based on multi-media lectures that are conducted by the Academic staff (recorded in the form of videos), and which are didactically adapted for elderly people. All the possibilities that an interactive form of lessons has to offer is used (pictures, charts, animations etc.). Part of the courses are formed by testing modules, text materials and communication platforms.

The semester-long course consists of 6 video sequences – lectures that are specifically adapted for VU3A purposes. Each sequence lasts about an hour to an hour and a half. A test follows each lecture, where the participant must earn a certain number of points in order to successfully pass it. Only when the student receives at least a minimum number of points on the tests, can he/she receive a Certificate of Completion of the given course module. Having completed 6 semester-long courses according to one's choice, the student receives a Certificate of Completion of U3A. Lessons (in the form of meetings where the lectures are played and model tests are taken in a group) are most often conducted in so-called Consultation Centres. These can be e.g. libraries, municipal houses, schools or other institutions; however, it is also possible to study in a full long-distance mode - through a direct link to the course's tutor.

FEM CULS Prague oversees the creation of the courses, provides technical support

during the creation of multimedia lectures, administers the learning www.e-senior.cz, and provides central organization including supplementary activities. Currently 17 subjects are offered in 148 Consultation Centres, in which 2576 elderly students study.
New participants of the Virtual University of Third Age are always approached with the survey when the first lecture series (semester) are concluded. The written-form questionnaire is completely anonymous and voluntary.
The questionnaire was put together ad hoc for the purpose of the research and it consists of four main blocks: socio-demographic data, social support data, data on the use of ICTs and data connected with lessons. The questionnaire includes 30 questions, out of which 10 questions have a bipolar range of answers (yes/no), 17 questions are multiple choice, one question includes 11 statements with a five-degree answer range from 1 (least important) to 5 (most important), and two open questions (one is focused on finding out the subjects that the participants are missing among the offered courses, the second question collects insights and comments regarding the organization of the lessons or the materials).
Up to now 680 respondents participated in the research, out of which 495 (72.8%) were women and 185 (27.2%) were men. Most often respondents have completed secondary education (67.7%). Fig. 1 shows age composition. 56.3% respondents live with a partner, 29.9% live alone, and 5% live in a retirement home or some other similar social facility.

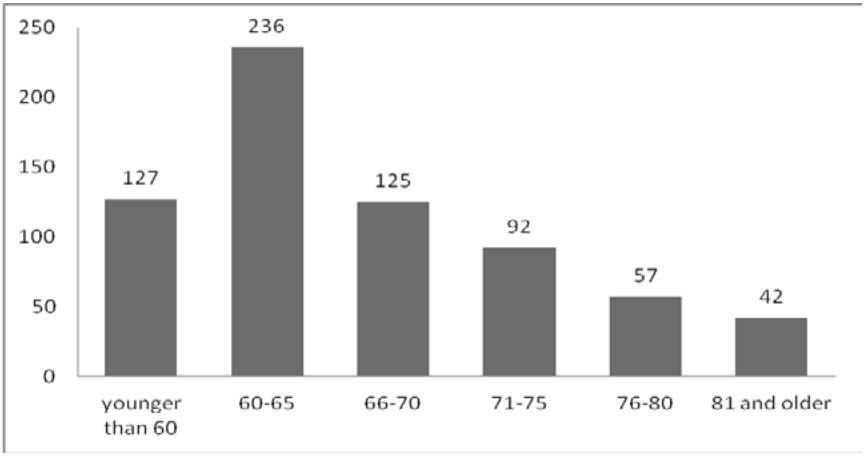

Fig. 1: Age Composition of Respondents

The methods of statistical analysis applied issued from the aims of the research conducted. The aims were to described selected socio-demographic characteristics of the date sample , to describe the features of their motivation to study, their experience concerning the educational form, and their expectations and educational needs. Because of that, the data were analysed by SPSS programme. The results of analysis are described in the following text and contain descriptive statistics (Escuder-Mollon, P., 2012; Vives Barceló, M, Orte Socías, M. C. and Macías Gonzáles, L., 2012) and a Factor Analysis of a part of the data sample (Table. 1).

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.683
Bartlett's Test of Sphericity	Approx. Chi-Square	766.787
	df	55
	Sig.	.000

Tab. 1: Results of KMO and Bartlett's Test

Results and Discussion

62.4% of respondents state that they had the opportunity to study during their active life according to their own interests. Most often their professional orientation was in the field of industry (24.7%) and in education (16.9%).

More than ¼ of respondents (26.1%) state that they did not work with a computer, respectively the internet, at work. After one course 67.3% of respondents state that they are able to start the learning programme completely by themselves, 28.1% then is able to start the programme with the help of fellow students or other people. Currently 65.0% of students responded that they have internet access at home. The results indicate that e-learning distinctly strengthens the given students' competences in the area of ICT.

For 79.9% of the respondents, studying in a virtual form it is their first experience with University of the Third Age. Respondents also referred the reasons that led them to study VU3A. Presented reasons (altogether 11) were evaluated on five-degree Lickert scales from 1 (least important) to 5 (most important). As the most important reason for studying VU3A 62.6% of respondents gave the need to receive new knowledge and information. The need to maintain their mental condition in good form (48.6%), next is the need to deepen and maintain current knowledge (44.3%), desire to spend time in a meaningful manner (31.7 %), and the tendency to maintain contact with other people (31.7%). Results of Factor Analysis as presented in the Table 1 show exactly the same thing: it shows three factors from which the first one concerns interest in contacts with people (items 10, 11). The second factor concerns interest in knowledge (items 1, 2) and the third factor contains items on qualification (items 6, 7, 9). The given results correspond with the findings that seniors' interest in studying is motivated by their desire to deepen their knowledge, to receive new knowledge, or because they just enjoy the learning process (Escuder-Mollon et al, 2013).

	Component		
	1	2	3
1) I want to get new knowledge	-.004	.751	.061
2) I want to develop further my knowledge	-.006	.746	.102
3) I want to use my leisure rationally	.466	.407	.018
4) I want to prove to myself I´m fit for the study	.453	.462	.162
5) I want to keep my mind in good condition	.363	.513	-.057
6) I want to study because there was no time for it previously	.078	.118	.718
7) I want to study because I have not been allowed to study in the previous years	.029	-.040	.779
8) I want to learn things which I would be able to use later	.021	.293	.448
9) I want to get a certificate	.147	-.037	.636
10) I want to spend my time together with people of similar interests as me	.864	-.032	.127
11) I want to keep contacts with other people	.870	.054	.121
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.			

Tab. 2: Rotated Component Matrix (FA)

The overall difficulty of the studies is evaluated by the participants as being adequately difficult (79.8%). All the surveyed technical parameters of the learning materials were evaluated distinctly positively. The quality of the video image was positively evaluated by 87.9% of respondents, the comprehensibility of the spoken word was positively evaluated by 87.2%, and the readability of the text was positively evaluated by 84.9%. After the first group projection 32.9% respondents stated that they had no problems understanding the contents of the material. Most respondents (66.8%) then took advantage of the option to replay the lecture and to study the material at home. 30.9% state that they needed to play the material over one more time in order to understand it, 36.6% then actually needed to play it over two more times.

The respondents also considered the main advantages virtual learning has to offer. The given form of learning was mostly preferred for its accessibility (79.4%), for the possibility to review the lecture's material (76.2%), taking into account one's own study pace (70.9%), and the possibility to study the material also individually (67.4%). Hrubý (2008) also states similar advantages of studying with the help of ICT. He presents them as an expression of freedom, which is a necessary component of adult learning. Contact

with other students within Consultation Centres was another significant positive aspect (62.2%). The possibility to meet with other members of the study group within the Consultation Centres, is something that is undoubtedly valued also by our respondents. This supports maintaining and creating new social contacts in one's surroundings and serves as prevention of social exclusion. (Scharf et al, 2001).
Last but not least the participants were also attracted by the possibility to choose a study programme (57.9%).
The need and requirement for the accessibility of this study form even corresponds with other results that show us that although 83.8% of the respondents do not feel that they are physically limited, 52.9% think that they are only able to participate in a course under the condition that it is within a walking distance from where they are residing. Another 37.5% feel they could travel maximum up to 20 km to take courses. The given results along with a high number of "first time students" at U3A that are enrolled in the virtual form of learning, show us that it is necessary to "export" adult education for the elderly from university towns even to less accessible or even secluded places, ideally right into their homes. E-learning then seems to be the most suitable form to carry out this mission.
The results of the open question, where respondents wrote which courses they would welcome, indicate that mainly culturally-historical subjects, especially dealing with art or architecture, are generally preferred. FEM tries to take these requests into consideration when creating new programmes for senior citizens.
The respondents' answers to the last question of the questionnaire, in which the students could give their insights or comments regarding the organization of the course or the learning materials, brought great satisfaction to the team organizing VU3A and was a reward for their work. There were very few negative comments (overall students regretted the physical absence of the lecturer) and words of praise and satisfaction received from the learning programme by far outweighed the negative comments.

Conclusion

The results of the survey clearly show the obligation of society to ensure that seniors' learning needs are satisfied, not only of those that are within reach of university campuses, but even of those (and perhaps mainly of those) that are in secluded locations, or of those that are socially excluded.
A suitable, accessible, and for elderly students acceptable method of learning seems to be e-learning. Not only with respect to the availability of the courses via internet, but also with respect to the fact that even seniors, who have minimum experience with internet technologies from their former professions, are able to quickly receive required skills that are necessary for this type of study. One of the reasons for this could be higher motivation to accept information technology as a medium enabling retired people to study, due to the simple fact that on account of their individual circumstances (residence, mobility etc.), they are not able to find other study options. The lessons are then organized with the assistance of centres that help elderly students handle ICT. Here students do not only exchange their knowledge regarding the studied subjects, but also their user experience with the e-learning programme. They can further consult the heads of the centres, who are specially instructed for this by the organizing faculty. The fact that the student can even enter the lesson's supporting programmes at home, further opens up space for intergenerational collaboration. Other members of the senior citizen's wider family can help him/her overcome lack of knowledge or other obstacles when communicating with the computer.

The research revealed the necessity to always keep developing new study methods in the area of senior education (in terms of applied technologies it will soon be necessary to consider the possibility of educating seniors through web interface of mobile telephones or by using adaptive forms of e-learning.). Furthermore, it showed the necessity to deal in greater depth with issues that are connected with the well-being of seniors and mainly to try to localize the attributes that significantly influence it.

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IMPACT OF HIGHER RATE OF SELF-STUDY ON RESULTS IN THE COURSE OF TRADE THEORY

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Abstract

Contact teaching reduction and increasing rate of self-study belongs to the current trends of teaching in bachelor and master study programs. This teaching organization assumes greater responsibility of students in individual preparation and training beyond their participation in lectures and seminars. The subject of Trade Theory has always belonged to subjects requiring an individual preparation of students due to the large extent of studied areas. The aim of the paper is to analyze the impact of a higher rate of self-study on study results this in course in two years after the accreditation of bachelor study programs in the Faculty of Economics and Management of the Czech University of Life Sciences in Prague which involved a contact teaching reduction. Any direct impact has not been discovered..

Keywords

Trade theory, bachelor study, re-accreditation, self-study, study results

Introduction

Globally, it is possible to see an increase of self-study rate as a trend in university teaching. Also in the Czech Republic, the increasing rate of self-study at full-time bachelor and master study programs is enabled and supported by currently improving equipment with information and communication technologies (ICT) both at the faculties and in households (according to CZSO (2013), 65% of households have at least one computer and 62% of households have access to the Internet). Consequently, ICT becomes available for students of all study branches. Moreover, the development of information and communication technologies also makes possible a huge implementation of learning management systems (LMS). These facts create more space for preparing and studying outside the faculty premises. However, there is a question whether such modifications of study organization do not negatively affect teaching quality and thus also study results (Kučera, Kvasnička and Krejčí, 2012).

The real impact of ICT utilization on higher collaboration and independent learning of student is a matter of research by Nechita and Timofti (2011). There are many methods for the evaluation of higher and university education, e.g. AQIP Model (Yarmohammadian, Mozaffary and Esfahani, 2011), SET methods (Langbein, 2008, Arnold, 2009, Spooren, 2010), and others. One of the main components of these methods is students' exam results. Based on similar trends abroad, the Faculty of Economics and Management (FEM) of the Czech University of Life Sciences (CULS) in Prague, also decided to change the study organization. This modification insisted in decreasing the volume of contact teaching in full-time study programs and has been implemented within the last re-accreditation of bachelors study programs since the study year 2011/2012. This new teaching system represents a shift in emphasis from the contact teaching to individual students' preparation.

More emphasis is put on lectures which represent two thirds of the total teaching time in single subjects while one third remains for exercises. Moreover, the reduction of exercise time allocation released some capacity in exercise rooms and enabled to take more students especially to large study branches. As a result, the number of students in the study branch of Economics and Management (EM) increased by 35% and in Business and Administration (BA) by 20% since the study year 2011/2012. Another important feature of this re-accreditation which may have impact on study results was the shift of several, especially more difficult, courses from 3rd to 2nd study year in order to create more space for students for working on bachelor theses.

The impact of the contact teaching reduction at FEM CULS has been already investigated in some cases of particular courses. Vasilenko et al (2012) stated that the new accreditation of bachelor study programmes at the Faculty of Economics and Management at the Czech University of Life Sciences has brought transformation of education process following the more independent and autonomous way of learning that puts higher demands for students. These authors also, in accordance with this assumption, realized deterioration in study results in bachelor ICT course. On the other hand, Kučera, Kvasnička and Krejčí (2012) discovered an improvement of study results, even in a theoretical course which was considered difficult. Another different situation was detected by Kučera, Kvasnička and Vydrová (2013): the study results get worse but the main reason did not insist in the contact teaching reduction but in other study organization changes within the re-accreditation. The article is concerned on analysis of contact teaching reduction and its impact of higher rate of self-study on results in the course of Trade Theory. The aim of this contribution is to show the relationship between the amount of hours of contact teaching and study results.

Materials and Methods

Content of the Course of Trade Theory

The course of Trade Theory is taught in the winter semester of 3rd study year in the BA study branch and in the summer semester of 2nd study year in the EM study branch, both before and after the study programs re-accreditation. In the course of Trade Theory, the contact teaching scope was reduced from two hours of lectures and two hours of exercises a week (2/2 system) to two hours of lectures and one hour of exercises a week (2/1 system – more precisely, the exercises take place two hours once in two weeks). This means that the original scope of the exercises was reduced by 50%. Thus the possibility of personal contact of teachers with students, space for discussion and a more detailed explanation of the problem areas and topics that could not be explained in detail during the lecture fell by half. In fact, the decline in contact teaching was even greater both in case of the lectures and the exercises. Namely, in 2010, the original 14 week length of the semester (i.e. 14 lectures and 14 exercises per semester) was shortened to 12 weeks (i.e. 12 lectures and 6 exercises). This restriction has, however, another effect: in the schedule of exercises it is supposed a large space for organizational information in the content of initial exercise. Explicitly, in the initial exercise, it is necessary to explain conditions for the successful completion of the course, assign projects and topics for student presentations, etc. As well, in the final exercise, the credit test is written and credits are granted. Finally, the actual teaching time for exercise must therefore concentrate only up to 4 or 5 blocks. For this reason, the amount of topics to which students must prepare in their self-study is much higher than it might seem by simply switching from the 2/2 system to the 2/1 system.

This situation, with all its consequences, is very much considerable especially in case of the subject of Trade Theory. This subject has always belonged among subjects which study assumes a certain degree of students' independence and homework to add some information concerning selected topics individually from recommended sources. It is determined by the range of studied areas, the variety of thematic units and by the necessary updating of information contained. Transition to the 2/1 system and consequently a quantitative restriction of the exercise time caused that the level of students' homework increased twice and in some cases even multiple times because of the reasons described above. Among others, the teaching schedule of the whole subjects had to be modified.

The content of the Trade Theory seminars before the re-accreditation consisted of the following topics:

1. Introduction to the subject
2. System approach to trade (internal trade)
3. Business Entities
4. Business Transactions
5. Survey in the field
6. Sales assortment, classification and identification of goods
7. Infrastructure of Internal Trade
8. Logistics in trade
9. Pricing in trade
10. Promotion, advertising and media advertising
11. Marketing concept business activities
12. The conclusions of the research in the field (presentation of results)
13. Credit test
14. The final exercise

The content of lectures, and exercises in particular, was revised. Some exercise topics were completely removed, some others restricted or shifted to lectures, in some cases two thematic units were merged into a single exercise, some themes were left to self-study. Inability to work with students in more exercises led e.g. to a significant deterioration of the results of mathematical calculations that are part of some topics. It turns out that face-to-face learning is in many cases irreplaceable in accordance with conclusions by Houška and Houšková Beránková (2011).

After these changes, the list of topics looks as follows:

1. Introduction to the subject. System approach to internal trade
2. Business Subjects. Business Transactions
3. Infrastructure of Internal Trade
4. The packaging of Goods, program Czech quality and other brands
5. Logistics. Pricing in trade
6. Marketing concept business activities

Study results were observed in case of BA in years 2010, 2011, 2012 and 2013, when the numbers of students were 272, 272, 260 and 273, respectively, and in case of EM in years 2011, 2012 and 2013, when there were 458, 472 and 634 students, respectively.

Study results analysis

The following two indicators are used for the analysis of study results. The first one is the Odds Ratio (*OR*) (Glass et al, 2003). It is used for the calculation of chance to pass the exam successfully. It is calculated as follows:

$$OR = \frac{ad}{bc} \quad (1)$$

where

a and b is the number of students who passed and failed the exam in the observed year,

c and d is the number of students who passed and failed the exam in the previous year.

For the evaluation of the *OR*, the value of 1 is crucial. If $OR = 1$, there is no dependency between the observed variables. $OR > 1$ means that affiliation with the second group (the previous year in our case) is a risk factor, and vice versa, $OR < 1$ means that the affiliation with the second group is a protective factor.

The second indicator is the Attributive Risk (*AR*) (Schechtman, 2002). The indicator is used to express difference in possibility to pass the exam in the observed year in comparison with the previous year. The *AR* is computed by this formula:

$$AR = \frac{a}{a+b} - \frac{c}{c+d} \quad (2)$$

Results and Discussion

Tab. 1 to 4 present study results of the BA study branch from 2010 to 2013. In 2010 the 2/2 system in contact teaching was applied while in the following three years the 2/1 system was implemented. The overall study results in the first three years of the observed period are practically the same; there are only some differences between male and female students. This observation is also supported by *OR* for all students in Tab. 5 which ranges between 0.7 and 1.35 and AR of absolute value slightly over 1% in Tab. 6. In 2013, a little progress in study results occurred, expressed by *AR* of 2.80% and *OR* of 2.34. To conclude, the contact teaching reduction has no significant impact on study results in the BA study branch in the Trade Theory course.

Of course, Tab. 1 to 4 also contains the following interesting information: although the number of students admitted to FEM has increased by 20% after the re-accreditation, the number of students in 3rd study year stays approximately the same. In other words, no extra admitted students have got to the 3rd study year.

In the end, let us note a curiosity that the mean grade of successful male students still slightly improved during all the observed period.

	All students	Female students	Male students
Total number of students	272	200	72
Number of successful students	259	191	68
Number of students who failed	13	9	4
Successful students (%)	95.22%	95.50%	94.44%
Mean grade of successful students	2.293	2.215	2.515
Average number of trials	1,308		

Tab. 1: Study results of the BA study branch in 2010

	All students	Female students	Male students
Total number of students	272	187	85
Number of successful students	262	183	79
Number of students who failed	10	4	6
Successful students (%)	96.32%	97.86%	92.94%
Mean grade of successful students	2.389	2.372	2.430
Average number of trials	1,174		

Tab. 2: Study results of the BA study branch in 2011

	All students	Female students	Male students
Total number of students	260	197	63
Number of successful students	247	187	60
Number of students who failed	13	10	3
Successful students (%)	95.00%	94.92%	95.24%
Mean grade of successful students	2.300	2.278	2.367
Average number of trials	1,239		

Tab. 3: Study results of the BA study branch in 2012

	All students	Female students	Male students
Total number of students	273	194	79
Number of successful students	267	191	76
Number of students who failed	6	3	3
Successful students (%)	97.80%	98.45%	96.20%
Mean grade of successful students	2.288	2.372	2.079
Average number of trials	1,133		

Tab. 4: Study results of the BA study branch in 2013

	All students	Female students	Male students
2011 vs. 2010	1.32	2.16	0.77
2012 vs. 2011	0.73	0.41	1.52
2013 vs. 2012	2.34	3.40	1.27

Tab. 5: *OR* for BA

	All students	Female students	Male students
2011 vs. 2010	1.10%	2.36%	–1.50%
2012 vs. 2011	–1.32%	–2.94%	2.30%
2013 vs. 2012	2.80%	3.53%	0.96%

Tab. 6: *AR* for BA

In case of the study branch of EM, the situation is rather different. During all three years observed in Tab. 7 to 9, the study results were worse in comparison with BA, and moreover, they still got worse, both in the number of students who failed and in mean grade of successful students. In particular, between 2011 and 2012 when the contact teaching extent was reduced, *OR* was approximately 0.5 (see Tab. 10), i.e. the chance for students to pass the exam got twice lower, and the *AR* (see Tab. 11) showed decrease by almost 10% in case of both the genders. A year later, the *OR* is much more auspicious (*AR* indicate decline only about 4%), and in case of female students, the chance to pass the exam is in 2012 and 2013 even almost the same (*OR* close to 1). In the same time, male students were considerably worse than female students during the whole observed period. This fact is apparently given by the more theoretical orientation of the EM study branch (in comparison with BA) and in such a case students dislike to learn subjects with wide range of studied areas and different thematic units without large possibility to apply logical thinking.

Let us concentrate on the number of students in single years and its impact on study results. In 2011 and 2012 the number of students was approximately the same, as both the whole number and single genders are concerned. Besides the contact teaching reduction, the study results decline might also be caused by the shift of relatively difficult courses to 2nd study year as mentioned in the Introduction. In 2013 the number of students was approximately by 35% bigger than in 2012, i.e. all the students extra admitted in comparison with the previous year still studied in the 2nd study year. It seems that their presence makes the study results worse. Moreover, between 2012 and 2013 the number of male students grew while the number of female students did not almost change; and the same is true for numbers of students of single genders who failed. It appears that the most of the extra admitted students were male students and they actually made the study results worse.

	All students	Female students	Male students
Total number of students	458	290	168
Number of successful students	405	269	136
Number of students who failed	53	21	32
Successful students (%)	88.43%	92.76%	80.95%
Mean grade of successful students	2.254	2.204	2.353
Average number of trials	1,249		

Tab. 7: Study results of the EM study branch in 2011

	All students	Female students	Male students
Total number of students	472	287	185
Number of successful students	372	240	132
Number of students who failed	100	47	53
Successful students (%)	78.81%	83.62%	71.35%
Mean grade of successful students	2.325	2.250	2.462
Average number of trials	1,280		

Tab. 8: Study results of the EM study branch in 2012

	All students	Female students	Male students
Total number of students	634	347	287
Number of successful students	472	289	183
Number of students who failed	161	58	103
Successful students (%)	74.45%	83.29%	63.76%
Mean grade of successful students	2.538	2.505	2.590
Average number of trials	1,397		

Tab. 9: Study results of the EM study branch in 2013

	All students	Female students	Male students
2012 vs. 2011	0.49	0.40	0.59
2013 vs. 2012	0.79	0.98	0.71

Tab. 10: *OR* for EM

	All students	Female students	Male students
2012 vs. 2011	–9.61%	–9.13%	–9.60%
2013 vs. 2012	–4.25%	–0.34%	–7.37%

Tab. 11: *AR* for EM

The impact of the contact teaching reduction at FEM CULS has been already investigated in some cases of other particular courses. Vasilenko et al (2012) stated that the new accreditation of bachelor study programmes at the Faculty of Economics and Management at the Czech University of Life Sciences has brought transformation of education process following the more independent and autonomous way of learning that puts higher demands for students. These authors also, in accordance with this assumption, realized deterioration in study results in bachelor ICT course in 1st study year. On the other hand, Kučera, Kvasnička and Krejčí (2012) discovered an improvement of study results, even in a theoretical course of Mathematical Methods in Economics taught in 3rd study year and considered difficult. However, a year after, when the course was shifted into 2nd study year, a different situation in this course was detected by Kučera, Kvasnička and Vydrová (2013): the study results significantly worsened and got deep below the level from the time prior to the re-accreditation. In summary, in case of 1st and 2nd study year, study results always get worse after the contact teaching reduction while in case of 3rd study year study results did not change or even get better.

Conclusion

The reduction of contact teaching and increase of rate of self-study often has a negative impact on study results and thus also on the quality of education. However, there exist situations without such effect. In this case such adjustment represents significant time savings for teachers during the semester. These modifications are tolerated especially by more talented students in higher study years. On the contrary, such approach can not be definitely recommended for students who begin their study and have low study experience, in particular in case of difficult courses. In case of the Trade Theory course, this attitude proved to be suitable for the students of 3rd study year of BA study branch but inappropriate for the students of 2nd study year of EM study branch.

Since the winter semester 2013, the written part of exam is and will be realized using the Moodle LMS. This change has been compensated for students by rather lower requirements for credit obtaining and exam passing. It might cause study results improvement mentioned in the Results and Discussion chapter. The impact of this exam modification should be an object of a future investigation.

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THE IMPACT OF TEACHING FORM ON STUDY RESULTS IN SUBJECT FOOD GOODS KNOWLEDGE

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Abstract

At the Faculty of Economics and Management of the Czech University of Life Sciences in Prague the volume of contact lessons in full-time study has been reduced after an accreditation since the academic year 2011/2012. Simultaneously, the Food Goods Knowledge subject was included as only elective. The main objective of the paper is to analyse statistically significant impacts of the teaching changes on the study results in the BSc. subject Food Goods Knowledge.

However the weak statistically significant correlation between year and grade was detected, the study results are better. The study results improving trend is demonstrated especially between two school years 2011/2012 and 2012/2013. The supposition that female students have better study results was confirmed in the B&A programme. It is true, that two years after the accreditation is a very short time for making serious conclusion. It is necessary to monitor this correlation also in the future.

Keywords

Accreditation, Food Goods Knowledge, learning outcomes, teaching form, elective object

Introduction

The current trend in education at universities leads to a decrease of contact teaching lessons. At the same time, the stress is put on self-study and using e-learning materials (Houška and Beránková, 2011). Decreasing the amount of contact lessons means shortening the academic semester from thirteen weeks to twelve weeks, and limiting the number of contact lessons from four to three per week. Before more several years the academic semester even had fourthteen weeks. This change also affects 2nd year BSc. students in the study program Business and Administration (B&A for further reference) at the Faculty of Economics and Management (FEM), Czech University of Life Sciences (CULS) Prague.

Kučera, Kvasnička and Krejčí (2012) conclude that "the reduction of contact teaching does not necessarily mean an overall fall in its quality". In the contrary, Houška and Beránková (2011) state that "face-to-face learning is necessary". A teaching form may to affect a quality and an evaluation of university education.

For the evaluation of higher and university education is possible use many methods. For the complex evaluation of education various methods can be used for example: AQIP Model (Yarmohammadian, Mozaffary, Esfahani, 2011), SET methods (Langbein, 2008, Arnold, 2009, Spooren, 2010), etc. One of the main components of these methods is the students' results in the examination. These study results are dependent on:

a) teachers approach (Shawer, 2009) and students skills,
b) study materials and
c) content of the course.

If the third part is changed, the first two have to be adapted to keep the education efficiency. It should be note, that learning outcomes should not only demonstrate what students know, but should also capture the changes that occur in their cognitive and affective development as a result of their college experiences (Ruhland and Brewer, 2001).
The Food Goods Knowledge had a long tradition as an obligatory subject to the B&A study program. The course is provided by the Department of Trade and Finance. This subject has been accredited only as an elective one since the school year 2011/2012. Simultaneously, the subject was included as elective for the student program Economics and Management (E&M for further reference). Since the school year 2012/2013 written part of the exam was transferred to the LMS Moodle. By way of summary, this course is taught in a very similar way (methods, procedures, exams) for both study programmes.
The question is how these changes influenced the trend of study results. Does the elective status of the subject Food Good Knowledge have an impact on better study results? Does the examining via the LMS Moodle have a negative impact on study results? How these changes affect study results of women and men? The main objective of the paper is to analyse statistically significant impacts of the teaching changes on the study results in the BSc. subject Food Goods Knowledge.

Materials and Methods

For the analysis, we have chosen following study years: 2009/2010, 2010/2011 (these years are prior accreditation) 2011/2012 and 2012/2013 (these years are after accreditation). First of all, we provided information about study result classification in this subject in these years from the study administration system. The B&A data were analysed from the year 2009/2010 to 2012/2013. The E&M data were analysed only from the year 2011/2012 to 2012/2013. The reason is that the subject was not concluded by an examination only for this study programme.
Next hypothesises were formulated:

a. Ho: There is not any statistically important dependence between the observed year and the final grade from the subject in the years from 2009/2010 to 2012/2013 for BSc. study programme B&A.
b. Ho: There is not any statistically important dependence between the period before and after accreditation and the final grade from the subject for BSc. study programme B&A.
c. Ho: There is no statistically significant dependence between gender of the respondent and the final grade of the subject in the B & A.
d. Ho: There is no statistically significant dependence between the analysed year and the final grade of the subject in the E&M study programme.
e. Ho: There is no statistically significant dependence between gender of the respondent and the final grade of the subject in the E&M.

Students, who had not accomplished exam of the subject, were deleted from a data matrix. There rested 842 students. The individual frequencies of students are given in tables. There was count with 783 students for the B&A study programme and with 27 students for the E&M study program.
The elemental statistical analysis is based on the frequency distribution which gives the overview of the output values. The dependency analysis of two variables was made in the contingency tables. The contingency tables are the basis for finding dependencies (can be derived from the values in the table) and computation of the intensity of these dependencies (Pecáková, 2008). The dependency analysis in the contingency tables was

performed using the Pearson's chi-square test. The test conclusion was based on the comparison of p-values and the significance level α. The construction of the dependency rate was derived from the values of the Pearson's contingency coefficient.
The statistical analysis was carried out using the SPSS software, version 19, and the MS Excel. The significance level was set to α = 0.05.

Results and Discussion

The main objective of the paper is to analyse statistically significant impacts of the teaching changes on the study results in the BSc. subject Food Goods Knowledge.
First of all testing the null hypothesis was performed for the B&A study programme. Ho: There is not any statistically important dependence between the observed year and the final grade from the subject in the field in the years 2009/2010 to 2012/2013.
In the B&A programme it was calculated with 783 respondents / students (see Tab. 1). It is evident from the partial frequency that after moving subject in optional courses that it increases the proportion of ones, reduces the share of threes, twos while remain balanced. In this period, after the accreditation it has not been also appear in any evaluation of four.

Frequency > 10 Marginal totals are not labelled.					
Grade/ Year	Excellent	Very good	Good	Fail	Total
2009/2010	50	124	132	0	306
2010/2011	45	144	111	15	315
2011/2012	14	33	42	0	89
2012/2013	28	32	13	0	73
Total	137	333	298	15	783

Tab. 1: Contingency table for B&A student – year and grade

Statistics	Statist. : Years(4) x Grades(4)		
	chi-square	df	p-value
Pearson´s chi-square	56,92883	9	0,00000
M-V chi-square.	59,20119	9	0,00000
φ	0,2696406		
Contingency coefficient	0,2603424		
Cramér. V	0,1556771		

Tab. 2: Testing results for B&A student – year and grade

The results (see Tab. 2) show that there is a statistically significant relationship between individual years and a final mark of the course in the B&A study programme. This dependence, however, is weak. The p-value is less than the significance level alpha (0.05). The results over the years are more balanced, significant improvement occurs between the last 2 years. This apparently causes this weak dependence. The difference in the study results between the last year and all previous years lies in the fact that the written part of the exam was in the last reported year transferred to the LMS Moodle.

It was also tested in the B&A study programme null hypothesis: Ho: There is not any statistically important dependence between the period before and after accreditation and the final grade from the subject. The main data are in the contingency table (see Tab. 3.).

Frequency > 10 Marginal totals are not labelled.					
Grade/ Accreditation	Excellent	Very good	Good	Fail	Total
Prior	95	268	243	15	621
After	42	65	55	0	162
Total	137	333	298	15	783

Tab. 3: Contingency table for B&A student – accreditation and grade

Statistics	Statist. : Accreditation(2) x Grades(4)		
	chi-square	df	p-value
Pearson´s chi-square	13,39119	3	0,00386
M-V chi-square.	15,68073	3	0,00132
φ	0,1307762		
Contingency coefficient	0,1296721		
Cramér. V	0,1307762		

Tab. 4: Testing results for B&A student – year and grade

The testing results (see Tab. 4) show, that there is the statistically important dependence between the period before and after accreditation and the final grade from the subject in the B&A study programme at a significance level α=0,05. The dependence is weak, however it is less weak than the dependence among single academic years.

Kučera, Kvasnička and Krejčí (2012) conclude, that "the reduction of contact teaching does not necessarily mean an overall fall in its quality". This corresponds with the results. The contact seminars reducing is also balanced by the electivity of subject. Overall, the change caused by accreditation has only a weak effect on better academic results in the programme of B&A. This influence can be the object of study of the students who have an interest in the issue. Unfortunately, it was not examined whether all students chose the subject because of interest in the issue or for other reasons.

The effect of gender belongs among the factors that could affect the final grade. It is often assumed that the female students have a better chance to succeed in exams. Therefore, we tested the hypothesis Ho: There is no statistically significant dependence between gender of the respondent and the final grade of the subject in the B&A. The main data are in the Tab. 5.

Frequency > 10 Marginal totals are not labelled.					
Grade/ Gender	Excellent	Very good	Good	Fail	Total
Female	111	237	179	5	532
Male	26	96	119	10	251
Total	137	333	298	15	783

Tab. 5: Contingency table for B&A student – gender and grade

Statistics	Statist. : Gender(2) x Grades(4)		
	chi-square	df	p-value
Pearson´s chi-square	29,08943	3	0,00000
M-V chi-square.	29,14653	3	0,00000
φ	0,1927466		
Contingency coefficient	0,1892630		
Cramér. V	0,1927466		

Tab. 6: Testing results for B&A student – gender and grade

The testing results (see Tab. 6) prove an existence of statistically significant correlation. The female students have better results in the subject exam. The dependence is weak.

The subject the Food Goods Knowledge was included in the elective courses of E&M study programme after accreditation. It is therefore calculated only with data in the years 2011/2012 and 2012/2013 (see Tab. 7). The volume of data and the results arising therefrom may be less relevant. It is mainly used for comparison with the results of the B&A between the years after the accreditation. Hypothesis aimed at changing the results before and after accreditation is not for the above reason implemented.

As a first it is tested the hypothesis Ho: There is no statistically significant dependence between the analysed year and the final grade of the subject in the E&M study programme.

Frequency > 10 Marginal totals are not labelled.					
Grade/ Year	Excellent	Very good	Good	Fail	Total
2011/2012	2	1	9	12	2
2012/2013	9	3	3	15	9
Total	11	4	12	27	11

Tab. 7: Contingency table for E&M student – year and grade

Statistics	Statist. : Years(2) x Grades(4)		
	chi-square	df	p-value
Pearson´s chi-square	8,222727	2	0,01639
M-V chi-square.	8,670135	2	0,01310
φ	0,5518564		
Contingency coefficient	0,4831661		
Cramér. V	0,5518564		

Tab. 8: Testing results for B&A student – year and grade

The statistical survey shows that there is a statistically significant dependence between years and a final mark of the course in the E&M study programme (see Tab. 8)**.** Dependency is medium strong. The content and form teaching the subject Goods Food Knowledge is the same in both fields.

Therefore it can be conclude, that better study results in the year 2012/2013 are caused by change of exam method. This is probably same reason of better results in the B&A study programme.

The testing results have not been proved statistically significant correlation between grade and gender for these years. The reason may be the small volume of date.

Conclusion

The decrease of contact lessons does not have an impact on degradation of study results in the Food Goods Knowledge subject after accreditation. It follows from the statistical correlation testing. However the weak statistically significant correlation between year and grade was detected, the study results are better. The reason may be the fact, that the subject has been elective since the accreditation. The students, who are interested in food goods, have logically better grades. The study results improving trend is demonstrated especially between two academic years 2011/2012 and 2012/2013.

This observation is the same for the B&A and E&M study programmes. In both programmes the written part of the exam was transferred to the LMS Moodle in the last year. This change could have been responsible for improvement of the study results. It is a question, why. It could be due to formulation of test questions or their type.

It is true, that two years after the accreditation is a very short time for making serious conclusion. This is especially true for the E&M study programme. The monitoring of study results trend is necessary in the next years. A more detailed investigation of the reason is needed.

Nearly the same situation appears for the statistical significant correlation between gender and grade. The supposition that female students have better study results was confirmed in the B&A programme. There is not a sufficient volume of input data for conclusions in the E&M study programme. It is necessary to monitor this correlation also in the future.

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PARENTAL CONTROL OF CHILD AS A PREDICTOR OF ACADEMIC PROCRASTINATION

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Abstract

This research aims examine the relationship between the parental control of school duties in the first five grades of elementary school and academic procrastination on college. A new method was designed to assess the level of parental control of school duties. To assess procrastination, modified versions of Lay's Procrastination Scale for Students (PSS) and Procrastination Assessment Scale for Students (PASS) were used. The questionnaires were filled in by 155 students of Czech universities. Moreover, 102 parents of these students self-assessed their level of parental control. Polynomial multiple regression showed a significant quadratic relationship between parental control and procrastination. As predicted based on previous research, the results showed a strong positive relationship between parental control and procrastination for higher levels of parental control, and a weak, but still significant, negative relationship between parental control and procrastination for lower levels of parental control.

Keywords

Education, parental control, parental styles, procrastination, self-regulation

Introduction

This study focuses on the relationship between academic procrastination and the level of parental control of school duties which the child was exposed to during first five grades of primary school. We understand academic procrastination as postponing work on school duties based on free will of the individual (Milgram, Mey-Tal and Levison, 1998), which leads to strong discomfort of the individual (Solomon and Rothblum, 1984) and creates a need to justify their behaviour to themselves (Ellis and Knaus In Vahedi, Mostafafi and Mortazanajad, 2009). The definition of parental control is based on research by Sad and Gürbüztürka (2013). The control of child's behaviour is a combination of the following factors: regular checks of child's everyday school duties, help with learning and preparation for exams, organization of child's free time (i.e. dividing the time for work and play), presence of manipulative and stressing practices or rewards and praise in case of child's success (i.e. system of rewards and punishments) and involvement in school affairs (e.g. regular attendance of PTA meetings).

The topic of procrastination has been heavily researched in recent years (Steel, 2007). The reason for that is an increasing number of procrastinating people in society as well as the major negative impacts of this behaviour on individual's life. About 50% of college students admit to regular procrastination that causes them numerous problems (Solomon and Rothblum, 1984; Milgram et al., 1998). For example, Tice and Baumeister (1997) showed that procrastinating students tend to have worse school results and more health complications at the end of a semester than their non-procrastinating peers. So far, the research on the causes of procrastination predominantly focused on personality

dispositions such as perfectionism (Kaur and Kaur, 2011), self-efficacy and anxiousness (Haycock, McCarthy and Skay, 1998; Ferrari, Parker and Ware, 1992) and other intrapersonal characteristics (Özer, Demir and Ferrari, 2009; Rosário et al., 2009). Less attention has been devoted to external influences, such as family. Onwuegbuzie (2000) suggested aiming future research towards the social environment of an individual which contains variables that may contribute the development of procrastination.

The influence of parents on children in primary family might be one of the most important variables predicting later academic procrastination. Children spend most of their time with their parents and the parents may have major influence on shaping children's attitudes towards fulfilling duties. The relationship between procrastination or related variables (e.g. self-regulation, school results) and three parenting styles defined by Baumrind (1966) was empirically researched. In permissive parenting style, parents fully accept all wishes and forms of behaviour of their child. This parenting style does not involve punishments and the child is left to regulate their behaviour all by himself or herself. Authoritarian parenting style is on the opposite side of the spectrum. Parents try to shape and control child's behaviour according to a strict set of rules which are presented to the child in an absolutist manner. Parents often punish the child which substantially reduces child's autonomy. The third parenting style is called authoritative. It emphasises the development of child's autonomy and self-regulation. Parents require child to fulfil their duties, but do not use a system of punishments and prohibitions. Authoritative parenting style seeks a compromise between child's freedom and the development of responsibility. It is clear from their definitions that these parenting styles are associated with different levels of parental control and therefore probably also with different levels of parental control of school duties. A permissive parent is likely to control the child's fulfilment of school duties only minimally. An authoritative parent is likely to use a medium level of parental control of school duties and an authoritarian parent is likely to control child's fulfilment of school duties the most. Given this perspective, we consider studies focused on parenting styles to be the main source of insight into the relationship between the level of parental control and procrastination.

In previous research, the effect of authoritarian parenting style on child's school success is described to the greatest extent. Using this style, parents gain psychological control over their children through manipulation which decreases child's performance and motivation and therefore causes the formation of the tendency to procrastinate (Mih, 2013). High levels of parental criticism towards children are also a distinct predictor of academic procrastination (Frost, Heimberg, Holt, Mattia and Neubauer, 1993). Furthermore, high demands on the child may cause increased perfectionism (Mih, 2013) which may consequently lead to procrastination as the child is not willing to work on the task for the fear of an inadequate result. On the contrary, authoritative parenting style positively correlates with the ability to deeply process learned information and induces effort and persistency in learning (Mih, 2013), hence may lead towards a lower tendency to procrastinate. The effect of permissive parenting style has not yet been explored in great detail. Huang and Prochner (2004) and Piotrowski et al. (2012) conducted studies about the effect of permissive parenting style on self-regulation and found a weak negative relationship. This helps us in estimating the basic trend in the relationship between permissive style and procrastination as procrastination is negatively related to self-regulation.

We presume that highly controlling parents take over their child's responsibility of organizing efforts in fulfilling school duties and diminish the chance that the child will

form healthy self-control and habits for successful task fulfilment. The system of external rewards and punishments may also substitute child's intrinsic motivation for extrinsic motivation. A child of highly controlling parents, similarly to one of authoritarian parents, should therefore have lower motivation, higher fear of failure, and thus a higher tendency to procrastinate. A child of non-controlling parents should be less sensitive to external demands and less able to deal with them due to a non-demanding manner of permissive parenting. Since the child didn't need self-regulation during childhood, it is less likely to have learned it and thus more likely to procrastinate in future. A child of medium controlling parents have the least tendency to procrastinate. Such a child should be accustomed to external demands and at the same time their intrinsic motivation should not be suppressed by excessive punishments and rewards. He or she is likely able to independently develop healthy self-control and habits for successful task fulfilment. In current study, examine how parental control of school duties in first grades of primary school predicts future academic procrastination on college. We focused on the early school age because work habits learned in childhood have a major impact on work abilities in adulthood (Corno and Xu, 2004). Based on previous research, we hypothesized that a nonlinear relationship exists between parental control of school duties and future academic procrastination in which high and low levels of parental control predict higher level of academic procrastination.

Methods

Sample

The data were collected from 153 Czech college students (87 women, 66 men) and 100 of their parents. The sample was recruited based on the availability of students with roughly the same academic workload. Only the students who a) were enrolled in at least one class with mandatory attendance, b) had to finish at least 5 and no more than 20 assignments, essays or projects and c) had to pass at least 4 and no more than 10 final exams (all in one semester) were recruited. These criteria were employed to exclude students with extremely low or high demands in one semester, because it could affect their scores of procrastination.

Methods

Two questionnaires were used. The first assessed the level of academic procrastination and the second assessed the level of parental control. The latter questionnaire had two versions - one for students and one for their parents - which were identical in their content.

Parental control of school duties questionnaire

Since there is no suitable method for in-depth assessment of the level of the parental control of their child's school duties, we created a new questionnaire for this research. This questionnaire consists of 15 items in which students reflect on their experience of the parental control of their school duties from the first five grades of primary school on five-point Likert scale. This questionnaire was loosely inspired by Turkish Parental Involvement Scale used by Sad and Gürbüztürk (2013). Some items were adopted (e.g. help with homework, communication with teachers and usage of rewards and punishments) and new items were added to cover all the facets of parental control. Prior data collection, we conducted a cognitive interview with 6 representatives of our target population. This interview confirmed the clarity of all items. The final questionnaire was highly internally consistent in the version for students ($\alpha = .89$) as well as parents ($\alpha = .93$).

Academic procrastination questionnaire

This questionnaire is a combination of two existing student procrastination scales. The first one is PASS (Procrastination Assessment Scale for Students). From this scale we used the part that assesses academic procrastination prevalence. This part consists of 12 five-point Likert scale items of which 6 focus on the tendency to postpone work on tasks in various parts of academic functioning and the other 6 items explore to what extent this is seen as a problem by the student (Solomon and Rothblum, 1984 In Gabrhelík, 2008). To describe facets of procrastination omitted in PASS (e.g. the tendency to engage in other activities instead of working on an assigned task), we also used modified version of Lay's Procrastination Scale for Students (PSS). We excluded 8 items, which were irrelevant to the academic context, and added 7 new items that focused on facets of academic procrastination not covered in the original version of PSS (e.g. problems with estimating difficulty of tasks, attendance and time management). Some of the new items were inversely scored versions of already covered facets. The modified PSS consists of 19 items rated on a five-point Likert scale. The final questionnaire showed high internal consistency ($\alpha = .95$).

Procedure

Students who met above stated requirements on academic workload and whose parent agreed with participating in this study were sent a link to the questionnaires. After a student filled in the questionnaires, a unique link to the parent version of the parental control questionnaire was generated. The student was then asked to send this unique link to the parent who was more involved in the control of his or her school duties in primary school.

Results

Two polynomial regressions were employed to analyse relationship between academic procrastination on collage and parental control of school duties at primary school as assessed by students and their parents. Student assessed control and parent assessed control share only 70% of variance ($r = .85$, $p < 0{,}001$) and thus were analysed separately. All variables have nearly normal distribution and their descriptive statistics can be found in Tab. 1. This table also shows descriptives after excluding cases with missing data, which were used in regression analyses. As the means remained unchanged after the exclusion of incomplete cases, any relationship of missing data with analysed phenomena is highly unlikely. Two models were tested in each regression: linear model (model 1) with parental control being the only predictor and quadratic model (model 2), which also included parental control squared. The data have met requirements for employing polynomial multiple regression in both cases. Both variables of parental control were centred on means to ensure easier interpretation and eliminate multicolinearity.

						Correlations		
Variable	N	M	SD	Min	Max	P	PCS	PCP
Procrastination (P)	166	93,31	25,82	36	149			
Parental control – student (PCS)	170	46,53	12,23	15	75	.274**		
Parental control – parent (PCP)	111	47,41	13,34	15	75	.344**	.855**	
Parental control – student*	155	46,65	12,39	15	75			
Parental control – parent*	100	47,33	13,95	15	75			

*values after excluding cases with missing data in Procrastination, **p < 0,01

Tab. 1: Descriptive statistics and Pearson correlations of variables

The first regression analysed the relationship between procrastination and the parental control assessed by students. In this case, a linear model explains 8% of variance (F (1, 153) = 12.21, $p < .01$, $R^2 = .08$). Adding a quadratic form of the predictor increased explained variance significantly by 10 percentage points (F (2, 152) = 16.92, $p < .001$, $R^2 = .18$) which supported our hypotheses of the nonlinear relationship between procrastination and parental control. The positive β value of the quadratic predictor implies a U-shaped relationship in which the level of procrastination is high for low levels of parental control, then decreases and reaches the minimum in 37.78 points of parental control, and finally increases again with the increasing level of parental control (see Tab. 2).

	Assessed by students						Assessed by parents					
	Model 1			Model 2			Model 1			Model 2		
Variable	B	SE	β	B	SE	β	B	SE	β	B	SE	β
Constant	93,22***	2,03		87,26***	2,33		92,94***	2,77		82,64***	3,23	
PC	.57**	.16	.27	.71***	.16	.34	.73**	.2	.34	1,12***	.2	.53
PC2				.04***	.01	.34				.05***	.01	.47
R2	.08**			.18**			.12			.30		
Δ R2				.11**						.18**		

**p < 0,01; ***p < 0,001

Tab. 2 Polynomial multiple regressions of centred parental control on procrastination

For the parental control assessed by parents, the second regression matches the results of the first one. The only differences are more explained variance for a linear (F (1, 98) = 13.20, $p < .01$, $R^2 = .12$) as well as quadratic model (F (2, 97) = 20.77, $p < .001$, $R^2 = .30$) and a more dramatic increase of explained variance after adding a quadratic form of the predictor (by 18 percentage points). This regression function reaches its minimum at

36.13 points of parental control.

Despite a strong quadratic relationship, the significant β coefficient implies a positive trend between the predictors and the dependent variable. It is also evident from Figure 1 and Figure 2 that there is an obvious relationship between the predictors and the independent variable for the high levels of parental control, while the negative relationship for the low levels of parental control is far less clear. Some of the respondents with low parental control procrastinate a lot and some seem not to procrastinate much which leads us to think that the relationship between parental control and procrastination in the low levels of parental control may be moderated by another variable. Therefore, although significant, the quadratic model does not fit the data as well in the lower levels of parental control as it does in the higher levels which implies heteroscedascity. This issue is taken into account in the interpretation of these results.

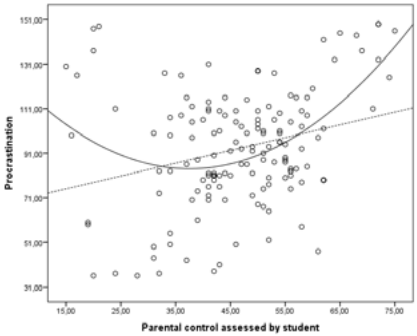

Figure 1 Quadratic relationship between parental control (X) and procrastination (Y) determined by student.

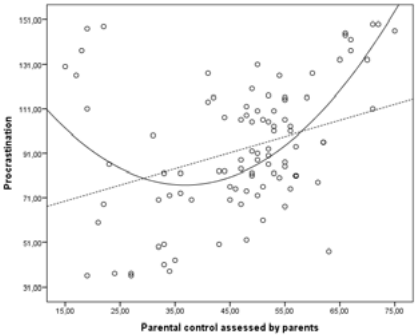

Figure 2 Quadratic relationship between parental control (X) and procrastination (Y) determined by parent of student

Discussion

The aim of this study was to examine whether parental control of child's school duties in the first five grades of primary school relates to their academic procrastination on college. We found support for out hypotheses that low and high levels of parental control are associated with academic procrastination on college. Based on our research, we conclude that the extent to which parents controlled their child's studies is a significant predictor of child's future academic procrastination. High levels of parental control are associated with high levels of procrastination. This finding is consistent with previous research which showed a close relationship of highly controlling authoritarian parenting style and procrastination (Mih, 2013) and a low capability for self-regulation (Vahedi et al., 2009; Huang and Prochner, 2004; Piotrowski et al., 2012).

Based on our findings, there is also a negative relationship between parental control and procrastination in low levels of parental control. However, this relationship is not as strong as in the case of high levels of control. This finding is consistent with research by Huang a Prochner (2004) which showed a weak negative relationship between self-regulation and procrastination yet differs from the results by Piotrowski et al. (2012). Piotrowski's research implies that permissive parenting style is a stronger negative predictor of self-regulation than the remaining two parenting styles. In future, research should focus on a deeper understanding of permissive parenting style which corresponds to our concept of low parental control. The lack of empirical evidence in this area hinders our understanding

of the influence of parenting style on child's self-regulation and efficacy. Moreover, our results suggest that students who were exposed to the medium level of parental control procrastinate less than their peers that were exposed to lower or higher levels of parental control. Since the medium level of parental control is linked to authoritative parenting style, this finding is consistent with results by Mih (2013), Vahedi et al. (2009), Piotrowski et al. (2012) and Huang and Prochner (2004).

Parents' approach to the fulfilment of child's school duties during the first years of primary school influence child's later approach towards fulfilment of academic duties. According to our research, the correct approach to raising non-procrastinating child is a medium level of parental control. Parents should be neither indifferent to child's fulfilment of school duties, nor take over all of child's responsibility for school duties.

While interpreting our results, it is necessary to keep in mind specifics of our sample. Since we excluded students with an extremely low or high academic workload, we can generalize our results only to a population of students with a more or less moderate academic workload. We expect that in case of students with a low workload, the found relationship would have been weaker, because these students would not have had tasks to postpone and the effect of parental control could not have fully emerged. Also in case of students with a high academic workload, the relationship would have been probably weaker due to a homogenous level of procrastination. A very high number of tasks could have resulted in the need of postponing tasks even by students who would not have otherwise procrastinated and thus the effect of parental control would not have proved so strong. The reason for this is that in order to emerge, the relationship between parental control and procrastination requires student to have an opportunity to procrastinate. Even though we excluded students with an extremely high and low workload, the amount of opportunities for procrastination could have differed substantially in our sample. Our respondents were students of a wide variety of academic fields that may differ in the amount of external control from teachers. For example, students who do not have to present the progress of their work regularly during the semester are more likely to get more tasks accumulated at the end of the semester which might result in more intense procrastination. Conversely, students who have frequent deadlines and exams have potentially more opportunities to procrastinate leading to more frequent procrastination.

It is also necessary to take the use of self-assessment questionnaires into account. In this research, self-assessment questionnaires proved to be very efficient because the only alternative way of exploring the relationship between procrastination on college and parental control in primary school is very demanding 15 years long longitudinal study. On the other hand, these questionnaires are a subject to various possible errors and biases in self-assessment. In the current study, this is apparent from an imperfect correlation between parental control assessed by students and parents. We controlled the effect of these errors by collecting data from both students and their parents. A strong correlation between both assessments and similar results of statistical analyses increase the validity of our findings.

Our findings may prove useful in educational and pedagogical contexts. Appropriate parenting may help in preventing child's future procrastination and protect the child from its harmful consequences such as increased stress levels inducing frequent health complications (Tice and Baumeister, 1997). This research could also serve as a warning for parents who in the attempt to make their child successful overly focus on their school performance and duties since the first grades of primary school. This effort may paradoxically prove harmful to their children. Our recommendation for future research is

to further explore the relationship of procrastination and parental control in low levels of parental control. Our result shows that low levels of parental control predict high levels of future procrastination in the majority of our sample, however, for some respondents, our results showed that low levels of parental control are associated with very low levels of future procrastination. It seems that under certain circumstances, a benevolent and permissive approach may be effective in preventing future procrastination. The focus of future studies could be set on discovering potential moderators which cause discrepancies in the effect of low parental control on procrastination.

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INTEGRATION OF ICTS IN EDUCATION AND RAISING THE DIGITAL LITERACY OF STUDENTS IN THE UNIVERSITY ENVIRONMENT

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Abstract

This paper discusses issues related to the effective use of information and communication technologies (ICTs) in the learning process and the need to promote and develop the digital literacy among students. The author focuses on the role of the new basic skills and competencies which enhance students‘ efficiency in the learning process and their adaptation to the ever expanding demands of the global dynamic market.

The paper also contains an empirical component related to studying the extent of using the digital technologies by university students, their level of absorption of the necessary skills and competencies and their motivation to increase their level of information and digital literacy in order to meet the constantly changing demands of work and life in the digital society.

Keywords

Information and communication technologies (ICTs), education, digital literacy, university students

Introduction

The development of information and digital technologies and their integration in all spheres of people's life and work gave for the first time a possibility for a fast and unlimited access to vast information which is constantly enriched, transformed and actualized. This new model of society needs citizens who possess the necessary skills and competences to take advantage of the potential of new technologies and take active part in the economic, social and cultural life. The Internet and new media communication technologies with their interactive and increasingly individualized digital services change people's habits and behaviour, build new value models and vital cues. They are becoming an irreplaceable source of education and self-education and important tool for the development of new literacy. The Web is more than a simple information search and social contact feature, it is also a learning tool that allows other ways to build and share knowledge (Loureiro and Bettencourt, 2014). In the digital era "the most fundamental change is not in the development of technologies as artifacts, but in their appropriation as tools and the power of these appropriations to change our thinking" (Huvila, 2012: 35).

The integration of many applications of ICTs, including different software systems and technology tools into the educational process and their successful use changes the content, methods and forms of training. The acquisition of skills and competencies in the digital age presupposes a new way of thinking and the ability of the user to continuously adapt to the new literacy required by the new technologies (Coiro et al., 2008).

Today, ICTs have become a "key lever" for effective learning, and creative, innovative and responsible behavior in the new educational environment in the 21st century. Contemporary learning theory focuses on learning as a active process of constructing

knowledge, which presupposes learning to be viewed as a personal understanding and meaning making (Oliver and Herrington, 2003). It is recognized that learners need to engage in cognitively complex tasks involving such activities as problem solving, critical thinking, collaboration and self-regulation. Chai and Lim (2011:4) consist that from a pedagogical perspective ICT has made the construction of "knowledge" a viable approach of developing the creative ability of students.

The impact of the Internet and new technology on education is becoming more and more in a powerful agent for change of many of the educational practices. For the learners is important not the transmission of facts and knowledge but formulating and acquiring significant skills and abilities to make research, select information sources and build their own knowledge so they can be always updated giving an adequate answer to the labour market (Goulão and Fombona, 2012:351).

The term digital literacy was introduced in 1997 by Paul Gilster in his book *Digital Literacy* where the author offers its definition focussing on the ability to understand, appreciate and use the information in multiple formats that the computer can deliver. Moreover, the ability to evaluate and interpret the information is essential. What matters is that due to digital literacy one acquires basic thinking skills and core competences without which one could not orientate and perform tasks in an interactive environment (Gilster, 1997). The Gilster's concept was also used by other authors striving to give a more deep understanding of the digital literacy which includes a combination of different kinds of literacy based on computer/ information competences focused on the skills to evaluate information and gather knowledge together with a set of understanding and attitudes (Bawden, 2008).

In determining the concept of digital literacy, some authors tend to understand it as a connection with the skills and competencies needed for effective use of the Internet and digital technologies (Martin, 2005; Cartelli, 2010; Ala-Mutka, 2011, etc.). The contemporary studies of digital literacy accentuate the need of getting beyond the basic skills of using the digital tools and information resources and developing strategies for a critical and efficient use of these means. That's why most researchers view this literacy as "continuum, with progressive stages where the basic abilities are only the first step. The upper end of the continuum contains increasing levels of cognitive competence in using the literacy in question for tasks, learning, creating and expressing new ideas, and this involves issues such as attitudes and social and cultural aspects" (Ala-Mutka, 2011: 17).

In defining the framework of digital competence (Ferrari, 2012) it came to the belief that it is not sufficient to be claimed that digital literacy includes all the skills and competencies required for Internet literacy, ICT literacy, information literacy and media literacy. There are other components that come into the picture of digital literacy and build a framework that identifies the vision of the new literacy needed for living, working and citizenship in the 21st century. Janssen et al (2013) suggest that digital competence is a conglomerate of knowledge, skills, and attitudes connected to various purposes (communication, creative expression, information management, personal development, etc.), domains (daily life, work, privacy & security, legal aspects), and levels.

The purpose of this paper is to show the role of South-West University in Bulgaria in the process of improvement of the information-communication skills of students as a response to the European priorities in the area of digital technologies and future education. The author directs attention to the significance of digital literacy and students' skills to use information technologies which will play increasingly important role in the development of university education. The paper presents the results of the survey which shows the

use of information technologies by students, the level of their digital literacy and their motivation to improve their digital competence.

Materials and Methods

The task that placed in front of today's students is related both with mastering the concepts, theories and basic knowledge of different disciplines and understanding of all the necessary criteria and strategies to find needed information, which is valid for their area of research. For students it is important to have knowledge and skills in the field of digital technology to be able to use the information sources in the form of e-publications, online video and audio recordings, digital libraries, databases, etc. Furthermore, students need to be able to work critically with these resources and have the competencies to handle independently in placing and resolving scientific issues in project design, case studies, etc.

Therefore, a team from the Center for New Media and Digital Culture of SWU "N. Rilski" conducted a survey in September 2013 among 60 students from the first and second courses from the Department of Cultural Studies at the Faculty of Arts and the Department of Philosophy and Political Science at the Faculty of Philosophy of the University. The aim of the survey was to determine: a) the extent of the use of information technology by students in the course of their learning, b) the level of digital literacy of students in humanities, c) the student motivation to increase their level of digital literacy and d) the opportunities and ways to increase this literacy in the university. It was important to understand the attitude of the students towards the use of digital technologies for effective searching, finding, critical evaluation and presentation of the needed information from different sources. The team members suggested that students of first and second courses need more support from the lecturers to successfully use the Internet and information technology.

By conducting three focus groups, the students openly shared their opinions about the owned by them skills in the use of digital technologies in the learning process and their views on how to enhance their digital competence within the university. As we know focus groups is one of the so called "qualitative methods" in sociology and can be used as a powerful means to collect subjective data. The study is based on the developed by the Association of University and Scientific Libraries standards and guidelines to improve information and digital competence in higher education (American Library Association, 2000), but also on the proposed by the Stanford University modules for assessing information literacy among the students.

The first set of questions relates to computer literacy of students to their ability to: work with computers to access information; use of computer tools for word processing; creating and formatting documents, generation of tables, pictures and images; using Microsoft Excel, databases and more.; creating graphs and charts; create presentations and slideshows, etc.

The second set of questions is to understand the students' access to the Internet and the skills to use the Web and to participate in the Internet environment. The students had to answer the following questions: what is their daily access to the Internet; how they use different tools and online resources to search, find and retrieve information; do they understand the basic concepts of the Internet including security issues, do they use search tools for finding and retrieving information, do they use e-mail and work with attachments.

The third set of questions is related to the establishment the ability of students to search independently and find effectively the relevant information and information resources for

specific tasks; knowing and using the library information resources in the network; using appropriate search strategies in different information systems (e.g. Google ™, Yahoo ™, Yandex and others resources for finding information), etc.

The fourth set of questions concerns the student skills for critical and reflexive attitude towards information and responsible use of information technology as a prerequisite for social adaptation and work in the digital society. It represents the students' skills: evaluating, analyzing, synthesizing, using and interpreting information, deriving new knowledge from acquired information and understanding the economic, legal and social issues related to the ethical and legal use of information.

The fifth group of questions aims to present student motivation to improve their skills and competencies for using the Internet and digital technologies. Therefore, to the respondents were asked the following questions: Do you think that your digital skills in the learning process are enough? Would you like to participate in training courses to increase your digital literacy? In what forms of training you prefer to be included in order to acquire skills for using ICT?

Results and Discussion

1. According to the survey the majority of the respondents positively evaluate their ability to work with computers to access information, as 76% of them share that these skills are good, 14% - Very good 10% - excellent. They use computer tools for word processing (40% say that their skills are good, 46% - very good and 14% - excellent). They are able to create and format documents, generate tables, pictures and images (76% assess these skills as good, 14% - very good and 4% - excellent). As for the ability to create presentations and present a slide show, 70% admit that they do well, 12% - very good and 18% - excellent.

2. The survey data shows that the majority of students use the Web and have daily access to the Internet (96%), of which 72% - mainly at home and 24% - at the university. They successfully use the Internet and information technology in the learning process having in mind that the easy and fast access to the needed information facilitates them in their individual preparation and enables them to respond in a higher degree to the requirements of lecturers and improve their academic results. Most of students admit they use without difficulty some search tools to find and retrieve information (98%). They are able to identify search results (78), know how to use E-mail (98%), create and send emails, and work with attachments (91%). Those who understand the basic Internet concepts, including security issues, however, are only 2%, and a significant portion answers "partially" (66%) or "not" (32%). Those students who can though rarely create their own web pages are only 7% (Table 1).

Internet Access	Every day	At home	At the university
	96%	72%	24%
Basic Internet Skills	Yes	Partly	Not
Using the WWW	96%	4%	-
Using search tools, to find and retrieve information	98%	2%	-
Identifying search results	78%	15%	2%
Using E-mail	98%	2%	-
Creating and sending emails, and working with attachments	91%	9%	-
Understanding of the basic Internet concepts	2%	66%	32%
Creating own web pages with text, images, and hyperlinks	-	7%	93%

Table 1: Internet access and basic internet skills of students

3. As for the information literacy of students, data show that 44% respondents have effective and efficient access to the information, and are satisfied with the *information* retrieval. More than half of the respondents recognized that they are partially satisfied by the searching for information. Half of students surveyed share that they can identify the key concepts and terms that describe the information need. 68% have no difficulties when they have to determine different types and formats of potential sources of information (e.g. multimedia, databases, audio /video, book). Moreover, the majority of students (90%) do not have the skills to distinguish the most important characteristics of the separate library information resources in the Web. 88% respondents can not identify types of resources in the catalog of the electronic university library to retrieve information. (Table 2)

Students' ability for information seeking and retrieving	Yes	Partly	No
Effective and efficient access to information	44%	56%	-
Satisfaction in information retrieval	44%	56%	-
Identification of key concepts and terms that describe the information need	50%	50%	-
Determination of different types and formats of potential sources of information (eg, multimedia, databases, audio / video, book)	68%	32%	-
Construction of strategies for locating information	48%	52%	-
Differentiation of the major characteristics of separate library information resources on the web	-	10%	90%
Identifying types of resources in the catalog of the electronic university library	2%	10%	88%

Table 2: Students` ability for information seeking and retrieving

The survey indicates that the students who can construct appropriate strategies for locating information in diverse information systems using different interfaces and search engines are 48%; 83% of the respondents prefer Google over other search engines for finding information.

Most respondents (82%) recognize that they hardly use print media (books, newspapers, magazines, etc.) to assist the learning activities and rely heavily on the electronic media (44%). Few are those who regularly use online video (15%), online photo galleries (10%), electronic audio records (12%), virtual museums (8%) and digital libraries (5%). (Table 3).

What resources do you prefer to use?	Regularly	Rarely
Print media - newspapers, magazines, books, encyclopaedias, etc.	6%	12%
E-media - newspapers, magazines, books, encyclopaedias, etc.	44%	23%
Online video	15%	20%
Electronic audio records	12%	10%
Online photo galleries	10%	7%
Virtual museums	8%	5%
Digital libraries	5%	5%

Table 3: Using of information resources

4. The next set of questions refers to skills of students for critical and reflexive attitude towards information and responsible use of technology. The study revealed that most students are able to analyze and synthesize the material (71%), compare information obtained from different sources (73%), interpret and present information (52%). Fewer are those who have skills to critically evaluate information and sources (45%) and have difficulties when they have to critically evaluate print and online resources based on specific criteria (72%), verify the authenticity and reliability of the data collected (64%). Although the majority of the respondents (75%) said they were aware of copyright, many of them (25%) only occasionally follow laws, regulations and tags associated with the access to and use of information resources, while 38% did not do this.

5. The last group of questions aims to provide the motivation of students to improve their skills and competencies for the use of the Internet and digital technologies. The study found that 56% of the respondents are willing to participate in specific training courses that will give them greater opportunities to increase their digital competence. To the question what types of training they prefer, 68% of the students answer these are courses included in the curriculum of the specialty, while 12% say that they can participate in specialized courses outside the specialty curriculum (in paid form of learning). There are also students (44%) who do not wish to participate in any training courses, lectures, seminars, etc.

To sum up, we can say that the average score, which put 66% of the respondents on their computer literacy is “good” and only 17% of them give ”very good”. 42% of the interviewed said they have difficulties using the Internet for various activities, including helping their learning process. The students recognize that the acquired web information is insufficient to be more highly valued by the lecturers. An average of 56% of the respondents says they have difficulty when they have to search and find the needed

information effectively and use specific information resources as the most preferred are e-publications (44%). Majority of students don't use the electronic university library and do not know its recourses. An average of 48% respondents recognizes they have difficulty for critical and creative attitude towards information and its use in an ethical and responsible manner.

The survey results show on which specific skills the lecturers and the university need to focus more the efforts to ensure a more effective inclusion of students in the educational process. In order to enable the students to quickly adapt to the challenges of the digital society and new practices for electronic learning environment is required to identify effective ways to attract, encourage and motivate towards the utilization of high quality theoretical and applied knowledge and skills for working with new technology.

Mastering digital information, the ability to find, understand, evaluate and use information effectively and ethically in order to meet their personal and academic needs is fundamental to the learning process of students. To achieve higher levels of learning in the new digital environment is not enough for students to have access to computer technology, or to work with multiple information sources. It's important for students to learn how to utilize those incredibly diverse and powerful technologies efficiently and effectively to search for, retrieve, organize, analyze, evaluate information and then use it for specific decision-making and problem-solving ends (Horton, 2008: 5-6). New technologies can be seen not just as tools but also as means of obtaining information, and formation of new ways of communication, affecting also the thinking and creative abilities of the individual. Not the gathering of information, but its contextualization, interpretation, investigation into its validity, creative explanation, use for solving problems turn to be of great significance for effective and efficient work of students in the learning process. K. Pérez and O. Torelló (2012: 1116) consist that ICTs have to understand "as symbolic and cultural technological systems needed to create, manage, analyze, communicate and transform information into new relevant knowledge". This opens an opportunity for the person-the professional to be the one who properly uses and integrates ICTs, not only into its teaching functions, but into the rest of its professional roles, according to the best of its knowledge and professional experience.

The survey found some gaps in learning to effectively use ICTs by students. This put in front of the researchers and lecturers the requirement to make the necessary efforts to raise awareness about the nature and importance of digital literacy in education. This study highlights an understanding among the researchers that the digital literacy must be considered as a situated practice, and that it concerns functional and communicative competencies rather than acquiring a set of technical skills (Knutsson, Blåsjö and *Hållsten,* 2012). The difficulties encountered by students in their using of new technologies indicate the need to find new effective approaches for the development of digital literacy skills and competencies on which have been given little attention in the education system. In the foreground stands the significance of acquiring key skills needed for seeking, finding and managing information, for critical and efficient use of digital tools and information recourses, and creation of new knowledge. For experts and scholars old pedagogy delivered with new technology does not work. Advances in information and communication technology have a significant impact on the way teachers teach and the way students learn, and for technology to result in quality learning (Pérez and Torelló, 2012). It is important to address the question of effective use of the opportunities for technology-mediated learning, on the one hand, and the processes of digitally based learning within and outside educational institutions on the other (Henriksen, 2011).

Conclusion

The achievement of greater efficiency of the learning process in the university environment requires successful use of information and communication technologies, which implies the acquisition of skills by students to search and find useful information and resources, but also the ability to analyze and synthesize received information, share and discuss different ideas and perspectives that can support students to solve problems in teams. The study highlights that students are facing urgent tasks related not only to acquisition of basic concepts and knowledge in different scientific disciplines. When they get into the wide world of information they should be able to use digital technologies confidently and critically.

The adaptation of students to the challenges of the digital society and the new practice of learning requires the involvement of students in various courses to enhance their digital literacy. From this perspective, particularly suitable are the enshrined in the curricula of various disciplines required courses that would supply the necessary knowledge and skills to use information and digital technologies. It may think about the issue of appropriate educational materials specifically targeted at improving the information and digital literacy of students, especially those with humanities. Involving students in additional short-term or long-term courses (paid form of learning) may also contribute to the acquisition of important knowledge and skills for that are not given enough space in the curriculum. Should not be underestimated and the conduct of scientific seminars and lectures, the ability to access online tutorials, e-books and other forms of enhancing digital literacy of the learners, through which we can expect the development of a wide range of skills of searching, identification, critical evaluation and use of information for a more independent and creative behavior in the digital environment.

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INFORMATION ETHICS AT THE UNIVERSITY OF ECONOMICS IN PRAGUE

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Abstract

This article deals with the topic of information ethics and preparations before its teaching at the University of Economics in Prague. Before introducing the topic into the new curricula a survey among students was carried out to identify students´ interest in the area of information ethics and then another survey took place which concentrated on students´ approach towards information ethics and keeping of its rules.

The results confirmed students´ interest in the topic and their pessimistic evaluation of the ethical situation in our society and on the internet. We analysed students´ approach in 4 categories of information ethics: privacy, accessibility, property and accuracy. Students seem to be quite cautious and critical. The survey also showed the area of information ethics is developing and the old codified rules are not valid absolutely. The young generation prefers a new approach towards digital content.

Keywords

Accuracy, copyright, information ethics, privacy, security

Introduction

With the preparation of the new bachelor and master programme at the Faculty of Informatics and Statistics of the University of Economics in Prague the idea emerged that students studying informatics shouldn´t understand its technical aspects only, but should know something about the ethical implications and effects ICT have in society. With the increased pervasiveness and complexity of ICT in everyday life the number and difficulty of ethical problems will increase as technological revolutions progress (Moore 2005).

Information ethics will be part of an introductory course for new students. Before the course will be taught some research was done to find out students´ attitude towards ethics. The objective of this article is to identify student´s interest in information ethics and their attitude towards ethics in the ethical domains identified by Mason (1986).

4 aspects of information ethics

Before the research we studied the analysis of today almost paradigmatic four key aspects of information ethics by R. O. Mason (1986): privacy, accuracy, property, accessibility. In our research we asked a few questions which may be included into those categories. It is true Mason´s division is quite old and new aspects of information ethics appeared. However his taxonomy may be very well used today, e.g. Altschuler, (2004); Smith, (2002), and is even considered the most influential categorization of information ethics (Smith, 2002), (Peslak, 2006).

Privacy

Privacy in the area of information ethics may be characterized by the question “What information about one’s self or one’s associations must a person reveal to others, under

what conditions and with what safeguards?" (Mason, 1986: 5). That question is related to the question what information can people keep to themselves. Privacy is threatened by the massive use of IT which can get, process and store big volumes of information. Surveillance, industrial espionage, big data analysis - all these phenomena are related to the privacy breaking.

Accuracy

The second aspect of information ethics is according to Mason (1986) called accuracy. It can be characterized by the question "Who is responsible for the authenticity, fidelity and accuracy of information?" (Mason, 1986: 5) Misinformation can bring about unpleasant consequences when official authorities use it or when other subjects, e.g. business partners, colleagues, family members etc. use it. As many people may publicize almost any information which becomes available to the public, the occurrence of inaccurate information is quite often. Nowadays people are overwhelmed with information, but their problem is to find out which information is reliable and accurate and which is not.

Property

Property of information is also a hot topic today. Mason (1986) characterized it as "Who owns information? What are the just and fair prices for its exchange?" Intellectual property rights do also belong into this sphere. It may be very difficult to produce the information, but its reproduction and distribution may be very easy. Moreover the original - especially in its digital form - will be unaffected by the reproduction. That is why information must be protected as it is easily available through communication channels. Its means of protection are more complicated than is the case with tangible property. Moreover it is difficult to identify the cases of information misuse and to reveal the offender. The easy reproducibility of the content of information, the character of knowledge and also of information as something that is communal and the democratic character of our society has led to a tension between the definition of information property rights and the practice.

Accessibility

Mason (1986) summarized the content of that aspect in the question "What information does a person or an organization have a right or a privilege to obtain, under what conditions and with what safeguards?" Access to information is a precondition for literacy and provides people with the opportunity to find their place in the market and the society as such. However the access is dependent on the computer, IT skills and internet connection which are not available to everyone. Previous literacy is also an advantage in information acquiring and analysing. That is why those with the advantage get more and more and those handicapped get less and less.

This paper will introduce the results of the research supplemented with comments. We will concentrate on the bachelor study programme. Our research is connected to some researches carried out in the Czech Republic, e.g. Vrbová (2013), Preiss et al (2013). Vrbová (2013) analysed various types of cheating of Czech pupils (15-16 years of age) at schools and applied exploratory factor analysis, Preiss et al (2013) addressed cheating of university students in their studies in relation to legal, social and economic factors and compared the results with a similar US survey. There are also many foreign researches dealing with this topic, e.g. Khalil and Seleim (2012) who analysed the approach to information ethics of Egyptian IT students, Eining and Lee (1997) who examined the role of information ethics in USA, Taiwan, Hong Kong and China, Jeffeson and Contreras

(2005) who examined the ethical perspectives of library and information science professionals prior to their entry into the profession.

Materials and Methods

Our research consisted of two parts. One was carried out at the end of the last academic year 15.1.-11.3.2013. The questionnaire was distributed via email and the results were collected using Google documents. We addressed 526 first year BA students, but only 147 (102 males, 45 females) submitted their answers. The participation was facultative. The research was conducted by the teachers of the University of Economics in Prague.
In the second survey we were more specific in our questions. The survey took part 30.12.2013-17.2.2014. We addressed 470 first year BA students, but only 77 of them (52 males, 25 females) participated. We asked students in our survey about their opinion on the extent of corruption in society, on the comparison of ethical environment in real life, and on the internet, on the standard of information ethics at the University of Economics and some questions related to the information ethics´domains.
In the data analysis we used standard methods of descriptive statistics and methods analysing contingency (Kruskal–Wallis and chi-square test), correlation (Spearman rank order correlation coefficient r_s) and two way ANOVA. All these tests were suggested by Řezanková (2007) for the type of variables we were analysing.

Results and Discussion

Research I: Students´ interest in information ethics

Out of 147 inquired students 9 students didn´t answer this question (6.1%), 103 students (70.1%) supported the idea of teaching information ethics, 34 students (23.1%) were against and one student (0.7%) didn´t know. At the 95% confidence interval we may expect the positive answer to this question to be between 82.7% and 57.5%. This result supported the idea of introducing information ethics into the new curricula as students seem to be interested in it.

Do you support the idea of teaching information ethics at the University of Economics in Prague?	
Yes	70.1%
Don´t know	0.7%
No	23.1%
Didn´t answer	6.1%

Tab. 1 Teaching information ethics

As for the content of the subject, 62 students out of 136 (45.5%) mentioned law as the suitable content of the subject. That shows ethics is closely related to law even though it is not identical. This result also shows students think above all practically and want to know the legal measures which may affect them and would like to know their rights and duties. With regard to those results we have decided to include information ethics into one of the compulsory subjects and carry out another research which would concentrate on the awareness and opinions students have in the area of information ethics.

Research II on students´ ethical behaviour

The majority of students who participated in our research think corruption in our society is very high (17.8% out of 77) or high (54.8% out of 77). Only 23.3% of participating

students think the level of corruption is identical in our country and in the rest of EU and only 4.1% of participating students consider the level of corruption low. At the 5% confidence level the results are not related to gender (p=0.549, χ^2=0.359) or average mark (p=0.992, r_s=0.001). The results are not very optimistic.

How would you assess the level of corruption in our society?	
Very high	17.8%
High	54.8%
The same as in the EU	23.3%
Low	4.1%

Tab. 2: Corruption in the society

If students who participated in our research compare the quality of ethical environment in real life and on the internet 57.7% of them think following ethical rules on the internet is poorer than in real life, 38% out of 77 participating students think it is identical and only 4.3% of them think it is better. At the 5% confidence level the results are not related to the gender (p=0.295, χ^2=1.096) or marks (p=0.369, r_s=-0.108). That is quite a common opinion as the anonymity and other options provided by technical tools make unethical behaviour easier.

Comparison of real and virtual environment in terms of ethics	
Virtual environment is worse than real environment	57.7%
Virtual environment is identical to the real environment	38%
Virtual environment is better than real environment	4.3%

Tab. 3: Real and virtual environment

However students participating in our survey are more optimistic regarding following ethical standards by students at the University of Economics. Only 4.5% of them think students don´t follow ethical rules in the area of information ethics at all, 37.3% think they follow them a little only, 55.2% of students would say students at the University of Economics very often follow the principles of information ethics and 3% of students think students always follow the principles of information ethics. The results are not at 5% significance level related to the gender of the respondents (p=0.878, χ^2=0.024), they are weakly negatively related to the students´ average marks (p=0.005, r_s=-0.341) – the minimal value for rejecting the hypothesis about the independence of the variables is however boundary.

Do students at the University of Economics follow the rules of information ethics?	
No	4.5%
A little	37.3%
Very often	55.2%
Always	3%

Tab. 4: Following the rules of information ethics

It is interesting students from our research are quite critical regarding the ethical situation

in the society and consider internet an area of worse ethical practices if compared to the real society. Even though they are critical, more than 40% of them don´t follow the rules of information ethics very often and so contribute to the situation. Later we will see what the biggest problem with information ethics may be. However the majority follows the ethical rules and we don´t know how exactly students interpreted the notion "a little".

Privacy

We asked our students if they mind that information entered on the internet is used by companies and institutions without informing the respective subject. 23.3% of students don´t mind that at all, 42.5% mind that a little and 34.2% mind that. It is interesting that there is no correlation between the question if students mind that companies and institutions use the information on subjects without their awareness of that and the question asking if students know who collects information on them on the internet (r_s=0.093; p=0.435). No contingency was also found between the question if students mind that information is used on the internet without the subject knowing about it and the question if they read and understand the terms of contract before using a service on the internet (p=0.076, χ^2=6.862, 3df) and surprisingly there is just a little contingency between the awareness of terms of contract and familiarity with the companies and institutions collecting information (p=0.409, χ^2=2.819, 3df). To be precise we must add that only 6.7% of students read the terms of use and understand them, 4% read them, but don´t understand them, 30.7% doesn´t read them at all and 58.7% read them sometimes and understands them. None of the questions is correlated to the average marks (p=0.183, r_s=-0.158 and p=0.239, r_s=-0.138 respectively) or on gender (p=0.510, χ^2=0.433 with 1 df and p=0.677, χ^2=0.174 with 1 df respectively).

Do you mind that information entered on the internet is used by companies and institutions without informing the respective subject?	
Not at all	23.3%
A little	42.5%
Yes	34.2%

Tab. 5: Using the information on the internet

Do you read and understand terms of contract of various internet services?	
Read them and understand them	6.7%
Read them, but don´t understand them	4%
Sometimes read them and understand them	58.7%
Don´t read them	30.7%

Tab. 6: Terms of contract

Accuracy

In our survey we asked students if they verify information they use and if they reference properly the sources they use. The tool to verify the accuracy of information is to use more sources and check if they contain identical information. That is why we asked in our questionnaire if students verify the information they use in their studies and work and if they reference all the sources they use. Out of 77 answers, 4.1% doesn´t verify

information they use, 35.1% sometimes verify and 60.8 always verify information they use for their studies or at work. The results are independent on gender (at 5% significance level χ^2=4.14 with 1 df, p=0.126 for gender) and average mark (r_s=0.064, p=0.588). With referencing the situation seems to be optimistic as 51.4% always reference properly used sources, 47.3% sometimes reference them and only 1.4% don´t. The results are at the 5% significance level independent on gender (χ^2=3.052 with 1 df, p=0.081) and there is no correlation between the average mark and referencing (r_s=0.062, p=0.598). However it is not clear how frank the students were even though the survey was anonymous.

Do you verify the information you use in your studies and work?	
No	4.1%
Sometimes	35.1%
Yes	60.8%

Tab. 7: Verification

Do you reference all the sources you use in your written work?	
Always	51.4%
Sometimes	47.3%
No	1.4%

Tab. 8: Referencing

Property

In our research we asked students if they pass off somebody´s else work as theirs and if they break the copyright of digital content. We asked in our research if students consider current regulation of copyright sufficient, too. We learned that a big majority of students (91.9% out of 77) doesn´t pass somebody else´s information as theirs, 6.8% sometimes do and just 1.4% do that regularly. However, the answers to the following two questions have shown interesting results. 38.4% out of 77 participating students regularly break the copyright of digital content, 32.9% do that sometimes and 28.8.% doesn´t break it. 36% of participating students doesn´t consider current regulation of copyright sufficient, 33.3% consider it sometimes sufficient and only 30.7% consider it sufficient. Surprisingly no correlation was found between the responses to these two questions (r_s=0.016, p=0.895).

Do you pass off somebody else´s work as yours?	
No	91.9%
Sometimes	6.8%
Yes	1.4%

Tab. 9: Cheating

Do you break the copyright of digital content?	
No	28.8%
Sometimes	32.9%
Yes	38.4%

Tab. 10: Breaking the copyright

Do you consider current regulation of copyright sufficient?	
No	36%
Sometimes	33.3%
Yes	30.7%

Tab. 11: Regulation of copyright

Neither of the questions is related to the gender of the students at the 5% significance level (χ^2=0.247, p=0.619, 1 df for the first question, χ^2=0.385, p=0.535, 1 df for the second question, χ^2=0.047, p=0.828, 1 df for the third question), nor average mark (r_s=0.149, p=0.206; r_s=0.038, p=0.751; r_s=-0.214, p=0.066).

Accessibility

As analysed students don´t seem to have problems with the access to information we excluded questions relating to that aspect from our research. However from the question aimed at the assessment of current copyright rules and the question if students break it we may conclude most of them would support easier, more comfortable and more liberal access to digital content.

Conclusion

What we found out and what is also important for our purposes is the fact that most students consider information ethics relevant (70.1%), they think the situation in the area of information ethics is not satisfactory, in cyberspace the principles of information ethics are followed even less than in real environment. As for the students´ following of information ethics´ rules, many of them break some principles of information ethics, especially the copyright. There seems to be a conflict which suggests that not all codified principles of information ethics are suitable for the current situation as students have different principles especially in the area of privacy and property. What we can experience now is the change in the behaviour of various actors. That supports the idea of introducing the subject into the curricula.

Regarding privacy students are not satisfied with the current situation which seems too complicated for them. They don´t seem to express a special concern on privacy even though they don´t disregard it totally. They rather mind information is used without their content, but read the terms of contract of various internet service providers sometimes only. As for accuracy students seem to be cautious and careful. They verify and reference the information they use. Regarding accuracy we may conclude students would support easier, more comfortable and more liberal access to digital content. With property the situation is more complex. Students don´t seem to cheat a lot themselves, but break the copyright of digital content as they mostly don´t agree with its protection. They tend to more liberal approach to the copyright of digital content. In this respects our results are similar to the results of Vrbová (2013) and Preis et al. (2013).

The results are according to the chi-square test and Spearman coefficient of correlation in all cases independent on gender and average marks at the 5% confidence level. We also computed two way analysis of variance which has shown there is no influence of gender and average marks on the questions asked except for the question on following the rules of information ethics by the participating students where age and marks have some interaction effect on the results (F=3.324; p=0.043). These findings support the conclusion that gender alone has no influence on ethical thinking (McCabe et al, 2006). It would be interesting to include in the comparison students of different age and years of study to

see how each of these variable and their combination affect opinions on ethics. However in general we are quite sceptical regarding simple determination of ethical behaviour. Ethics may be influenced, but not determined. It can´t be reduced to anything else. The contradictory results of the efforts to find some ethical determinants prove our idea.

It is difficult to simply generalize the findings to the whole population of IT professionals or of all young people or all students. Our sample group consisted mostly of 1st year students of the Faculty of Informatics and Statistics. Future similar research that would inquire a sample of various students or IT professionals would be necessary to verify the research results.

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UNDERGRADUATE STUDENTS FROM FAMILIES WITH LOW SOCIAL STANDING

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Abstract

Issues related to education attainment of students from families with low social status frequently occur in current education policy debates. One of the reasons is that the percentage of persons from low-income families who graduate from college is substantially lower than the percentage of children from other families. However, all students regardless of social background of family, should have the equal access to education. The aim of this paper is to analyse the relationship between educational attainment of students and the socioeconomic status of their families from the perspective of students coming from families with low social status. The key variable represents the subjective assessment of social status and we are looking for the relationship between this assessment and the different issues of study. The analysis contains the access of these students to the study, satisfaction with study and school, their living conditions and future plans.

Keywords

Expenditures of students, future plans of students, satisfaction with the study, socioeconomic status

Introduction

One of goals of education is to make sure that every student has a chance to excel, both in school and in life. Education should be accessible for all students, regardless of race, income, class, and prior achievement. Educational attainment is a major determinant of career patterns, a fact which provides the strongest and most direct link between family background and the assets and liabilities with them the individuals enter the labour market. Many of factors affecting the educational attainment are strongly related to the socioeconomic status of family. The association between poverty and educational attainment is a long well-known phenomenon. The children from low-income families have less potential for graduating college. The social status of the family is determined primarily by parental education. Sewell and Shah (1968) or later Fischer and Lipovská (2013) show the intergenerational transmission between parents and their children in the level of education. Tertiary education of children is obviously connected to the tertiary education of the more educated parents. The same relationship was found between upper-secondary educated persons and their parents up to the upper-secondary level. According to Lee and Burkam (2002), children from families with low socioeconomic status begin school at kindergarten and in lower quality elementary schools than their more advantaged counterparts. The linkage between the family's socioeconomic status and the educational status of the young adult is according to Crosnoe et al (2002) partially explained by the tendency for disadvantaged parents to be more pessimistic about their adolescents' prospects of attending college.

The study by Jencks (1973) showed that inequality of level of education, occupational

status, inequality of job satisfaction and income inequality are determined by family background. For similar analysis from another point of view, it can be used the results from the survey Adult Education Survey; this survey and findings are written in Mazouch and Fischer (2011). Davis (1962) argues that children in small families have better life chances. The child from the small family should tend to achieve a higher level of educational and occupational status than the child from the large family, other things being equal. Large families take more difficult advantage of educational and other opportunities that lead to higher status of their children.

This paper also deals with the relationship between educational attainment of students and the socioeconomic status of their family. But the aim of our paper is to analyse this relationship from the perspective of students coming from families with low social status. We have chosen the subjective assessment of social status as our dependent variable, and to focus on the correlation of different issues of study. We want to verify hypothesis on dependency of these issues of social status of parents. We expect strong relationships between the income of respondents and their occupational and educational level and subjective social class.

The rest of paper is organized as follows. Firstly we introduce the data sources and used statistical methods and then we present the results of our analysis. The analysis includes the evaluating the study conditions of students from low social class and their incomes and expenditures.

Material and methods

Our research is based on the data from survey EUROSTUDENT V[1]. This survey was conducted in all EU countries and was coordinated by the local ministry of education. The main aim of the project is to obtain comparable data on the social dimension of European tertiary education. It focuses on the socio-economic background and on the living conditions of students but it also investigates temporary international mobility. The project strives to provide reliable and insightful cross-country comparisons. The main users of findings are tertiary education policy-makers at national and European level, researchers in this field, managers of tertiary education institutions and finally the students within Europe.

The survey in the Czech Republic was conducted in two rounds during 2013. EUROSTUDENT V was focused on students in all public, state and private universities. It involved all public and state universities and 29 private universities. 95,177 students were interviewed in total. The data set consists of 6,382 responses from college students. Several questionnaires were not completely filled or were wrong filled. Such responses had to be excluded from the survey. 4,664 questionnaires remained for analysis. The data were weighted to ensure the explanatory power of survey. The weighting system is based on the data from the register of students.

The following analysis focuses on students from low social class. The key question is a subjective assessment of the social status of their parents. The question in EUROSTUDENT V was: “Think about the social status of your parents and place them on a scale of 0-10, where 0 = high social class and 10 = low social class”. For the purposes of our paper, we created five categories:

[1] EUROSTUDENT V was realised within the project Ipn KREDO CZ.1.07/4.1.00/33.0005.

0-2	3-4	5	6-7	8-10
High class	Upper middle class	Middle class	Low middle class	Low class

Tab. 1 Social class categories

We have used the standard statistical and descriptive methods. We especially operate with qualitative variables; therefore we have applied the analysis of variance and contingency tables (more see in Jarošová et al, 2005).

Results and discussion

General characteristics of students from low social class

The results show that social status of the family is perceived as low especially by the students older than 30 years (32.5%) and younger than 21 years (26.5%). This evaluation is not dependent on sex (49% women vs. 51% men). The students from low social class are studying most often on bachelor degree (80%) and they are graduates from vocational schools including lycées (62%) and from secondary school (35%). The subjective assessment of social status of family differs by field of study programs. The students of humanities and arts most often consider their social status as a low (10.1%), on the other hand, the lowest proportion of students who feel low social status of family comes from engineering field of study (5.3%).

The study conditions of students from low social class

Tertiary education is the last and highest educational degree. It is the top of educational system and it is achieved by the smallest proportion of population. According to Stinebrickner (2003), the students from higher social class attend better schools and colleges and school quality is found to be positively related to college grades and college persistence. The results from survey EUROSTUDENT can confirm this statement. The students from low social class are less satisfied with some selected issues of study than total students, regardless of social status of parents (see Tab. 2).

	The quality of schooling		School equipment		Schedule of study	
	Students from low social class	Total students	Students from low social class	Total students	Students from low social class	Total students
good	72.5	78.6	74.9	81.0	64.0	67.2
neutral	22.0	16.9	19.1	13.4	24.0	21.7
bad	5.5	4.6	6.0	5.7	12.0	11.1

Tab. 2 The satisfaction with selected issues of study (in %)

Motivation plays an important role in participation on study at university. According to Keller (2008), the students are most often motivated to study by an interest of study, employment opportunities after graduation or they are influenced by the family tradition. Other motives for study are occurred rarely, e.g. distance from place of residence, the prestige of the field of study, no difficulty of entrance examinations, advice from friends etc. (Keller, 2008).

There were observed four motives (priorities) for study in college in the survey

EUROSTUDENT V. For students from low social class, the most important motives for study in college are the employment opportunities and the interest field of study. On the other hand, the financial affordability is not so important for them, surprisingly (see Fig. 1)

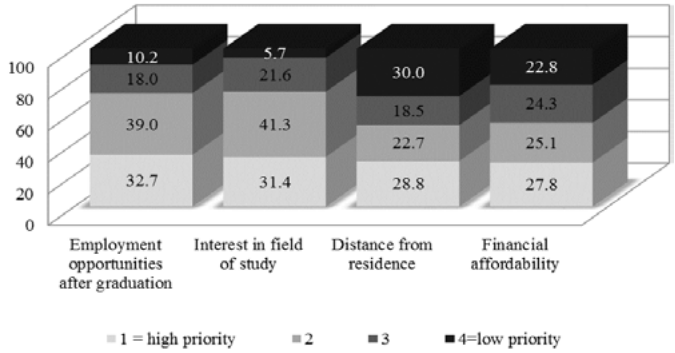

Fig. 1 Motives for study of students from low social class (in %)

The social status of family influences economic activity during the study and future plans of students. More than three-quarter of students from low social class are working during the study. 55.5% of these students have regular employment and 21% works occasionally. Only 23.5% students from low social class have no employment during the study at the university. The financial affordability as well as distance from place of residence minor matters to students from high social class – one third of students marked these priorities as low. They are more interested in field of study and employment opportunity than students from low social class.

The financial situation often plays a significant role before decision on studying at college. The families, whose children are considering higher education, are thinking about the financial demands of study. Some students decide not to continue on the upper degree of study by reason of these considerations. Fig. 2 shows plans for further studies of students in bachelor degree of study. 63.3% students from low social class want to continue in study in master degree, 17.1% of students not and 19.6% of students don't know yet.

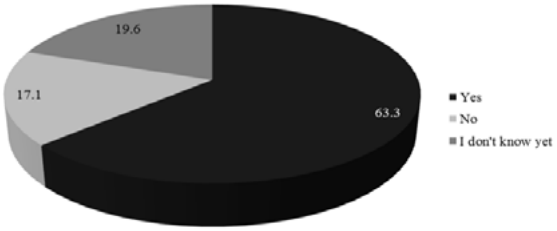

Fig. 2 Do you want to continue in upper degree study program? (in %)

There is no doubt that the work is the most common reason for finishing the study on current degree for students from low social class. The students, who do not continue with their studies at the master level of study, want mostly to find the new employment (46%) or to go on in current employment (30%). Before the beginning of the study in college,

41% of students from low social class family have regularly worked, in comparison with 23% of total students (without distinction of social background).
From the statements mentioned above the section results, that the employment opportunities of students affect the educational attainment, occupational and social status of parents. The subjective evaluation of the employment opportunities of students from low social class family are expressed in Fig. 3.

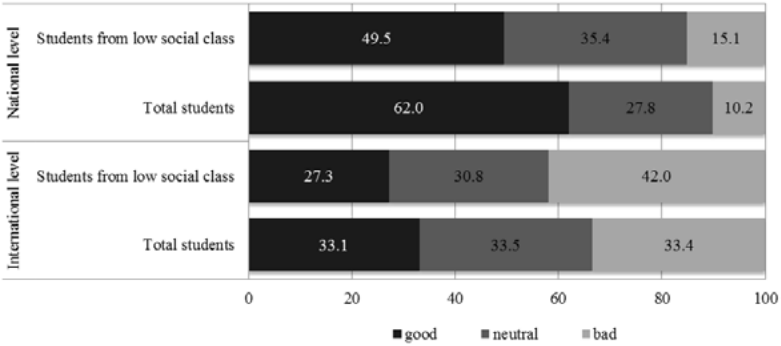

Fig. 3 The subjective evaluation of employment opportunities (in %)

The students from low social class family consider their employment opportunities generally worse than total students. The half of students from low social class evaluates their opportunities in national labour market as good, in contrast to 70% of students from high social class. 42% of students from low social class rate their opportunities in international labour market as bad (compared to 25% of students from high social class). A statistically significant dependency (Cramér's V = 0.156) is observed between the assessment of the social status of the family and the degree of troubles with finance. The lower is the social status of parents, the higher is the proportion of students dealing with financial problems.

The incomes and expenditures of students from families with low social status

The financial situation represents an important topic for students and their families. The student life has as well as any other financial requirements. Money is therefore an important part of life for each student. The analysis of variance (ANOVA) confirms (at the 5% significance level) that the monthly income of students depends on the social status of families (pvalue = 0.018). The following table shows the structure of financial resources of students from low social class. The average monthly amount of money gained from parents or partner is lower in the case of students from low social class than total students without distinction of social background. On the contrary, the average monthly self-income of students from low social class is higher by 2,045 CZK; self-income represents 67% of total income for students from low social class. Other incomes originate from a non-refundable student grant, reversing student loan, public sources (pension, allowances) etc.

	Total students		Students from low social class	
From parents/partner	3 543	28.7	3 047	20.8
Self-income	7 779	62.9	9 824	67.0
Others	1 045	8.5	1 787	12.2
Total	12 367	100.0	14 658	100.0

Tab. 3 The structure of monthly incomes of students (in CZK, %)

The consumption expenditures of college students are currently one of the often discussed topics (e.g. in connection with introduction of tuition fees). According to ANOVA the monthly expenditures depend on the social status of families (even at the 1% significance level). We distinguish the expenditures of students by the source of funding to expenditures paid by students (p-value = 0.000) and expenditures paid by someone else (parents, partner) (pvalue = 0.005).

The total amount of expenditures of students of low social class paid by themselves is 10,644 CZK on average. It is about 2,538 CZK more than total students without distinction of social class of family. On the contrary, the amount of expenditures paid by someone else is lower of almost about 1,500 CZK in the case of students from low social class. The students from low social class have the expenditures paid by someone else only in 27% (in comparison with total students – 40%). The students from low social class do not have so financial family background as the students from high class family, they have to more often rely on themselves.

	Paid by oneself				Paid by someone else			
	Total students		Students from low social class		Total students		Students from low social class	
Food	1 749	12.9	2 234	15.2	1 108	8.2	901	6.1
Living	2 009	14.8	2 901	19.7	2 384	17.6	1 822	12.4
Culture and leisure	846	6.2	757	5.1	168	1.2	80	0.5
Study	841	6.2	1 180	8.0	584	4.3	426	2.9
Transport	766	5.7	990	6.7	397	2.9	222	1.5
Others	1 896	14.0	2 582	17.5	794	5.9	616	4.2
Total	8 106	59.9	10 644	72.4	5 435	40.1	4 067	27.6

Tab. 4 The structure of students' expenditures (in CZK, %)

The costs of university studies are today very high for many families. Food, living, books, transport, etc. – all these issues mean financial burden for parents. The highest amount students are spending on food and living. The students with self-income spend more money for all of items (besides living) than students without self-income (Fischer and

Vltavská, 2014).
The economic situation and social status is also one of the reasons for work of students during their study. The work while studying may be positive activity when it should be related to field of study. It could provide practice for students and increase their chances on the labour market. Unfortunately, this survey shows that about 50% students have work not related to their field of study.

Conclusion

Many studies show the effect of the parental education and socioeconomic status of the family on educational attainment of students. According to these studies, less potential is assumed for graduating of students from family with low social class. We used data from the survey EUROSTUDENT V that allowed evaluation of the impact of social status of family on student's life, from point of view of students in the Czech Republic. In this survey students expressed their feeling about the quality of college, the satisfaction with their study, the future plans or employment opportunities after their graduation. The survey has also been focused on the sources of financing of expenditures of students. It allows us to identify the differences in funding of students from various social class of family.
The paper provided a viewpoint of students from low social class of family on their study. We proved the hypothesis describing the dependency of issues of students' life on social status their family. We found that the social status of parents have significant impact on life of college students. The students from low social class more often work during their study than other students. The conducted survey shows that three-quarter of students from low social class are working during the study. The economic situation and social status is also one of the reasons for finishing the study before the next level. Some students from low social class have future business plans instead of further study. Another factor of students from low social class is their worse evaluation of employment opportunities after graduation in national and international labour market.
All students should have the equal access to education; the investment in human capital is important regardless social background of family. Nowadays, there is the support for students coming from low social class in the form of scholarships but unfortunately they are not satisfactory. The knowledge of the impact of family background on educational attainment of students is relevant to government education policy from the standpoint of tuition subsidy.

Acknowledgements

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ESP SKILLS: 20-YEAR REFLECTION OF FIM GRADUATES

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Abstract

The paper analyses data collected in the form of questionnaire from 282 respondents who have graduated from the Faculty of Informatics and Management, University of Hradec Kralove, Czech Republic, since it was established in 1993. Within the quality assessment of study programmes the analysis mainly focuses on foreign language instruction (English for specific purposes) and related fields from the graduates and employers point of views. Despite not the latest methods of instruction are applied in the process of instruction, the research results show rather good experience in graduates´ fulfilment on the labour market. The research results, being compared to selected world results, will be reflected in the new ESP concept at the institution.

Keywords

English for specific purposes, graduates, higher education, informatics, management

Introduction

The Faculty of Informatics and Management (FIM), University of Hradec Kralove (UHK), Czech Republic, has had a short history of 20 years, been established in 1993. Starting with 50 students in 1993, more than 2,400 students have been enrolled in 2013/14 academic year. Within the 20-year period the institution has accredited eight study programmes (Applied Informatics; Information Management, General Informatics, Information and Knowledge Management, Tourism & Management, Financial Management, Sports management, Health Management) in the bachelor, master and doctoral degrees, in the present (full-time) and/or combine (part-time) form of study.

Relating to the main field of study, the faculty has become the leader in the process of the ICT implementation in university education in the Czech Republic. More than 220 online courses have been designed by faculty staff (Šimonová, Poulová and Šabatová, 2009: 6) and used in full-time and part-time forms of study.

English for specific purposes (ESP) has been taught at FIM for four terms in full-time study programmes (two lessons (90 minutes) per week and for six terms in part-time study (four blocks per term, six lessons each), totally 24 lessons per term. The learning content focuses on developing all language skills; the process of instruction is supported by online courses in the LMS Blackboard. The main learning objective is to reach such a level of language skills so that graduates were able to succeed on the labour market.

The ESP definition was given by Dudley-Evans (1998) in terms of 'absolute' and 'variable' characteristics (1) covering meeting learners´ specific needs, using methodology and activities underlying the discipline it serves, being centred on the language appropriate to these activities in terms of grammar, lexis, register, study skills, discourse and genre (absolute characteristics); (2) relating to, or being designed for specific disciplines, being used in specific teaching situations, applying a methodology different from that of

General English, being designed for adult learners, either at a secondary, tertiary level of education or in a professional work situation, for intermediate or advanced students (variable characteristics). This definition was influenced by that of Strevens (1988), although he has improved it substantially by removing the absolute characteristic that ESP is "in contrast with 'General English' (Johns and Dudley-Evans, 1991: 298) and has included more variable characteristics. From his definition, we can see that ESP can but is not necessarily concerned with a specific discipline, nor does it have to be aimed at a certain age group or ability range. ESP should be seen simple as an 'approach' to teaching, or what Dudley-Evans (1998: 1) describes as an 'attitude of mind'. This is a similar conclusion to that made by Hutchinson and Waters (1987: 19) who stated, "ESP is an approach to language teaching in which all decisions as to content and method are based on the learner's reason for learning". They answer the question 'What is the difference between the ESP and General English approach?' as follows: "in theory nothing, in practice a great deal" (Hutchinson and Waters, 1987: 53).

The 20-year history is the period long enough to be evaluated, strengths defined, weaknesses discovered and opportunities and threats considered. Similar studied were conducted e.g. in Finland focusing on the period of five years at Finnish universities (Aarresaari network of the Academic Career Services, 2011) or in the Czech Republic (Kubanová and Linda, 2013). In 2013 the FIM graduates were addressed to provide assessment and present their post-graduate opinions and experience relating to the study programme they graduated from. In this paper data and results relating to the foreign language teaching/learning, respectively to English for specific purposes (Anthony, 1997) are presented and analysed. The main objective of this research was to monitor, analyze and evaluate graduates' opinions and experience, and implement them in the new proposal of efficient ESP instruction.

Materials and Methods

In this chapter, the research design and methodology are introduced first, followed by research sample description.

Research design and methodology

The questionnaire method was applied to collect the data which were processed by means of quantitative descriptive statistics, particularly by the method of frequency analysis. In this paper partial data relating to ESP were analyzed.

The questionnaire was designed and piloted at the Faculty of Informatics and Management for internal purposes, i.e. to provide feedback for improving the quality of study programmes by tailoring them to latest requirements of practice. Despite numerous institutions collect the feedback, the data are difficult to be compared as (1) institutions strongly differ in ESP load (number of lessons per semester, number of semesters per study period etc.) From this point of view each set of data is unique and any comparison between institutions would be redundant and purpose-built.

The whole questionnaire was structured in ten parts focusing on (1) evaluation of graduates´ competences developed within the study and required by employers, (2) the process of searching for jobs, (3) starting and current job positions, responsibilities and work load etc., selected criteria been considered from the point of graduates´ satisfaction with the quality of the programme they had studied, others from the view of employers´ satisfaction with graduates knowledge and skills, or both. Totally the questionnaire contained 85 items; 27 items of multiple-choice type, 27 items of short open answers,

four long open answers (of paragraph type), 10 items of Yes/No answers, 15 items of scale type, or combinations. The questionnaire was available on the university web page for three months since April to June 2013 and potential respondents, i.e. graduates registered on the Alumni portal of the faculty were addressed to fulfil the questionnaire by e-mail. The foreign language acquisition, i.e. ESP knowledge and skills, were reflected in several items of the questionnaire and considered under following criteria: (1) study programme – graduates´ evaluation; (2) emphasized teaching methods – graduates´ evaluation; (3) graduates´ ESP knowledge and skills – graduates´ and employers´ evaluation; (4) work and/or study experience abroad – graduates´ evaluation.

Research Sample

In 1993/4 (resp. 1995/6) – 2013/14 academic years 5,034 students have graduated from the Faculty of Informatics and Management (resp. 4,448 until 2012/13); approximately 900 of them have registered on the Alumni Portal. These graduates were addressed to fulfil the questionnaire described below. It was presented on the university web page for three months. Finally, 282 graduates participated in the research (male 158, female 121, not answered the gender item 4), the return rate was 32 %, i.e. 6 % from the total amount of all graduates. From the above mentioned eight study programmes graduates of five of them participated in the research (Applied Informatics, 15 %; Information Management, 49 %; Tourism & Management, 22 %; Financial Management, 11 %; Sports Management, 4 %). More than three fourths of graduates (78 %) were the full-time students and 22 % of part-time one; more than half of them (53 %) studied in the bachelor study programmes, 46 % were graduates from master programmes and 1 % graduated from the doctoral study programme (Information and Knowledge Management). Most respondents graduated in last eight years (figure 1).

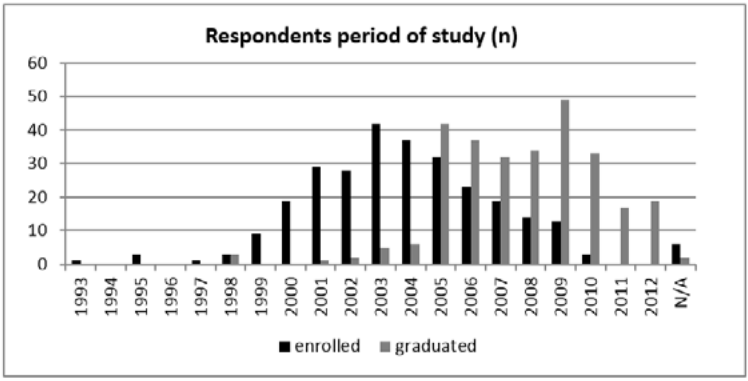

Fig. 1: Respondents period of study

Results and Discussion

The data collected by the questionnaire were analysed and discussed under the four above mentioned criteria.

Study programme – graduates´ evaluation

Graduates of all study programmes evaluated the quality of background they started the professional career from. Providing their opinions on several areas where two opposite

options (´yes´, ´no´) were offered in each criterion, plus the ´I am not sure´ attitude in between them. This attitude was frequently declared, possibly expressing respondents either do not feel competent enough to exactly assess the state after many years from graduation, or they hesitate whether ´yes´ or ´no´ answer is reflecting the state, as each option is supported by opposite experience. Despite this indecisive result, 30 % of respondents declared strong contribution of the study programme for their personal development, followed by support when starting work, further preparation for work and future career, coping with work (all items in the interval of 14 – 17 %), while only 2 % of respondents mean the programme developed their entrepreneurial activities. On the other hand, this criterion received 16 % of ´no´ answers, which was the highest negative rate, followed by 7 % of those who stated they had received no background from the study programme for starting work. The question is what knowledge and skills they actually expected to receive if nothing they had learned within the study helped them start work. To sum up data under this criterion, although more frequent occurrence of ´yes´ answers would be appreciated, hardly any negative results were detected.

Emphasized teaching/learning methods – graduates´ evaluation

Nine items were considered within the teaching/learning methods/approaches, i.e. prevailing theoretical knowledge, practical skills, lecturing, teacher as the main source of information, team work, work on projects, participation in research projects student´s presentations, testing knowledge. Rather strong occurrence of ´yes´ answers in emphasizing theoretical knowledge (34 %) and ´no´ answers in participation in research projects (46 %) were detected; neither of them provides positive assessment of teaching/learning methods. Above all, teacher-centred lecturing and learner-centred students´ presentations under ´yes´ answers as emphasized methods and no practical skills development under ´no´ answers were mentioned by 17 % of respondents each. Frequency of other methods (both positive and negative) considered emphasized was detected under 10 %.

Graduates´ ESP knowledge and skills – graduates´ and employers´ evaluation

Under this criterion, which focuses on ESP knowledge and skills in speaking, listening, reading, writing from both graduates´ and employers´ points of views were detected. In other words, the graduates´ view provides opinions what graduates mean their own knowledge and skills in ESP are, while the employers´ view presents what graduates state their employers mean on their ESP knowledge and skills. The high level of ESP is defined as upper intermediate plus, while low level students include beginners and false beginners below B1 level of CEFR – Common European Framework of Reference for Languages (2011: 24). The high level of graduates´ knowledge and skills was often achieved or developed within studying and/or working abroad (before, during the study period), as monitored below (figure 2).

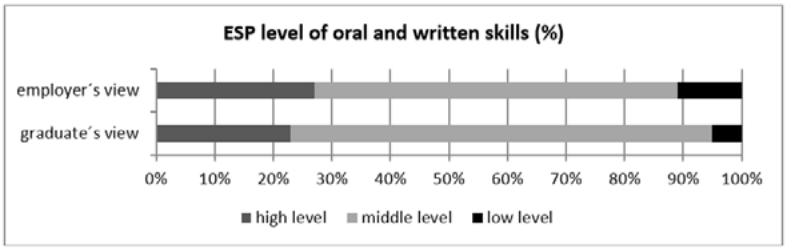

Fig. 2: Level of ESP knowledge and skills

Two features are clearly visible: (1) the uncertain, indecisive area is large and (2) employers´ evaluation of graduates´ ESP skills is higher relating to the high level. In other words, graduates stated their employers considered their ESP knowledge and skills to be better than they did (i.e. graduates state 27 % of employers mean that graduates´ knowledge and skills in ESP are on high level, while only 23 % of graduates mean their ESP level is high). On the other hand, 11 % of employers consider graduates´ level of ESP low, while only 5 % of graduates agree with this evaluation.

Work and/or study experience abroad – graduates´ evaluation

Learning a foreign language in the natural environment belongs to factors which may strongly influence both the processes of teaching and learning. The work experience, where usually an advanced level of ESP knowledge is required as minimum, provides learners with additional value, i.e. with the chance to develop and the requirement to perform good command of the language in real situations. That was the reason why the item focusing on learners´ experience in working/studying abroad was monitored. Above all, the FIM provides students with possibility both to study and work abroad within their study period. Nearly 100 seats in study programmes are provided every year and the amount of students interested in summer jobs (qualified and unqualified) is not limited. Under this criterion, stronger than others, the data are influenced by the year of graduation, as the number of students in exchange programmes is increasing every year.

The results show that 38 % of 106 graduates who provided the ´yes´ answers experienced a stay abroad, either studying (24 %; 69 graduates), or working there (13 %; 37 graduates). More than half of respondents (53 %, 56 respondents) spent 4-6 months abroad, 18 % (19 respondents) experienced even a longer stay (7-12 months) and 12 % (13 respondents) spent 1-3 months abroad. We expect respondents participated in Erasmus (or similar) study programmes for 1-3 months, part of them spent abroad one semester, i.e. 5 months, or two semesters (10 months). Unfortunately, the data do not reflect whether respondents studied or worked there. Data reflecting longer periods of staying abroad (13-24 months, 25-60 months, 61+ months) are expected to relate to work experience.

Several limits should be taken into consideration within the data interpretation, i.e. research tool, research sample, graduates´ competences, equipment, academic staff. As mentioned above, the research tool (questionnaire) covered a wide area of topics and items relating to the field of graduates´ competences, opinions and experience in asserting themselves on the labour market. This feature resulted in the fact that a large amount of data was gathered. Having analysed them the requirement of other, more detailed data has appeared, i.e. the strong call for further research has been detected, so that all discovered features and correlations could be explained in detail and further on reflected in curricula,

as intended in the research design. Despite the 6 % of respondents participating in this research from all those who graduated within the 20-year period may seem not to be a large amount, the group of 282 respondents contradicts this statement. Professional and social requirements for graduates, covering such competences which enable them to succeed on the labour market, are changing within the course of time. That is why the needs analysis should be run at the beginning of each course every two-three years and the learning content tailored to its results. For this purpose (but not only) the HIT Cluster (Hradec Information Technologies Cluster) was established in Hradec Kralove region providing the reflection of latest practical requirements into the theoretical learning content. The member companies provide students with the study and/or work opportunities abroad and the reflection on the learning content currently taught in ESP and other subjects. Above all, hardware, software and other class and workplace equipment have strong (but not sole) impact on the quality of instruction, and consequently on graduates´ competences, as well as teachers´ competences do. The quality and quantity of equipment changed substantially within the 20-year period; the substantial change appeared in 2008, when the faculty moved to new premises equipped with latest technology, and the academic staff has been continuously trained in efficient use of latest information and communication technologies in education.

All the above presented criteria and results provide impact on the process of instruction and thus they influence the graduates´ competences, including the field of ESP. They are listed neither in the order of importance, nor the consequence. They aim at describing the whole environment providing support to the 20-year long period of instruction targeting to building graduates ´adequate competences. Finally, the results will provide background to designing a new ESP teaching/learning model for FIM students. Having established partnership with numerous universities all over the world, currently similar features and needs are appearing at several Asian higher education institutions (e.g. Taiwan, Hong Kong, Japan etc.). Their experience is steadily implemented in the ESP model which will be applied at FIM within two years. The model is structured in three areas which will finally form a compact goal-oriented and well-targeted syllabus implementing learning content reflecting latest needs analysis results, efficient and real-life teaching/learning methods and strong motivators.

The learning content will reflect results of needs analysis collected from both students/graduates and employers (HIT Cluster members). To reach the required graduates´ competences the syllabus will focus on developing following areas:

- *Presentation skills*, both written and oral. As Sukitkanaporn and Phoocharoensil researched (2014: 91), weaknesses were discovered in organization of content and its delivery to listeners. Above all, the presenter´s performance could be significantly improved by the help of native speaker, both in the field of content and pronunciation, intonation etc. Generally, advanced level of oral communication (not solely presentation skills) is required by all employers so reflective practices should be also implemented in the syllabus (Juhary, 2014).
- *Professional vocabulary*, including tools which will prevent from its attrition, both productive and receptive. Work in an international company, or simulating such environment in ESP lessons keeps the vocabulary active and contributes to its development in natural environment, Alharthi (2014) emphasizes.
- Developing English through *workplace communication*. The workplace has become increasingly volatile, intercultural and multilingual environment in multinational companies, where specifically professional genres can be studied in detail and in

linguistic professional context, supported by work with written documents. Both the context and documents form a broader and natural educational environment (Lam, Cheng and Kong, 2014). The creating *authentic learning environment* in language classroom has been highlighted by CLIL (content-language integrated learning) which aims at simulating the real environment (Tsoi, 2013).

- *Reading comprehension*. This skill, closely relating to all language skills, forms a basis for the presentation skills and professional communication (Rosnidar, Lilia and Kamisah, 2010). Its importance being recognized by both European and Asian institutions, it was researched by three universities in Kermanshah, Iran (Rahmany, Hassani and Fattahi, 2014) focusing on instructors´ competence in teaching reading comprehension of engineering major students. Despite the process of instruction was held in thee institutions, students performed similar level of knowledge in the final test.

Conclusion

Reflecting the 20-year-long graduates´ experience in ESP knowledge and skills developed within their study at the Faculty of Informatics and Management, University of Hradec Kralove, a new concept of teaching/learning will be designed. Changes will be applied within two following academic years and will particularly focus on three fields: ESP load, learning content and teaching/learning methods. Results of this survey and experience of other world institutions will be taken into consideration in designing the new ESP concept. The above presented sources and many others, e.g. Peters and Fernández, 2013; Trinder, 2013 etc. will be implemented in the new syllabus. Under the FIM conditions reflecting criteria of economic efficiency, the ESP load will be decreased from six semesters to four ones since 2014/5 academic year. Unfortunately, the didactic requirements will not be strongly supported by this step. As the previous load will not be re-established in near times, the learning/teaching concept, after been piloted next year, will have to meet all the above mentioned criteria and needs resulted from needs analyses which will be continuously running. Factors influencing the impact on the process of building and developing the ESP knowledge and skills also include the quality of academic staff, instruction, material equipment, co-operation between the faculty and companies, and as well as the criterion of time has to be taken into consideration.

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CHANGES IN DEMOGRAPHIC STRUCTURES OF ED5-6 GRADUATES WITH AN IMPACT ON THEIR ECONOMIC (IN)ACTIVITY

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Abstract

During past 12 years, the number of university graduates increased nearly threefold. This rapid change has an impact on the labour market and economic activity of the population. Therefore, the paper focus on the analysis of development of the number of university graduates by ISCED-97 classification in relation with the (in)active population of the Czech Republic by the education level. We particularly analyse the changes in the ED5-6 educated population structures based on demographic approaches: the moving of age-and-sex specific demographic structures using the Multi-tree charts. More students in the study programs mean increased number of economically inactive population in the age groups where the population have already been economically active in the past. Extension of studies and getting more degrees increases the economic inactivity in these age groups. We came to the conclusion that current trend worsens the position of young on the labour market.

Keywords

Economic activity and inactivity, demographic structures, ISCED-97, university graduates

Introduction

University education is increasingly popular goal not only for young people. Over past 12 years (and especially since the accession of the Czech Republic to the European Union in May 2004), there has been a significant increase in the number of students at the Czech universities. The number of students in particular branches have increased recently (Fiala, Langhamrová and Průša, 2011) and they are currently filled to the maximum allowed by the directives. Nowadays the Czech universities leave almost three times more graduates, (who have at least one bachelor degree) than 12 years ago. The time until graduation increases as same as the number of students who study more than one program at the same time (or after the graduation at the one university they continue to study at another one). The increase of students and university graduates extends the period of economic inactivity of the population than ever before (Šimková, 2011). According to the classification of the highest attained education ISCED-97, the most frequent age group of economically inactive persons with education ED3-4 (upper secondary and post-secondary non-tertiary education) was 20–24 years. These were the students who successfully gained high school diploma and continued to study at the university (ED5-6, first or second stage of tertiary education) (Mejstřík, 2005). This age group of 20–24 years is now much numerous, but the higher frequencies can be seen in the female population. This is mainly due to higher number of female university students and due to higher numbers of female graduates from high schools who are already on parental leave (Nývlt, 2013a). In addition, together with the increasing of number of economically inactive people in the age group of 20–24 years, also increases the number of persons in the middle age groups (i.e. 25–29, and

mainly 30–34 and 35–39 years). It is caused by studying other study programs, during which the student doesn't work and neither enters economically active population (Nývlt, 2013b). Furthermore it is caused by the study in doctoral programs in which the student is depended on scholarship or short-term job agreements, and, of course, the parental leave, which is postponed to the later ages (Dvořáková, Langhamrová, 2013). The birth of the first child is nowadays, more postponed as well (Fiala, Langhamrová and Průša, 2011). Females predominate in the middle age groups (especially 30–34 and 35–39 years) and in the number of economically inactive population. This number has increased almost three times within the past 12 years. The long-term trend is the interruption of studies at the universities with a tendency to graduate later, (this trend is becoming worldwide) (Park, Yu, 2013). In the past 12 years the number of students with interrupted studies in the age group of 20–24 and 25–29 years more than doubled. The main reasons for the interruption include short-term jobs, working abroad and short-term internships, maternity leave and also lack of e-learning opportunities (for detailed discussion see e.g. Jindrová et al., 2013). In this paper we analyse the changes in the ED5-6 educated demographic structures of the Czech population based on selected demographic approaches: the analysis of economic age-and-sex specific demographic structures using the "Multi-tree charts" (Šimpach, 2013). These changes are captured in time and are connected to the development of economic activity and inactivity of the population in the relevant age groups. The important consequences are evaluated. We determine the gender and age group with the largest proportion on the number of economically inactive population with specific education and which factors influence this proportion. In the same manner as the numbers of university students increase (and also the numbers of graduates increase), the risk that freshly graduated are unemployed is higher than before (Miskolczi, Langhamrová and Fiala, 2011). Labour market with these positions is slowly filled and staff fluctuation is not so frequent as e.g. before the crisis period (Potužáková, 2009). We describe how the labour market of ED5-6 educated persons has developed and evaluate the risks for fresh university graduates on the labour market.

Materials and Methods

We use the database of the Institute for Information in Education (IIE), particularly the performance indicators (IIE, 2012) obtained by the Ministry of Education, Youth and Sports (MEYS). The dataset include the numbers of students who have not yet graduated by age and sex and numbers of students with interrupted study, who have not graduated yet. We also use the number of first time university graduates by age and sex (*FTUG*) and university graduates in total (*UG*). The full data matrices are available from 2001 to 2013. Given that the estimates of economic-statistical indicators of labour market surveys, provided by Eurostat, are published later, we have currently available data matrices of these indicators by the end of 2012 only. Therefore, we use the data matrices from the IIE until 2012. Given that the population (*POP*) according to the methodology of International Labour Organisation (ILO) is divided into the population economically active (*ACT*) and economically inactive (*INACT*), using the known time series from the Eurostat (2014) database (point estimates from Labour Force Survey) it is possible to calculate the inactive population as

$$INAC_{x,t}^{s,e} = POP_{x,t}^{s,e} - ACT_{x,t}^{s,e}, \text{ where } x \in \langle 20-24\,;\,40-44 \rangle,\ t \in \langle 2001\,;\,2012 \rangle, \tag{1}$$

where x is the age-group in population, t is the time, s is *male* or *female* and e is the code

of ISCED-97 level. Eurostat database uses 3 groups of ISCED-97 levels, where ED0-2 are persons with pre-primary, primary and lower secondary education (without high school diploma), and groups of ED3-4 and ED5-6 were explained in the introduction of the paper. If a person is economically active, he/she may be classified (again according to ILO) as an employed (*EMP*) or unemployed (*UNEMP*). We calculate the unemployed persons as

$$UNEMP^{s,e}_{x,t} = ACT^{s,e}_{x,t} - EMP^{s,e}_{x,t}, \text{ where } x \in \langle 20-24\,;\,40-44\rangle,\ t \in \langle 2001\,;\,2012\rangle. \tag{2}$$

Inactive and unemployed population by age, sex and highest level of education attained is not published in the Eurostat database in the structure suitable for our analysis. Statistics about the number of students and graduates have the final age interval opened as 40+. We closed the interval as 40–44 years. Given that the number of students and graduates who are 45 years old or older is very small, (almost negligible), we will not make the big mistake if we consider the age interval 40+ and 40–44 as equivalent. The age and sex specific proportions of the first time university graduates (*ixFTUG*) on the numbers of economically inactive population with ED3-4 education level we obtain as

$$ixFTUG^{s}_{x,t} = \frac{FTUG^{s}_{x,t}}{INAC^{s,ED3-4}_{x,t}},\ x \in \langle 20-24\,;\,40-44\rangle \text{ and } t \in \langle 2001\,;\,2012\rangle \tag{3}$$

and the age and sex specific proportions of the total university graduates (*ixUG*) on the numbers of economically inactive population with ED3-4 and ED5-6 education level,

$$ixUG^{s}_{x,t} = \frac{UG^{s}_{x,t}}{INAC^{s,ED3-4}_{x,t} + INAC^{s,ED5-6}_{x,t}},\ x \in \langle 20-24\,;\,40-44\rangle \text{ and } t \in \langle 2001\,;\,2012\rangle. \tag{4}$$

Note that in the total numbers of university graduates are included persons who already have at least one university degree). The statistics about students, graduates and persons by economic status are displayed in the population pyramids as Multi-tree charts. Multi-tree (Šimpach, 2013) is a special bar chart, where the bars are displayed in contour without padding. In order to highlight the development in time (males – M2001, M2002 … M2012 and females – F2000, F2001 … F2012) it is possible to use the appropriate spectrum of the contours. The resulting stripes represent higher or smaller deviations of observed characteristics over time. On the left side of the zero centreline of each chart there is always displayed the male population, on the right, the female population.

Results and Discussion

The long-term trend of increasing number of students at the Czech universities is shown in Fig. 1 (left). The largest absolute increase is evident in the female population in the age group 20–24 years. During the analysed period, the numbers of students in this age group increased by more than 40,000. Development of the students with interrupted study program is shown in Fig. 1 (right). We can see that these numbers have increased in all age groups. The highest increments are evident in the middle age groups (30–34, 35–39 and 40+), where the relative increase was more than several hundred %.

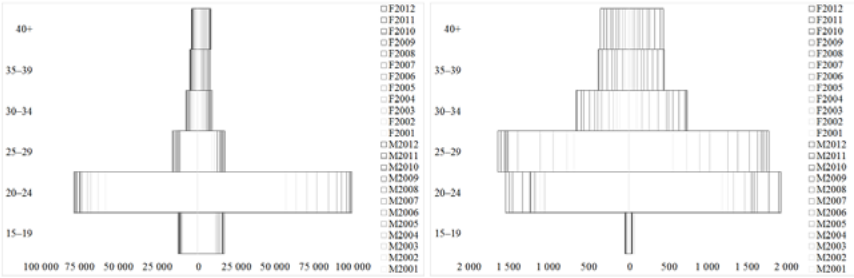

Fig. 1: Students who have not already graduated by age and sex (left) compared with interrupted, who have not already graduated (right). Source: MEYS, IIE, authors' illustration

These interrupts are currently popular because some students accept lucrative short term employment considering it an important item in their CVs (see e.g. Nývlt, 2013a). Unfortunately, this interruption often ends with unsuccessful end of their studies. The time expires and sometimes the issues of family planning and parenthood arise. Together with an increment in the numbers of university students, we can also observe a similar increase in the numbers of the first graduates. These numbers are shown in Fig. 2 (left), which indicate a similar trend (especially for the female population) as in the case of university students. There is a significant increase in the numbers of female university graduates over the last 12 years (almost triple). Nowadays especially females study more than one study program and get more degrees. Overview of all university graduates in total is shown in Fig. 2 (right), where the numbers of female graduates (especially in the age groups 20–24 and 25–29), increased also nearly threefold. The economic (in)activity of the population is an important social issue. During the whole duration of university studies, all students who have not yet acquired any degree are classified as persons with ED3-4 as the highest level of education attained.

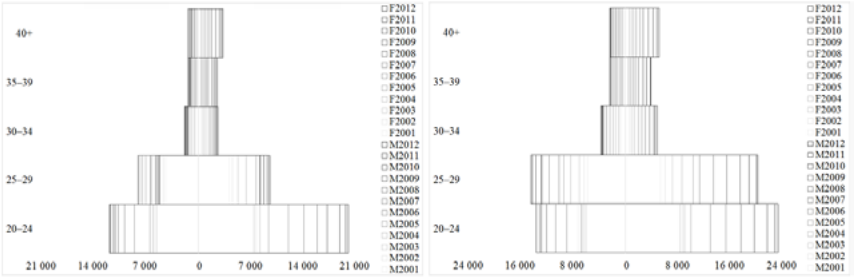

Fig. 2: The first time university graduates (ED5-6) by age and sex (left) compared with university graduates in total (right). Source: MEYS, IIE, authors' illustration

In the conditions of the Czech Republic it is common that many students do not work (especially at the bachelor level). Those students also do not search an employment and therefore they are classified as economically inactive persons. The development of economically inactive persons with the highest education ED3-4 is shown in Fig. 3 (left). The number of economically active persons in the analysed period is shown in Fig. 3 (right), where it is evident, that the absolute numbers of economically inactive persons increased, while the number of economically active persons reciprocally decreased. The significant predominance in numbers of economically inactive females aged 25–29, 30–

34 and 35–39 years is mainly due to parental leave when mothers stay at home to take care of their children.

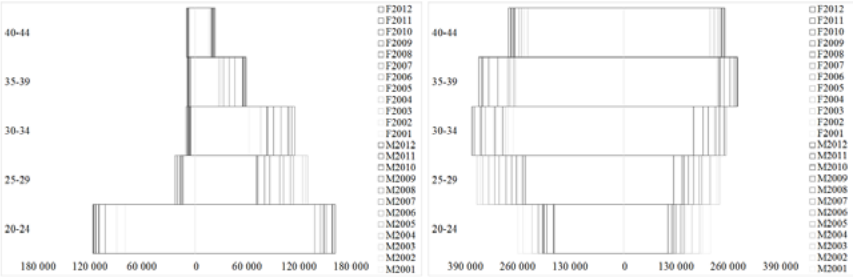

Fig. 3: Economically inactive population educated ED3-4 by age and sex (left) compared with active population educated ED3-4 (right). Source: Eurostat, authors' illustration

We can see the numbers of economically inactive population with ED5-6 education level in Fig. 4 (left). Since the age of 30 there are almost no economic inactive males with university education. They either work or they are unemployed and consistently and are purposefully seeking new job. High number of economically inactive females aged 30+ with ED5-6 education are females on maternity and parental leave, whose numbers in past 12 years increased more than 2.5 times. The number of economically active persons is shown for comparison in Fig. 4 (right). Before the student can enter the first degree program at the university he/she must have at least the upper secondary or post-secondary non-tertiary education. A large proportion of students who have not yet graduated for the first time is classified as economically inactive. It is interesting to see the proportions (in %) of the first graduates on the economically inactive persons, who until their graduation were registered as persons with ED3-4 education.

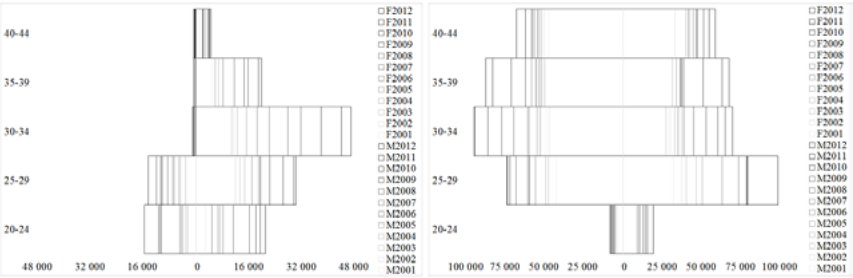

Fig. 4: Economically inactive population educated ED5-6 by age and sex (left) compared with active population educated ED5-6 (right). Source: Eurostat, authors' illustration

These proportions are shown for each age group and sex in Fig. 5 (left). The proportions of males aged 25–29, 30–34 and 35–39 years are higher. It is due to the fact that especially in 25–29 and 30–34 are females who do not study at the university on the parental leave, and therefore these numbers predominate over males. The proportions in the age group 20–24 and 40+ are equivalent and between 2001 and 2012 they have developed in the same way. On the right in Fig. 5 there are shown the proportions of all graduates in total on the numbers of economically inactive persons with education ED3-4 and ED5-6. It is because the people who study another study program are already classified as persons with tertiary education ED5-6. If they do not work and do not consistently search new

job, they are according to ILO economically inactive. Again, significantly predominate the proportions of males aged 25–29, 30–34 and 35–39 years old. There are no longer equivalent proportions of males and females in the age group 40+ and they have not developed in the same way between 2001–2012.

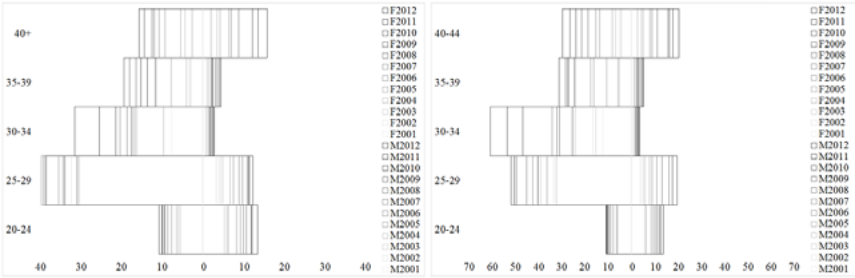

Fig. 5: The proportions of first time university graduates on the numbers of economically inactive population educated ED3-4 in % (left) and the proportions of university graduates in total on the numbers of economically inactive population educated ED3-4 + ED5-6 in % (right). Source: MEYS, IIE, Eurostat, authors' illustration

The situation of unemployed tertiary educated males and females (ED5-6) aged 25–29 is curently dramatic. The numbers of freshly unemployed university graduates enormously increased especially in the years 2010, 2011 and 2012 and from the surveys still rising. See e.g. study of Kubanová, Linda (2013) who is concerned with this topic. While the number of unemployed persons in the education level ED3-4 decreased in almost all age groups during the years 2001–2012, the risk of unemployment has been increasingly shifted to university educated persons (see Fiala, Langhamrová, 2013). This is due to the fact that the labor market with university educated employees is getting overfilled (see Nývlt, 2013b and Dvořáková, Langhamrová, 2013). The development of unemployed males and females with education ED3-4 is shown in Fig. 6 (left), the situation of ED5-6 educated males and females is shown in Fig. 6 (right). For the purposes of the comparison are both of two graphs displayed in the range of 15–19 to 40–44 years. The high number of university graduates causes higher risk of unemployment. On one hand, there is a goal to increase the number of university graduates (Fiala, Langhamrová, Průša, 2011), but on the other, they lack the jobs opportunities.

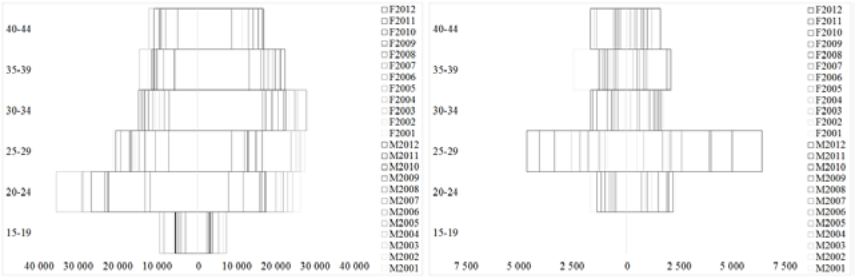

Fig. 6: Unemployed population educated ED3-4 by age and sex (left) compared with unemployed population educated ED5-6 (right). Source: Eurostat, authors' illustration

Conclusion

The aim of the paper was to analyse the development of the number of university graduates by ISCED-97 classification in relation with the (in)active population of the Czech Republic by the education level. We analysed the changes and explained the moving of age-and-sex specific demographic structures. During the years 2001–2012 the number of economically inactive persons educated ED5-6 in some age groups increased almost three times. The reason for this is the extension of study, study more programs at more universities and postponing the birth of the first child to the later ages. Nowadays many young people think firstly about their studies, then of a career and (in the last phase) they plan a family. Females also reassess their behaviour. They do not take care of the household that much, but focus more on their personal and professional growth, which is related to the need of higher education. The number of female university students increased the most in the age group 20–24 years. This increase meant more than 40,000 persons (more than 70 %). In the middle age group, where 12 years ago were almost no female students, this increase was more than 150 %. It is still true that if a young couple decide to have children, it is mostly female, who stay on maternity and parental leave (Nývlt, 2013a). This is evidenced by the high number of economically inactive females (both with the highest education of ED3-4 and ED5-6). The exception is the case of ED5-6 where the proportions shifted by one 5-year age interval later.

The challenges for future research are many. Firstly an economical-population projection can be done and expected future developments of dependency of the population can be described, see e.g. Fiala, Langhamrová, (2013). Their approach could be complemented by a probabilistic model that takes into account the risk of interruption of study and the subsequent unsuccessful termination. The second addition to this approach could be to include the expected level of unemployment based on expected trends (see e.g. Miskolczi, 2010). This addition would improve the current level of projections and could provide the greater information capability.

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TELEWORKING AND E-LEARNING

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Abstract

In our paper we deal with the topic of teleworking and e-learning. These two practices are interrelated as they both reflect the technical possibilities of information society. Both have their advantages and disadvantages. We carried out a research where we asked students about their opinions on e-learning and teleworking. The results confirmed students support the ideas of teleworking and e-learning, but respect the qualities of classical education and work practices and patterns.

Keywords

Classical education, e-learning, teleworking, work practices and patterns

Introduction

Teleworking has been approached in many ways: as an icon of technological innovation, as a new way of working or as a modern life style for couples with small children where both of the partners want to keep their jobs. Teleworking is suitable for students as a full-time or part-time occupation. Teleworking involves the use of various kinds of electronic equipment, and the product of that work is transmitted remotely, using telecommunication links. Education is very important for teleworking. Educational programs may be used to support the development of people working at a distance. The five main ways of teleworking are: Home/Office combination, Satellite offices, Local centres, Homeworking, Mobile Working. That is why we prepared a survey among university students about their opinions especially on e-learning. Some questions concerned teleworking as a way of virtual activity similar in its form (virtuality) to e-learning.

The topics of e-learning and teleworking are quite popular and have been addressed several times in the scientific journal and conferences. E.g. De Graaff and Rietveld (2007) analysed the dependence of the preference for working at home on various features (age, education, commuting). Hjorthol (2006) focused on the reason for low occurrence of teleworking in Norwegian suburban areas. He found categories that affect teleworking popularity. Ruohonen (1998) addressed the fact that people in Finland are still moving into city centres in spite of the ICT development. Schumann, Grebenstein and Weber (2004) stressed the importance of competence for good results in e-learning.

Material and Methods

In 2002 we conducted a research among students of Czech Agricultural University (ČZU) - Faculty of Economics (PEF) and in 2003 among students of the Czech Technical University (ČVUT) - Faculty of Engineering (FS). 406 students (especially in the 3rd year of the economic studies and in the 2nd year of the Faculty of engineering) took part in the survey. The selection was carried out as a two-stage random selection. The sample of respondents is therefore restricted to a particular group of the population, namely

university students. We can say that this is the group for which it is possible to observe an increased interest in teleworking due to their age, qualification and computer literacy. This interest can be expected after graduating the university as well. The research was conducted as a structured interview. Responses were recorded "on paper" and processed using SPSS software.

Further research related to studies of subjects in e-learning mode and focused on the personal experience of students to work remotely through the management group of students who studied humanities subject in e-learning. Student opinions were gathered through a questionnaire. The questionnaire was filled out by 23 students who studied social psychology via e-learning. The answers were as well as in the previous research coded using SPSS software. (Sládek, 2006)

Another survey was conducted at the Faculty of Mechanical Engineering in 2014. 86 full-time students participated in it. Students´ responses were recorded on a computer. The results were processed using SPSS software.

Results and Discussion

The 2002 and 2003 survey´s results were as follows: 41.1% of respondents (45.1% men, 34.2% women) responded positively to the question if they plan to work via teleworking. The remote work is or was used by 10.1% of respondents (out of those who knew the term "teleworking" 15.3 % was working remotely). Men think of this work more, although the differences in the actual number of teleworkers are smaller (11.3 % men and 8.1% women). More than half of the students will consider education of employees to be important. Our respondents consider training staff to be very important. Only 3.4% of them doesn´t consider workers' education important. 18.4% respondents considered it important in some cases.

Students who answered the question in our questionnaire "What form do you prefer in job education?" voted by more than 85 % for the classic form of business education, i.e. education in areas where a person works or at a distant training centre. From this perspective, it is interesting that for our respondents workplace training is more attractive than in distant education centre. From the perspective of a mental hygiene rather classical education is to be recommended, because student, who works at a distance, may be purchasing at various e -shops, spend his leisure time in various chats and control his bank account via e-banking.

Students' are satisfied with education at the workplace (51.7 % of employees) because they already know the workplace. Students' opinions on this point are identical. Off-site employees´ training brings the advantage that employees are not distracted by work tasks. If an employee is educated off-site, according to the students the biggest advantage is the fact that it is very difficult to withdraw the employee from such training casual business tasks. Training through e -learning is convenient, especially for the temporal and spatial independence. (75.7 % of students answered yes). Students appreciate spatial and temporal independence in e-learning, the most. If we compare its popularity among students with the earlier research at ČZU and CVUT, we get similar results.

Students had to answer the question "Do you like the idea of e-learning?" (Fig 1) This question was answered positively by 76 % of them. Students most often answered "probably yes" (28.7 %) and "yes" (33.3 %). 14% of students reported that they definitely like the idea of e-learning. Some students would also like to attend at least part of a subject in the form of e-learning. Their responses were, however, compared to the previous question more careful. 68.7 % wanted at least one object studied in this manner. This

question´s results were less clear-cut as “definitely yes” replied only 4.7 % of students.
Students were also asked what it is on e-learning that they like. (Fig 3) Most students appreciated the time independence (36.2 %), namely, that their study can be carried out, whenever they feel like. Example of a frequent student´s opinion: “It’s definitely a non-traditional form of teaching, which has its pros and cons. In my opinion its advantage is that it is not tied to a timetable, but we can perform it just when we have the time and inclination, we can freely join the discussion, and we can think about it more.” Another positive comment: “But maybe it will be easier for someone to write his opinion than to say it in people’s eyes. It will probably be an advantage. On the other hand, I have to invest more time into this subject than I had planned.” That they do not need to be transported to the faculty and the opportunity to work at home suits some students (17.4 %). Another reason why students choose e–learning is financial savings (7.4 %) and the ability to work during the study (8.1%). Another reason was to overcome health problems, fear to speak publicly, the need for self-study and popularity of trying new things. A smaller proportion of students is aware of some disadvantages. (Fig 4) The greatest disadvantage is by the students considered the absence of contact with the teachers (32.9 %). The second most frequently cited disadvantage (18.1%) was the inability to separate the study and leisure time, or the coercion to study when one is in the home environment surrounded by many distracting stimuli. These are examples of a negative assessment of students: “When a person sits on the bench, it’s generally indifferent if one has to sit there an hour and considers learning as part of his duties in the classroom.” “But at home it’s different. I sit at my computer full of games, movies, music and internet full of interesting information and entertainment. There are also friends, girlfriend, and I’m not talking about a lot further learning “ and “I see the biggest disadvantage in the fact that now is up to my discretion when I come here and I have to be constantly cautious not to be excluded from the discussion , or even worse – not to lose the credits”.
In addition, students resented the lack of contact with other students (14.8 %), partly due to the lack of collaboration, but mainly lack of common leisure time activities.
E-learning method is attractive for most students, as they need not regularly attend seminars and exercises, not everyone understands, though, that learning in the form of e-learning is often more difficult than attending the subject in a classical way.
It is interesting that all students from small settlements up to 2,000 inhabitants considered the costs of e-learning a big issue. It is caused by non-existent or limited supply of these services in some rural regions where there is usually only one monopoly provider.
If we compare the willingness to work remotely and the ability to remotely educate oneself, we may conclude that students are more careful when teleworking is concerned. (Only 41 % would be willing to work in this way, while the e-learning would like to try 68.7% of students.) This difference was caused by the fact that e-learning is applied only to a part of education (for certain subjects), while teleworking would be exercised for a longer period of time. Another reason may be the fact that e-learning can be seen as a looser form of learning.
As is evident from the students´ responses, some of them have problems with public speaking at a seminar, and it’s one of the reasons why they are satisfied with the e-learning. In teleworking the main objective is employee´s productivity and other attributes, and communication only serves this purpose. E-learning is a form of education, however, and it should remove similar barriers (in our case it is the social barriers) and not preserve them. E-learning on the other hand (as teleworking) is a very interesting way of communication, which also belongs to the “communication equipment” of a university graduate. From this

perspective, we can say that e-learning can also be seen as a preparation for teleworking. The student, who was successful in e-learning and to whom this style of work suits, has good potential to succeed when working remotely. Otherwise, the student will probably has to choose a different way of working in his future career, because some of the advantages and disadvantages of these two phenomena are common.

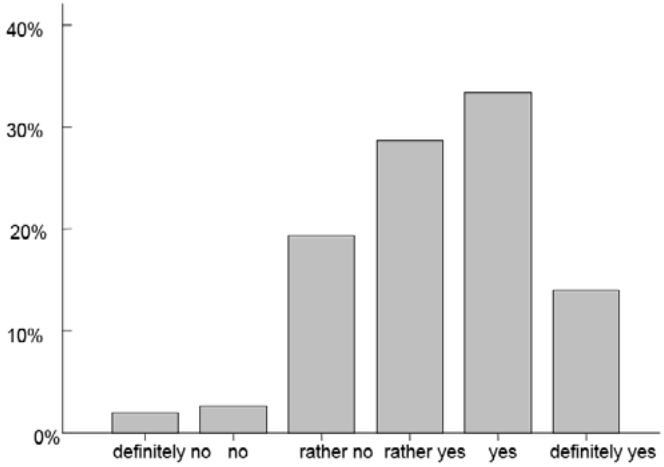

Fig 1: Popularity of e-learning

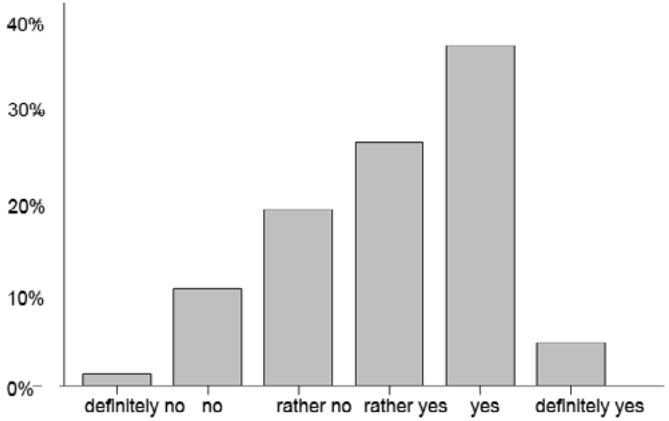

Fig 2: Using of e-learning

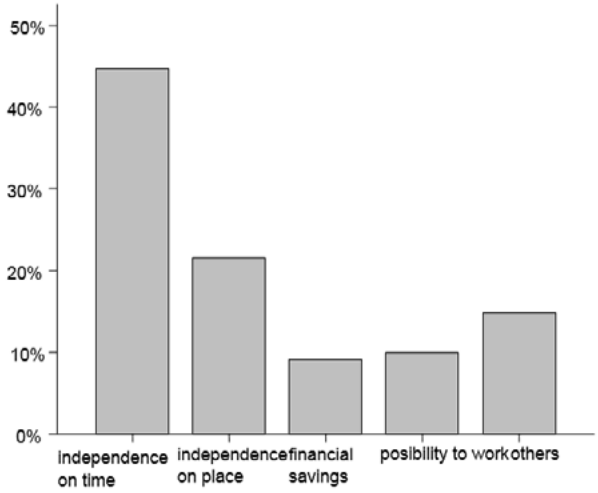

Fig 3: Advantages of e-learning

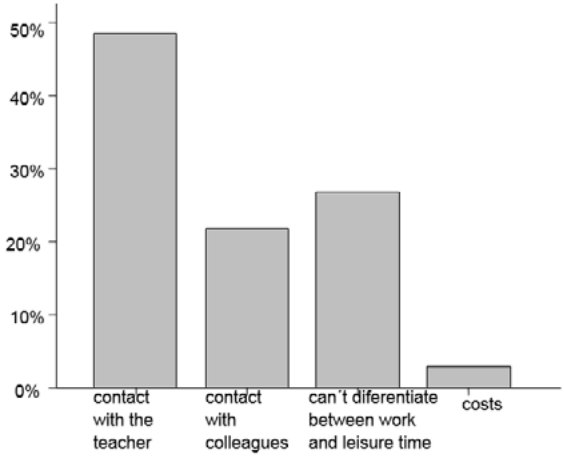

Fig 4: Disadvantages of e-learning

In 2014 we carried out a similar research among the students of Technical university (ČVUT). The results were to some extent similar. We formulated 3 hypotheses: Hypothesis 1: Students who consider their studies very difficult or difficult, will in most cases work only in the form of occasional part time jobs. Our survey didn´t confirm that hypothesis. Hypothesis 2: 20 % of students will work remotely (or think about that type of work). Our survey confirmed that hypothesis as 36.9 % of students answered positively our question. Hypothesis 3: Students appreciate the independence of education on space and time. We confirmed that hypothesis as 75.7% students appreciate that advantage of e-learning.

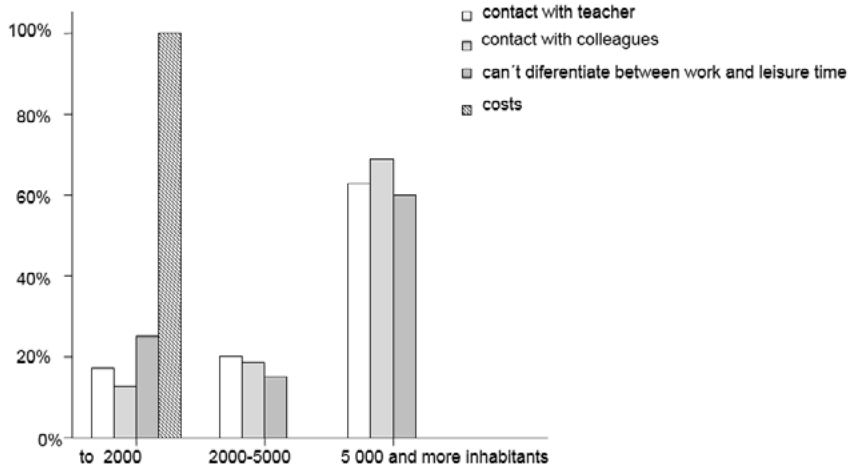

Fig 5: Disadvantages of e-learning based on residence

Conclusion

Students appreciate in e-learning, spatial and temporal independence the most. If we compare popularity of e-learning among students of ČZU and ČVUT, we get similar results. More than half of the students will consider education of employees to be important. Employees are satisfied with education at the workplace because they already know the workplace. Students' opinions on this point are identical. Students will prefer the traditional form of education. It would be necessary to perform a more detailed research to get a more detailed information on students approach towards e-learning and teleworking. The correlation of the results with gender, age, level of education etc. may show interesting results.

If we compare the numbers of our 2014 survey with the results of the previous surveys (2002 and 2003), we will come to very similar results. 41.1% of respondents from the older surveys plan to work remotely; in the new research, the number is slightly lower - 36.9%. The difference between older and recent results is not essential, but it must be remembered that at the time of new research students are much better informed about teleworking, and many of them actually use this type of work. The research also suggests a different approach in the perception of teleworking and e-learning. While teleworking is perceived as much more serious and conservative, e-learning in some areas perceived only as an enrichment of teaching.

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KNOWLEDGE ANALYSIS OF REGISTERED STUDENTS FOR COMBINED AND FULL-TIME STUDY AT THE UNIVERSITY OF ECONOMICS, PRAGUE

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Abstract

In the paper we have presented and further analysed the results of the entrance proceedings for full-time and combined forms of study for a Bachelor's Degree at the Faculty of Management, University of Economics, Prague. For this purpose we used files of anonymous results from the years 2010-2013. We analysed the results of entrance tests in English Language and prerequisites for making management decisions. On this basis we reached the following conclusions: applicants for combined studies have better average results in all the years covered than those applying for daytime studies. At the same time, applicants for combined studies have a larger range of points over the four-year period in the case of the English test, and therefore also greater differences in knowledge. In the last year covered the results achieved in the case of applicants for both daytime and combined studies were closer together. From the wider viewpoint, with regard to demographic development in the context of tertiary education and the continuing decline in the number of applicants for combined studies, it is necessary to make this field more attractive for people with what is known as a deferred demand for university studies.

Keywords

Knowledge analysis, admission examination, combined study, full-time study, university

Introduction

For universities in the Czech Republic combined studies are becoming more important, mainly due to the changes in the demographic distribution of the population. This significant development is also reflected in the models in the sphere of tertiary education created for the purpose of increasing competitiveness (Fischer, Finardi, 2010), (Finardi, Fischer, 2011) or the possibility of setting adequate school fees in the Czech Republic (Finardi, Fischer, Mazouch, 2012). The universities are trying in this way to make up for the decline in teenaged applicants by addressing older age-groups with a higher population, offering them the opportunity to complete a university education in the form of combined studies (utilising the so-called deferred demand). Whereas this approach was formerly mainly the speciality of private university-level institutions (see the accredited forms of fields of study in private universities at MSMT, 2014), in recent years more and more public universities have begun to focus on this through universities of the third age (U3A) or paid education. This development is due to the decline in the populations of years, which continue straight after school to study at universities.

A further possible path is to attract a larger number of students from abroad who would like to study also in Czech study programmes. For instance at the bachelor level of Management studies, which is studied here (in both daytime and combined form), the percentage share of foreign applicants who applied over the past four years for the field of Management, stating a nationality other than Czech, is stable at around 15 %. Roughly

half of these are applicants from the Slovak Republic and the remainder are chiefly applicants from the former Soviet Union (Russia, Ukraine, Kazakhstan, etc.).
A connected problem of tertiary education is not only the declining number of teenaged applicants for university education, but also the maintaining of the number of students admitted to universities. In this way there is a decline in the quality of the students admitted, as the majority of school-leavers applying for university studies are admitted. This development has a fundamental influence on the structure of educational institutions in the Czech Republic, including the future age distribution of university-educated professionals in the overall population (Fiala, Langhamrova, 2010). With the shortage of applicants at present, there is an increase in the competition among universities, which again has further consequences – the amalgamation of universities or their closure. In 2014 we have 72 universities (26 public, 2 belonging to the state and 44 private) in the Czech Republic, as in comparison with 2011 there has been a negligible overall drop of two private universities (MSMT, 2013).
The University of Economics, Prague (UEP) is also reacting to this development and is including in its study programmes some fields that can be studied in the combined form. This form of study includes elements of both distance and full-time forms of study, which is preferred by universities in the Czech Republic to the purely distance form of study – see (MSMT 2014). In the UEP they are also trying to evaluate the course of this type of study and retrospectively apply changes for the purpose of increasing its quality, especially in the area of support for the student's independent study (Kunstova, 2012; Kunstova, 2013, Strizova, Smutny, 2013). Combined study at the Czech Agricultural University in Prague is being evaluated in a similar way (Jarkovska et al., 2011). Also relevant to our theme are wider views of the problems of tertiary education offering comparison with foreign countries (Maryska, Doucek, 2011), comparing different approaches to tuition within the framework of distance education (Cubric, Clark, Lilley, 2011) or analyses of the success rate of university studies in connection with the results of the entrance examination (Polackova, Svatosova, 2013).
The purpose of this paper is to analyse the knowledge of applicants for daytime and combined studies from the viewpoint of the results of the admission proceedings. We have at our disposal data from the years 2010-2013 concerning the admission proceedings for the field of Management at the Faculty of Management in the UEP. Although other fields of combined and distance studies can also be studied at the UEP, we selected this field because the entrance examination is the same for both forms of study. It is our intention to analyse this data and find answers first and foremost to the following questions:

- What was the level of knowledge of applicants applying to study the field of Management at the University of Economics, Prague in the individual years?
- Is there a difference in the levels of knowledge of applicants for full-time studies and combined studies?

In this paper we present the results of the basic analysis of the admission proceedings in English Language and prerequisites for management decision-making (PMD) for the last four years according to the form of study.

Materials and Methods (Data Collection)

The data for this project are collected regularly in the course of the admissions procedure from all applicants for studies. In accordance with the provisions of Law No. 101/2000 Coll., on the protection of personal data, the data of applicants are rendered anonymous for the requirements of processing and are then worked with in such a way that all personal

identification factors are removed and they are processed in such a way that there is no possibility of ascertaining which applicants they originally indicated.

Methodology

The primary data used for evaluation were imported to the database of the Microsoft SQL Server 2008 R/2 (Microsoft SQL) through data extracts. These were exported from the central database systems of the University of Economics in Prague. We have proposed, developed and implemented a specific data model in the application Microsoft SQL that supports requirements on the analysis of data sources. Data were analysed with two different approaches. The first one was based on usage of OLAP cubes in the Microsoft SQL, in which a larger number of statistical indexes were created. These statistical indexes enable to statistically describe the data gathered from the primary database systems. The second approach to the evaluation of the data was based on the use of the Microsoft Excel 2010. This application was used to analyses of acquired data by means of statistical methods.

In order to verify whether there are differences in knowledge of English and PMD in combined and full-time studies we used the test of the significance of the difference of two selective means (t-test) for the statistical testing of hypotheses. For this test it is necessary first of all to test the similarity (H_0) or difference (H_1) of the variances of the two samples with the aid of the test for the significance of the differences of two variances (f-test). (Hendl, 2004)

For the t-test itself we are interested in whether the mean values in both studied tests of the admission procedure for full-time and combined forms of study are equal (H_0) or different (H_1). On the basis of this we reach a conclusion with regard to the knowledge of applicants for full-time and combined studies. The combination of the above-mentioned approaches also enabled mutual verification of the results. The combination of the above mentioned approaches enabled both the mutual verification of the results.

Results and Discussion

The overall numbers of applicants for bachelor study courses in Management in the Faculty of Management are higher than the numbers of applicants given in Table 1. In the table there are only the numbers of applicants who actually took the entrance examination. In Table 1 the applicants are not included who did not attend the admission proceedings or who, on the basis of their results from secondary school or the SCIO tests, were exempted from the entrance examination. The total number of applicants for full-time studies were: 2010 – 821 persons, 2011 – 781 persons, 2012 – 655 persons and 2013 – 594 persons. The total numbers of applicants for combined studies were as follows: 2010 – 348 persons, 2011 – 337 persons, 2012 – 294 persons and 2013 – 262 persons. The discrepancy in the numbers of applicants at the PMD test and at the English test is due to the fact that some of the applicants chose a different language test (at the UEP it is possible to take the entrance exam in six foreign languages). The set of data acquired from the entrance exams in English Language has the basic statistical characteristics given in Table 1.

English	2010 / P	2010 / C	2011 /P	2011 / C	2012 / P	2012 / C	2013 / P	2013 / C	Total for four years / P	Total for four years / C
Number	272	128	180	99	197	91	185	90	834	408
Average	51,32	52,91	52,22	55,52	49,68	57,65	55,57	57,62	52,07	55,64
Median	51,00	52,00	50,00	58,00	48,00	56,00	54,00	58,00	50,00	56,00
Mode	42,00	48,00	56,00	58,00	36,00	56,00	60,00	62,00	56,00	58,00
Maximum	98,00	100,00	90,00	96,00	88,00	98,00	100,00	90,00	100,00	100,00
Minimum	14,00	18,00	14,00	18,00	14,00	22,00	20,00	28,00	14,00	18,00
Deviation	16,52	18,62	16,87	18,73	15,37	16,85	16,88	16,67	16,51	17,90
Variance	272,93	346,70	284,51	350,70	236,22	283,87	284,77	277,92	272,67	320,30
Skewness	0,34	0,34	0,24	0,07	0,33	0,05	0,37	0,12	0,34	0,14
Kurtosis	-0,23	-0,69	-0,79	-0,77	-0,60	-0,70	-0,44	-1,06	-0,45	-0,80

Tab. 1: Basic Statistical Characteristics of the English Data Set.
P – Full-time Study; C – Combined Study

The set of data acquired from the entrance exams in PMD has the basic statistical characteristics given in Table 2.

PMD	2010 / P	2010 / C	2011 /P	2011 / C	2012 / P	2012 / C	2013 / P	2013 / C	Total for four years / P	Total for four years / C
Number	347	164	202	123	227	113	213	90	989	501
Average	39,76	43,59	47,49	53,71	50,48	53,24	43,71	44,22	44,65	48,38
Median	38,00	42,00	46,00	50,00	50,00	52,00	42,00	44,00	44,00	46,00
Mode	44,00	40,00	46,00	64,00	42,00	52,00	48,00	36,00	42,00	48,00
Maximum	88,00	90,00	86,00	100,00	96,00	94,00	90,00	76,00	96,00	100,00
Minimum	6,00	10,00	10,00	16,00	16,00	16,00	4,00	16,00	4,00	10,00
Deviation	15,02	17,23	15,15	17,41	15,18	17,42	16,18	13,28	15,90	17,24
Variance	225,74	296,81	229,58	303,06	230,50	303,52	261,86	176,39	252,69	297,33
Skewness	0,33	0,31	0,29	0,40	0,48	0,05	0,31	0,11	0,31	0,29
Kurtosis	-0,09	-0,39	-0,14	-0,41	0,03	-0,70	-0,17	-0,37	-0,07	-0,34

Tab. 2: Basic Statistical Characteristics of the PMD Data Set.
P – Full-time Study; C – Combined Study

General Data Characteristics

In the case of the English Language we can say that the average number of points acquired in the individual years is rising, whether the full-time or the combined form of study is concerned, with the exception of the data from 2012, where there is a drop. The tendency is preserved, however, in the following year of 2013. With regard to the PMD test applicants in 2010 and 2013 acquired on average less points than in the years 2011 and 2012, regardless of whether they were applying for full-time or combined studies.
The variance of the achieved point values in English Language in 2012 is smaller in the case of full-time study than in other years. In combined study the variance is considerably smaller in 2012 and 2013 than in the years 2011 and 2010. From the point of view of knowledge in the sphere of prerequisites for management decisions the variance of values in the case of full-time studies is approximately equal in the individual years. The exception is 2013, where the variance rose, which again alludes to the different level of knowledge of applicants for full-time study. From the point of view of achieving the maximum number of points the most successful year for full-time study was 2013, regardless of whether it concerned English or management decisions.

Comparison of Full-time and Combined studies

The development of the number of applicants for study given in Table 1 and Table 2 follows a trend similar to that observed in the demographic development of the university-age cohort. On the basis of the data from 2010-2013 we can trace a continual drop in the numbers of applicants. Within the next few years, however, it is expected that the rapid decline will end and there will be stagnation around a certain number of applicants.

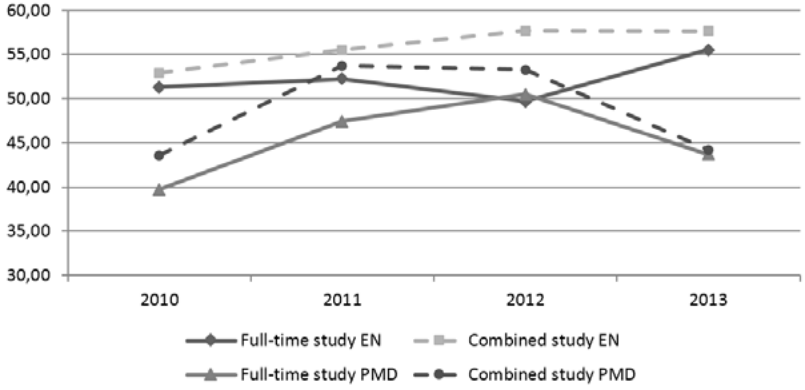

Fig. 1: Development of the Average Number of Points from Individual Tests in Years 2010-2013.

In the case of the tests in PMD and English the applicants for combined studies have better average results than the applicants for full-time study, this being the case in all the years studied (Fig. 1), which may be due to practical experience in the case of applicants for combined study and their active use of the English language at work. In order to verify whether the levels of knowledge of English differ in the given four-year period in the case of applicants for full-time and combined study, we decided to find out first of all the statistical significance of differences in variances (using the f-test). The critical value for the double-sided test comes out as and the value of the test criterion came out as . The test

criterion did not exceed the critical value. We can therefore continue the t-test with the use of the criterion with equality of variance because we are interested in the differences in the median values of points acquired in English Language. The critical value for the t-test comes out as and the value of the test criterion came out as . The test criterion exceeded the critical value. The quality of the knowledge of English Language in applicants for combined and full-time studies is not the same on the basis of the points acquired in the entrance proceedings.

We carried out a similar test in the case of prerequisites for making management decisions. The critical value for the two-sided test comes out as and the value of the test criteria came out as . The test criteria exceeded the critical value. We can then continue the t-test using the criterion with inequality of variance, because we are interested in the differences in the average values of the points acquired for PMD. The critical value for the t-test comes out as and the value of the test criteria came out as . The test criterion exceeded the critical value. The quality of the knowledge of PMD in applicants for combined and full-time studies is not the same on the basis of the points acquired in the entrance proceedings.

From the point of view of the size of the variance in achieved values, including most frequently achieved values in both tests and forms of study, the years 2010 and 2011 are stable. Growth does occur, however, in the average number of points from the individual tests, see Fig. 1. According to the tables given in this article, the average distance of values from the mean number of points for the test is higher in the case of both tests among the applicants for combined studies. On this basis we can conclude that there are more marked differences in knowledge among the actual applicants for combined studies.

The following two years are less easy to interpret. In 2012 the growth of the average number of points from both tests comes to a halt (see Fig. 1). The only exception is the English test in 2013 for the full-time form of study, where the growth continues, whereas in the case of combined studies it stagnates – but in spite of this the modus and the variance in both forms of study are similar. In 2013 there is comparison of the average points in English Language (including variance and modus) in both forms of study, where the levels of knowledge of applicants for both forms are comparable.

In the case of PMD there is also a cessation of growth in the average number of points in 2012 (see Fig. 1). In the following year there is a drop in the average number of points from PMD in both forms of study. In spite of this there is again comparison of the average number of points, but the variance of points from the PMD test is greater in the case of full-time study. There are greater differences here, then, among the levels of knowledge of applicants for full-time study.

Conclusion

The research presented, apart from comparing the incoming knowledge of students in full-time and combined studies in the given fields, demonstrates the connected problems at the level of tertiary education, which, as a result of the drop in applicants, must be handled not only by the Management Faculty of the University of Economics, Prague. It is first and foremost a matter of increasing the attractiveness of combined fields of study for potential applicants from the population of stronger birth years. Deferred demand for study is still an important challenge in the coming period, especially for public universities, in the direction of expanding the portfolio of fields of study by the addition of distance and combined forms of study. A further possible path is the attraction of a greater number of students from abroad who would also like to study in Czech study programmes (from the Slovak Republic, for instance).

If we return to the two questions posed at the beginning of this paper, then we can state on the basis of available data that the students applying for combined studies have better initial knowledge of the fields examined at the admission proceedings than do students applying for the full-time form of study. This may be due on the one hand to the active use or, on the contrary, lack of use of English language in the workplace (the variance of points acquired is greater), and also to the wider viewpoint provided by practical experience and reflected in the results achieved in PMD. As far as concerns the level of knowledge of applicants in individual years, the most interesting point is the convergence of the knowledge of applicants for both full-time and combined studies in 2013 in both fields studied. Perhaps this was a year when more students applied for the combined form of study straight after completing secondary school.

On the basis of the analysis made above we arrived, then, at the following conclusions:

- In all the years studied applicants for combined studies have better average results than the applicants for full-time study. This difference in knowledge (English and PMD) between applicants for combined study and for full-time study is statistically significant with a significance level of 0.05.
- In the tracked period of four years the applicants for combined studies have greater points variance in the case of the English test and therefore also greater differences in knowledge.
- There were greater differences in knowledge among applicants for combined studies in the years 2010 and 2011 in both the tests than among the applicants for full-time study.

Whereas at the beginning of the period studied clear differences can be seen in the tracked statistical values, from which we may deduce differences between the levels of knowledge of applicants for combined and full-time study, in the last year studied the results achieved were closer together.

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ASSESMENT OF THE SUBJECT INTERNATIONAL ACCOUNTING STANDARDS TAUGHT AT THE CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

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Abstract

The paper presents the results of a survey focused on the subject of International accounting standards taught at the Faculty of Economics and Management of the Czech University of Life Sciences Prague. The respondents were full-time students of the second year of the Master‘s degree programme of Business and Administration field of study. The students completed two questionnaires at the beginning and at the end of the winter term 2013/14. The survey was evaluated both qualitatively and quantitatively using appropriate statistical methods. The survey showed that nearly three-quarters of the students considered the subject beneficial. Their opinion does not depend on whether the students are currently working somewhere or whether they work in areas related to accounting (very close independence). However, students´ evaluation of the course benefit depends on their future plans to work in the field of taxes, auditing and accounting. Material ensuring of the subject is evaluated by the students very positively. The students would welcome a wider connection of the subject with the practice and at the same time they criticize the insufficiency of time allocation for seminars. A possible way of ensuring even greater satisfaction of the students with the subject has been outlined.

Keywords

Examination success rate, hypothesis, International Financial Reporting Standards IFRS, questionnaire survey, student´s satisfaction with classes, subject contribution

Introduction

The aim of the subject “International Accounting Standards” is to provide international aspects of financial accounting with the focus on one of the main instruments of International Financial Reporting Standards IFRS harmonization (former, until 2001, IAS - International Accounting Standards.

The IFRS is one of the most significant accounting systems influencing the global development of financial accounting (Hinke, 2013). The financial statements prepared in compliance with the IFRS should include quality, transparent and comparable information relevant to users (Dvořáková, 2011).

The origin of issuing standards can be dated back to 1973, when International Accounting Standards Committee IASC was founded (Hinke, 2007, Epstain, Jermakowicz, 2009). The year 2005 marked the start of a new era in the global conduct of business, and the fulfilment of a thirty-year effort to create the financial reporting rules for a worldwide capital market. During that year´s financial reporting cycle, as many as 7,000 listed companies in the European Union member states, plus many other countries, such as Austria, New Zealand, Russia, and South Africa were expected (in the EU, required) to produce annual financial statements in compliance with the IFRS (Mackenzie et al, 2013). More than 120 countries all over the world require or permit the use of the IFRS by publicly

listed companies on the basis of higher information quality and accounting comparability from the IFRS application (Horton et al, 2013). In the near future other countries such as Brazil and China, then India, Canada and South Korea should join the IFRS (Jílek, Svobodová, 2013). Most other national GAAP (generally accepted accounting principles) standards have been reduced or are being phased out as nations all over the world are now adopting IFRS (Epstain, Jermakowicz, 2009). However, the empirical evidence about presumed benefits is often conflicting and fails to distinguish between information quality and comparability (Horton, Serafeim G. and Serafeim I., 2013).

In 2009, the IFRS for small and medium-sized enterprises was adopted. It is already applied in more than 80 countries all over the world (IASB, 2009). In the Czech Republic, currently there is no political will to adopt the IFRS for the SMEs. Strouhal et al, (2009) on the basis of a carried out survey, show that companies are not interested in the problems of international standards. However gradually, the basic principles of IFRS are incorporated into national accounting system. First, so called selected accounting entities in the Czech Republic (such as organizational units of the state) took over the principles of the IFRS to a large extent. It appears that in the future, the global harmonization of accounting will go through the application of IFRS principles. Therefore, the students who learn the principles of the IFRS, enter the labour market with a competitive advantage. And because the IFRS are international standards, their knowledge can help the students succeed in international competition.

At the Czech University of Life Sciences Prague, the subject is taught in the second year of the full-time and combined Master studies of Business and Administration field of study. It is a compulsory subject. If a student chooses the corridor "Accounting" for the state final examinations, the subject becomes a part of the State Final Examination. The course has been taught in the winter term since 2007 in the regime 2/1, i.e., a lecture every week and an exercise every second week.

The course "International Accounting Standards" consists of lectures and seminars provided by the Department of Trade and Finances. Lectures form the background for seminars. Lectures aim to activate students in the area of international accounting so that they would ask the questions. *"In the last years, universities put an increasing emphasis on self-study. The development of information and communication technologies makes possible a huge implementation of learning management system (LMS)"* (Kučera, Jindrová and Vostrá Vydrová, 2013). At the Czech University of Life Sciences Prague, Moodle is implemented – *"the most widespread LMS. Under this system almost all e-learning files now operate"* (Mošna, 2013). Moodle LMS is used during lectures of the mentioned subject to inform students about the International Financial Reporting Standards (IFRS) requirements. Students' knowledge is also tested using Moodle. The seminars are used to develop and train the knowledge gained from the lectures and recommended literature (CULS, 2013). During exercises, the students work with the textbook "Workbook of International Accounting Standards" by Stárová (2012) under the supervision of a teacher. As there are only 6 exercises per term, a teacher explains complex issues with examples during the lessons, and the students work out easier examples at home. For these reasons, the vast majority of examples is given with solutions at the back of the textbook. Selected examples without solutions are worked out by the students independently according to the instruction.

All materials needed for the study related to lectures and seminars are available in Moodle LMS which is also used by the students to communicate with the teacher when being involved in off-class activities related to the course.

To obtain a credit, the students have to fill in the textbook, have to pass 3 "home tests" in Moodle at minimum of 70%, cannot miss more than one exercise, and have to fulfil the project requirements (CULS, 2013).
The examination consists of the combination of the computer assisted test and oral examination. If students receive less than 65% from the test, they have to re-sit the test in another term and cannot sit the oral examination that checks the skills and competencies of students. The points from the oral examination and points from the computer assisted test are summarized and converted into the grade used at the CULS Prague through the ECTS grading procedure. The final grade is due to be announced in the day of the exam (CULS, 2013).

Materials and Methods

The application of the IFRS in accounting units requires high demands on the quality of the professional accounting staff who need to understand the details and differences between the IFRS and Czech legislation (Bohušová, 2008). The subject "International Accounting Standards" aims at CULS students to be prepared for the use of standards in practice.
The investigation was focused on full-time students. The survey was conducted by questionnaire survey in the winter term 2013/14. Students completed two questionnaires electronically. The first questionnaire was submitted at the beginning of the term. Its aim was to find out the views of the students on the benefits of the course for their education and practice, as well as on the estimate of students' success in the examination. In the first questionnaire there was also the survey of the workload of students. The second was completed at the end of the term. It should have found out the opinion of the students on the benefits of the subject and the estimate of success in the examination. Moreover, it was focused on the evaluation of lectures and exercises, as well as on the demands of home preparation. The first questionnaire was answered by 129 respondents (88.4% women, 11.6% men), which is 63.55% of the total number of 203 students in the class. The second questionnaire was answered by 158 respondents (88.6% women, 11.4% men), i.e, 77.83% of the total. The vast majority of the students graduated from high schools of economic orientation - 88.4%, 8.5% graduated from grammar schools, other schools are represented by 3.1%. 44.2% of students come from the Central Bohemian Region, 25.6% from the capital of Prague, 7.8% from the South Bohemian Region, 5.4% from Ústí nad Labem Region, other regions are represented by 3.1% to 1.6%. The questionnaires were anonymous, so it was not possible to directly combine the data from individual questionnaires and real outcomes of individuals. When compared to each other the summary values are used. To compare the data within single questionnaires contingency tables (in the form of a four-field table) were used. The processing was carried out in the Excel spreadsheet application.
To find out the contribution of the subject depending on various factors, the following hypotheses were formulated:
$H_{1:}$ Students consider the subject as beneficial if they are currently employed or if they have a regular temporary job
$H_{2:}$ Students consider the subject as beneficial if they currently work in the field of taxes, audit, accounting
$H_{3:}$ Students consider the subject as beneficial if they plan to work in the field of taxes, audit and accounting
The hypotheses were tested using a two way contingent table (a four-field table), and

compared on the level of 0.05% to the value of $\chi 2$ of one degree of freedom. If the $\chi 2$ criterion was greater than critical value of the $\chi 2$ designation, the null hypothesis can be rejected.

Further, the survey found out students´ satisfaction with the teaching of the subject. The students answered the questions concerning material availability, linking the subject with the practice and time allocation of lectures and exercises. Responses were qualitatively evaluated and commented.

Results and Discussion

From the first questionnaire survey, the following facts resulted. Six (4.65%) respondents stated that they worked full-time, 83 (64.34%) part-time or they had regular temporary job, 20 (15.55%) had an occasional temporary job, 2 (1.55%) respondents did business with the trade licence and the same did business in another way. Only 16 students from the total number of 129 students stated that they did not work during the studies. It is necessary to emphasize that they are not full-time students. The biggest representation in working fields were taxes, auditing and accounting 27 cases (23.89% from 113), administrative jobs with 4 students (3.54%), the second place represents trade and retail management with 17 students (15.04%), then tourism, hotel industry and gastronomy with 9 students (7.96%) and furthermore banking and instance industry in 8 cases (7.08%). Most working students - 63 (55.75%) are in a secretarial work, 19 (16.81%) realise independent creative activity, 11 (9.73%) work as auxiliary manual workers and from single individual answers it can be summarised that 5 respondents work as an assistant accountant. It is interesting that most of respondents - 103 (79.84%) think that they will work in the field of taxes, auditing, accounting. 43 students (33.33%) suppose that they will work in banking and insurance industry, 23 students (17.84%) think that they will work in marketing and PR, 16 (12.4%) in tourism and gastronomy, 9 (6.98%) in transport and logistics, 6 (4.65%) in education and in agriculture 5 (3.88%). Other fields are represented in one or two cases.

From the survey it follows that the majority of respondents suppose to join their future job with taxes, auditing and accounting. Logically, every subject from the field of accounting should be contributional.

In table 1, answers to the question “What is the significance of this subject for your future job?“

Alternative	Frequency	Percentage
Essential (use substantionally)	1	0.78
Considerable (use often)	27	20.93
Middle (use sometimes)	67	51.94
Small (use very little)	22	17.05
Negligable (do not use)	12	9.03

Tab. 1: Significance of the subject for future job of respondents

From the conducted survey it follows that 28 students (21.71%) consider the subject essentialy or considerably significant, 67 students (51.94%) beneficial and 34 students (26.08%) consider it less significant or negligable. The question arises why more than the third of students in the field of Business and administration (80%) think that the subject “International Accounting Standards” less significant. From the questionnaire survey it was asked if the significance of the subject is in any connection with students´working experience or other factors.

The contingent table for the dependence on the job (students work full-time or part-time or they have regular temporary jobs) is the basis for testing hypothesis $H_{1.}$

Significance of the subject for current or future job	Job or regular temporary jobs	No job or unregular temporary jobs	Total
Middle to considerable	62	32	94
Small to none	29	14	35
Total	83	46	129

Tab. 2: Contingent table of the relation between the job and subject perception

$H_{1:}$ Test value 0.384198 is smaller than the criterion $\chi^2_1(0.05) = 3.841459$, null hypothesis cannot be rejected. It means that students´ evaluation of the subject contribution does not depend on the fact if they currently work.

The contingent table for the dependence on the job in the field of taxes, accounting and audit is the basis for testing hypothesis $H_{2.}$

Significance of the subject for current or future job	Job in the field of taxes, auditing, accounting	No job or another field	Total
Middle to considerable	23	71	94
Small to none	4	31	35
Total	27	102	129

Tab. 3: Contingent table of the relation between the field in the job and subject perception

$H_{2:}$ Test value 3.758246 is smaller than criterion $\chi^2_1(0.05) = 3.841459$, null hypothesis cannot be rejected. It means that students´ evaluation of the subject contribution does not depend on their current field of work. Weak dependance is apparent (only 4 students working in the field do not consider the subject significant for future job). There are logical reasons for these results. At present, the students do not need to work in their chosen field after completing the University, so their opinions are not unambiguous.

The contingent table for the dependence on the supposed future job in the field of taxes, accounting and audit is the basis for testing hypothesis $H_{3.}$

Significance of the subject for current or future job	Future job in the field of taxes, auditing, accounting	Another field	Total
Middle to considerable	82	12	94
Small to none	21	14	35
Total	103	26	129

Tab. 4: Contingent table of the relation between the supposed future field in the job and subject perception

$H_{3.}$ Testing value 10.3518 is higher than the criterion $\chi^2_1(0.05) = 3.841459$, null hypothesis can be rejected. It means that students who plan to connect their future professional life with taxes, audit and accounting perceive the subject as contributional.

In table 5, there is the answer for more questions concerning the satisfaction of students with the lessons.

Alternative	Yes	Rather yes	Rather no	No	Do not know
Subject was contributional	12.0	58.2	23.4	1.3	5.1
Sufficient materials	41.8	48.1	7.0	2.5	0.6
Connection with practice	5.7	32.9	43.0	12.7	5.7
Sufficient time allocation of lectures	26.6	54.4	12.0	3.8	3.2
Sufficient time allocation of exercises	1.3	7.6	23.4	66.5	1.3

Tab. 5: Students´ evaluation of the subject in %

The evaluation of the benefits of the course and the quality and sufficiency of study materials are very satisfactory. For 70.2% of the respondents, the subject was beneficial. The role of teachers for next years will be to convince even higher percentage of students that will benefit from the knowledge of the principles of international accounting standards in the practice. Of course, this will depend on the social atmosphere and the procedure for adopting IFRS principles into the national accounting legislation. The students appreciate the availability, scope and content of the study materials very much. Almost 90% of the students think that provided materials are sufficient. Furthermore, teachers plan to expand home tests and hope that this will lead to even greater student´s satisfaction in this area.
The space for the improvement of teaching, and thus a higher percentage of the students who are convinced about the benefits of completing the course, is the connection of the subject with the practice. The ratio of satisfied and dissatisfied students with the connection of the subject with the practice is 55.7% to 38.6%. As there are practical seminars only 6 times per term there exists a little space to practise exercises.
We could think about if lectures should partially substitute for seminars. For the students, this would mean more home study theory instead of solving problems. Teachers do not have a unified opinion on this issue. To increase the attractiveness of the subject it is possible to be inspired by the experience of teachers from other disciplines. For example Houška and Rauchová (2013) propose the methodology of creating the knowledge text, Beránek and Remeš (2012) deal with the course of e-commerce based on active learning, Bartošová and Frolková (2012) are interested in the interactive learning of molecular biology, and Pacáková (2013) searches for students´ motivation to study.
It could be assumed that students who were involved in the working process would prefer the lowest frequency of school attendance. But, as it is shown, students prefer (probably in specific subjects) contact teaching.
The conducted research shows students´ dissatisfaction with the number of seminars. When evaluating the time allocated for seminars, 90% of the students responded that the time was insufficient (66.5%) or rather insufficient (23.4%).
In connection with this, the students evaluate the demands for homework. The results are summarized in Table 6:

Home preparation	Rather undemanding	Undemanding	Adequate	Rather demanding	Very demanding
Time demands	5.1	8.2	48.7	32.9	5.1
Content demands	3.8	4.4	46.2	38.0	7.6

Tab. 6: Demands for home preparation %

Despite the fact that the vast majority of students evaluate the time allocation of seminars as inadequate, almost half of the students (48.7%) consider time demands of home preparation for adequate. 38.0% of the students consider home preparation demanding

and 13.3 % of the students think that home preparation was not time demanding. As far as the content is concerned, 46.2% of the students think that home preparation is adequate, for 45.6% it was demanding and for 8.2% undemanding.
However, responses to optional questions, in which students proposed the improvement of the course, imply that seminar frequency once every 14 days is not sufficient for them. 69.1% (38 of 55) of students, which is 24% of the total respondents of 158, supported this view.

Conclusion

The surveys conducted among full-time students of the second year of the Master´s degree of Business and Administration field of study at the Faculty of Economics and Management of the Czech University of Life Sciences Prague resulted in the following findings.
Almost 74% of the students considered the subject beneficial or very beneficial. Statistical investigation showed that the students considered the subject beneficial regardless of their current inclusion in the working process. It even does not depend on whether they work in the field of taxes, auditing and accounting. Although in the latter case, the independence was borderline. On the other hand, the opinion of students on the benefits of the course is dependent on their intended future professional life in the field related to accounting.
Positive responses came from respondents' satisfaction with the course material ensuring. 90% of the students considered the course material to be sufficient. Space for teaching improvement is offered in connection with the subject practice.
An insufficient number of exercises to practice the specific accounting procedures seems to be a problem. The question remains whether to enrich a lecture with plenty of practical examples. The survey showed that 90% of the students considered the time allocation of seminars insufficient. Despite this finding, 49% of the students considered time demands for home preparation adequate, but 38% of the students demanding. When the students proposed the improvement of teaching, it was shown that they missed the space for practising a subject matter at school. As far as the content is concerned, students think that home preparation is adequate and demanding (46%).
The challenge for teachers is to find and use the tools for the attractiveness of the subject so that the percentage of the students, who will consider the subject beneficial, could increase. A possible way is the inclusion of more practical examples in lectures or the acceptance of other teaching (e-learning) methods.

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STUDENTS'EXPECTATIONSINTHETECHNICALUNIVERSITYSERVICES QUALITY ASSESSMENT

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Abstract

The basic object of the contemporary universities services quality level concerns mainly the education efficiency evaluation which is focused on the learning outcomes realization and innovative features of the teaching programs. Typical, common expectations of students and candidates for students related to the technical supportive elements, such as university facilities and administrative workers empathy, are ignored in the context of the ministerial requirements strictly concentrated on the education quality level resulting from the obtained students' skills.

The aim of this study is to identify the expectations of both students and candidates for studies at technical universities, what allows identifying university services areas needs improvement in terms of not only the educational services but also technical university facilities.

Keywords

University services, service quality, expectations, SERVQUAL

Introduction

Education is one of the key factors, which is the subject of the service quality assessment of contemporary universities. It is a key mission component of each university, what underlines the main component of the university evaluation.

Nowadays, many assessments and rankings of higher education institutions (HEI) and their faculties are published by wide range of agencies and organizations. Due to the higher education globalization, the focus has shifted to worldwide rankings and assessments. Evaluation of HEI seems to become a very popular and important supporting decision tool. University leaders believe that good rankings help to maintain and build institutional position and reputation, students and postgraduates exploit rankings to make a university choice (Furková, 2013). There are several institution bodies that measure higher education services with applying of different indicators or metrics. In Poland the agency dealing with evaluation of the higher education institutions is the State Accreditation Commission that evaluates the education quality. In Czech Republic the quality of higher education is fostered by the Accreditation Commission (Urbancová and Urbanec 2013, Stacho, Urbancová and Stachová, 2013). In Slovak Republic there are two agencies dealing with assessment and ranking of HEI: Accreditation Commission and ARRA (Academic Ranking and Rating Agency) (Furková, 2013). The quality of education services at universities is traditionally evaluated by study results of students or graduates. Important information for graduates is the percentage of employed on appropriate posts. The students' results can be measured not only by the examination grades but also by subjective satisfaction of students (Vostrá Vydrová, Jindrová and Dömeová, 2012).

Identification of the university services quality needs to verify different definitions and

concepts of service quality in the literature. A general definition of the service quality is "the totality of features and characteristics of a service that bears on its ability to satisfy stated or implied needs" (Johnson and Winchell, 1988). Service quality is important to all organisations as it is "regarded as a driver of corporate marketing and financial performance" (Buttle 1996:8). More recently, LeBlanc and Nguyen (1988: 7-18) suggested that corporate image, internal organisation, physical support of the service producing system, staff-customer interaction and degree of customer satisfaction all contribute to service quality. Further, Edvardsson, Gustavsson and Riddle (1989) present four aspects of quality that affect customers' perceptions: technical quality, integrative quality (the ease with which different portions of the service delivery system work together), functional quality (manner in which the service is delivered to the customer, style, environment and availability), outcome quality (if the service product meets service standards and customer needs/expectations).

The education services performance in the form of skills and competences gained by students at technical universities results from the tangible and intangible assets. Furthermore, the learning process effectiveness can be influenced by many factors. Students' personalities and qualities can be one of them (Kostolányová, Šarmanová and Takács, 2011, Urbancová, 2010). However, the technical universities services quality is related to both education and research activity. In the result it may arise from the different sources related to students' expectations such as: university facilities, technical conditions, teachers and administrative workers competencies, empathy, reliability of offered services, assurance, availability. Service organizations that care about quality should get to know the client's requirements and measure their satisfaction what is useful in the process of the organization performance improvement towards a more complete fulfilment of the clients' expectations in the context of the service value analysis (Urbancová, 2012).

The aim of the study is identifying students expectations related to all technical university services and verifying a valuable service quality factor that needs improvement. The research model was based on SERVQUAL method. Research findings were compared with the research findings obtained in the survey conducted among the candidates for technical universities studies (at chosen vocational schools).

Materials and Methods

The most popular, widely cited and best researched method of assessing service quality is SERVQUAL developed by Parasuraman (1985, 1988) with the scale used to measure the perceived quality (Zeithaml, 1987). This methodology is tried and tested primarily within the commercial sector (Kaye and Dyason, 2013). Brysland and Curry (2001) concluded that the literature clearly supported the use of SERVQUAL in the public sector. SERVQUAL was used also successfully in undergraduate academic teaching evaluation (Hill, 1995).

Figure 1 presents SERVQUAL methodology model with differences (gaps) related to some different levels of expectation and perceptions resulting from the client and organization point of view (Kaye and Dyason, 2013). All the gaps identify differences between clients (students) expectations and its perception resulting from different factors related to the service provider (university and university campus). These factors are associated mostly with the reliable knowledge about students' expectations, specification of university services quality, adequate supporting service process in appropriate research and technical equipment and adequate procedures. All differences discussed consequently form a key gap between the expected service and the received service, which affects on the

university service quality perceived by the student. It could be argued, that the foundation for the realization of a satisfactory service is the student's precise knowledge on his/her expectations and skilful processing of these expectations on the aims and objectives of a service organization. The fifth gap in the analyzed model consists in measuring the customer satisfaction with numerical values. This gap is the basis for SERVQUAL methodology and it determines the difference between clients' (students') expectations and perceptions.

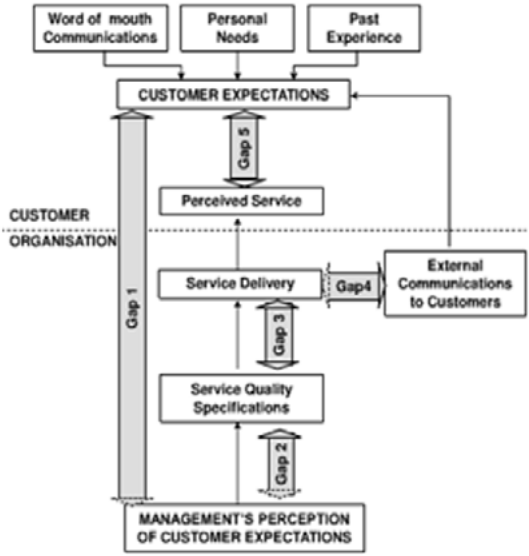

Fig. 1: SERVQUAL methodology model (Kaye and Dyason, 2013)

Students' satisfaction is the subjective feeling resulting from individually students' experience and theirs emotion. It reflects the feeling of satisfaction with unfulfilled expectations of the student as a result of the acquisition of a particular service. The perception of a students' satisfaction is associated with the experience of his/her positive impressions. The students' satisfaction is a reflection of the extent to which the overall product offered by the organization meets a set of students' requirements. In this context, the service quality function is expressed as the function of students' expectations (E) and students' perception (P) with regard to all technical university services:

$$\boldsymbol{Q = f\,(E - P)} \tag{1}$$

Students' expectations and their perception level related to services offered by technical university were analyzed by statements including five service quality criteria (dimensions of the clients'/students' expectations and perceptions):

- Tangibles. Appearance of physical facilities, equipment, personnel and communication materials.
- Reliability. Ability to perform the promised service dependably and accurately.
- Responsiveness. Willingness to help clients/students and provide prompt service.
- Assurance. Knowledge and courtesy of employees and their ability to convey trust and confidence.

- Empathy. Caring, individualised attention the organisation provides to clients/ students.

The questionnaire survey contains statements (Table 1), which were created according to the following attributes of technical university services, such as: university indoor, an equipment, dormitory conditions, the courtesy and the staff, the ability to provide the desired services in a reliable, accurate and consistent way, the image or the reputation of an institution providing education services. Some of these features are called "hard service elements" (e.g. equipment) that easily affected by objectification and thus allows to set the acceptability standards for students. An evaluation of the service implementation process is the more difficult the more it is personified. Students and high school graduates identify elements important for the survey statements during the previous pilot research study. In such a situation, the qualitative characteristics of services are not assessed primarily through the prism of these "hard elements", but the individual students' feelings, their sensations, moods, emotions and experiences.

The survey statements investigating the quality level of services provided by chosen technical university		
1.	Recruitment process at the university is done in an efficient and well-organized.	1 2 3 4 5 6 7
2.	Staff recruiting candidates for the university is polite in relation to the prospective student.	1 2 3 4 5 6 7
3.	Parking availability.	1 2 3 4 5 6 7
4.	External appearance of the university buildings and offices.	1 2 3 4 5 6 7
5.	Internal appearance of the university buildings and offices.	1 2 3 4 5 6 7
6.	Marking indoor enables efficient movement inside and outside the university buildings.	1 2 3 4 5 6 7
7.	University lecturers have appropriate knowledge and skills.	1 2 3 4 5 6 7
8.	The university has modern equipment for research and well-equipped laboratories.	1 2 3 4 5 6 7
9.	University staff cares about the cleanliness and safety.	1 2 3 4 5 6 7
10.	The meals served in the cafeteria and students canteen are appropriate (portion size, temperature, taste).	1 2 3 4 5 6 7
11.	Price of external services available on the campus (cafeteria, bookstores, photocopying) is adequate for its quality.	1 2 3 4 5 6 7
12.	At the university opening hours of students offices are convenient for the students.	1 2 3 4 5 6 7
13.	Teaching staff in relation to students friendly and attentive.	1 2 3 4 5 6 7
14.	A student can always rely on help from the teachers.	1 2 3 4 5 6 7
15.	Price for tuition is adequate to acquired skills.	1 2 3 4 5 6 7
16.	Exams dates are convenient for students.	1 2 3 4 5 6 7
17.	Extramural classes schedule are convenient for students.	1 2 3 4 5 6 7

Tab. 1: Statements characterizing the technical university services included in the survey

The group of 3000 respondents included both students of technical universities (65% of men and 35% of women) and 200 high school graduates (40% of men and 60% of women) who want to study at the technical university. They were asked to evaluate an importance degree in terms of the university service quality. The selection of respondents' group had a random and accidental character. The choice of students and graduates as candidates for technical studies has comparative character crucial for the research result. The research scale used to evaluate service quality level was seven-rating Likert scale, where "1" indicates the least important factor and "7" indicates very important factor. However, in the case of survey, "1 means very low factor assessment carried out by the service provider and "7" - very high rating of a given factor.

Results and Discussion

Analysis of obtained results (Table 2) allows to conclude that students' expectation (ideas) on particular areas affecting the technical university services quality are not fully met their expectations (in 85%) as to present and future students. The biggest difference between the average value of the expected and experienced service can be seen on issues relating to: the parking availability (-5.25) and opening hours of students‘ offices (-2.65). The other great difference between students‘ expectations and their experience concerns a doubt about the skills and knowledge of the teaching staff (-2.35). The significant gap was identified also in the dimension on the price for tuition that is not adequate to acquired skills (-1.9). In the case of questions concerning the purity and safety, the assessment of the facts made by the students don‘t exceed expectations of future students‘ ideas (-1.6). Expectations of the future students‘ group has been exceed in terms of the canteent meals quality (0.2) and its price (0.75).

Statement's number in the survey questionnaire	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
The survey part investigating perceived service quality level by the current student of technical university (P)	5.4	5.3	1.5	5.3	5.6	5.3	4.65	6.1	5.35	6.55	6.45	4.15	5.35	5.75	5.1	5.9	5.1
The survey part investigating perceived service quality level by the future student of technical university (E)	6.2	6.55	6.75	5.7	6.65	6.7	7.0	6.6	6.95	6.35	5.7	6.8	7.0	7.0	7.0	6.4	6.65
Quality level (Q = E – P)	0.8	1.25	5.25	-0.4	1.05	-1.4	2.35	-0.5	-1.6	0.2	0.75	2.65	1.65	1.24	1.9	0.5	1.55

Tab. 2: Average quality level values on the expectations of candidates for technical university and the service quality level perceived by current technical university students

Expectations of future students have been outperformed with regard to external appearance of the university building (-0.4) and the internal appearance (-1.05), which are related to the indoor marking enables efficient movement inside and outside university buildings. Research findings on this part of the study show that expectations are higher than the facts (-1.4). Expectations weren't met also in the way in which technical universities organize

recruitment process (-0.8) and treatment of the candidates for study in the recruitment process (-1.25). Expectations have not been met also in terms of the modern research and laboratory equipment that should be aimed at students' qualifications improvement (-0.5). The important service quality area, that was low-rated (-1.65) as the exam terms, doesn't meet students' expectations (-1.55).

Research results show a high importance of some processes included in the offer of technical university services such as the recruitment process and the learning process. The criteria of empathy are crucial in the recruitment process since it is based on the process of gathering information about candidates and their expectations. As the important one, the recruitment process was identified in the research study as the significant one since it is the first candidates' contact with the university. The laboratory equipment at university, which was low assessed by students, plays the great role not only in the university research development process but as well as the learning process. The modernity level of the laboratory equipment has the basic meaning for the students' skills and competences development. This service element is crucial for technical university service improvement because candidates identified university knowledge and skills as one of the most important element, what can be supported by appropriate level of technical equipment.

Conclusion

The conclusion is that in order to receive the appropriate, planned level of the service quality, taking into account a students' satisfaction, the process of creating university services quality should be properly managed. An important function of the university services management, as the basic for the service quality improvement process, is the identification of valuable elements of the university offer, its evaluation and the control in accordance to approved correction actions. The specificity of tuition services at technical universities and other intangible services is the difficulty of defining clear service quality, and hence determining a clear methodology for its evaluation. An important determinant of the teaching services quality evaluation is undoubtedly a satisfied student, where SERVQUAL method is a useful tool of expectations and perception measurement.

One of the most important issues mentioned in the survey and low-rated element is technical infrastructure of the technical university that support realization of the teaching process and ensure students' skill and their qualifications. The well-equipped laboratories can be a source of both students' and teachers' skills development and can result in the university research progress. Perspective of arrangement university offer in accordance to modern technologies and learning process challenges in relation to SERVQUAL model can help the technical university in creating high quality level of education offer.

Acknowledgements

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THE DIAGNOSTICS OF STUDENTS' DIFFICULTIES IN CLIL (ENGLISH AND MATHEMATICS)

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Abstract

The paper deals with CLIL (content and language integrated learning), integrating mathematics and English. I briefly introduce methodology CLIL and its pros and cons and I focus on the assessment and evaluation of CLIL, specifically on the matter if a student has difficulties in English or math and how this issue can be diagnosed. I introduce three written test from different parts of mathematics and English, which can be used for this diagnostics and I suggest the way of using these tests. I also include modifications. Two of these tests were used in experiments with students to show the diagnostics in practise.

Keywords

Alternative tests, assessment in CLIL, assessment integration

Introduction

Globalization of current world provokes need for new methods of teaching; one of these (chronologically not so new, but definitely rediscovered) methods is CLIL (Content and Language Integrated Learning). CLIL could be characterised as a dual-focused approach, where the language is taught via other subject and other subject is taught via the language (MEYS, 2009). It means that both language and subject are taught at the same time. CLIL has many advantages – first of all it is motivating for students, it offers the opportunity to learn the language in natural environment and it develops the confidence in speaking, which is very important for learners (Koteková, 2013). CLIL is oriented at students and they actively take part in lessons. The teacher uses activating methods and different forms of education; communication and cooperation are supported (Novotná et al., 2010).

CLIL has also some problematic aspects – one of them is great demands on a teacher, who has full responsibility to choose effective forms and ways of teaching, because there is still kind of ambiguity in CLIL teaching – the methodology is not fully developed, there are nearly no textbooks, especially in the Czech Republic.

Other problematic issue of CLIL is evaluation and assessment. Majority of teachers assess the content subject only (Hofmannová, Novotná, Pípalová, 2004), but the education has two aims and evaluation and assessment should include both language and content. The subjects could be assessed separately, but often it is difficult to say whether the students make mistakes or have problems with the subject matter because they do not understand the content or because they do not understand the language. So the question is "how to integrate both parts" (Novotná, 2011a).

The main objective of this research was to create and analyze alternative tests, which would diagnose these difficulties in learning integrating English and mathematics. The ways of written assessment in CLIL are tests aimed at content or vocabulary, alternative tests, performance tests (students perform what they are asked for), portfolios and "can do" tables (Cambridge ESOL, 2011).

Materials and Methods

This research, which is a part of more extensive research aimed at diagnostics in CLIL, was inspired by the research of Novotná, Hoffmanová and Pípalová (2004), who were focusing on the most suitable assessment instruments for Czech bilingual classes and on the fact if the assessment reflects integrating of mathematics and English. They did not consider traditional tests as suitable and they recommended using 'complex structured test covering a number of mathematical as well as linguistic items' and portfolios. Novotná (2011b) introduces an alternative test, which is a set of graduated tasks – some tasks are graduated in English and some are graduated in math.

My research was based on alternative tests, which I designed on the base of theoretical background including CLIL issues, assessment and evaluation generally and in CLIL and theory of designing tests. More information on assessment and evaluation can be found for example in Kolář, Šikulová (2005). More information on theory of testing and the method of designing tests which I used can be found in Chráska (2007). More information on testing in CLIL can be found rarely, we can find some information for example in Hofmannová, Novotná and Pípalová (2004). I will discuss three tests. The test no. 1 deals with basic terminology and fractions and decimals, the test no. 2 with polygons and modal verbs and the test no. 3 with percents and basic tenses. Tests no. 1 and 3 were also used for analysing students' solutions. All three tests are designed as sets of individual tasks where specific math operations or language issues are repeated. We can conclude where students' difficulties are by comparing the results of individual tasks or by studying the math procedures.

The test no. 1 was given to the class of 18 children in the 5th grade (5.B) of an elementary school in Benešov. The children had never had regular lessons in CLIL, but they had one lesson of math in English fourteen days prior to testing. During the testing they were not allowed to have any dictionary.

The test no. 3 was given to three classes of 8th grade of two primary schools in Prague. There were classes 8.A and 8.B (37 students) and 8.C (23 students). Classes 8.A and 8.B (FZŠ Táborská) had never had any CLIL, 8.C (ZŠ Červený Vrch) was partly a CLIL class, they had one extra CLIL lesson per week beyond the number of lessons set in the Framework Education Programme for Elementary education in 8th grade (for 6 month in the time of doing the testing). The students were not allowed to use any dictionary, but they were allowed to use calculators, because I did not want them to be disturbed by simple operations.

Basic terminology and fractions and decimals (test no. 1)

Count:
1) Add 1.5 to 3.1.
2) Multiply 3.1 by 4 and add to 2.4.
3) Compare 12/13 and 13/12.
4) Multiply 3 by 1/2 and compare with 1.5.
5) Subtract 5/7 from 9/7.
6) Add 22/7 to 6/7 and divide by 2.
7) Divide 6.6 by 3 and subtract from 5.7.
8) Subtract 0.25 from 1 and compare with 1/4.

The test no. 1 is intended for beginners of CLIL. From the linguistic point of view it tests only terminology of basic operations – "add", "subtract", "multiply", "divide" and

"compare". The teacher can see if the student understood the term or not by analyzing student's procedure and combining results from individual tasks. For example, if a student really added the numbers in both tasks 1 and 2, it is probable that he/she understood the term.

From the mathematical point of view it tests fractions and decimals. It can be modified for example with natural numbers or expressions. If the test was dictated, it would test also listening and notation of fractions.

Polygons and modal verbs (test no. 2)

If possible, sketch a polygon and label how long are the sides (note: "angles" mean "interior angles"):
1) A polygon. It must have equal angles. It can't have all sides equal. 2) A square. It mustn't have the area larger than 25 cm2. 3) A convex quadrilateral with an angle of 45°. The sides don't have to have the same length. 4) A polygon. It must have equal sides and the perimeter of 18 cm. 5) A rectangle. It can have five sides, it doesn't have to. 6) Four connected equal triangles. They must form a polygon with equal angles. 7) A triangle. It doesn't have to have a right angle. It should have the area of 10 cm2. (label 2 sides) 8) A quadrilateral. Opposite sides mustn´t have the same length. It may not have equal angles.

The test no. 2 (inspired by Novotná, 2011a) deals with polygons from the math point of view. It pushes students to analyse the figures they know and to realize the characteristics of these figures by using given conditions in individual tasks. These conditions relate mainly to angles, sides, area and perimeter. From the linguistic point of view test no. 2 focuses on specific vocabulary relating to plane figures and a grammar of modal verbs (especially the differences among „must – mustn't – don't have to", which cause many problems to Czech students).

The test no. 2 could be modified from the math point of view for example by using solid figures and/or testing congruence, similarity, symmetry, volume or surface. From the linguistic point of view we could use different vocabulary, not only math terminology, but also for example relative pronouns or prepositions of place.

The vocabulary is tested by analysing students' procedures; it is repeated on purpose so the students can prove they know the meaning of the word by sticking with the same meaning in more tasks. The understanding of modal verbs is tested by comparing procedures in individual tasks, for example if the conditions of "must" are fulfilled in all four tasks 1, 2, 4 and 6, it is probable that the student understood the meaning.

Percents and basic tenses (test no. 3)

Answer the questions with a whole sentence and prove the results:
1) Shane wants to buy a guitar. It costs £220. She earned 85 % of the amount this summer. Her Grandpa gave her £25 for her birthday. Her Granny is going to give her £10 for her help with gardening. Does she have enough money to buy the guitar at the moment? 2) Betty's train home leaves at 6 p.m. Betty left her friend's house at 5:30 p.m. It is 5:51 p.m. now and she has already run 75 % of the distance to the train station. Will she catch the train?

3) Brian is buying a new jacket that has a regular price of $150. It is on sale for $105 at the moment. The discount was 50 % 2 months ago. What is the percent of the discount now?
4) Lisa and Luke needed 70 % to pass their biology test. Lisa had 30 points and scored 75 %. Luke had 29 points. Did he pass?
5) Justin's Grandpa has lived with Granny for 80 % of his life. He will be 100 in 10 years. How old was he when they got married? (They started to live together after the marriage.)
6) Emmett is one of 13 students of his class who are studying Spanish. There are 20 students in the class. What is the percent of students studying Spanish?
7) Alice has already read 125 % of books she planned at the beginning of the year. She has read 20 books. How many books did she plan to read?
8) Yesterday Rachel baked a cake and cut it to several pieces. She ate 2 pieces, she gave 2 to a neighbour and she sent 5 to her parents. Her partner will eat the rest, which is 25 % of the cake. To how many pieces did Rachel cut the cake?

The test no. 3 is a set of word problems. From the math point of view it focuses on percentages. The test was designed so it includes also more difficult word problems which must be solved with different strategies. From the linguistic point of view it deals with basic tenses and their understanding. There are tenses on the level of A2-B1(according to CERF – Language Policy Unit, 2000) (present simple, present continuous, present perfect simple, past simple, "will" and "going to"). The test contains rather simple language, so the student can focus only on math and tenses. An answer in whole sentence is required, so the test tests also little bit of writing.
Individual tasks include extra information, which are not necessary for solving the problem and which can be eliminated by correct understanding of the problem regarding the tenses. For example in task 1 - if the student understands "going to", he/she will know that the info about money which Shane will have is not important at the moment.
The test no. 3 can be modified and used with nearly any type of word problems. From the language point of view we could test for example different structures of clauses – e.g. subordinate clauses, conditionals, passive.

Results and Discussion

Test no. 1 – Basic terminology and fractions and decimals

The teaching part of testing in 5.B was interesting because the pupils enjoyed that the lesson was different from their normal lessons, despite the fact that some pupils refused to speak at first. The test was solved with different success. I am stating two illustrative solutions.
Lenka (11 years old) (fig. 1)
Lenka (11) understands the terms "add", "multiply" and "compare", but she switched the terms "divide" and "subtract". She is probably able to add, multiply and subtract, but she has problems with dividing and she made a mistake in task 3 and changed the order.
Adam (11 years old) (fig. 1)
Adam (11) probably knows what does "add" mean and he is able to add correctly. He knows the term "compare", but he has problems providing it. He does not know "subtract" and "multiply" and he probably chooses the meaning randomly. He is not able to divide very well. He made an interesting mistake in task 2 – he wrote just part of a number 0.9.

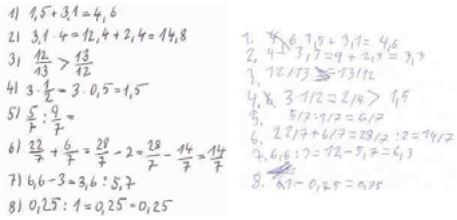

Fig. 1: Lenka (on the left) and Adam (on the right)

The class as a whole was able to add very well, but they had problems with dividing and comparing. More mistakes occurred in tasks with fractions than in tasks with decimal numbers.

Test no. 3 – Percents and basic tenses

There were many results of individual tasks of students; I am stating several illustrative solutions to show how the test works.

Julie (14 years, 8. B)

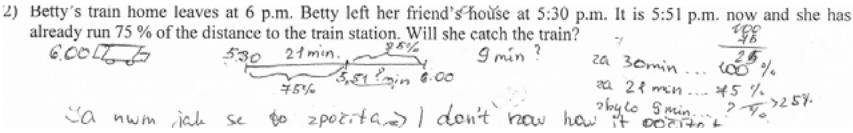

Fig. 2: Julie

Julie understood the problem, she made a legend, but she was not able to count it.

Lucie (14 years, 8.C – CLIL class)

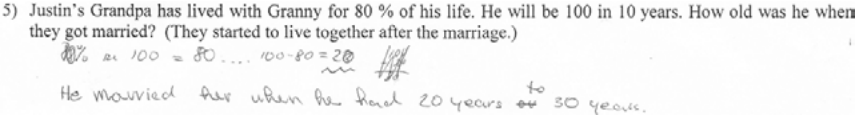

Fig. 3: Lucie

Lucie did not solve the problem correctly, because she probably did not understand the term "in ten years" correctly, but as "during next ten years".

Veronika (14 years, 8.C – CLIL class)

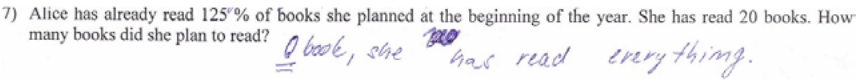

Fig. 4: Veronika

Veronika probably did not understand the question, because she answered to something else.

There was a great difference between classes 8.A and 8.B (non-CLIL classes) and 8.C (CLIL class) – not only in results, which could be influenced by the fact that 8.C had one extra lesson of math per week comparing other classes, but especially in the attitude of students. Students of non-CLIL classes rated the test as very difficult, they were demotivated by the fact it is in English and several students refused to solve the test at all. Two students translated the whole test to Czech before solving, one boy answered only

in Czech and four students wrote a note they could not think about math and English at the same time. Some students also wrote they did not like English, or math, or percents.
Analysing the result of individual word problems from the set, the easiest one for students was no. 6 (Emmett) – it was solved by 39 from 59 students (22 CLIL students). The most difficult word problem was no. 1 (Shane) – solved correctly only by 6 students. The problem, which the most students did not try to solve, was no. 2 (Betty) (30 students, 3 CLIL students).

Conclusion

The issue of CLIL is particularly topical problem, because with globalisation and social diversity and changes in fields of culture, economics and politics, there is the need to change the education in Europe regarding languages (Jäppinen, 2005). CLIL is a convenient and motivating way how to help students with learning foreign languages. For the teacher it is not only important to be able to choose correct strategies and forms of teaching, but also to be able to asses and evaluate in CLIL – and because the learning is integrated, the assessment should be integrated as well. I focused on written tests of learning integrating math and English and I created three alternative tests which suggest the ways how this integrated assessment could be done and how to diagnose, if a student has problems in language or the content. I made an experiment with two tests to be able to verify expected results and to be able to demonstrate analysing of a test. Alternative tests can be used not only for analyzing individual students, but also for a class as a whole. Analysing these tests demonstrated where problems of individual students probably were – we can usually estimate if the student has problem in math, but understands English, or if he/she understands both. It is more difficult to say if the problem is in English, but there is no problem with math. The student is influenced by both aspects when doing a test, language and content cannot be separated, which is a similar result as in Hofmannová, Novotná and Pípalová (2004).
Students who had CLIL lessons were more successful in solving word problems and their attitude was completely different, they were not afraid of using English and they were trying to find the solution despite the fact they did not understand every word – they were more flexible than non-CLIL students. Novotná and Tejkalová (2011) point out that sometimes the same methods of assessment and evaluation can be used for CLIL as for teaching of a foreign language – for example matching the sentences, filling the gaps and so on. This helps students to adopt different strategies which help solving problems in testing. The positive aspects of CLIL teaching were shown for example in Jäppinen (2005).
The presented research showed how alternative tests can be used for assessment of students' difficulties in CLIL regarding problems with language or content and it showed that the content and language are connected and cannot be separated in assessment. Other research should include other ways of diagnostics of students' problems, not only in other forms of written tests, but also in spoken assessment and in teaching and learning generally. The tests I created could be used in experiments with students in Czech or other languages and the results could be compared.

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PUPILS' REASONING IN PROBLEMS FROM COMBINATORICS AND THEORY OF PROBABILITY

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Abstract

With the growing use of IT technologies in school education there is another, less positive tendency developing. Pupils do not learn by heart anymore. Inquiry based learning is becoming very popular and PCs are used to look for information. The findings then need to be analysed and processed which usually cannot be done without the basics of descriptive statistics altogether with theory of probability and combinatorics. However, all of these topics are missing in our curriculum. Our article emphasizes this problem and tries to offer a solution. The current situation is contrasted with other countries where it differs a lot.

Keywords

Inquiry based learning, pupils reasoning, teaching of combinatorics, theory of probability

Introduction

The content of mathematics education learned in Czech basic schools is usually considered comparable to the rest of OECD countries, especially to our neighbours = Poland and Slovakia. However, as far as combinatorics and probability theory are concerned, our Framework Educational Programme for Basic Education does not cover these particular areas at all. In opposite to this, combinatorics and probability theory in Slovakia are taught in the 6th, 7th and 8th grade in more or less 25 lessons each year (since 2003 when "Štátny vzelávací program" (National Institute for Education – statpedu.sk, 2014) was settled, there is not a strict time schedule anymore). In Poland (Pazdro, 2010), the assumed number of lessons is slightly lower but the content is nearly corresponding to the Slovakian. In both of these countries, pupils are introduced to these topics even earlier – the propaedeutic takes place latest during the 5th grade using dice or other games. This phenomenon occurs very rarely in the Czech Republic.

This situation comes in hand with the following fact – 'It is interesting to take a look at how successful pupils from other countries were when solving this particular problems. If we compare our students' level of success to the average of OECD countries the picture changes. All five problems the pupils had trouble to solve belong to the area of probability theory and statistics.'(Hejný et al, 2012: 13). Similar problems follow the students in their future. A research among university first year students (Štěpánková and Tlustý, 2013: 586) gave the following result: 'We assume that the late start of probability teaching, the lack of clarity, and also other factors may make the students feel insecure in problem solving. We found out that their answers are often wrong and do not even make sense.'

Our aim is to implement combinatorics and probability theory to basic school education not with use of any formulas but built on inquiry based learning. The important part shall be making schemes and educated guessing. Kollofel (2009: 503-504), with respect to other researchers, says: 'Diagrams are considered to be most useful as an aid to understanding

when materials are complex or difficult to understand. Diagrams are effective because they make relations among elements explicit and make information more concise by summarizing or highlighting what is essential.' As Rubel (2007: 531-532) summarizes: 'The inclusion of probability and data analysis as one of NCTM's five Content Standards reflects an increasing societal use of data and of the requisite ability to infer conclusions based on such data. Probabilistic decision making is a crucial aspect of a wide range of professional activities and, more broadly, is commonplace in the course of everyday life.' Tlustý and Binterová (2013: 611) mention the changes more generally: 'The changes we have experienced recently influenced various areas of our lives and significantly affected also the educational system.'

Our long-term goal is to examine students' level of success in this area and their solving strategies. In this article we focus on solving strategies before the topics are introduced to the students. The following step after this research will analyse the progress after teaching these topics using a heuristic method. As Konold et al (1993: 393) refers to other researchers, this method is often omitted: 'A large body of research indicates that people employ a small set of heuristics when making probability judgements.' It is, however, easily applied in basic school lessons and hence we have decided to support it.

Material and Methods

In our presentation we will analyse probability and combinatory skills of 143 8th grade students. The questions tested are taken from the international researches TIMSS and PISA (Frýzková, Potužníková and Tomášek (2006); Tomášek (2009); Úlohy z matematiky a přírodních věd pro žáky 8. ročníku: třetí mezinárodní výzkum matematického a přírodního vzdělávání: replikace 1999 (2001)) to make sure that the results can be compared to the national standards from a few years ago. We have chosen combinatory and probability tasks to be able to analyse students problem solving strategies. That should help us to choose suitable methods for our future teaching.

Our main hypothesis is:

1. The results of our tests will be similar to the national results in the PISA and TIMSS researches.

Another interest:

2. Problem solving methods of the students will be mostly inquiry based, for example trial and error, educated guessing, use of diagrams and drawings but also systematic calculus.

Students were not informed about the testing in advance. To prevent cheating we assured them that the test will not be marked. We also highlighted the importance of the reasoning of their answers. This last requirement was not accepted by some pupils who only wrote their results.

The following problems were tested:

1. There are 36 coloured beads in a bowl. They are of the same size and different colours - blue, green, red and yellow. We pick one bead without looking at it. The probability that we pick a blue bead is 4/9. How many blue beads are there in the bowl?

A) 4 beads B) 8 beads C) 16 beads D) 18 beads E) 20 beads

2) Emil likes skateboarding. He went to the shop SKATER to learn about the prices. You can buy a readymade skateboard here. You can also buy a board, set of 4 wheels, set 2 suspensions and set of joining elements so that you can complete your own skateboard. These are the prices:

Equipment	Prices in Zeds
Skateboard	82 or 81
Board	40, 60 or 65
Set of 4 wheels	14 or 36
Suspension	16
Joining set (bearings, rubber layer, screws and nuts)	10 or 20

a) They have three types of boards, two types of wheels and two types of joints in the shop. There is only one type of suspension. How many different skateboards can Emil make?

A) 6 B) 8 C) 10 D) 12

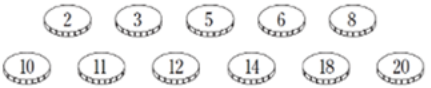
b) Emil has got 120 Zeds and he would like to buy the most expensive skateboard he can afford. How much money can he spend on each part of the skateboard?

Part	Price in Zeds
Board	
Wheels	
Suspension	
Joining set	

3) In the smaller box there are 20 sheets of paper with numbers from 1 to 20 on them. In the larger box there are 100 sheets of paper with numbers from 1 to 100 on them.
You pick one piece of paper from each box without looking. For which box is the probability rate of paper with number 17 higher?

A) Box with 20 sheets.
B) Box with 100 sheets.
C) Probability is the same for both boxes.
D) It is not possible to decide.

4) Eleven wheels displayed in the picture are put into a sack and mixed.



Jane picks one wheel without looking at it. What is the probability that the number on it is divisible by 3?

A) 1/11 B) 1/3 C) 4/11 D) 4/7

5) One hundred of 3000 light bulbs was randomly picked and checked. Five of these light bulbs were defective. How many dysfunctional light bulbs can be expected in the whole set?

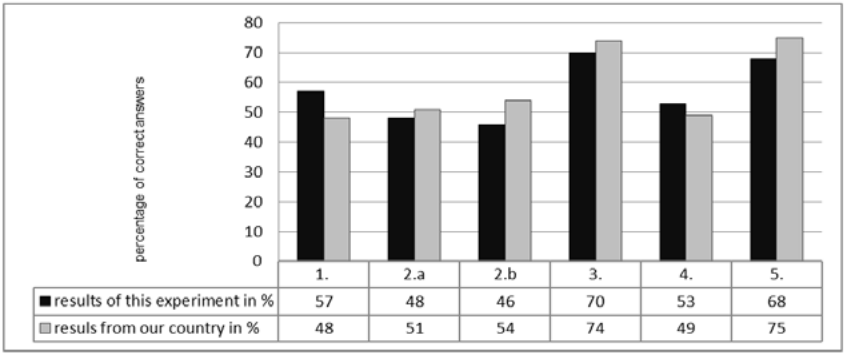
A) 15 B) 60 C) 150 D) 300 E) 600

Results and Discussion

1. hypothesis

As Fig.1 suggests, the results are usually slightly worse than the national average standard. That can be caused partially by the accumulation of combinatory and probability theory problems. Hence the test was quite difficult for the students and we do not consider the different results to be too important. For clarity, we can look at Fig.2. She shows us the overall results of pupils in our test.

It is however obvious, that students' competences in this area have not improved and, as we have already mentioned, solving problems from this area is generally the most unsuccessful comparing to other OECD countries.



	1.	2.a	2.b	3.	4.	5.
results of this experiment in %	57	48	46	70	53	68
resuls from our country in %	48	51	54	74	49	75

Fig.1 – comparison of our research and national results

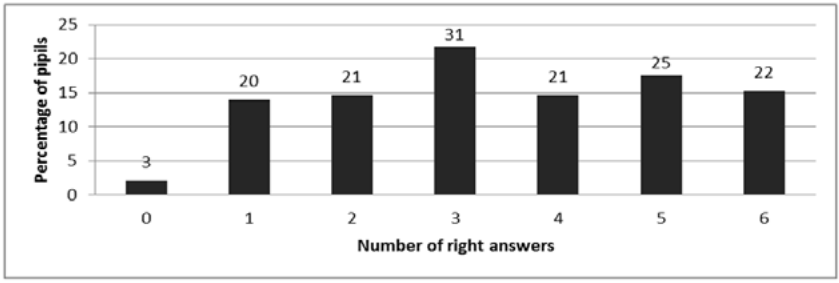


Fig.2 – overall results of our test

2. hypothesis

1st problem

This problem was usually solved with the use of calculus. One pupil solved it using logical deduction and guessing. (see Fig.3) Some interesting strategies occurred even in unsuccessful solutions. The most frequent incorrect answer was A. 4, which was chosen because of the numerator of the fraction 4/9.

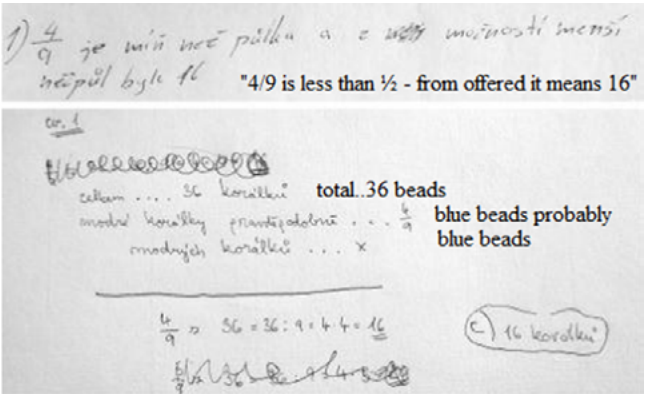


Fig. 3 – Example of pupil's solution of the 1st problem

2nd problem

a) This problem was the most difficult one. Successful students used drawings – diagrams, charts pictures of skateboards etc., but an example of a tree graph also appeared (see Fig.4). The rule of product is not familiar to the pupils so nobody used it. In case of an incorrect answer, the reason usually was a wrong estimation or a forgotten combination.

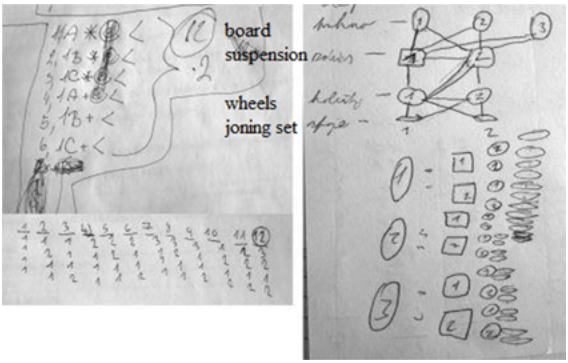


Fig. 4 - pupil's solution of 2.a)

b) Comparing to a), this part was a less troubling one but still one of the most difficult. The most frequent error was that an incorrect (60 Zeds) board was chosen – the rest of the components were correct. This might seem strange at first but the students explained it was caused by choosing a wrong set of wheels which they later realized and corrected but they forgot to change the board as well.

3rd problem

Despite the fact that students needed only to check the correct answer, this problem provides for a very interesting analysis. The most often incorrect answer was C) Probability is the same for both boxes.

Pupils' reasoning was – "It is random, so the probability is the same." The two other incorrect answers occurred as well but less frequently. Some pupils even gave a schematic solution (see Fig.5).

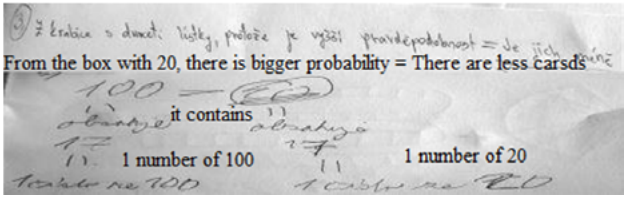


Fig. 5 – pupil's solution of 3rd problem

4th problem

The difficulty of this problem was similar to the second one. Most of the students did not know how to solve it, so they guessed it is 1/3 because of the number of numbers divisible by 3. That was also the most frequent answer. Students who answered correctly usually worked with a picture or added some comments (see Fig. 6).

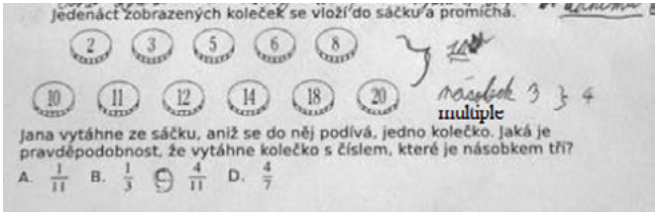


Fig. 6 – pupil's solution of the 4th problem

5th problem

The last task was quite easy for most of the students. It could have been solved using percentage (see Fig. 7).

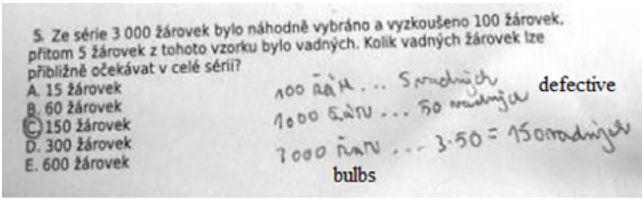


Fig. 7 – pupil's solution of 5th problem

Most of the pupils but did not understand that the result is only approximate and commented on it - „This is an ordinary word problem, how is it connected with probability?" This situation should captivate our attention and it is to reflect in our future lessons. It is mentioned also by Morsanyi et al (2009: 210): 'The notion of probability is notoriously hard to grasp. One reason for this is that the concept of probability incorporates two seemingly contradictory ideas: that the individual outcomes of events are unpredictable.'

What probability offers us is basically an estimation that something will happen and how probable it is. That means that we cannot expect the actual number of defective light bulbs will be exactly the same as the estimation.
Surely, we also want to prevent pupils' beliefs emphasised by Watson and Moritz (2003: 271-272): 'We identified a number of people like the mathematics major who claimed, after completing several hundred trials tossing a coin and confirming equality of heads and tails, "I know the chance of heads and tails are the same but I always chose tails because it comes up more for me."

Conclusion

The research shows that our results are accordant to those from PISA and TIMSS (see Tab.1 or materials which we used for our test). The interesting parts are some strategies pupils used to solve the problems, especially the estimation and guessing. As we expected, the most frequent method was calculus and schematic solving. This type of problems is not usually taught at our school so pupils are not familiar with any algorithm they might use. That is why their solutions are of inquiry based learning nature like drawing schemes, guessing and estimating. These are the strategies important to us as a base for our future worksheets and methodology of probability and combinatorics teaching. As a next step we will compare pupils' solving strategies before and after the lessons.

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FOREIGN LANGUAGE AS AN OBSTACLE IN THE SOLVING OF A MATHEMATICAL PROBLEM FOR NON-CLIL ELEMENTARY SCHOOL PUPILS

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Abstract

This paper presents a piece of research focusing on the role of a foreign language in the solving of a mathematical problem taken from the pilot testing of The Programme for International Student Assessment (PISA) by 15 year old pupils and the difference in academic achievements of CLIL and non-CLIL pupils. The presented research was based on an assessment of didactical tests taken by pupils who have undertaken some mathematics lessons in a foreign language and pupils who have undertaken mathematics lesson only in the mother tongue. The academic achievements of both groups of the pupils are compared with the overall PISA results of Czech pupils from the year 2012. The obtained outcomes of the research were evaluated using various statistical methods.

Keywords

CLIL, PISA, mathematics education

Introduction

The essential part of the European dimension is the education of future European citizens as responsible and creative characters, who are capable of mobility and flexibility in their citizen and working spheres and in their personal lives. The educational area, implemented within Framework Educational Programmes, which is important for the realisation of these aspects is called Language and Language Communication. The knowledge of foreign languages has a practical importance for both educational and working citizen mobility. It is a means that is necessary for the utilisation of original sources when learning about life and European and world culture.

The School Educational Programmes prepared in accordance with the Framework Educational Programmes may create the preconditions for applying various delivery methods or different timetables based on the teachers' experience with new instructional methods. One method which elementary schools are allowed to apply in their School Educational Programmes (SEP) is the teaching of non-language subjects in foreign languages (referred to as CLIL). CLIL stands for Content and Language Integrated Learning and it refers to teaching subjects (for example science, mathematics, history, or geography) to students in a foreign language. This can be by an English teacher using cross-curricular content or a subject teacher using English as the language of instruction. Both methods result in the simultaneous learning of content and English. The term CLIL was coined by David Marsh, University of Jyväskylä, Finland (Mehisto et al., 2008).

As the learning is simultaneous, students are exposed to the target languages without requiring extra time in the curriculum. The aim of this teaching is to develop knowledge of the content (non-language) subject and at the same time, exposure to a foreign (target) language helps students to develop their knowledge of this foreign language.

This presented research is closely connected with the CLIL issue. The primary aim of

this research was to identify the role of assignments in a foreign language which are significantly dependent on reading comprehension and which, naturally, strongly influences the resultant academic achievement. For this reason, the difference in the academic achievement of pupils with no or little experience with the CLIL environment was the secondary goal of the presented research.

Marsh (1999, p. 8) claims that "CLIL does not only promote linguistic competence. Because of the different thinking horizons which result from working in another language CLIL can also have an impact on conceptualization, literally how we think." In other words, learning mathematics in a different language provides the learners with a different perspective on the content area; different vocabulary creates further associations; different methods necessary for instruction through a foreign language can trigger more active approaches and deeper understanding.

Also Thomas, Collier, and Abbott (1993) tested CLIL students to determine their performance in mathematics and English language arts, and oral proficiency in the target language (Japanese, Spanish, or French). After two years of study, the immersion students scored at least as well, and to some extent better than, non-immersion students. There was no evidence that the CLIL experience hampered academic and cognitive development. However, some studies do not support the assumption made in some earlier studies on immersion which have shown that the mathematical skills of the pupils were almost similar in the CLIL classes and in the so-called normal classes (Cummins and Swain, 1986).

It is obvious from the presented outline of longitudinal research conducted in the field of the CLIL method used in lessons of mathematics that the research conclusions concerning the skills and knowledge of participating pupils and students are not always consistent.

The presented research focuses on the difference in academic achievement of elementary school pupils when solving mathematical problems assigned in a foreign language which is closely influenced by the reading comprehension of the test assignments. This psycholinguistic activity comprises three relations. The first one is the relationship between phenomena of the objective reality and the text elements. The second one is the relationship between particular elements of the text (words, sentences), and the third one between the text elements and the recipient's knowledge. Gavora (1992) proved that reading comprehension can take place only if the reader (recipient) of the text is fully aware of these relationships.

In addition, Jošt et al. (2013) warn that pupils whose reading skills are weak cannot compete with other pupils in other subjects as they may fall into a trap of lower self-concept (a complex self-image made by the pupils her/himself which energizes the pupil to solve a more difficult problem). Moreover, Štěpánková and Tlustý (2012) claim that the lack of clarity (and understanding) of mathematical problem assignments makes the students feel insecure in solving mathematical problems.

To summarize the objectives of the presented research, the following are crucial research questions:

- Is there a significant difference in the academic achievement between pupils with and without (or with little) experience of the CLIL environment when solving a mathematical problem assigned in English? Is there a significant difference when compared with the results of the PISA testing conducted in 2012?
- Is a foreign language perceived by pupils as an obstacle to solve mathematical problems even though their language competence is sufficient to understand the assignments?

Materials and Methods

The presented research is based on an analysis of didactical tests presented to 32 elementary school pupils aged 15 from Základní škola Matice školské in České Budějovice which participated in the years 2008-2011 in the project supported by the European Union called *The Interconnection of a Foreign Language and a Content Subject at Elementary School Level*[1]. The pupils were divided into two groups according to their experience with mathematics lessons presented in a foreign language in the CLIL environment. One group (M/A) consisted of 15 pupils who undertook mathematics lessons in a foreign (target) language (English) regularly once a week, while the other group (M/C) consisted of 17 pupils who undertook mathematics lessons only in the mother tongue (Czech).

Both groups of pupils were given the same didactical test containing one mathematical problem chosen from the PISA tests (coordinated by the Organization for Economic Cooperation and Development) presented to elementary school pupils worldwide in 2012. The PISA tests were chosen in order to have relevant data for comparison of the research results with the national level results. At the same time, the authors of this paper think that the mathematical problems contained in the PISA portfolios are more complex than mathematical problems contained in the Czech textbooks and are more demanding with respect to the reading comprehension abilities of pupils. As the aim of the research was to identify the role of the assignments in a foreign language, the selection of a suitable mathematical problem from the PISA portfolio was made with respect to an extensive word assignment of the problem so the understanding of the problem is significantly dependent on reading comprehension.

Generally speaking, it is important for the assignment of a mathematical problem to be as clear as possible to avoid possible and unnecessary misunderstanding. Therefore, it is crucial to keep in mind that in the original sense, the language (written or spoken) is a representation of thoughts and the bearer of the language is a man who is the only creature having thoughts (Pavličíková and Sapík, 1999). This could be interpreted in a way that also an author is the only person who knows best the content of his/her spoken or written discourse and this may cause a problem with understanding for the receivers.

For this reason, to avoid possible obstacles to understanding some words in the assignment, the chosen mathematical assignment was supplemented with a short vocabulary list. The assignment in English was approved by the pupils' teacher of English regarding the vocabulary used and structure of the test. The selected problem was assigned as follows:

Vocabulary:

- *shortcut – zkratka*
- *speedometer – tachometr (měřič rychlosti)*
- *including – včetně*
- *it takes/took – trvat / trvalo*
- *journey - cesta*

[1] Project No. CZ.1.07/1.1.10/02.0073

Zuzana has got a new bicycle with a speedometer. The speedometer shows the distance Zuzana has gone on the bicycle and the average speed of the total journey.

1.1: One day, Zuzana went 6 km during the first 16 minutes and then 3 km during the next 8 minutes. Which of these statements is true?

a) During the first 16 minutes, Zuzana's average speed was higher than the average speed during the next 8 minutes.
b) During the first 16 minutes, Zuzana's average speed was the same as the average speed during the next 8 minutes.
c) During the first 16 minutes, Zuzana's average speed was lower than the average speed during the next 8 minutes.
d) From the given information, it is not possible to say anything about Zuzana's average speed.

1.2: Zuzana went 7 km to her aunt's house. The speedometer showed that the average speed during the journey was 21 km/h. Which of these statements is true?

a) It took Zuzana 20 minutes to go to her aunt's house.
b) It took Zuzana 30 minutes to go to her aunt's house.
c) It took Zuzana 3 hours to go to her aunt's house.
d) It is not possible to say how long it took Zuzana to go to her aunt's house.

1.3: Zuzana went from her house to a river, which is 3 km away from her house. The journey took 9 minutes. On the way back, she took a shortcut to her house for 2 km and it took her only 6 minutes. What was Zuzana's average speed (in km/h) during the whole journey to the river and back?

To detect possible problems with understanding and to identify the pupils' perception of the English language in the assignment, selected pupils who had not answered some of the questions were interviewed by the teacher.

Results and Discussion

The didactical tests were assessed using the PISA assessment system considering three basic possible outcomes – the right answer, a wrong answer, no answer (no solution at all). Two right solutions of the last problem are showed in Fig.1. The academic achievements of both groups of the participating pupils in particular problem questions assigned in the didactical test are presented in Table 1. The table also shows results of the academic achievement of the pupils who took the test within the pilot PISA testing in 2012 in elementary schools in the Czech Republic. The percentages in the brackets indicate the unanswered questions.

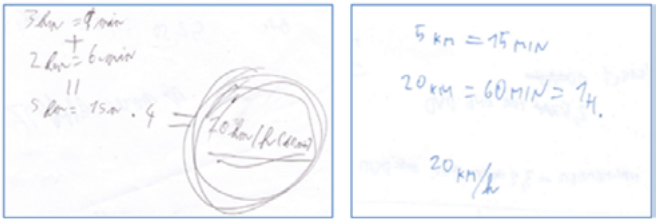

Fig. 1: Solution Samples of Question 1.3

	Question 1.1	Question 1.2	Question 1.3
Group M/A	73.3% (13.3%)	53.3% (6.7%)	26.7% (20.0%)
Group M/C	47.1% (35.3%)	35.3% (23.5%)	5.9% (76.5%)
Total (M/A+M/C)	59.4% (25.0%)	43.4% (15.6%)	15.6% (50.0%)
PISA	71.7% (2.0%)	48.9% (2.9%)	14.6% (15.8%)

Tab. 1: Didactical Test Results

The results show that there is a significant discrepancy between the achievement of the pupils who are used to undertaking mathematics lessons in English and the pupils who have no experience with such lessons. The statistical analysis using the chi-squared test tested the following null hypotheses:

- H_0-1: The academic achievements in the didactical test of pupils with experience of the CLIL environment (group M/A) and with little or no experience with the CLIL environment (group M/C) are the same.
- H_0-2: The academic achievements in the didactical test of pupils with experience with the CLIL environment (group M/A) are the same as the results of the PISA testing.
- H_0-3: The academic achievements in the didactical test of pupils with little or no experience with the CLIL environment (group M/C) are the same as the results of the PISA testing.

These findings should be considered with respect to the fact that the number of the pupils in each of the groups is limited and that each pupil represents 6.7% (M/A), and 5.9% (M/C) of the particular group. To be able to make more general conclusions, more pupils would be necessary to participate in the research.

	Calculated test criterion	Critical value $\chi 2$
M/A vs. M/C	48.68844	7.814728
M/A vs. PISA	10.71749	5.991465
M/C vs. PISA	17.40683	5.991465

Tab. 2: Statistical values of the chi-squared testing

The statistical analysis (see Tab. 2) shows that we have to reject all three null hypotheses and accept the alternative hypotheses:

- H_A-1: The academic achievements in the didactical test of pupils with or with no (or little) CLIL experience are not the same. We can say that the M/A group scored better results than the M/C group.
- H_A-2: The academic achievements in the didactical test of pupils with CLIL experience are not the same as the results of pupils with PISA testing. We can say that the M/A group scored significantly better results than their peers in the Czech Republic in the pilot PISA testing.
- H_A-3: The academic achievements in the didactical test of pupils with no (or little) CLIL experience are not the same as the results of pupils with PISA testing. We can say that the M/C group scored significantly worse results than their peers in the Czech Republic in the pilot PISA testing.

In accordance with Marsh (1999), we found out that different (foreign) vocabulary creates further associations; different methods necessary for instruction through a foreign language can trigger a more active approach and deeper understanding. At the same time, we can say that there was no evidence that the CLIL experience hampered academic and cognitive development of the CLIL pupils, as claimed by Thomas, Collier, and Abbott (1993). Contrary to expectations, some good students did not solve all three parts of the problem correctly. Even though this was exceptional, it is in accordance with the claims of Gaya (1994) that to some extent, it can be assumed that CLIL pupils do not reach maximum results in mathematics

It is interesting to compare the numbers of unanswered questions (recorded in the brackets in Table 1). For both groups of pupils, the numbers of unanswered questions are higher than in the case of the PISA testing. The importance of this could be attached to the fact that the foreign language (English) of the assignment was perceived as an obstacle and the pupils were not willing to deal with the particular problem. This might be a reason, especially in the case of Questions 1.1 and 1.2, which were multiple-choice questions, when students often make at least a random guess.

The interviews with the pupils confirmed the above mentioned assumption. All pupils from the M/C group who had not answered the questions and had not made any calculations admitted that the reason was that the assignment was in English. Even though the language level of the assignment was adjusted in order to be comprehensible for the pupils, the foreign language seemed to be perceived as an obstacle. Students also admitted that, in spite of the fact that they could understand the meaning of the assignment, their first meeting with English in the mathematics environment was surprising for them, and they did not believe in themselves or that they could have actually dealt successfully with the given mathematical problem.

In group M/A, there was only one pupil who had not dealt with any part of the problem. This pupil admitted that he had not been in the mood to deal with the problem as the assignment had not corresponded with the current topic of the regular mathematics classes.

Conclusion

The presented piece of research showed that even though the teaching of foreign languages is emphasized and supported significantly in elementary schools, it seems that final year pupils with little or no CLIL experience struggle with the use of English in another environment than foreign language lessons. The English language functions as an obstacle and prevents them from the correct comprehension of the problem. Although the teaching of foreign languages should prepare pupils to use these languages in every-day life situations, pupils are fixed to its use solely in foreign language lessons and their ability to use them outside these lessons is rather limited.

The presented research also showed that pupils who have experience with the use of a foreign language in mathematics lessons are used to it and therefore they scored better results than their peers without this experience and also than the average results of the pilot PISA testing in mathematics. As the pupils with no (or almost no) foreign language experience in mathematics lessons perceive the foreign language as an obstacle, they scored significantly worse results than their peers in the Czech Republic who took the pilot PISA testing as they did even not try to deal with the presented mathematical problems.

As the number of pupils participating in the presented research was limited and the research was conducted only in one school, the research was considered as a pilot study.

To be able to make more general conclusions, more pupils and schools have to be included in a subsequent piece of research (which is planned in the near future).

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HOW ARE STUDYING MOTHERS WITH CHILD?

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Abstract

The aim of this paper is to analyse the satisfaction and financial situation of students, particularly women who have a child or children. Nowadays, there are a lot of studies of handicapped students or students from socially disadvantaged families. However, there is not many analysis of studying mothers with children. The paper is based on the survey EUROSTUDENT, which provides the data about social dimension of European tertiary education. The aim of this paper is to evaluate whether the fact that a woman has a child (under 18 years) has impact on satisfaction with study and financial situation. The analysis contains the priority during choosing school, evaluation of their schools and financial situation of women with child at the Czech universities, including their economic activity, income and amount of their expenditure compared with other women without children. The partial aim of the paper is to analyse and define a typical student with a child in the Czech Republic.

Keywords

Survey EUROSTUDENT, evaluating of education, studying mothers

Introduction

In the long term, there is an increase in the number of students at the Czech universities. It also increases the proportion of women – graduates (CZSO, 2012; Mazouch and Fischer, 2011). However, there is no evidence how many women had to interrupt their studies due to motherhood. How many women voted for family life instead of learning opportunities or career? What about women who have decided not to continue studies because of the baby or after a break they again returned to school? This paper aims to find out who are the women who continued studying with the baby. Are these woman satisfied and how is their financial situation?

In general, there are a lot of studies of impact a level of education on productivity (e.g. Fischer and Vltavská, 2011) or analysis of monitoring the impact of education on the economy in the form of rates of return (Finardi, Fischer and Mazouch, 2012). In the world, we can find a lot of analysis evaluation of women career (Buschor et al., 2014), accessibility of schools for women (Bielby at al. 2014) or analysis of the behavior of women and men in universities (Jackson, 2010), but all these analyses are focused on women without children. In the Czech Republic, it doesn´t exist any analysis about education at universities of women who have a child. There are local studies very often, for example for one school or type of education. One way of exploring education of women with children shows analysis by Dömeová, Vydrová and Jindrová (2010) who created own questionnaire, but only for students in distance studies. This article monitors demographic situation and motivation for studying of women and men. In the world, problems of mothers at the universities are monitored for example by Tiu Wu (2013),

but she analyses it again only in a limited view, and that's doctoral studies. Students, however, must decide not only about motherhood, but also about what awaits them if they have a child. Still they have a chance in a good job? Will they be discriminated in wages (Hasselbach, 1980)? Kricheli-Katz (2012) defines "Status of Choice", that women decide for motherhood despite the possibility of future discrimination, they continue in work or studies. The problem of "choice" can be found as also in Lips and Lawson (2009). Previously, motherhood was a possible cause of leaving a school, but nowadays women must often return to school to finish their education, just to improve their position in the labour market (Scott, 1998).

The aim of the paper is to analyse priority during choosing school, evaluation of their schools and financial situation of women with child in the Czech universities.

The goal of this paper is to find the answer for following question: Who are the women with child at the universities, what kind of school they study? Are there differences in the criteria in the selection of schools for mothers with children or are there differences in evaluation of schools?

At first, paper would present a survey EUROSTUDENT V. The rest of the paper is organized as follows. We introduce the data and the statistical methods we used. We then present the results of our analysis. Firstly we define typical woman with child studying at the university, included their age, type of school or form of study. Secondly we focus on their priority during choosing a school and evaluation of study.

Finally we analyse financial situation of these women compared with other women. It means economic activity, income, and their type and amount of their expenditures.

Materials and Methods

Our sample comes from the survey EUROSTUDENT V[1]. Survey EUROSTUDENT V was realised in all EU countries and is coordinated by the local ministry of education. The main aim of the EUROSTUDENT project is to collate comparable data on the social dimension of European higher education. It focuses on the socio-economic background and on the living conditions of students, but it also investigates temporary international mobility. The project strives to provide reliable and insightful cross-country comparisons. The main users of our findings are higher education policy-makers at national and European level, researchers in this field, managers of higher education institutions and - of course - students within Europe.

Survey in the Czech Republic was conducted in two rounds during the year 2013. Survey EUROSTUDENT included all public, state and private universities. It involved all public and state universities and 29 private universities. In total, 95,177 students were interviewed. Total of 6,382students entered into the questionnaires. 703 questionnaires were not completely filled. 1,015 questionnaires had to be excluded from the survey.

In our analysis there were involved only women studying bachelor and master degree. They also have to indicate, whether they have at least one child and the youngest child is less than 18 years old. Other women were considered as a control group to compare the results.

All data were processed in the statistical program SPSS. Factors affecting assessment study for women with children were examined using chi-square test of independence in contingency table and the values of Cramer's V, and Independent sample test.

[1] Data obtained within the survey EUROSTUDENT V, carried out within the project IPn KREDO CZ.1.07/4.1.00/33.0005.

Results and Discussion

In sample of data from EUROSTUDENT V, there were 56.3 % of women and 43.5 % of men. Not all women had a child. In the sample only 8.8 % of women declared they have at least one child younger than 18 years old. Before evaluation the studying quality or financial situation, we tried to find a typical studying woman with young child.

Women could indicate how many children they have. The most commonly reported was one child (41 %) or two children (48.1 % of women). However, there were also women with three or four children. The youngest child is on average 6.7 years old.

An important factor affecting not only the number of children, but also the overall evaluation of the study itself, is age (Cramer´s V = 0.655) (see Fig. 1). 82.9 % student women with children are older than 30 years. 14.9 % women are between 26 and 30 years. Only 2.2 % of these women are younger 21 years.

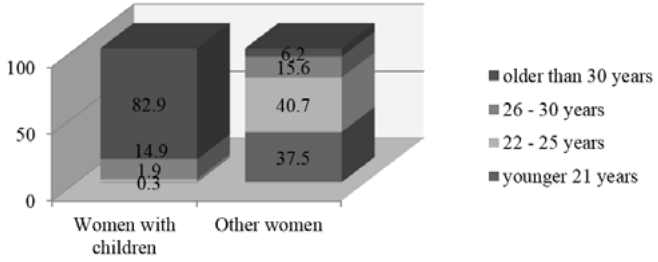

Fig. 1: Distribution of women´s age (in %)

Form of study, means presence and distanced study, and type of university also play an important role. A statistically significant correlation is observed between the having a baby and form of the study (Cramer's V = 0.539), and having a baby and type of university (Cramer's V = 0.116). We can suppose that women with small child prefer combined study to attendance study. They also prefer private school, where is more personal approach and very often bigger offer of combined programs. Distribution of the form of study and type of school is showed at Fig. 2. As Fig. 2 shows, the highest proportion of women with child is indicated for combined study and in private school.

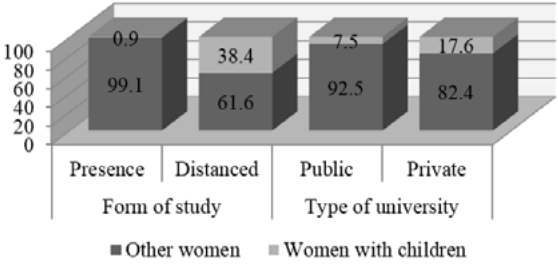

Fig. 2: Distribution of form of study and type of university (in %)

From the above, we can consider that the majority of studying mother is a woman aged 30 years, who is studying combined studies at a private school. Therefore, we divide in the following analyses the mothers by the age under30 years old and above 30 years old.

In relation to school, women without children feel more to be a part of school than women with children. One of possible explanation is, that women with children very often study

in combined studies, and in general these students are not so closely connected with their school. Independent sample test confirms dependence between having a child and feeling of belonging to the school at the 5% significance level (p-value = 0.001).
In our analysis, we focused on priorities when choosing schools today. Fig. 3 shows, the most important factor for women with children is distance from place of residence, unlike other women, for that was the most important employment opportunities after graduation.

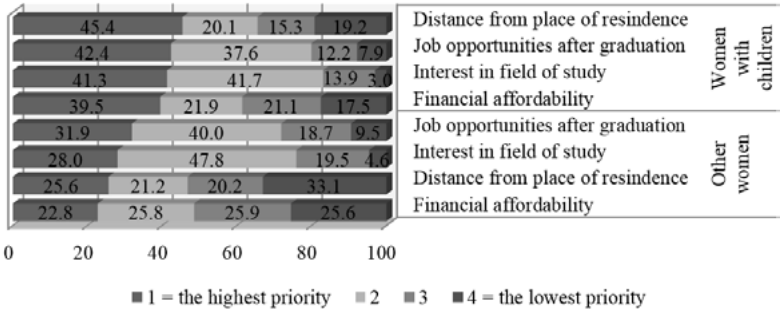

Fig. 3: Priority in choosing school (in %)

In the analysis of quality of education evaluated by women with children it is also important (Cramer´s V= 0.09) to show results from other students without children, particularly women. Fig. 4 shows us the evaluation of school by women with children and by other women. Women with child are more satisfied with quality of teaching (83 % of these women were very satisfied or satisfied), other women are more satisfied with school facilities.
Women with child are most dissatisfied with the possibility to choose from a wide range of subject. However, it can be caused by smaller choice of subjects at private schools.

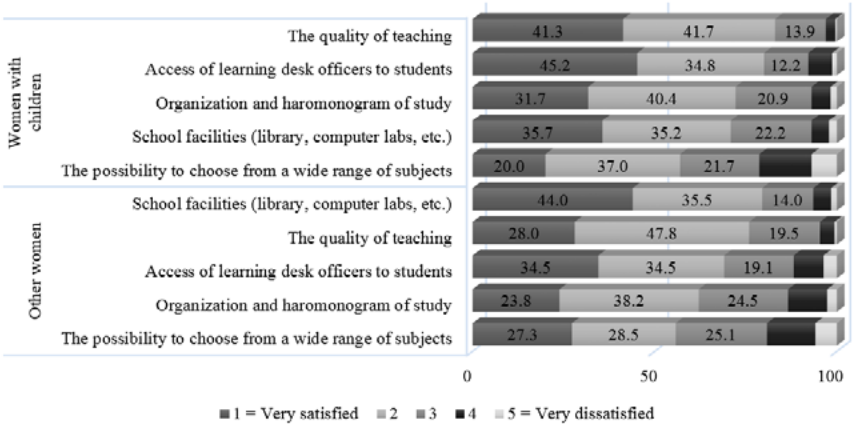

Fig. 4: Evaluation of school (in %)

In the questionnaire, women reported whether they faced financial problems or not. They also reported the economic activity. There were also observed a statistically significant correlations (Cramer´s V = 0.106 for financial problem; Cramer´s V = 0.193 for economic

activity).
Women with children rather said, they are confronted with serious or very serious problems (Fig. 5) by more than 6 percentage points than the other women. It can be reason why during the semester women with children work more than other women (Fig.6).

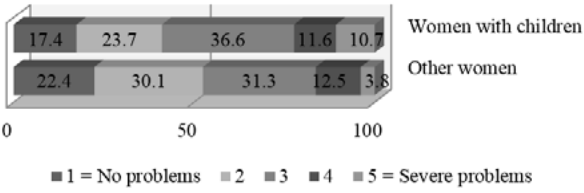

Fig. 5: Have you financial problems? (in %)

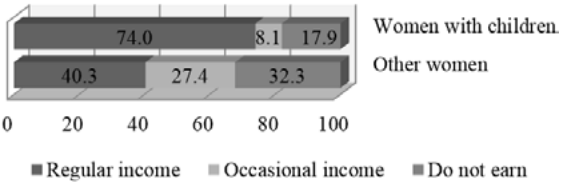

Fig. 6: Economic activity (in %)

The last area, which we focused on within the analysis were finance. At first, we focused on the income of women. The average income of students varies by age. According to Independent Sample Test the monthly incomes depend on age of women (even at the 1% significance level). The highest income is reached by students in the oldest age category regardless they have children or not. (see Fig. 7).

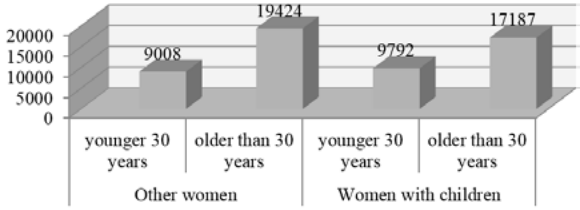

Fig. 7: Income of women by age (in CZK)

Tab. 1 shows us a distribution of type of expenditures by source of payment and by age of women. The costs of type strongly depends on the age of the woman (p – value = 0.000). The share of expenditures remain the same for all women. However amounts of money, which women pay themselves, are at an average of 2000 CZK higher for older women e.g. housing.
Women without children spend most money on housing costs and expenses for daily consumption, the third highest expenditures are associated with culture and entertainment. For women with child, housing costs and expenses for daily consumption are also the most important costs. The third big items of expenditure for women with child are the costs of child welfare. Expenditure for culture and entertainment are minimal. The largest item paid by someone else is housing cost. These costs represent more than40 % of the cost paid by someone else.

	Expenditures paid by myself				Expenditures paid by someone else			
	Other women		Women with children		Other women		Women with children	
	Younger 30	Older than 30	Younger 30	Older than 30	Younger 30	Older than 30	Younger 30	Older than 30
Housing costs	1 173	5 303	2 233	3 784	2 747	1 337	4 152	3 728
Expenditure daily consumption	1 190	3 624	2 113	3 625	1 152	630	2 031	1 539
Transport	484	1 606	827	1 498	395	241	565	583
Expenditure on phone, internet	224	612	418	635	239	150	206	280
Medical expenditure	101	217	165	245	71	6	64	118
Child welfare	1	546	2 050	2 389	40	81	1 571	1 241
Repayment of debt	110	1 089	587	659	125	221	118	730
Cultural and leisure activities	636	1 356	413	683	192	95	477	318
Other expenditure	761	1 779	1 007	1 318	279	30	496	604
Total	4 680	16 131	9 813	14 834	5 240	2 791	9 680	9 140

Tab. 1: Types of expenditures by source of payment and age (in CZK) (data from EUROSTUDENT V)

Previous studies have shown a motivation of women to study with child. They focus mainly on demographic data. Our findings correspond to the findings Dömeová et al. (2010) in their analysis that mothers are very often older than 25 years, which corresponds to the current demographic situation where a child is deferred until later ages. With the data from the survey EUROSTUDENT we can expand the view to identify these women and their financial position or school evaluation. The economic activity of these women is also consistent with other authors. The criteria for selecting schools, financial situation and the types of expenses depend on whether the woman has a child or not.

Conclusion

Students with dependent children are very often women older than 30 years and most of them are economically active, which is the starting point for further analysis of the position of such persons. The students, who are less than 25 years old and have a minor child are almost absent in our sample. Students with children choose more often combined (distance) studies at private schools, where the offer of these courses is bigger than on public schools. They prefer schools that are near their place of residence. They also places big emphasis on employability after graduation. These women are more satisfied with quality of teaching than other women, but they are more dissatisfied with the possibility to choose from a wide range of subjects.

In terms of financial problems, students with children evaluate their financial situation worse than women without children. There are also large differences between the age

groups of women with children. The highest incomes have students aged over 30 years, but they also have higher cost of living and expenses of daily consumption.
In comparison with other female students in the same age, women with children have minimum expenditure on culture and leisure.
The results show that monitoring of students with children is very important for the further possibilities for improving status of Czech universities. Public schools should create more combined programs for students with children.
Data from EUROSTUDENT V are unique from some point of view. They are one of the few data that are interested in the opinion of the students and their living conditions. This paper describes just one part of education of students with children. The further research could be focused on the other parts and could describe and analyse this data with other economic indicators, mainly wages and salaries and the unemployment rate. Another possible direction is analyses of the impact of university education on the number of born children.

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PLAYING BOARD GAME: LESSONS (NOT ONLY) FOR STRATEGIC MANAGEMENT TEACHING

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Abstract

Paper examines students´ ability to use explicit and tacit knowledge. With students studying Strategic management in two following courses we play a board game "Power Grid" to test whether they are able to use knowledge we assumed they have in the second course. We tested their ability in specified criterions suitable for the game and students previous knowledge. As the result we found out low ability of students to use tacit knowledge and in the paper we discuss this issue.

Keywords

Business game, business faculty, management, experiential learning

Introduction

In engineering and technological fields experiments can be conducted for students to have the opportunities to test and employ the theories and concepts that they have learned (Sun, 1998). However, in management areas as in the field of social science are such experiments if not impossible thus difficult to carry out. According to Jarošová (2005) there are different approaches to educate future managers which can be divided into two main streams: an academic and an experiential approach. Academic approaches to learning understand learning as a process of learning highly formalized objective scientific knowledge and capability development process of critical review and skills to apply knowledge in practice (Jarošová, 2005).

Experiential approach is represented by the experiential learning. Experiential learning according to Kolb (1984) is learning process whereby knowledge is created through the transformation of experience. Hawtrey (2007) sees the experiential learning as the incorporation of active, participatory learning opportunities in the course which is sometimes also call as situational learning.

To the discussion about management teaching Mintzberg (2004) adds that university professors overemphasize the science of management while ignoring its art. He contends that even graduated students have inflated views of their competence and ability to be successful. Mintzberg (2004) argues that many essential managerial skills can be learned only from personal experience and suggests a major change in management education which will allow students to gain more experience.

In the Strategic Management course at FEM CULS we use experiential learning approach with usage of case studies, team work, experiential exercises, active students' presentations, and active discussions to give rise the experience between students. There are also studies confirming the enhancement of students' managerial competencies (Švec, Tichá and Kadeřábková, 2011).

But there is a critique of some experiential learning tools (e.g. McCarthy and McCarthy, 2006) and as Jarošová (2005) stated to know is a must but it is more difficult to be able

to apply knowledge in real managerial situations. In paper we test the students' ability to apply acquired knowledge in specific managerial situation. As a test tool we use common board game which meets the criteria of complex situation in managing the company on strategic level. The aim of the paper is to find out the level of explicit and tacit knowledge (taught in the previous course of Strategic Management) which the students are able to use during the model situation (board game playing).

Materials and Methods

The game was played with 25 students, 17 women and 8 men, who studied the course Applied Strategic Management in their final year in masters´ study. This course follows the course of Strategic Management, where students learn strategic management principles, rules, and techniques with help of real life case studies. Therefore all students playing the game were supposed to have skills coming from the previous course of Strategic Management. Students passed the examination in Strategic Management course with different results. The structure of results is: (i) excellent 4 % of students, (ii) very good 48 % of students, (iii) good 36 %, and (iv) 12 % of students did fail to pass exam. The official studying results we can see as structure of knowledge level within the observed group of students. We also measure students´ managerial competencies during the course of Strategic Management in six competency sets (Švec, Tichá and Kadeřábková, 2011): (i) Planning and organising (competencies of planning, organizational skills, and delegation), (ii) Impart information (competencies of transfer of information, presentation of opinions, written communication), (iii) In-person competencies (learning by doing, creativity, perspective, self-knowledge), (iv) Decision making (problem solving, quality decision making, early decision, cope with uncertainties, critical thinking), (v) professional competencies (business issues knowledge, specific field competencies), (vi) Team building competencies (co-creation of an effective team, building relationships with colleagues, dispute settlement, focus on results, issue instructions). Competencies affected in Strategic Management courses taught at FEM CULS Prague were identified and elaborated on basis of competency models of Lombardo and Eichinger (2009), and Stevens and Campion (1994). The structure of competencies of students involved in the experiment is seen in the Fig. 1.

Fig. 1: Competencies structure of students involved in the course of Strategic Management Game-play

Students were given rules of the game in advance for a week to precisely identify the driving forces, principles, barriers of the game, and to set up goals and their plan. With game rules came the task to study it, so students were not explicitly instructed to work more with the principles of the game as they were tested whether they will prepare themselves more or not and whether they exploit the experience and knowledge gained in previous course of Strategic Management.
In the workshop where experiment took place, before the game playing itself started, the students were given task to write down their main goal and strategy for the game. During the game playing were students also making the notes about their decision making process and its results. After the game playing they were asked to make an evaluation of each decision they had made. Students were also observed during the game playing.

The Power Grid Game´s Phases

The Power Grid game is played over several rounds. Each round of the game has five phases (Fig. 2).

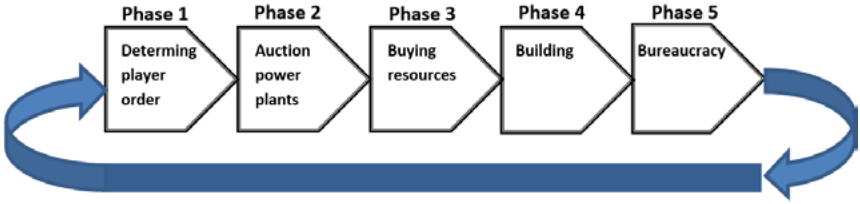

Fig. 2: Power Grid Game´s Phases

During the phase 1 players´ order is set up. Starting player is always the player with the most cities in his network. Determination of the order of remaining players follows the same rule. Strategic point with the players´ order is that if you are the first one, you can pick a power plant from auction, but you buy the resources for your plants as the last one (and vice versa). In the phase 2 each player has the opportunity to buy at most one power plant according to his/her needs, which means to have plants with enough capacity to power all the cities in his/her network and to decide what kind of resource will the player use (the same as desired power plant needs). In the auction the player can do just two decisions: to pass or to choose the power plant for auction. In the phase 3 players buy resources for their power plants from the resource market. The strategic point here is revers: player with the smallest number of cities in the net starts. The phase 4 is building and as in the previous phase the last player starts to add cities to his/her network on the map which is essential to win the game. The phase 5 is called bureaucracy and players in this phase – according to detailed rules - earn money, re-supply the resource market, remove and replace power plants from the auction. This phase brings some strategic points for players: (i) Payment – according to number of cities connected to their network players earn amounts of cash known in advance (seen as table in rules). (ii) Re-supplying the resource market – players re-supply the resources used in their power plants and give them back to the game in the amounts according to the game rules, the amounts are also known in advance. (iii) Updating the power plant auction, where each player can see the new offer of power plants before the next run starts. After phase 5 new round of the game begins with the phase 1 again. The whole game ends immediately after phase 4 when at least one player has at least 17 cities connected and fully supplied in his/her network.

The winner is the player who can supply electricity to the most cities in his network with the power plants and resources he/she has. Only if there is a tie, the player with the most remaining money wins.

Used approaches

To find out what lessons from playing board games can be brought back to teaching of Strategic Management course we used combination of above mentioned competencies approach (Lombardo and Eichinger, 2009) and general views on strategy (Mintzberg, 1987).

Strategy and competency of planning

According to Mintzberg (1987) the word strategy has been used implicitly in different ways even if it has traditionally been defined in only one. Explicit recognition of multiple definitions helps people to manoeuvre through this difficult field. Mintzberg (1987) provides five definitions of strategy: Plan, Ploy, Pattern, Position, and Perspective. Strategy as a plan is some sort of consciously intended course of action, a guideline (or set of guidelines) to deal with a situation. By this definition strategies have two essential characteristics: they are made in advance of the actions to which they apply, and they are developed consciously and purposefully. Strategy as a Ploy is a specific manoeuvre intended to outwit an opponent or competitor. Pattern is seen as stream of actions. As strategy is consistency in behaviour, whether or not intended. The definitions of strategy as plan and pattern can be quite independent of one another: plan may go unrealised, while patterns may appear without preconception. Plans are intended strategy, whereas patterns are realised strategy. From this we can distinguish deliberate strategies, where intentions that existed previously were realised, and emergent strategies where patterns developer in the absence of intentions, or despite them. Strategy as Position are means of locating an organisation in an environment. Strategy is the mediating force between organisation and context (between internal and external environment). Perspective strategy is not just a chosen position, but the perspective shared by members of an organisation, common thinking or behaviour of employees in specific organisation.

Research questions

In this article we want to find the lessons which can be taken from board game playing during workshop back to Strategic Management teaching. We take advantage of continuing teaching the same group of students in two consecutive semesters. The main research question is whether the students are able to use knowledge taught in the previous course of Strategic Management in current course during the model situation substituting the real situation.

Partial research questions follow:

1. Are students able to propose for the “real” managerial situation the goals in SMART format?
2. Are students able to propose goals which are relevant to the context of the managerial situation they face?
3. Are students able to propose the strategy corresponding with the set goals in the managerial situation they face?
4. What kind of strategy are students able to propose and follow in the “real” situation?
5. Are students able to identify strategic failures correctly?

Results and Discussion

Based on proposed researched questions we followed six basic criterions: students´ knowledge of rules, the ability to invoke the principle of SMART goals setting, the ability to propose goals corresponding to the context of the situation students face, the ability to derive strategy from the goals, type of strategy students used in game, and type of any poor decision they did in the game.

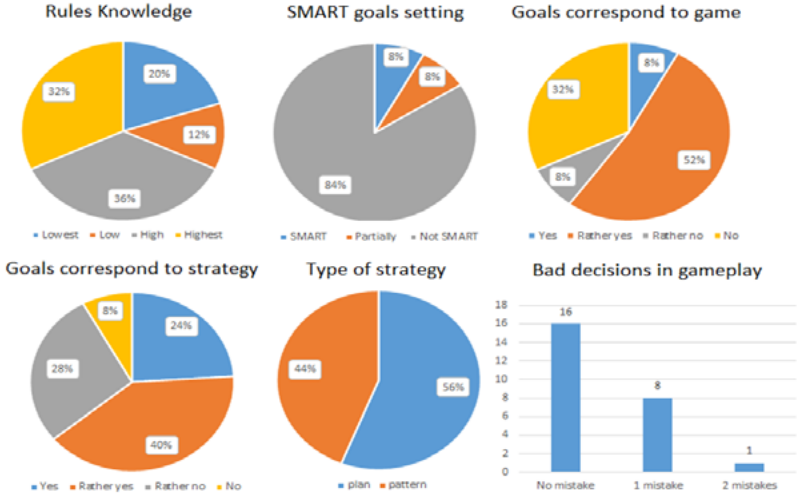

Fig. 3: Students results in observed categories

The level of rules knowledge can be deduced from the number of rounds played in the game. As students had the same time slot for the game (90 minutes) and they had to arrange the game in the beginning, the number of rounds played is showing who mastered the game rules and who did not (see graph Rules Knowledge in Fig. 3). Students who mastered the rules (32 %) should be in advantage according to the others who had not paid attention to conditions in which the competition took the place (68 %).

In the previous course of Strategic Management were students taught to use SMART approach for proposing any strategic goal, which means to set goals: specific, measurable, acceptable, realistic, and reachable in time. The game rules offer such a possibility, even more, the rules itself are giving students the exact wording of goals in SMART form. Despite that fact only 8 % of students were able to fully follow the SMART approach of goals setting, 8 % of students were partially successful with setting the SMART goals, and 84 % of students were just not able to formulate SMART goals (or just to copy them out from the game rules, where the goal is explicitly expressed) – see SMART goals setting in Fig. 3. Setting the goals is not only about being SMART, but goals should correspond with the context in which they are set. In our case this context were game rules and the main goal of the game was to "… supply electricity to the most cities in his network with the power plants and resources he has." (Friese, 2004, p. 7). With this criterion we examined whether the set goals are appropriate and achievable in the game. As it is seen in Fig. 3 – Goals correspond to game - fully corresponding goals had only 8 % of students, rather corresponding goals had 52 % students, and 40 % of students were not able to formulate appropriate goals. In proposing the strategy the setting of goals is followed by strategy

formulation. These two steps are tightly linked and proposing strategy have to be based on set goals. Therefore we examined whether students strategies correspond to their goals they set before. In 64 % of cases the strategies were based on goals students set before, although only 24 % of cases did match perfectly – see Fig. 3 – Goals correspond to strategy. The last criterion we examined - strategy setting category - was type of strategy students used. We used two of Mintzbergs´ five views on strategy (Mintzberg, 2001) – plan and pattern, as they fit best to our intention and conditions. Mintzberg (2001) sees plans as intended strategy, whereas patterns sees as realised strategy. From this we can distinguish deliberate strategies, where intentions that existed previously were realised, and emergent strategies where patterns developer in the absence of intentions, or despite them. Students did not have to improvise with the strategy in 56 % of cases – see the Fig. 3 – Type of strategy – the rest of students (44 %) did not have clear strategy or was not able to perform strategy well and had to adapt to the situation they faced.

During the game playing students noticed their decisions into the forms and after the end of game playing students made after-action-evaluation. The strategic decisions in the game are following: (i) choosing a city to start with, (ii) choosing the power plant to or not to, (iii) choosing to or not to start ploy within the auction system. According to the after-action-evaluations there were 16 students who made no strategic mistake during gameplay, 8 students made 1 strategic mistake and 1 student made 2 strategic mistakes. Results can be seen in Fig. 3 – Bad decisions in gameplay.

Discussion about take away lessons

Students did fully recall the need of SMART goals only in 8 % of examined cases and only 8 % of students were able to propose the goals fully corresponding to the managerial situation they faced. If students set any goals 24 % of them were able to propose a corresponding strategy. These results are quite negative because of low rates. On the other hand 56 % of students proposed strategy with intended purpose (plan) and 64 % of them did not take a wrong strategic decision during the game.

These results show the dominant inability to use properly the competency of planning, which according to Lombardo and Eichinger (2009) means to accurately scope out the length and difficulty of tasks and projects; to set objectives and goals; to develop schedule; anticipate and adjust for problems and roadblocks; measure performance against goals; and evaluate results. On the other hand students showed the ability to foresee the situation, in major to take a good decision when needed.

As our intention was to find out what can be taken from playing the board game with students to the strategic management teaching, the statistical dependence of six variables on students grades from Strategic management course were calculated. The results we present in Table 1.

Testing dependence between:	Pearson´s chi square	P value	α
Level of rules knowledge vs. Grade	0.0188537	0.89079	0.05
SMART goals setting vs. Grade	na	na	na
Goals correspond with the main goal of the game vs. Grade	0.0267094	0.87018	0.05
Strategy correspond to the goals vs. Grade	0.0712251	0.78941	0.05
Type of strategy vs. Grade	0.0509907	0.82135	0.05
Mistakes evaluation vs. Grade	0.3216257	0.57063	0.05

Tab. 1: Dependence between monitored variables and grades

According to statistical test in Table 1 we found out no variable is dependent on the grades. Dependency between setting the SMART goals and students´ grades from previous Strategic management course could not be calculated as they did not meet the statistics´ conditions. Above mentioned results mean that the grades students gained in previous course did not have any influence on their behaving during the game (in each case is $P > \alpha$). As the grades from previous course represent the recognized level of knowledge which students achieved or demonstrated during the exam (written and oral) and the game we can see as a model of real strategic situation, therefore we can say students do not use their knowledge of strategic management in situation(s) or in the moment(s) where/when this knowledge should be used.

This result brings further analytical question: "Why do not students use the knowledge they probably have when facing the "real" managerial situation?" The most likely answer is: "They do not possess adequate knowledge." During the course we predominantly teach them explicit knowledge and we do not focus enough to experience also so called tacit knowledge despite the fact we use variety of experiential learning tools.

Conclusions

From the view of above presented results we agree with Mintzberg (2004) who said that many essential managerial skills can be learned only from personal experience and who also suggested a major change in management education which would allow students to gain more experience. Such a major change might be a change in portfolio of teaching tools which can provide more personal experience for students and thus can increase the tacit knowledge level.

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SYSTEM DYNAMICS METHODOLOGY: APPLICATION IN PROJECT MANAGEMENT EDUCATION

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Abstract

The article offers a new approach to teaching project managers in the creative industries. The teaching method that is presented in the article is based on system dynamics modelling and the principles of project management according to the international methodology PRINCE2 and it utilizes the principle of the Earned Value Management method of the Project Management Institution organization standard. The process of designing the structure of the systemic dynamic model is part of the education of students in the subject of project management. This method allows the students to understand the importance of system thinking in project planning. The project plan as a system dynamic model is designed so that when carrying out the project students will be able to compare the actual results achieved with the planned ones. This view provides a strong argument to the project manager for the implementation of early intervention in managing the project team.

Keywords

Earned value management, project management, system thinking, system dynamics model, cultural events

Introduction

When teaching project management at university, we come across students' doubts regarding the need for creating a project plan. Students often make a mistake arising from their insufficient understanding of the dynamic environment the projects are carried out in – they assume that the activities included in the project are separate events, and planning of outputs delays the process of the project implementation. Non-traditional system dynamics concept of instruction aims to make the students see the project the same way as we see it with the help of systemic thinking concept and system dynamics – as a flow of events that mutually influence one another in time and space.

The teacher's responsibility in the educational process is to explain the dynamics of project management to the students, and make their argument using something that is close to the students – modelling of the projects they solve themselves. That is the way to make students aware – with the help of a simulator – of the difficulties that they will have to handle later on as project managers in real life situations.

A simulation project model lives its own life; it is filled with data in the form of figures provided by students. The project model enables the students to understand the impact of managerial decisions on the project development. It is safe, cheap, effective and risk-free. It is the teacher's responsibility to create environment in which the students learn to understand the sphere of project management within context. Without a context there is no understanding or progress.

The objective of the article is to contribute to the process of increasing effectiveness of the

educational process in the subject of project management. Project management teachers are aware of their own responsibility for the future results of cultural projects managed by the graduates from our project management courses.

Students as managers of specific cultural projects require creative atmosphere in the team rather, than a qualified managerial approach. Managers of cultural projects find a creative project environment more important than detailed planning of project activities. They have little interest in consistent ongoing checking of the project outcomes, as production is quite on the edge of their interest. Project team members in the creative sphere are volunteers. This fact which partly determines the specific features of these type of projects. The work of volunteers is not free of charge, but it is not rewarded as is common in other industries. Nevertheless, not even in the student environment can we resign on the efforts that should be invested into project planning and management, since uncontrolled projects do not pay off in any organization in the long-term.

Theoretical Background to the GPS-PM Method

Yet, we cannot rely on traditional project management either. Managers' requirement for a detailed plan of a cultural event provided a couple of months ahead of time is feasible, but when the plan is implemented later on, new circumstances arise that were not included in the plan. In the cultural environment we have to rely on the project dynamics already in the course of planning by creative teams. A project manager in the cultural sphere needs to find ways of project management that support creativity, not supress it. Similar conflict within the need for project management methods in the environment characterized by constant changes is discussed by Manfred Saynisch (2010) in his article Beyond Frontiers of Traditional Project Management. Saynisch came to the conclusion that in projects we inevitably face dynamic situations and states of instability, and we face the need for progress to a higher level by an evolutionary leap (evolution of the 2nd degree; PM-2). Saynisch encourages further research into this new situation and calls on universities to participate in a research programme describing PM-2. This article deals with application in project management education of student projects carried out with the use of system dynamics modelling within real-life projects implemented at universities, and as such is a specific, independent contribution to the research (Saynisch, 2010). This article introduces a new approach to project planning with regard to monitoring of the actual progress of the project implementation. The method introduced in the article is based on system dynamics modelling and project management principles outlined in the internationally recognised PRINCE2 methodology. It also makes use of the principle set in the EVM method, which is a part of the standard of the Project Management Institute. The method resembles checking the route by a traveller with the use of GPS navigation (Global Positioning System Navigation), which is why we named it GPS-PM.

Research Methods

The GPS-PM method is a new method for project planning and management, which uses some elements of two process-oriented methodologies for project management. "A Guide to the Project Management Body of Knowledge" (2000) and PRINCE2 (2009). Apart from these two methodologies, the new method, GPS-PM, is based also on the system dynamic modelling.

The starting point for the development of the system dynamics tool for designing a plan and monitoring of the actual project development is the Earned Value Management method (hereinafter referred to as "EVM", A Guide, 2000). We adapted the method in order to use the elements that are well applicable on the projects in cultural sphere. For

measuring the values in the model we used the following key parameters: Planned Value (PV), the value of points in the plan for output production; Earned Value (EV), shows the number of completed outputs according to the project team members' reports, converted into points; Actual Costs (AC), are costs reimbursed for the project converted into points in agreement with the Planned Value concept and with the use of the BAC parameter; Budget at Completion (BAC), the total budget, a key parameter for determining the point values of separate budget costs.

According to PRINCE2 there are six aspects of project implementation that have to be always controlled (Fig. 1). With the use of the GPS-PM method in this article we control three of these aspects: Time, Scope, and Cost. The remaining three aspects can be controlled in a similar way and forecasted through simulation. Issues concerning incorporating these aspects (Benefits, Risk, and Quality) into the model will be subject to further research, which should lead to intended improvement of the GPS-PM method.

Fig. 1: Graph that shows Project Performance Aspects was created according to PRINCE2

Another foundation for the GPS-PM method is the international process-oriented methodology PRINCE2 (Projects in Controlled Environments, PRINCE2, 2009), with a process approach to project management based on the principle of dividing a project into manageable, controllable and monitored stages. The internationally recognised PRINCE2 methodology gives the GPS-PM method certainty as to what variables to select for modelling, and provides guidelines for the preparation procedure and creation of project documentation for the subsequent simulation, including forecasting the future development of the project.

The teacher's responsibility to the students while preparing new teaching concepts for the subject of project management includes his or her awareness of the fact that the university graduates will work within multicultural international environment. Therefore, it is essential that they master not only understanding of project as a dynamic system but also internationally recognized terminology and processes in project management.

Furthermore, the GPS-PM method is based on system thinking and system dynamics modelling (Forrester, 1961, Sterman, 2000, De Marco, Rafaele, 2006). The project plan is converted into a computer model, which simulates first the planned, then the actual behaviour of a cultural project. The GPS-PM method is designed with the use of software for dynamic simulation Vensim. For graphic depiction of the simulation outcomes, the programme Sable was used.

System Dynamics Methodology

The System dynamics deals with behaviour of complex systems over time. It focuses on describing and understanding a system and policy analysis. Computer simulation supports the understanding of complex dynamic systems (see e.g. Sterman, 2000, Forrester, 2009 or Krejčí, Kvasnička and Dömeová, 2011). The process of modelling with the use of system dynamics can be divided into five stages (Sterman, 2000): the first two steps (problem articulation, formulating dynamic hypotheses) concern qualitative modelling, while the other three steps (formulating a simulation model, testing, policy design and evaluation) concern computer-based modelling for quantitative simulation. The benefit of approaching the project planning as a model lies in the possibility to simulate the real and expected behaviour of the project in condensed time.

Problem Articulation

Computer modelling which was employed to monitor the project development has also certain disadvantages that we had to cope with. The model is not supposed to be the goal in itself; the aim of designing the model is to solve the questions set in advance. However, each project is specific and it is impossible to determine in advance what problem will have to be solved in the course of the project. We can set the problem to be solved only in general terms. In project management practice we can find a number of failures from the point of view of extending the project financial budget, extending the deadline or not meeting goals and objectives of the project. False steps or wrong assessment leading to losses are the results of insufficient or missing competence on the part of project managers (Bartoška, Svobodová and Jarkovská, 2011). The model certainly cannot pretend to be the real thing; it only reflects the reality with its many limitations. The actual project will probably behave in a different way than we expect. All the same, it holds true for system dynamics modelling that the model should be as simple as possible. That does not imply we can omit its important elements and their mutual relations, i.e. significant factors influencing the project development. The basis for the entry data is drawing up the Product Breakdown Structure (hereinafter referred to as "PBS", following the PRINCE2 methodology), determining the difficulty of individual outputs with the use of a common unit (points), arranging their production in a sequence, incorporating the completion of outputs into project stages, and setting the final deadline for completing all monitored outputs.

Formulating Dynamics Hypotheses

System thinking is the basic premise for creating a system dynamics model. The creation of the model is preceded by compiling feedback loop diagram for the project for organizing a cultural event, which can serve as a general basis for project modelling. The key feedback loop in the following picture (Fig. 2) explains the core of the mental model with the use of the system thinking tools.

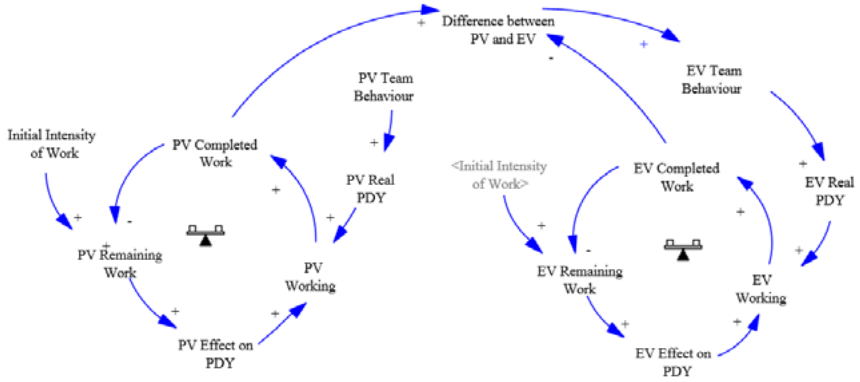

Fig. 2: Proposal of a simplified causal loop diagram for the GPS-PM method

According to Mildeová (2013), when we are solving a research question with the use of a model, we must work on the the principle that every cause is connected with both its effect and every other cause in a loop with feedback. First of all, the entry difficulty of the PBS element enters our train of thought. It influences the amount of the remaining work, i.e. the work stock, which has not been carried out yet. The amount of work remaining influences the work productivity (bigger amount of remaining work, higher productivity) and higher productivity leads to a bigger amount of work completed. A bigger amount of completed work causes lower stock of work not yet completed, which leads to a lower work productivity (PDY) and lower created value. The feedback loop is thus negative, self-adjusting, which is emphasised by the symbol of the balance state inside the loop. The plus and minus symbols next to the arrows show the tendency for growth or decrease for the following element in the model in comparison with the previous element.

Formulating a Simulation Model

The software used for modelling was the Vensim programme by Ventana Systems, Inc. (Vensim, 2005). In order to make use of the GPS-PM method we used the tools according to Hines – Structure molecules (2005). Our requirements for compiling a project model were met by a structure molecule: level of completed work protected by productivity. This structure molecule is designed to solve the problem of the level of remaining work which must not have negative value. The scheme (Fig. 3) shows – with the use of levels and flows – how project team members gradually reduce the level of remaining planned work by working on the project. This task is solved by getting to understand the change in value of the variable "productivity" (PDY) which must reach the value zero when no tasks remain in the level. The level of tasks decreases through the influence of the production flow, while the production flow is influenced by productivity which also decreases at the same time as the stock of work remaining. The aim is to create such a model that enables comparing the plan against the actual situation, and provides a possibility to forecast to what extent the plan will be fulfilled at the end of the time period determined for the project. We used the structure molecule because of the setting of the level of work remaining.

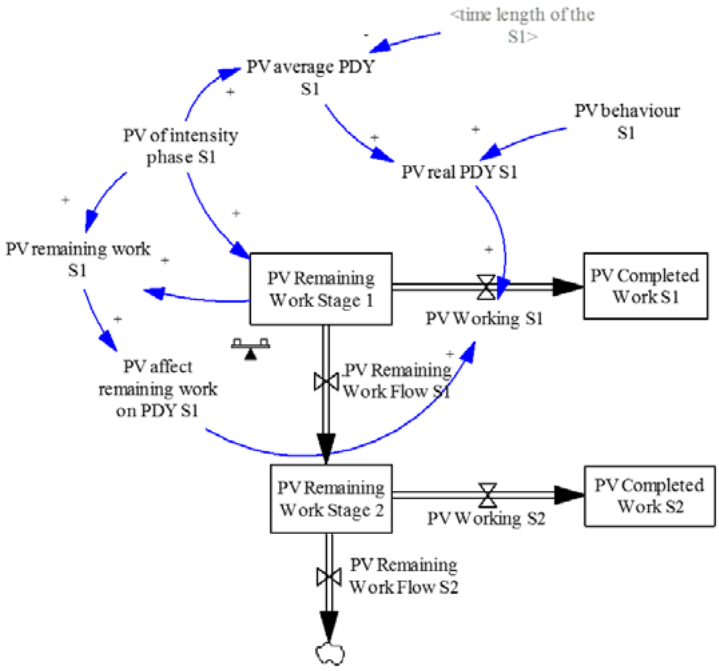

Fig. 3: Key part of the model: levels and flows within the project

The picture (Fig. 3) shows a part of the final model. The complete model is large and its full version is not published in the article. Nevertheless, the picture adequately shows the recurring basic sequence of the model elements and their mutual relations. The picture (Fig. 3) shows the three key elements characteristic for the whole model: the level of work that has to be completed (Work Remaining), the level of work that has been done (Completed Work) and the work flow (Working), which connects both levels.

Testing

The traditional project management (Saynisch, 2009) uses EVM method and other project management tools with the premise that we need to allow longer periods of time or allocate more workforce for more complicated activities. The EVM method uses man-days converted into money value as a measurable parameter. For our method, the measurable parameter will be the difficulty of the planned outputs of the project (not of its activities), which we also have to establish by estimate. We looked for a suitable approach to estimating the difficulty which would be simple and understandable for the project team. The following table (Tab. 1) presents a 60-point scale and a selection of nine possible states, and combines the variability of the procedure for achieving a quality output and effort on the part of a team member.

variability of procedure / team effort	Low variability of procedure	medium variability of procedure	high variability of procedure
low effort	max. 10	20	30
medium effort	20	30	40
high effort	30	50	60

Tab. 1: Proposal of criteria for allocating points to the key outputs – work packets

The Table (Tab. 1) shows the limit amount of points for evaluating the difficulty of outputs. Every output defined by the project team is evaluated (given points) in the same way, while each output can be divided into more parts for detailed planning of the next stage of the project.

In order to verify the GPS-PM method we used the plan and development of the project Conference. The project is managed by a team of students and we have monitored its modelling since the end of November 2013 when the 1st stage started. Interviews with the managers from the student team enabled us to find out not only the number but also the difficulty of outputs. The interviews resulted in a statistics which has been summarised in Table 2. The interviews were carried out in several stages. In the first stage, the students planned all project outputs and identified the project plan. We continued with the interviews after finishing each stage, in order to find out how the project implementation is progressing. In total, we prepared and carried out 4 sets of interviews. At the time when the modelling outcomes were prepared for this article, we assessed stage 3.

Project Team	Number of Outputs - PV	Activities	Output Difficulty in Points – PV
outputs - total	83	432	2130

Tab. 2: Statistics: numbers of outputs, relevant activities and difficulty in points

Results

Graph (Fig. 4) below shows the actually achieved value (EV = 1095, which will probably be achieved in the 20th week) in the project after completing stage 3 of the project, i.e. at the beginning of week 13. The graph shows the total planned difficulty of the project and total actually achieved value of the project at the beginning of week 13, while between weeks 13 and 22 it indicates forecast which is in agreement with the up-to-date behaviour of the project team members. Each stage lasts 4 weeks. The two final weeks (21st and 22nd week) are reserved for project assessment.

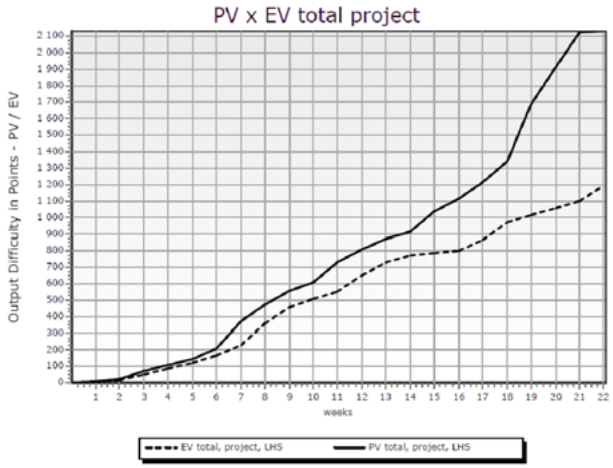

Fig. 4: Comparison of the planned and actual value of the work achieved within the project

The graph (Fig. 4) clearly shows that until week 5 the project team followed the plan. In the following period of time, especially at the end of stage 2 and 3 (beginning of weeks 9 and 13) a difference between the planned value and actually achieved value is beginning to show.

Therefore, another parameter will be added to the previously monitored and graphically assessed values (Fig. 4), i.e. costs, in both the planned value and actual value at the given moment. The parameter of costs is made understandable by converting financial resources planned and really consumed into points, so that the total number of planned points for costs equals the total number of points used in terms of money.

All three limitations of the project can be conveniently shown in one graph thanks to the usage of the GPS-PM method. We processed the plan into an independent system dynamics model, which contains the same variables as the model for project implementation. The plan is a comparative platform for monitoring the progress of project implementation. The plan is a model of a project and it can be said it is as good as it gets. Project implementation is a model which has the same basic structure as the project plan. We can add variables that slow down or speed up the work on the work outputs into the model which simulates the real implementation of the project. The project manager in cooperation with the Project Assurance team can analyse the reasons that lead to the delay in the reality against the plan, while assessing the actual progress of the project, and corrective measures to remedy this situation can be prepared.

Discussion

Cultural events are specific projects whose organization involves challenges that are hard to predict and not always possible to solve satisfactorily. A project manager is in most cases unable to foresee fully the impact of the current delay in project implementation against the plan within the context of the whole project before the project is completed. The traditional approach to project management is based on detailed planning of all activities from the beginning to the end of the project. The presented approach, which serves as the basis for modelling of the project progress, is based on project planning for shorter periods of time, or stages. At the end of each stage the progress of work assigned

for the particular stage is assessed by the management; the value of the actually achieved outputs is measured and compared against the plan. Detailed outputs for the following stage are planned only after the previous stage has been completed and assessed. Project management for cultural managers is based on the ability to measure the achieved project outputs and to forecast its future development. A tool for dynamic planning and monitoring the project development including the forecast is the simulation of project development and system dynamics modelling. The GPS-PM method complies with the new requirements that project management has to handle: to get past the limitations of technical and engineering disciplines and to create a procedure which will correspond with the trans-disciplinary and integration approach (Saynisch, 2010).

Creative environment must remain dynamic and must always offer new challenges, including the inherent possibility of changes to the planned processes. Yet, we shall not consent to purely intuitive management of projects in culture and creative industries. It is the teachers' responsibility to lead their students to efficient planning and understanding of project dynamics. We need a plan that will be adapted if needed, but that will still provide comparison against the results actually achieved. Moreover, in creative industry, we need to predict further development, terminate projects that make loss or do not bring real benefits for stakeholders. As Huang (2008) says students can get system thinking ability with SD-based teaching and this ability can help them improve their decision-making process in project management.

The efficiency of dynamic project planning with the use of a simulator is, however, limited in many aspects. The main problem that we encountered while simulating a real project implementation was the method of measuring the soft parameters that influence the workflow: behavioural competences of the team members. Competences can be measured, for example, with the use of a questionnaire, using scaling methods. However, we believe that the competences can be measured alternatively with the use of other creative methods. Their setup shall be subject to further research.

Conclusion

The advantage of the GPS-PM method lies in the possibility to incorporate exogenous variables, which can measure all outputs – planned, achieved, and predictable – as well as the financial resources invested into the project. Furthermore, we are able to model even parameters that are harder to quantify, those that represent the behavioural competences of the team members. Their setup shall be subject to further research. System dynamics modelling is useful for a team which carries out cultural events and other projects that are based on human creativity and invention, and whose outputs cannot be effectively specified in detail at the beginning of the project. The GPS-PM method contributes to the range of project management tools for monitoring project development. In further research, we would like to examine how to simulate not only scope, time and costs of cultural projects, but also other aspects of project implementation: benefits, quality and project risks. The method is used in real projects within the university environment and contributes to increasing the success rate of cultural projects.

Acknowledgements

I would like to thank all the students - cultural events managers and project team members for their kind collaboration regarding the interviews that I carried out with them. The paper is supported by the grant project IGA/MFS/2013/001 within the project 'Creative Class Potential in the Zlín Region: Audiovisual and Visual Arts'.

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STATE EXPENDITURES TO THE EDUCATION IN RELATION TO GDP AND THEIR IMPACT ON QUALITY

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Abstract

The aim of the study is to compare the Czech Republic state expenditures to pre-primary and primary education in relation to GDP with results of pupils achieved in knowledge tests. According to the international research PISA 2012, Czech pupils have improved in mathematics, but in comparison with other pupils are still mediocre and not too skilled in labor works. The survey also shows that Czech students do not perceive the school as a friendly environment. According to Eurostat data, no other Member State has issued so little money on preschool and primary education, meaning the kindergarten and the first years of primary school. Generally under-funded nursery and primary schools force parents to look for quality schools for their children, and therefore the Czech Republic has an above-average number of selective schools of all kinds.

Keywords

Education, European funds, GDP, knowledge tests, primary education, pupil

Introduction

There has been placing more and more emphasis on developing key and transferable skills and the ability to learn throughout whole life in the current Czech education system. If teachers want to educate young people to be well prepared not only for work but also for personal and public life and to be able to adapt quickly to dynamic developments in the labor market it is necessary to move education from narrow specialization to a broader knowledge-skill profile at all levels of the education system. The aim of this paper is to express the relationship between Czech state expenditures to primary education in relation to GDP and acquired competencies of pupils which were proved by international tests.

The issue of state expenditure to education of young people at different levels of Czech educational system can be found in works of Průcha (1999), Straková (2013), Kleňhová and Štastnová (2012) and other educators and politicians.

Since the mid-1960s, international agencies, such as the International Association for the Evaluation of Educational Achievement (IEA) and the Organization for Economic Co-operation and Development (OECD), have conducted many international tests - such as the Trends in International Mathematics and Science Study (TIMSS), the Programme for International Student Assessment (PISA), and their predecessors - of student performance in cognitive skills mathematics, involving science, and other subjects. In order to make performance on a total of 36 international tests from 12 testing occasions comparable, Hanushek and Woessmann (2009) develop a common metric to adjust both the level of test performance and its variation through two data transformations (Hanushek and Woessmann, 2010). The Program for International Student Assessment (PISA) focuses on older students (15-year-olds), and includes assessments on math, science, reading, and the cross-disciplinary problem-solving subjects. More than 40 countries have participated in

each of the three PISA studies carried out so far (i.e., 2000, 2003, 2006, 2009 and 2012) (Perez and Socias, 2010).

Materials and Methods

Pre-primary education and preschool education is defined as "putting early childhood to school-type environment" by the OECD in terms of methodology and present various types of educational programs for children of preschool age, most often implemented in kindergartens. Age entry is at least three years. More than 342 thousands children were attending kindergartens in the Czech Republic in the school year 2011/2012; it was over 354 thousands children in the school year 2012/2013 and the growing trend still persists (CZSO, 2014).

According to the International Standard Classification of Education ISCED (1997) primary education is characterized as the beginning of a systematic education, respectively Compulsory school attendance. "Only the first stage of basic education belongs to this level in countries where primary education is part of basic education. It means concluded primary education on this level of education in some countries (such as the Netherlands, Germany, USA) it is sometimes called an elementary school, while others countries (such as Sweden, Finland, Denmark and the former socialist countries) put only a few "early years of elementary school" into this level. The typical length of education is 4-6 years" (Kopecká, 2011). More than 795 thousands pupils went to primary school in the Czech Republic in the school year 2011/2012; it was almost 808 thousands pupils in the school year 2012/2013. Decreasing number of primary school pupils stopped two years ago and now it is increasing (CZSO, 2014).

Mainly descriptive method (particularly in Introduction) and comparative analysis (especially in chapter Results and Discussion) were applied when processing the paper. Quantitative analysis of the examined data is also suitably supplemented by graphs.

GDP and Expenditures on Primary Education

EU-27 countries spent about 160,000 CZK in average per pupil in primary education on 2011 but The Czech Republic spent only about half of this amount - 82,000 CZK. The Czech Republic has therefore a shameful leadership within the European Union. According to Eurostat data, no other Member State has issued so little money on preschool and primary education, meaning the kindergarten and the first years of primary school. According to data from 2011, the Czech Republic spent only 0.55 percent of annual GDP on these schools. EU-27 average is 1.69 percent and Denmark for example invests almost 4 percent of GDP to kindergartens and first years of primary school (see Fig. 1) (Eurostat, 2014).

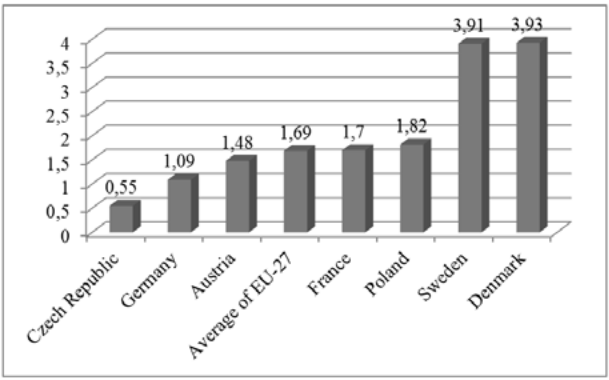

Fig. 1: The Czech Republic Expenditures on Preschool and Primary Education in 2011 (in percent of GDP) (Source: Eurostat, 2014)

This is the result of incorrect priorities of the Czech education system. According to Straková (2013) the Czech Republic has been characterized by low investment in preschool and primary education, and vice versa by high investments in secondary education for a long time. The development is in a conflict with the recommendations of economists and experts on education policy. "It is necessary that the financial resources expended on the education and transfer of knowledge are an investment and not a cost (Rauchová et al, 2013)". Straková believes that under-funded nursery and primary schools force parents to look for quality schools for their children, and therefore the Czech Republic has an above-average number of selective schools of all kinds. However, it is provable that due to the lack of money there are not enough spaces in nurseries and parents have to look for private ones.

There is a stabilization and slight strengthening of position of pre-school and primary education segment as a part of the ongoing reform of the financing of Czech regional education; however, it will probably not reverse the general trend. Thus the reform of the financing should lower risk that state will not guarantee the quality of education. „Risk can be viewed as a difference between the real future state and expected future state. This difference arose due to the change of risk factors, which translated utility of subjects" (Šrédl, 2010).

The Comparison of the Development of GDP in the Czech Republic and the EU

It is necessary to express the development of the GDP in the Czech Republic in relationship to other EU Member States next to the comparison of Czech state expenditures to the pre-primary and primary education. As the Fig. 2 shows, the gross domestic product per capita in the Czech Republic slightly declined in recent years compared with the average value of GDP in the EU. The value of Czech GDP decreased by two percent in relation to the EU-27 average in the year 2012 compared to 2009. The Czech Republic significantly lost against rich countries such as Germany and Austria, as well as poorer countries such as Slovakia and Poland over the past years. The process of moving towards the European Union in the Czech Republic virtually stopped for the past four years. This is especially because of the industrial nature of the Czech economy, which reacted very negatively to the Global Financial Crisis and the slump in demand of the EU. Czech pessimism associated with reluctance to spend has also increased the slump in GDP growth. According to Gallup

research institute more pessimistic then we were only Greeks and Swiss in Europe in 2012. This certainly affected the possibility of increasing of expenditures from the state budget to the education segment.

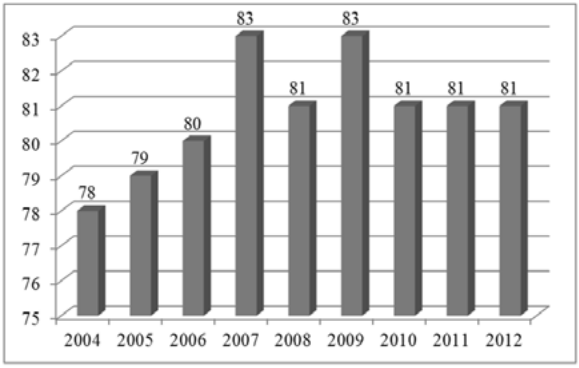

Fig. 2: Czech GDP per capita in purchasing power parity compared to the EU-27 average (in percent of GDP) (Source: Eurostat, 2014)

Results and Discussion

Position of Czech Students in International Comparative Tests (PISA 2012)

The Czech pupils have improved according to the international PISA survey in 2012, but they are still mediocre compared with other pupils. 6535 students from 297 Czech schools participated in the survey. British, Danes and Austrians have also similar results as we.

Czech pupils have gotten better in math for the past three years, but they are still not good enough. Just ten years ago the Czech pupils were much better in the knowledge of mathematics than they are now and they were above average worldwide. According to the survey there is currently one in five pupils aged 15 who is not enough fluent in math. According to the results of surveys boys are traditionally placed over girls in mathematics in all countries. In comparison of countries the most successful pupils in math tests are from Shanghai, followed by pupils from Singapore, Hong Kong and Taiwan, i.e. regions with predominantly Chinese community. Self-confidence plays a big role in mathematics for which the survey was specifically targeted. Czechs have considerably lower confidence compared to other students in the world which is negatively reflected on the results of math tests.

The results of Czech pupils in natural sciences are, in turn, above average in long term in the Czech Republic and abroad and results in natural science knowledge are generally comparable between boys and girls. Schoolchildren from Shanghai best succeeded even in a test of literacy, schoolchildren from Hong Kong, Singapore and Japan placed below them. Contrary to mathematics girls are better than boys in the context of literacy. Schoolchildren from Peru, Indonesia, Qatar, Colombia, Tunisia and Albania had the worst results from all tests (OECD, 2014).

Students from the Southern Region experienced the weakest results from all regions of the Czech Republic; schoolchildren from the Pardubice region were, in turn, the best. The Czech School Inspectorate also verified knowledge of all the children of the fifth and ninth grades in national tests in the CR. Contrary to the previous, northern Bohemia regions (Ústí nad Labem, Karlovy Vary and Liberec) had the worst results. These three regions

have the biggest problems with the quality of education at least in the Czech Republic in the last two years. For example, schoolchildren in ninth grade from Ústí were worse than schoolchildren from Prague in mathematics by almost seven percent. Differences in results from English tests were even larger.

According to the survey, Czech schoolchildren do not perceive school as a friendly environment. Evaluation of the school as a friendly environment by Czech schoolchildren is the lowest among the OECD countries. Czech Republic belongs to the countries with the greatest dependency of school results on social and economic background of schoolchildren among the developed countries of the world. Czech School Inspectorate will further analyze the international survey and will suggest solutions for improvement. Schools will also have a new opportunity to continually test schoolchildren due to the electronic database of tasks. "Study materials should be didactically prepared to alleviate the study to the maximum extent" (Bílý, 2006).

Higher subsidies from European funds would undoubtedly contribute to the growth of the quality of teaching in elementary schools which would lead to improving student achievements in knowledge tests.

Subsidies for education from EU funds

It is necessary to motivate preschoolers to be interested in mathematics and technical subjects to reduce slump of Czech pupils and students in international comparisons. Ministry of Education, Youth and Sport currently intend to use two billion crowns (approximately 80 million euro) from European funds to solve the problem.

The Czech Republic could draw 80 billion crowns (approximately 3 billion euro) at maximum for education and research from the EU till the year 2020; the new Operational Programme for research, development and education counts with a budget of 60-80 billion crowns for the years 2014-2020. Money will not be used for financing the construction of new research centers, as it has been until now, but will be used to improve and modernize education, support of handicapped students or attracting adults to lifelong education (Klimešová, 2013).

Nursery, primary and secondary schools could again apply for the finances in a simplified manner via so-called templates. The aim is to establish much easier way of allocating subsidies; these schools usually do not defraud, they do formal mistakes, but usually create necessary outputs as they undertook. Schools could draw European subsidies for example on buying modern teaching aids or on teacher education. Ministry of Education will further discuss the possibility that schools can use this money to pay for construction works related to the expansion of apprenticeship training department.

Elementary schools should however draw European subsidies primarily on e-learning, when interactive learning materials in a tablet would replace printed textbooks. The preparation of teachers for this change, connecting schools and the equipment itself should be paid from EU funds (Klimešová, 2013).

Priorities of the Ministry of Education Leading to Growth of Quality of Education

Ministry of Education, Youth and Sport therefore plans significant changes to improve the state of Czech education system and thus ensure qualified workers in the Czech Republic. Czech economy should be based on quality people in the future. The plan intends to make students more interested in math or in natural sciences; the system of school financing should also change. Even teachers could improve their positions: at first, the teachers would not need to do unnecessary administration and at second, there is ready new career system for teachers, which should be valid since 2015.

Priorities of the Ministry of Education, Youth and Sport include five activities to improve preschool, primary and secondary education (Chládek, 2014):

1. Introducing a state contribution which will be the same for every student and removes differences in quality between schools in the region. School in small villages will be encouraged at the same time for a better future success of schoolchildren.
2. Increasing of children's interest in studying mathematics and technical subjects.
3. Allowing schools to develop the framework educational programs, such as strengthening the working classes.
4. Increasing the prestige of the teaching profession via the introduction of a new career system providing professional career growth.
5. Reducing bureaucracy so the teachers and head teachers could have more time for teaching.

Also the Ministry of Education is recently considering the possibility of introducing compulsory one year of pre-primary education for children.

Conclusion

The study thus suggests the relationship between state expenditures to the education and results of Czech schoolchildren in knowledge tests. The Czech pupils have improved according to the international PISA survey in 2012, but they are still mediocre compared with other pupils. According to Eurostat data, no other Member State has issued so little money on preschool and primary education, meaning the kindergarten and the first years of primary school. This is the result of incorrect priorities of the Czech education system. The Czech Republic has been characterized by low investment in preschool and primary education, and vice versa by high investments in secondary education for a long time. There is a stabilization and slight strengthening of position of pre-school and primary education segment as a part of the ongoing reform of the financing of Czech regional education; however, it will probably not reverse the general trend.

In the future it will be necessary to consider increasing of funds from the state budget to primary education particularly on teachers' salaries to boost their motivation to improve the quality of teaching and thus improving student results in PISA tests. Therefore the proposal of the state budget by the Minister of Finance, in which are the planned resources to the education sector decreased by 2 billion CZK, seems irrational.

The ability of graduates to continue their education must be to a greater extent the result of elementary education next to the qualification for the profession. The first requirement is necessary with regard to the above needs of modern society, the second one supports easier employability of young people in the labor market and reduces the risk of unemployment.

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HIGH CLASS STUDENTS: COMPARISON, CHARACTERISTICS AND LIFE CONDITIONS

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Abstract

In the Czech Republic there is a strong intergenerational transmission of socio-economic status. Our paper is just one puzzle in the wide issue of inequality in tertiary education. We focus on the social origin and investigate the life conditions of the high class students and their characteristics. We want to find the Achilles heel of the topic of high class student with comparison to low class students.

Another issue appearing with this context is the difference between public and private sector. Private schools might be perceived as schools for privileged students according to the tuition fee, however, we find out attendance from the low class student group is also above average.

Using the data from EUROSTUDENT we analyse financial situation of different social classes. We determine no financial division between students from high class and low class as might be expected. Therefore we suppose the segregation starts much earlier.

Keywords

EUROSTUDENT, high class, financial situation, intergenerational transmission, social origin, social inequality

Introduction

The issue of inequality of access to education has been investigated from the early 1970s, for example Boudon (1974) and Bourdieu (1977) in France, Sewell (1971) and Jenks (1972) in the Unites States, Halsey (1980) and Goldthorpe (1979) in the United Kingdom or Erikson (1979) in Sweden. The issue was explored in detail from the view of education policy and barriers in the educational system or differences between countries or intergenerational transmission.

According to Bourdieu, the education system of developed countries is about to legitimate class inequalities. The success in the education system depend on cultural capital and higher class habitus, so the lower class pupil in general does not succeed often. While Boudone and Bourdiere investigated the education system, Sewell discussed it also in the context with access to the labour market and pointed that, life chances will not be equal until opportunities for advanced education are equal (Sewell 1971). Erikson, Goldthorpe and Lucienne (1979) tried to quantify the social class mobility (outflow and inflow) between Sweden, France and England, in order to disagree with previous statement that all Western countries are the same according to pattern of social mobility.

Tertiary education system in the Czech Republic went through a massive expansion in the last two decades (Mazouch, Fischer 2011), the increase in the last decade was by more than 70% (CZSO 2012). Although the number of students increased, the chances of acquisition of tertiary education are not equal. According to the publication “Who gets a degree” by Koucký, Bartušek, Kovařovic (2010), which considers parents´ education and

occupation in the Czech Republic to be still under the European level[1]. Also current data published in article by Fischer, Lipovská (2013) confirms impact of parents´ education on the adult educational level, which is especially closely connected in the case of tertiary education.

In our article we divide the sample into five social classes corresponding to a subjective question: "How would you evaluate your parents´ social status?". This question correlates with variables parents´ education degree and occupation. We are looking for characteristics of high class students and try to find connections to socio-economic variables, which might help to explain if students are advantaged or not. We focus on economic activity of high class students and compare it with low class. As follows we want to verify the hypothesis whether the differences in expenditures differ in social classes and what the difference is. Additionally, we want to confirm the statement that the stratification of social classes starts much earlier than at the university.

Materials and Methods

Our sample is from the survey EUROSTUDENT V[2]. EUROSTUDENT V was realised in all EU countries and is coordinated by local ministry of education. The main aim of the EUROSTUDENT project is to collect comparable data on the social dimension of European higher education. It focuses on the socio-economic background and on the living conditions of students, but it also investigates temporary international mobility. The project strives to provide reliable and insightful cross-country comparisons. The main users of our findings are higher education policy-makers at national and European level, researchers in this field, managers of higher education institutions and - of course - students within Europe.

Survey in the Czech Republic was conducted in two rounds during the year 2013. Questionnaires were addressed in all public, state and private universities during the survey EUROSTUDENT. It involved all public and state universities and 29 private universities. In total, 95,177 students were interviewed. The questionnaire entered a total of 6,382 students.703 questionnaires were not completely filled. 1,015 questionnaires had to be excluded from the survey.

We divided the sample in five social classes corresponding with a subjective question: "How would you evaluate your parent´s social status?" The analysis is focused on high class, which is determined by numbers 0,1 and 2 on scale from 0 to 10, where 0 means high class status and 10 means low class status.

Points on scale	0-2	3-4	5	6-7	8-10
	High class	Upper middle class	Middle class	Low middle class	Low class

Tab. 1 Social class categories

Social class categories are correlated with parent´s education and occupation, for more detail see Table 2. We considered the social status as the best variable, which would explain the real condition. Similar variables were used in the study by Reynolds, Ross (1998), where father´s education and occupation was an input to variable class origin

[1] Results from 2000-2009

[2] Data obtained in the survey EUROSTUDENTV, carried out within the project Ipn KREDO CZ.1.07/4.1.00/33.0005, both authors participated on the project

and also in publication by Koucký, Bartušek, Kovařovic (2010). All correlations were significant at the 0.01 level.

	Father´s education	Mother´s education	Father´s occupation	Mother´s occupation
Pearson Correlation	0.31	0.33	0.26	0.23

Tab. 2 Correlation with social class categories

In this article we mainly worked with ordinal variables. We used descriptive methods, correlation analysis, one-sample t-test and contingency tables. Data were analysed in SPSS using weight system set up according to the representative sample.

Results and Discussion

Characteristics

The high class consists of 398 students, which is 15.9% of the whole sample. There are significant differences between age categories. There are more young students in the high class (see Figure 1). Age is often a decisive characteristics according to previous research on EUROSTUDENT V. Age implies the economic activity of student, living conditions and also the choice between state or private universities.

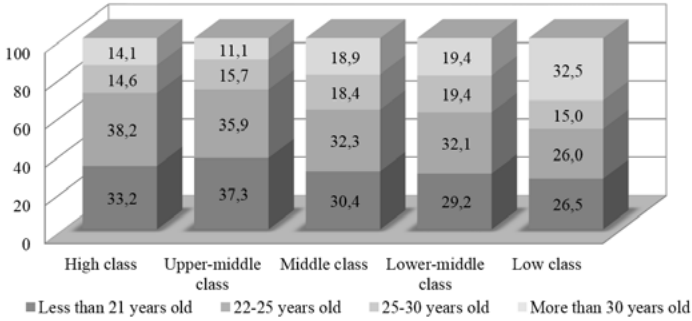

Fig. 1 Distribution of social classes by age (in %)

This diversity of age groups might partly explain the economic activity. 68.8% students from high class are economic active, in comparison to low class where 76.5% has some job. If we consider only economic active students we find a difference in job perception. While 60.1% students from high class perceived themselves as students with a paid job and 32.2% as employed, who also study, the share of these groups doesn´t differ that much for low class students. The question is: "Does the high class have to work less?" If the answer is "Yes" it might have an influence on the fact that students from high class attend more often the full-time learning, the high class students don´t have to work and can fully focus on studying.

In addition to characteristics connected with age groups, we distinguish between students at public and private universities. There are two forces going against each other. One of it is the tuition fee at the private universities predicting high class student will go to private school. On the other hand there is an increasing number of private institutions offering distance programmes, which are more suitable for employed students. There is a bigger proportion of employed students between low class students. That is why they

might prefer private school as well. The results on Figure 2 agree with these statements. Supporting literature for the second statement was by Ayalon et al. (2008). They consider the diversity of educational system as possibility for disadvantaged groups to participate on tertiary education and at the same time as a "second chance" for members of privileged groups, who for several reasons (academic skills, convenience) prefer those institutions. Even the article is based on United States and Israel school system, we might find a loosely link to our school system. The issue is, for whom actually are private institutions in the Czech Republic? One of their barrier is the tuition fee, on the other hand the entry conditions in general are usually not as hard as on private schools and they offer more programs for distance students[3].

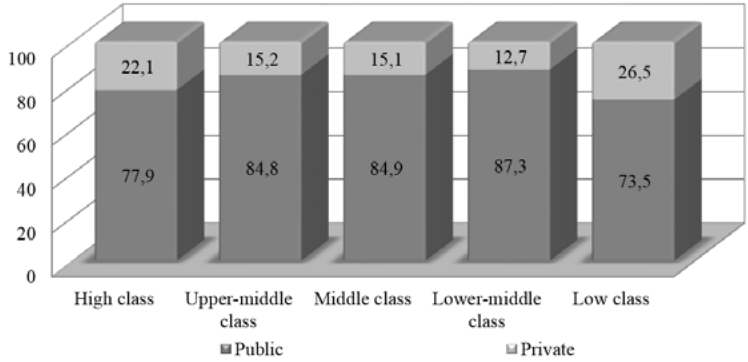

Fig. 2 Distribution of social classes by university type (in %)

However, in previous studies (Koucký, Bartušek 2009) there were found differences in choice of field of study, we cannot confirm this result. Differences between social groups for field of study were in our dataset insignificant. So we might assume the situation has changed.

As we already mentioned the social status is correlated with parent´s education and occupation. Although we don't know the exact age of student´s parents we can assume that it might be for most of the cases between 40 and 60. For these cohorts only about 14% of males and even smaller proportion of females attained the tertiary education level (CZSO 2011). This leads us to the statement that stratification starts in the earlier age of the student and the situation at universities is only a consequence.

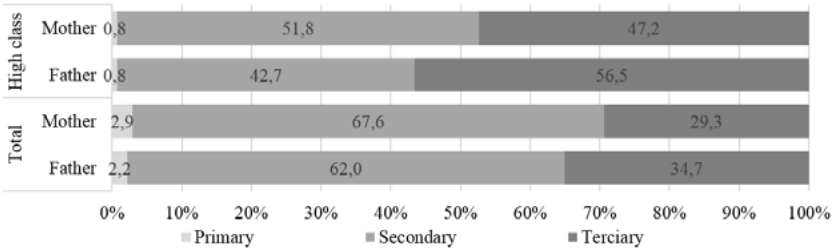

Fig. 3 Distribution of parent´s education (in %)

[3] Results from EUROSTUDENT V.

Life conditions

Surprisingly, when expenditures were explored, in total numbers there were not found any differences between expenditures of high class and low class students. Remarkably students from the low social class have higher average expenditures in total, they spend about 6% more than high class students.

First when we had a look at the structure of expenditures according to person who is paying them, we found a significant difference between amount paid by student and amount paid by someone else (see Table 2)[4]. High class student´s expenditures are from 42.9% covered by someone else, while low class student´s expenditure only for 37.8%. According to the result in Table 2, students from high class spend on average less money on repaying the debt. This number may reopen the question whether we have reasonable loans for students in Czech Republic.

	Expenditures paid by myself		Expenditures paid by someone else	
	High class	Low class	High class	Low class
Housing	1809	2901	2 626	1 822
Daily consumption	1864	2234	1 198	901
Transport	757	990	428	222
Phone, internet	319	413	209	136
Medical care	134	138	43	72
Child care	285	730	94	115
Repayment of debt	210	481	219	139
Culture and leisure time	838	757	218	80
Others	875	820	286	153
Total	7072	9464	5 306	3 641

Tab. 2: Expenditures by social classes (in CZK)

Conclusion

From the results about economic activity and expenditures we may assume that our systems count on (at least minor) financial support from parents. That is why students from high class are advantaged. They have more often the possibility to focus only on their studies. This may explain why they are in general younger, they don´t need to prolong their study time, because they only focus on school, not work. Another dominant advantage is the possibility to go to private school, because of sufficient financial sources for school fee.

According to the expenditures, we did not confirm the hypothesis that expenditures differ for high class students. But we found out that the source of money is different. The proportion of money given to students from parents is significantly higher by high class students.

We also suppose the segregation starts much earlier. This confirms the structure of parents´ education, which is for the whole sample from EUROSTUDENT totally different than

[4] Tested by one sample t-test.

the sample corresponding cohort in the Czech Republic. In our sample there is higher proportion of tertiary educated people.

Acknowledgements

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ANALYSIS OF FACTORS AFFECTING THE ADDED VALUE OF LEARNING IN FIRST YEAR BACHELOR ICT COURSES

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Abstract

The paper presents the analysis of level of skills and knowledge in ICT of first year bachelor freshmen that entered several study programmes in economy and technical fields at Czech University of Life Sciences in the academic year 2013/14. The main goal of the paper is to analyse the added value of learning in the informatics course among first year bachelor students. The analysis of the added value is based on data sampling (n=507) from entry test and examination test in ICT courses. Seven variables at the entry test and eight variables at the examination test were tested. Only gender and type of faculty had some influence on test scores. Differences between certain types of secondary schools and countries were also proved. We found that the level of acquired basic ICT knowledge and skills might be homogenized at bachelor level despite students' various backgrounds stemming from educational, geographical, demographical and even cultural differences in secondary education.

Keywords

Added value modelling (VAM), ICT knowledge, ICT skills, informatics, bachelor students

Introduction

Remarkable level of effort in outlining ICT (Information and Communication Technology) competencies of secondary school graduates can be observed these days in Czech educational system. Even there is a set of learning outcomes and competencies in ICT given by the national authority (the Ministry of Education, Youth and Sports), each school can set up its own educational programme with its specific learning outcomes derived from the national framework. Hence, the nation-wide school-leaving exam in ICT skills has not been introduced yet in the Czech Republic, the quality of ICT knowledge and skills of students entering the university from various secondary schools cannot be easily compared (Ocenasek, Ulman and Vydrova, 2013).

ICT skills are still getting higher importance in the contemporary economic environment. People working in positions of ICT professionals need to constantly expand their knowledge and they need to be combined with "non-ICT" knowledge, such as marketing or business (OECD, 2010) (EC, 2010). Impact of ICT on the whole economy is evaluated in majority of cases, and its general implementation and putting in use might be the boost to the economy (Hanclova and Doucek, 2011; Fischer and Vltavska, 2011). There is a relationship between ICT adoption and level of e-skills and e-knowledge as it was confirmed in Slovakia (Delina and Tkac, 2010). The e-skills education needs to be supported by higher education at both bachelor and master level. The distance between requirements of enterprises on ICT specialists' knowledge with university ICT study programmes needs to be found and compared. The distance is identified as the gap that should be reduced by university training and education, and that is based

on communication between enterprises and universities (Maryska and Doucek, 2012). Currently, there is a large discrepancy between the supply and the demand of ICT labour at the market. According to (Maryska and Doucek, 2012) results, the current bachelor study programmes do not provide sufficient knowledge spectrum for their graduates to enter the ICT business on leading positions without additional training in the Czech Republic. One of the recommendations is to set up the methodology for evaluation of competitiveness of ICT related study programmes across the country and to assess them with business requirements. With regards to disparities in university curricula and secondary schools' educational programmes we propose to analyse level of skills and knowledge in ICT of secondary school graduates that enrol to university bachelor programmes and become potential prospects for ICT labour market.

Although "student's progress" has been attracting attention of teachers and parents since history, the added value of education was introduced in half of 1980s (Koretz and Hamilton, 2006). Value-added modelling (VAM) provides a quantitative measure of student learning that can be supposedly attributed to the professional efforts of individual educators and schools (Sanders, 2000). Value added measures capture how much students learn during the given period of time (school year, semester) regarding their various levels of knowledge and skills in the beginning of studies (Ryška, 2009). According to OECD (2008), the term value-added modelling is used to denote a class of statistical models that estimate the relative contributions of schools to student progress with respect to stated or prescribed education objectives (e.g. cognitive achievement) measured at least at two points in time. However, it is important to compare the contribution of the school and other effects and factors that may conduce to learning. This is a very complex question that cannot be answered in a trivial way.

The development in the added value measurement was partially divided at primary and secondary levels of education while the tertiary level has some specifics as well (Ryška, 2009). The requirements for reaching excellent research and quality education become more diversified (Astin, 1999; Clerehan et al, 2003). The evaluation of education at the tertiary level is intended to identify output characteristics of learning. There are efforts to characterize the increase of knowledge and skills of students at higher education in a clear manner. The traditional approaches to assess higher education quality can be organized into four groups: (1) actuarial data; (2) ratings of institutional quality; (3) student surveys; and (4) direct measures of student learning (Chun, 2002). The direct measures of learning are appropriate means to assess the quality of undergraduate education (Chun, 2002). Docq, Lebrun and Smidts (2010) provide set of three criteria and thirteen indicators of the added value to measure effects of online learning in tertiary education, and conclude that to reach the added value in learning the technical and pedagogical innovations must be brought hand in hand.

Added value modelling is based on statistical methods and it assumes the normal distribution. But there are factors such as structure of study groups that are not random, students may be absent at the time of measure and they can select the school according the distance, transportation conditions, level of study costs and fees, teachers may select courses and study groups, etc. Therefore we should consider school data as observatory study rather than statistical experiment. Mere comparison of schools by average results or average test scores is incorrect and biased. Students' knowledge and education need to be interpreted fairly and correctly, not only tested. Efforts in added value modelling might help to compensate unequal conditions in education at different schools due to various

students' entry knowledge and education and various structures of study groups (Ryška, 2009).

The main goal of the paper is to analyse the added value of learning in the informatics course among first year bachelor students from different study programmes at the Czech University of Life Sciences. The research questions we want to answer are such follows: "Which factors influence the study results in ICT undergraduate courses? To what extent these factors can determine added value of education?"

Materials and Methods

Data were gathered through learning management system Moodle where all courses at Czech University of Life Sciences are placed. We examined first year bachelor students that entered in six different study programmes at two faculties in the winter semester 2013/2014. All students in the first semester of their study must take obligatory course Information and Communication Technologies at both faculties. Students from bachelor study programmes Economics and Management and Business Administration taught at the Faculty of Economics and Management both in Czech and English languages participated in the survey. Students from bachelor study programmes Agricultural machinery, Road Transportation and City Traffic, Trade and Business Dealing with Machinery, and Information and Control Technology in Agri-food Complex taught in Czech language took part in the survey at the Technical Faculty. In total, we obtained valid data from 507 students.

The added value was estimated as a difference between score reached at the entrance test and the score of the examination test. Firstly, students in the observed cohort took the entrance test that covered basic identification of their previous secondary studies as to gender, type of school, year of graduation, whether the state school-leaving exam was taken and in which subjects, and city and country of the graduated school. Students also needed to answer eleven questions on basic topics in ICT. The extent of questions followed the Catalogue of Requirements in Informatics that was introduced by the Czech Ministry of Youth, Education and Sports in 2010 and which could be taken as a common set of knowledge, competencies and skills for undergraduate freshmen (Ocenasek, Ulman and Vydrova, 2013). Secondly, the results of the examination were downloaded from LMS Moodle and study information system Hroch.czu.cz. We counted only the results of the first attempt of the examination test.

The analysis of the added value is based on data sampling from entry test and examination test in ICT courses and evaluated by descriptive statistics, hypotheses testing and regression analysis in SAS program. Hypotheses were tested by means of two-sided test to tell the difference between population and sample mean values (Siegel, 2011). The relationship between the type of secondary school and students' performance, and its strength were investigated by means of linear regression model (Siegel, 2011).

Results and Discussion

The first part of the analysis aimed to reveal which factors have influence on the score of the entry test and which factors affect results of the examination test. The factors and hypothesis are listed in the Tab. 1 below.

Entry test	Examination test
H1 – Gender	H1 – Gender
H2 – Secondary school	H2 – Secondary school
H3 – Country	H3 – Country
H4 – State school-leaving exam	H4 – State school-leaving exam
H5 – Graduation in the year of entry	H5 – Graduation in the year of entry
H6 – Maths at state school-leaving exam	H6 – Maths at state school-leaving exam
H7 – Faculty	H7 – Faculty
	H8 – Entry test result

Tab. 1: Factors influencing entry and examination test results

The null hypothesis stated that the averages of both groups are equal. Hypotheses H1, H4, H5, H6, H7 and H8 were tested with non-parametrical tests because the normal distribution of the dataset was not confirmed (Siegel, 2011). Hypotheses H2 (secondary school) and H3 (country) were tested with Kruskal-Wallis (KW) test that does not assume normal distribution of the dataset (Siegel, 2011) – see Tab. 4.

The influence of gender (H1) and type of entered faculty (H7) on entry test results was confirmed and hypotheses were accepted at the 0.05 significance level (see Tab. 2). The impact of the state school-leaving exam (H4), graduation in the year of entry (H5) and mathematics at the state school-leaving exam (H6) on the entry test results were not confirmed and these hypotheses were rejected at the 0.05 significance level.

Two-Sided Pr > |Z|	Entry test	Examination test
H1	<.0001	0.0151
H4	0.2194	0.5004
H5	0.7728	0.7072
H6	N/A (multiple choices)	N/A (multiple choices)
H7	0.0001	-
H8	-	<.0001

Tab. 2: Hypotheses testing of factors influencing tests results, α=0.05

The influence of gender (H1) and type of entered faculty (H8) on the examination test results was confirmed and hypotheses were accepted at the 0.05 significance level (see Tab. 2). While state school-leaving exam (H4), graduation in the year of entry (H5) and mathematics at the state school-leaving exam (H6) impact on the examination test results were not confirmed and hypotheses were rejected at the 0.05 significance level. Faculties (H7) are examined in Tab. 3 (see below).

Differences between genders in performance in ICT courses correspond with the same findings of the previous study on ICT courses (Ocenasek, Ulman and Vydrova, 2013). Gender differences in study results can be generally anticipated also in non-IT courses (Kovarova, Kucera and Navratilova, 2012). Exact differences between genders and faculties are summarized in Tab. 3. Interesting fact is that freshmen at technical faculty gained slightly better score at the entry test, but performed much worse at the examination test than their economic faculty peers.

Factor	Value	Female	Male	Difference [% points]
Gender	Entry score [%]	44.5	58.9	-14.4
	Exam score [%]	53.9	50.0	+3.9
		Economy	Technical	
Faculty	Entry score [%]	51.1	56.4	-5.3
	Exam score [%]	61.6	45.7	+15.9

Tab. 3: Comparison of average score of entry and exam tests by gender and faculty

The differences between female and male scores were larger at the entry test, but much smaller at the examination test. Females ranked almost equal in performance as males at the examination test. Larger contrast can be seen between faculties where the gap increased to 15.9 % points at the examination test in favour of the economy faculty. The students from the economy field are also taught to become competent to work in management and to cooperate with ICT specialist so they are expected to have fundamental knowledge in ICT. Whereas the students from the technical field are rather profiled to become specialized in technical issues including ICT. This brings also minor variances in teaching hours donations and curricula at both faculties.

To test the hypotheses of the impact of secondary school type (H2) the KW test was used because more than two groups were compared (Siegel, 2011). We tracked secondary schools such as: grammar, technical, business, lyceum, vocational or other. The null hypothesis was rejected both for entry and examination test. Significant differences in average score of entry test were detected only between technical schools and other types of school (+15.3 % points). The average scores of exam tests were significantly dominated by business schools over technical (+12 %) and vocational schools (+13.3 %), then other schools over technical (+11.2 %) and vocational (+12.5 %) schools, and grammar schools over technical (+7.4 %) and vocational schools (+8.6 %). It seems that students coming from technical schools were better prepared for the entry test in ICT skills but reached worse score at first attempt of the examination than students from most other schools.

Pr > Chi-Square	Entry test	Examination test
H2 – Secondary school	<.0001	<.0001
H3 – Country	<.0001	0.0021

Tab. 4: The influence of type of secondary school and country on tests results

The impact of country where the secondary education and school-leaving exam was taken (H3) was also tested with KW test. The null hypothesis was rejected both for entry and examination test, which signals a significant difference in average score of entry test between some countries. The differences were detected between the Czech Republic and former Soviet Union countries (Russia, Kazakhstan, Ukraine, Uzbekistan and Kyrgyzstan). The first reached by 14.7 % points higher score than the latter. There were major differences at the exam test where students from Asia (mostly Vietnam) win over former Soviet Union (+19.2 % points), the Czech Republic (+20.9 %) and Western Europe and Overseas (+28.5 %).

Finally, the regression analysis between entry test and exam test scores was conducted and produced the model for % score of examination test: 45.45382 + 0.10538 * entry test score (all parameters are statistically significant). However, the R-Square value was

negligible (0.1 %). The regression model based on student's performance in the beginning of semester does not correspond with achieved learning results in the end. Fig. 1 displays predicted values of points in examination test in relation to achieved test results. In this case, the added value of ICT courses taught for first year bachelor students cannot be stated as a mere difference between scores of entry and examination tests. However, we can tell that despite the entrance level of skills and knowledge the output test score was given mainly by what students learned during the semester and not so much by their previous knowledge and skills. The highest added value was received by those students that are capable and used to learn.

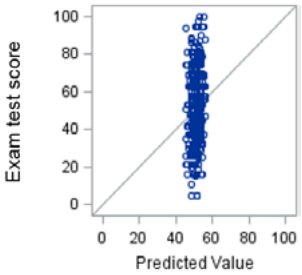

Fig. 1: Predicted value of the examination test score based on the entry test score

After consideration of results of similar studies and literature review following variables were chosen: previous study (secondary school type, state-leaving exam, year of graduation), demography variables (gender, country), and point scores in the entry test and the examination tests. The set of variables fall to direct measures category (Chun, 2002). The most remarkable influencing factor was gender. Other influencing factors such as the population of the locality where they reside and the fact of devoting time exclusively to study or combining study and work (Jaen and Ferra, 2011) were not regarded. The student's self-assessment was not included, but it might have impact on their ICT skills (Volman, Van Eck, Heemskers and Kuiper, 2005; Lofstrom and Nevgi, 2007; Kubiatko and Halakova, 2009; Verhoeven, Heerwegh and De Wit, 2010; Dukic and Kozina, 2012). The indirect impact could also have the further professional development of teachers (Docq, Lebrun and Smidts, 2010).

Conclusion

The paper summarizes the effort to evaluate and measure the added value of learning in first year ICT courses at the Czech University of Life Sciences. The survey was based on data retrieved from entry test and examination test. Seven variables at the entry test and eight variables at examination test were tested as to the impact on the test scores. Only the influences of gender, type of entered faculty, difference between certain types of secondary schools and countries were proved. However, there was no significant relationship between the entry test score and the examination test score. We can conclude that the previous secondary studies, location and performance in the entry test has no significant impact on the outcome of the study results in first year ICT courses. On the other hand, those students that performed worse in the beginning of the course were able to reach better results in the end. Direct measures of student learning should not be the only indicator of success and value-added modelling. The extended survey should be

implemented including students' self-assessment on ICT skills at the beginning and the end of course.

Our study brings contribution with findings that the level of basic ICT knowledge and skills might be homogenized at bachelor level despite students' various backgrounds stemming from educational, geographical, demographical and even cultural differences in secondary education. When we know that students can be trained efficiently to certain level of ICT skills in the system of bachelor higher education, the question that still remains is how and to what capacity these skills meet business requirements at the labour market and in the practice.

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DEVELOPMENT OF TRAINING METHODS USED IN CZECH ORGANISATIONS

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Abstract

Training and employee development form an integral part of each and every organisation since they represent a tool for achieving a competitive advantage. It is therefore necessary for organisations not to underestimate this important activity and to pay sufficient attention to it. The main objective of the article is to identify and evaluate the use of training methods in Czech organisations in the period 2011–2014 and to evaluate causal associations. Primary data has been obtained by means of a quantitative survey carried out in organisations in the Czech Republic. The outcomes show that the majority of organisations observed conduct systematic employee training. The most frequently applied methods in the above-mentioned period are lectures (in more than 63% of organisations) and self-education (in more than 62% of organisations). Usage of methods depends on an existence of human resource department and size of organisation.

Keywords

Learning/training methods, employees, organisations, competitive advantage, survey

Introduction

Increasing technical demands of production, opening of new markets as well as growing competition require technical enhancement of production processes, improvement of the quality of production and services, and the introduction of information technologies and innovations on the part of organisations (Kachaňáková, 2013; Finegold et al. 2009; Vodák and Kucharčíková, 2007). All this is possible only with quality employees. The field of human resources thus becomes one of the most dynamically developing areas of organisational management (Farrar-Myers and Dunn, 2010; Cambridge, 2008). Organisations should therefore support employee training and development. At present, education is becoming a life-long process in which organisations and their training activities play a very crucial role (Stacho et al., 2013). Often the efficiency of employee training depends primarily on the approach of heads of human resource departments. It is essential to view employee training as an investment that returns in the form of trained and skilled employees (Kontoghiorghes et al. 2005; Johannessen and Olsen, 2003).

The education process is thus increasingly determined by organisations and their training activities (Stacho et al., 2013). More and more attention is being paid to development activities that focus on a spectrum of knowledge and skills which are broader than currently required by the job position as well as on shaping employees´ personality, their value orientation and also their adjustment to the organisational culture (Stacho and Stachová, 2013; Šujanová et al. 2012; Koubek, 2011).

The objective of the article is to identify and evaluate the use of training methods in Czech organisations in the period 2011–2014 and to evaluate causal association (to test dependencies between the selected quantitative characteristic). The first part of the article

focuses on the theoretical background of training issues in organisations while the second part presents, compares and evaluates the findings of the survey in the field of training in individual years. The final part summarises the conclusions of the article and proposes recommendations for organisations. It also provides the theoretical and practical benefits of the article and outlines the future direction of the research.

Materials and Methods

The article is composed of two crucial parts, i.e. theoretical background that was developed on the basis of an analysis of secondary sources of scientific journals and monographs and the findings of the primary research obtained through a quantitative survey and data collection conducted by means of a questionnaire technique. The questionnaire was aimed at the level of implementation of individual human resource activities in organisations including employee training. Within the frame of the article, methods of synthesis, deduction and induction were also used and the results from years 2011/2012, 2012/2013 and 2013/2014 were compared. Organizations that took part in the survey were selected by random quota sampling from organizations presented on Internet and actively participating organizations. Their managers were addressed; the structure corresponded to the structure of organizations in the Czech Republic according to the Czech Statistical Office (business sector, size). The questionnaire was completed by managers of these organizations on the middle and top management by email. The formulation of questions has arisen from co-operation with School of Economics and Management in Public Administration in Bratislava.

The primary survey in 2011/2012 was conducted in Czech organisations. A total of 109 randomly selected organisations took part in the survey. The structure of these organisations was as follows: **According to business sector:** 71.6% from the private sector and 28.4% from the public and state sectors. **According to size (number of employees):** 49% of organisations with less than 50 employees, 29% with 51 to 249 employees; 22% with 250 and more employees. A total of 43.1% of organisations have a human resources department established and 53.2% of heads of these departments belong to the organisation´s top management. This is in compliance with Kachaňáková (2013) and Koubek (2011) who emphasise that human resources management policy and strategy need to be based on companywide policy and strategy, which is easier to achieve if HR employees form part of an organisation´s top management.

The primary survey in 2012/2013 was also conducted in Czech organisations with the participation of 364 organisations. The structure of these organisations was as follows: **According to business sector:** 63.5% from the private sector and 36.5% from the public and state sectors. **According to organisations´ size (number of employees):** 37.1% with less than 50 employees, 27.5% with 51 to 249 employees; 35.4% with 250 and more employees. A total of 45.6% of organisations have a HR management department established whose activities are targeted at employee training. In 57.1% of organisations the position of an employee responsible for human resources management is included in their top management.

The primary survey in 2013/2014 was also conducted in Czech organisations with the participation of 167 organisations. The structure of these organisations was as follows: **According to business sector:** 76.7% from the private sector and 23.3% from the public and state sectors. **According to organisations´** size (number of employees)**:** 31.2% with less than 50 employees, 34.7% with 51 to 249 employees; 34.1% with 250 and more employees. A total of 52.1% of organisations have a human resources department

established and 67.1% of heads of HR departments hold a position in top management.
To evaluate the outcomes of the survey methods of descriptive statistics (absolute and relative frequency, testing of dependency between set qualitative characteristics and power dependency test) have been applied. The Pearson´s Chi-square test and Cramer´s V have been applied. If the p–value calculated by means of the $\chi 2$ test (Pearson Chi-Square) was lower than the selected level of significance $\alpha = 0.05$, null hypothesis was rejected. The analysis was carried out using the Microsoft Excel 2007 statistical software SPSS 20. There were tested: H0: The use of the identified learning methods do not depend on the size of the organization. H0: The ways of learning do not depend on the size of the organisation; do not depend on existence of HR department and business sector.

Theoretical Background of the Paper

Although the knowledge, skills of employees are important for the organization nowadays, it is not given the sufficient attention in organisational learning/training. Within the frame of the theoretical background the system of employee training and the approach of organisations to employee training and individual training methods have been characterised. Finally, the results of using learning/training methods in Czech organisations are presented in the chapter "Results and Discussion".

Training System in Organisations

Armstrong (2007) states that learning does not primarily take place within the frame of formal training programmes. People may learn up to 70% of what they know about their work through strictly informal processes that are not organised or supported by organisations. Informal training is learning by experience. Formal training means a planned and systematic process that takes advantage of structured training programmes, incorporating instructions and practical testing of the knowledge learned (Gravill and Compeau, 2008; Varol, 2010). When determining the desired qualification of its labour, an organisation should follow its written training and employee development strategy and policy (Dvořáková, 2011). The short-term as well as long-term positive impacts of training will only become evident if training is closely linked with an organisation´s mission, vision and strategy and if carried out in a professional manner (Chatti et al. 2010; Vodák and Kucharčíková, 2007).
According to an organisation´s approach to training, it is possible to distinguish three basic approaches to the development (and subsequently implementation) of a training policy and strategy (Dvořáková, 2007):

1. Organisations without any strategy. Employee training is not included in their strategic priorities.
2. Non-systematic conception of internal training. Training in these organisations takes place on a casual basis and is aimed at the satisfying of actual needs.
3. Systematic training. Organisations pay continuous attention to employee training and development and these factors become one of the key issues of personnel activities.

Training methods are a tool to realise the training process. The choice of a training method should correspond with an organisation´s individual needs and requirements (Vodák and Kucharčíková, 2007). Some methods support knowledge sharing, another support skills development. It is possible to distinguish between on-the-job training methods which stress the mastering of the necessary skills and the required work behaviour and off-the-job training methods focusing on acquiring expertise. In practice, however, various

modifications may be seen which reflect specific organisational needs (Dvořáková, 2007). A common feature of on-the job methods is the possibility of an individual approach to the trained employee. For these methods (e.g. coaching, mentoring, delegation, job rotation, etc.) the personality of the trainer, his/her will and ability to teach, listen and provide feedback play a very important role (Dvořáková, 2007). Off-the-job training anticipates a collective nature and is aimed at more participants (e.g. lectures, demonstrations, case studies, workshops, brainstorming, simulations, role playing, etc). A number of these methods permit a certain level of variability and adjustment to the group of employees trained (Chatti et al., 2010; Gravill and Compeau, 2008). Off-the-job training is usually organised by both internal training units (that are well acquainted with the organisation´s environment) and external trainers or educational institutions (Dvořáková, 2007). With respect to the above-mentioned characteristics of training methods it is possible to summarise that off-the-job training methods are primarily suitable for the development of work skills of managers or specialists. On the grounds of the summary of the theoretical background it is possible to state that the most efficient method of employee training in organisations is well-organised systematic training (Stacho et al. 2013; Kantoghiorghes et al. 2005; Urbancová and Urbanec, 2013; Koubek 2011; Dvořáková 2007). It is, however, necessary to ensure that employees are prepared and most importantly willing to learn. People have to realise what they need to know and what they need to be able to perform. It is also necessary to ensure that they are willing and able to accept responsibility for their education by making full use of the existing sources of training (Armstrong, 2007). Vodák and Kucharčíková, (2007); Kleibl et al. (2001) and also Armstrong (2007) refer to the importance of the approach of employees as participants of the training process to training. Motivation to learn is a very important and a key factor of the training process which also significantly determines the efficiency of training (Stacho et al., 2013).

Results and Discussion

Based on the evaluation of the survey outcomes it is possible to summarise how organisations in the Czech Republic approach the area of employee training. In years 2012/2013, training issues were dealt with by 78.02% of organisations while in years 2013/2014 the figure increased to 82.04% of organisations. The outcomes reveal that in the monitored years 2011 to 2014 a major part of organisations systematically plan both in-the-job and off-the-job training activities (for detailed results see Table 1). These are organisations with a personnel strategy of systematic training. In years 2011/2012 and 2013/2014 they included a series of time-limited training activities and tasks to be fulfilled (42.10%; 23.95%). Organisations also used planned methods of training not requiring further task fulfilment (e.g. self-learning, e-learning, etc.).

Ways of learning	2011/2012	2012/2013	2013/2014
Planned, a series of training activities is planned for a certain period of time with tasks to be fulfilled in between individual courses	42.10	21.15	23.95
Permanent training, both internal and external trainers provide training “on-site”	8.40	7.14	7.78
Limited to obligatory training	28.0	6.87	6.59
Unplanned, the necessary courses are organised as needed	21.50	16.48	20.96
Planned, a series of training activities is planned for a certain period of time	0.00	26.36	22.75

Tab. 1: Ways of learning and training in the Czech Republic in %

Nevertheless more than 1/3 of responding organisations do not plan training in advance; it is a random activity carried out as needed (development in the years monitored: 21.50%; 16.48%; 20.96%). These organisations have a non-systematic conception of internal training. Organisations that organise solely obligatory training belong to the category of organisations without a training strategy. An access of organisation to ways of learning depends on size of organisations (p-value=0.000; Cramer´s V=0.594, substantial in 2011/2012; p-value=0.000; Cramer´s V=0.595, substantial in 2012/2013). Ways of learning thus depends on existence of HR (p-value=0.000; Cramer´s V=0.460, substantial in 2011/2012; p-value=0.000; Cramer´s V=0.451, substantial in 2012/2013). The dependency on business sector was confirmed in 2012/2013 only (p-value=0.022; Cramer´s V=0.145, low in 2012/2013).

The survey also concentrated on the application of individual training methods (on-the-job and off-the-job). Organisations´ representatives were allowed to mark all methods used by their organisation (i.e. the possibility of giving more answers). The results shown in Table 2 reveal that the most commonly applied methods are lectures, followed by self-learning. The most common method used in practice is so-called blended learning, which is a combination of e-learning and lectures. On the contrary, the least frequently applied method is videoconferences.

Methods	2011/2012	2012/2013	2013/2014
Self learning	66.97	62.09	64.67
Outdoor training	18.35	12.09	19.16
Coaching	22.01	19.78	25.15
Mentoring	11.93	10.71	22.16
Internet	30.28	31.87	32.34
Videoconference	3.67	6.04	13.17
E-learning	29.36	29.95	37.13
Practical learning abroad	8.26	11.54	16.77
Rotation	16.51	17.58	23.35
Lectures	77.06	63.46	68.26
Case studies	24.77	25.55	40.12

Tab. 2: Using of learning and training methods in the Czech Republic in %

Practical experience gained abroad and job rotation has shown a continuously growing trend in the period monitored. Other methods, such as the internet, coaching, etc., demonstrate a relatively balanced trend. The using of all tested methods in 2012/2013 (see Table 2) depends on size of organisation (H0 was rejected) except for Outdoor training (p-value=0.169) and Internet (p-value=0.737). The power of dependency (Cramer´s V) was from 0.159 (low) at practical learning abroad and to 0.303 at E-learning (moderate). The situation in 2011/2012 was very different. There were dependence only at E-learning (p-value=0.019; Cramer´s V=0.269, moderate) and Case studies (p-value=0.005; Cramer´s V=0.312, moderate).

On the basis of the theoretical background and the survey outcomes it is possible to summarise that it is an obligation of each and every employer to provide initial training to every newcomer. Deepening of qualification and other employee development through training is an obligation of each individual employee – s/he must show the will to learn – and secondly an obligation of employers. Despite the fact that qualification broadening may be primarily considered an employee´s issue, at present employers are constantly recommended to support such activities. This is because investment in employees is one of the most efficiently invested funds. Last but not least, it is necessary to realise that creating conditions for learning and further individual development motivates employees and increases their overall satisfaction with the job performed, which is confirmed also by Stacho et al. (2013) or Kontoghiorghes et al. (2005). It also facilitates human resource branding.

Research conducted by Finegold et al. (2009) states that at present (in the course of the last 15 years) the number of employees working part-time or temporarily, etc. continues to grow. However, these employees need to be trained too. There are two opposing views. The first one (conventional) says that these employees are not as loyal and stable as organisations would wish them to be. Therefore employers do not want to invest in their training, since trained part-time (temporary) employees are sought after also by competitors and there is a threat of their leaving. The second opinion is based on the premise that gaining experience and undergoing training is not only beneficial to employees, even temporary ones, as it broadens their skills, but is also an asset for the organisation. The latter theory which sees employees as an organisation´s asset stimulates organisations to invest in their

training, realise the importance of the human factor as its wealth and approach it as such. At first, organisations must correctly identify the need of training programmes, then plan training activities according to personnel plans and implement them correctly. This must be followed by the evaluation of outcomes of the training conducted, which is considered the most important task for organisations organising such employee training programmes. If an organisation develops a correct plan that is subsequently implemented, then it brings the advantage of financial savings.

Conclusion

Achieving long-term success by any organisation is determined by qualified employees. Therefore organisations, in order to have qualified employees and thus to fulfil the set goals, need to conduct systematic training to ensure their success. Each organisation selects such a form of organisational training which is in harmony with its set human resource strategy. The strategy becomes the "alpha and omega" of defining of an organisation´s systematic training which includes: needs identification, planning, implementation and subsequent evaluation. Each organisation selects its own training methods; most frequently off-the-job (e.g. lectures) and on-the-job (e.g. coaching, mentoring) methods are combined. The outcomes have revealed that the majority of organisations that took part in the survey conduct training for their employees and develops their knowledge, skills and abilities. The selected mix of training methods depends on size of organisations and existence of HR department. It corresponds with other current surveys (Kachaňáková, 2013; Stacho et al., 2013). The theoretical merit of the article lies in the verification of theoretical premises for the application of individual training methods. Its practical contribution lies in the presentation of the results of application of training methods in Czech organisations and their development with respect to trends in training. Future research will focus on the identification of differences between the use of individual training methods for individual categories of employees (employees without practice, experienced or senior employees) and on the comparison of results in the area of training with the Slovak Republic where similar research takes place.

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STUDENTS' RESULTS RELATION TO SUBJECT STRUCTURE

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Abstract

University studies cover a broad extent of knowledge. Individual subjects usually have more than one topic and often intersect with one another. Nevertheless, for the core subjects of a specific study programme it is typically possible to identify a set of common principal topics. The topics can be related to particular students' skills and competencies and thus arrange the subjects into groups. The students' skills and thus the subject grouping should be reflected in the students' results. The aim of the paper is to determine whether any structure can be observed in the students' exam grades and if so, whether the structure is related to the subject grouping.

Keywords

programming education, computer science education, students' results analysis, clustering, dendrogram, subject structure

Introduction

The paper is part of ongoing research at the Faculty of Informatics and Management of the University of Hradec Králové into how students' aptitude projects to their results. Milková, Petránek and Janečka (2012), Milková and Kořínek (2013) and Petránek, Janečka and Milková (2013) studied the association between results in a programming aptitude test taken at the very start of the first term and the results in the term test in the algorithmic design subject.

In Vaněk and Ježek (2013) we presented the role of computer graphics subjects within computer science curricula and we advertised computer graphics as an efficient and motivating platform for practicing and integrating programming and mathematical knowledge and skills. We had analysed students' results in compulsory subjects of the Applied Informatics study programme to assess whether the simultaneous use of the various skills projects into the results, or more precisely into the associations between computer graphics, mathematics and programming subjects. The data provided only limited evidence of a difference in the strength in associations between these subjects and the remaining ones. All the subjects turned out to be significantly associated. The greatest factor influencing the correspondence in the students' results was probably the students' overall study aptitude, which occluded the more subtle per-subject variances.

Because of the somewhat inconclusive results in the paper mentioned above, in this paper we try to answer a simpler but rather more fundamental question whether any structure across subjects can be observed in the students' exam grades at all and if so, how it relates to the subject topics. In other words, the aim of the paper is to explore the topical structure of subjects, the structure of students' grades and assess the possible relations between the two.

The presence of a structure in the students' grades is a prerequisite for the use of the grades

data in any potential analysis of the dependence between the efficiency of educational process and its parameters, such as learning styles, students' abilities, teaching styles or subject composition. Since most of the parameters are closely linked to subject focus and contents we explore the following hypothesis: if the students' grades reflect the parameters, a relation should be observed between the structure identified in grades and the structure found in subject topics.

There are works, such as Schibeci, and Riley (1986), Hanushek (1997) or Clotfelter, Ladd and Vigdor (2007), that study how individual parameters of educational process, especially teacher qualities, associate with different measures of achievement including grades. There are also works, such as Lethbridge (2000) or Zhang, Liu, Janssens, Liang and Glänzel (2010), that try to identify the topical structure of subjects. We have, however, found no works that would deal with the relation of subjects and grades in general.

Material and Methods

University studies cover a broad extent of knowledge. Individual subjects usually have more than one topic and often intersect with one another. Nevertheless, for the core subjects of a specific study programme it is typically possible to identify a set of common principal topics. The study programme discussed further in the paper is the Applied Informatics study programme at the Faculty of Informatics and Management of the University of Hradec Králové.

The Applied Informatics study programme is scheduled into five years, ten terms. The first three-year leg, the Bachelor´s degree study programme, provides the basis necessary for careers in computer systems administration (including both hardware and software aspects) and in sophisticated applications of ICT. The Master's degree programme is a follow-up two-year study programme. It combines subjects from the core fields of Computing and related areas, Information Systems and Software Engineering, Image Processing as well as Communication Technologies. Necessary skills in the field of designing and building secure information systems, information and knowledge technologies, as well as methods of collecting, structuring and evaluating large quantities of data are developed. The options of some background in the associated disciplines of managerial psychology and economics are offered as facultative courses for students as well.

We analysed the 31 exam-concluded core subjects of the study programme, i.e. we omitted foreign languages, facultative subjects, general curriculum courses and credit-only subjects. A list of the subject names and Czech abbreviations (used in figures and tables) can be seen in the first two columns of Tab. 1 and Tab. 2.

Based on discussion with teachers of the core subjects and students, who finished the studies of Applied Informatics, four main topics were identified within the selected subjects: mathematics, programming, technology and management. These were expected to be the four subject clusters. However, to verify it in this pilot study we asked two colleagues and two former students to fill out a table similar to Tab. 1 and Tab. 2 with percentage weights totalling to 100% for each subject. These values were averaged into the final weights, which are presented in the last four columns of Tab. 1 and Tab. 2 rounded to integer. In order to obtain finer-grained results we used these weights in the subjects' topic structure analysis rather than just a categorical assignment to the four topics.

The follow-up Master's study programme is available since 2002, so we evaluated 12 years of results from students that passed both Bachelor's and Master's study programme at the faculty. Only the first exam attempts were taken into account to take the most of an advantage of variability in the data. In total, data from 186 students were processed.

In order to identify the possible structure in the subjects we measured and tested the correlations among the subjects with Spearman's rank correlation coefficient rho with p-values corrected for multiple testing using Holm's method (Holm, 1979) and we performed hierarchical cluster analysis (Hartigan, 1975) with Euclidean subject distance and Ward's clustering method (Ward, 1963).

Czech abbreviation	Subject	Mathematics	Programming	Technology	Management
Bachelor's study programme					
ARCH	Computer Architecture	5%	0%	95%	0%
DBS	Database Systems	18%	38%	44%	0%
DBS2	Database Systems 2	18%	41%	41%	0%
DIMA	Discrete Mathematics	75%	25%	0%	0%
LP1	Logic Programming 1	21%	68%	11%	0%
OMO1	Object Oriented Modelling 1	4%	39%	39%	18%
OS1a	Operation Systems 1	13%	8%	78%	0%
PGRF1	Computer Graphics 1	24%	59%	17%	0%
PGRF2	Computer Graphics 2	23%	56%	21%	0%
PRIPO	Computer Principles	10%	0%	90%	0%
PRO2	Programming 2	12%	59%	29%	0%
PSIT1	Computer Networks 1	4%	4%	91%	0%
PSIT2	Computer Networks 2	4%	4%	91%	0%
PSTA	Probability and Statistics	83%	8%	0%	9%
UOMO	Introduction to Object Oriented Modelling	4%	29%	44%	23%
ZMI1	Mathematics 1	100%	0%	0%	0%
ZMI2	Mathematics 2	100%	0%	0%	0%
ZT2	Knowledge-Based Technologies 2	4%	13%	67%	16%
ZT4	Knowledge-Based Technologies 4	9%	62%	24%	5%

Tab. 1: List of analysed subjects - Bachelor's study programme

Czech abbreviation	Subject	Mathematics	Programming	Technology	Management
Master's study programme					
APSTA	Applied Statistics	87%	4%	4%	5%
DMO	Discrete Methods and Optimization	64%	31%	3%	3%
DORDB	Distributed and Object-Relational Databases	11%	49%	40%	0%
NUMA	Numerical and Computational Mathematics	61%	33%	5%	0%
OBDAI	Data Protection and Information Security	16%	4%	78%	3%
PGRF3	Computer Graphics 3	35%	45%	20%	0%
PPRO	Computer Principles	0%	55%	45%	0%
PRI2	Information Systems Projecting 2	0%	0%	27%	73%
STOMO	Stochastic Modelling	80%	11%	4%	5%
SYPRO	System Programming	0%	63%	37%	0%
TINF	Theoretical Informatics	68%	32%	0%	0%
UMTE	Introduction to Mobile Technology	0%	60%	40%	0%

Tab. 2: List of analysed subjects - Master's study programme

Results and Discussion

Based on the topic weights, subjects clearly fit into three distinct clusters, as can be seen in Fig. 1. The clusters roughly correspond to mathematics (cluster 1), technology (cluster *2*) and programming topics (cluster **3**), though the third cluster has a broader extent. See Tab. 3 for the topic weights averaged per each of the clusters. The table indicates overall cluster focus.

Cluster	Mathematics	Programming	Technology	Management
1	80%	16%	2%	2%
2	8%	5%	84%	3%
3	12%	48%	32%	8%

Tab. 3: Average topic weights in clusters by weights

In terms of grades and the Spearman's correlation, the subjects are not strongly associated in general, as can be seen in Tab. 5. This suggests that students' overall study aptitude is

not the predominant factor. Only a few associations are significant at $\alpha = 0.05$, though the p-values are biased by varying numbers of missing values and thus cannot be used for comparison. Tab. 5 indicates stronger associations among subjects of clusters 1 and **3** than cluster *2*.

The clustering analysis based on grades also splits the subjects into three well defined clusters shown in Fig. 2. Cluster A overlaps to a large extent with cluster **3** and cluster B is a subset of cluster 1. Cluster C is a mix of subjects from all the topic weight clusters. The clusters correspond to the topics clusters only partly but they are distinct in terms of the topics, as can be seen in Tab. 4, which shows topic weights averaged per each cluster. Once again, one cluster (cluster B) is clearly mathematics-heavy.

Cluster	Mathematics	Programming	Technology	Management
A	12%	35%	47%	6%
B	86%	10%	1%	2%
C	33%	29%	33%	5%

Tab. 4: Average topic weights in clusters by grades

There is also notable closeness of some subjects in the clustering that reflects the actual affinity of the subjects, such as PGRF2 and PGRF3, APSTA and STOMO, OMO1 and UOMO and the whole cluster B, of course.

The research question and hypothesis formulated in the introduction is supported by the data. Clear structure can be seen in the clustering analysis of both subject topics and students' grades, even though it is not corroborated by statistical significance. The clustering of subjects based on students' grades evidently corresponds to the focus and contents of the subjects.

The results are of no clear and immediate use in terms of application to decision making and planning at the university, at least they do not call for any immediate action. They suggest the closer integration of which subjects would be congruent with students' aptitudes, but the benefits of the integration cannot be inferred. The purpose of the study, however, was not to draw any specific conclusions from the data but to assess the viability of the data already present in the university information system as an analysis input. The interpretation of the discovered structures requires further research and is beyond the scope of the paper.

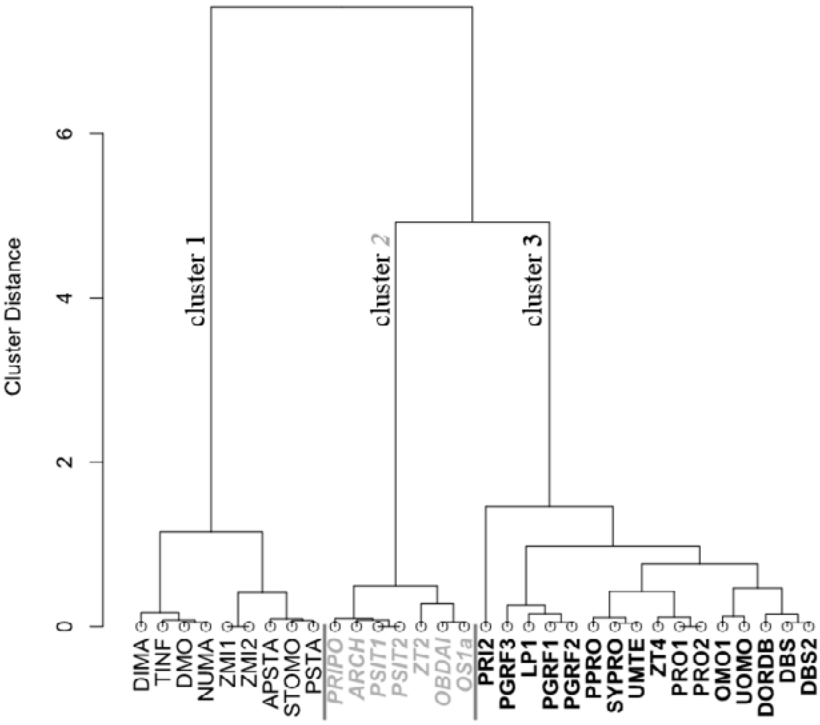

Fig. 1: Dendrogram of subject clustering based on topic weights, clusters 1, *2*, **3 are labelled**

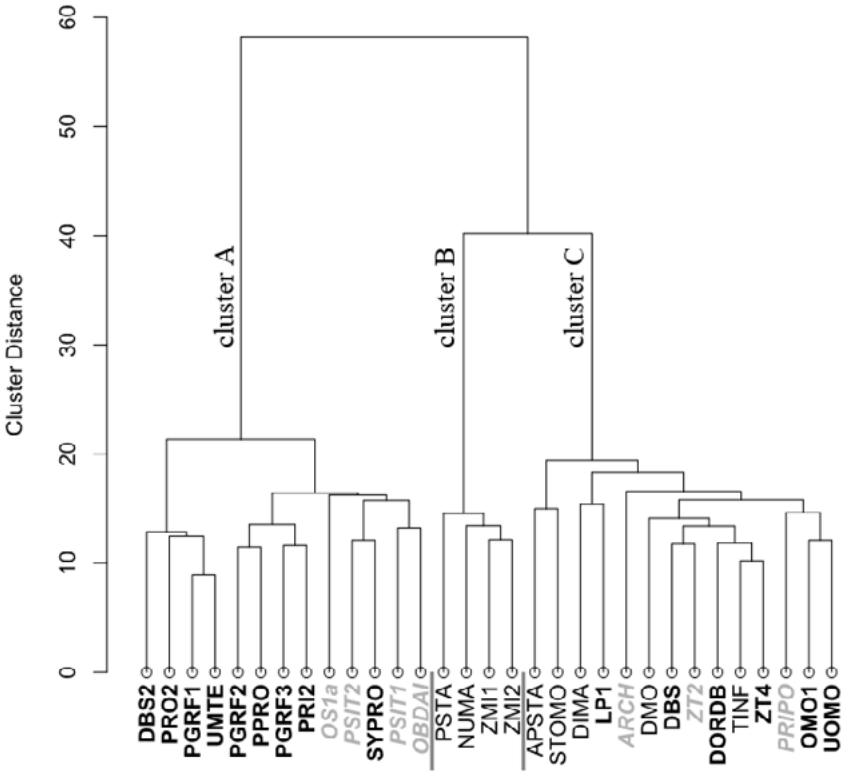

Fig. 2: Dendrogram of subject clustering based on students' grades, clusters A, B, C are labelled

	APSTA	DIMA	DMO	NUMA	PSTA	STOMO	TINF	ZMI1	ZMI2	ARCH	OBDAI	OS1α	PRIPO	PSIT1	PSIT2	ZT2	DBS	DBS2	DORDB	LP1	OMO1	PGRF1	PGRF2	PGRF3	PPRO	PRI2	PRO2	SYPRO	UMTE	UOMO	ZT4
APSTA		0.38	0.25	0.38	0.29	0.43	0.41	0.26	0.32	0.01	0.18	0.13	0.09	0.29	0.25	0.29	0.32	0.04	0.31	0.29	0.32	0.06	0.22	0.26	0.24	0.2	0.13	0.43	0.21	0.29	0.45
DIMA	0.38		0.48	0.35	0.4	0.31	0.43	0.36	0.49	0.14	0.26	0.22	0.19	0.19	0.39	0.38	0.43	0.33	0.49	0.47	0.41	0.2	0.32	0.39	0.27	0.31	0.28	0.37	0.25	0.31	0.5
DMO	0.25	0.48		0.46	0.34	0.37	0.43	0.32	0.45	0.23	0.29	0.01	0.25	0.32	0.2	0.37	0.43	0.15	0.45	0.4	0.41	0.11	0.3	0.39	0.38	0.34	0.28	0.29	0.05	0.22	0.5
NUMA	0.38	0.35	0.46		0.34	0.46	0.45	0.41	0.34	0.25	0.18	0.18	0.28	0.36	0.28	0.34	0.42	0.03	0.43	0.43	0.3	0.17	0.36	0.41	0.26	0.26	0.27	0.39	0.27	0.27	0.55
PSTA	0.29	0.4	0.34	0.34		0.33	0.39	0.36	0.43	-0.03	0.17	0.13	0.19	0.2	0.26	0.3	0.45	0.07	0.37	0.33	0.33	0.18	0.33	0.26	0.25	0.3	0.14	0.32	0.31	0.24	0.46
STOMO	0.43	0.31	0.37	0.46	0.33		0.4	0.2	0.3	0.19	0.09	0.03	0.23	0.12	0.24	0.17	0.28	-0.09	0.31	0.17	0.26	0.08	0.2	0.25	0.25	0.25	0.03	0.35	0.26	0.25	0.5
TINF	0.41	0.43	0.43	0.45	0.39	0.4		0.32	0.4	0.15	0.28	0.09	0.21	0.28	0.18	0.33	0.46	0.12	0.46	0.36	0.41	0.25	0.33	0.37	0.31	0.39	0.4	0.46	0.22	0.3	0.64
ZMI1	0.26	0.36	0.32	0.41	0.36	0.2	0.32		0.48	0.11	0.07	0.29	0.14	0.2	0.11	0.23	0.41	0.03	0.28	0.38	0.17	0.26	0.22	0.35	0.29	0.27	0.18	0.26	0.23	0.21	0.34
ZMI2	0.32	0.49	0.45	0.34	0.43	0.3	0.4	0.48		0.11	0.29	0.07	0.16	0.23	0.28	0.29	0.42	0.29	0.39	0.41	0.34	0.17	0.3	0.27	0.18	0.23	0.32	0.24	0.17	0.33	0.38
ARCH	0.01	0.14	0.23	0.25	-0.03	0.19	0.15	0.11	0.11		0.16	0.06	0.29	0.11	0.17	0.19	0.32	-0.08	0.33	0.19	0.21	0.24	0.3	0.09	0.1	0.12	0.04	0.19	0.2	0.21	0.26
OBDAI	0.18	0.26	0.29	0.18	0.17	0.09	0.28	0.07	0.29	0.16		0.05	0.02	0.35	0.11	0.07	0.24	0.17	0.28	0.16	0.13	0.13	0.29	0.31	0.1	0.23	0.29	0.21	0.04	0.25	0.35
OS1α	0.13	0.22	0.01	0.18	0.13	0.03	0.09	0.29	0.07	0.06	0.05		0.14	0.2	0.09	0.15	0.17	0.16	0.03	0.1	0.12	0.16	0.18	0.25	0.15	0.02	0.07	0.27	0	0.12	0.12
PRIPO	0.09	0.19	0.25	0.28	0.19	0.23	0.21	0.14	0.16	0.29	0.02	0.14		0.21	0.22	0.2	0.21	-0.01	0.32	0.15	0.29	0.21	0.13	0.08	0.2	0.06	0.18	0.18	0.22	0.21	0.29
PSIT1	0.29	0.19	0.32	0.36	0.2	0.12	0.28	0.2	0.23	0.11	0.35	0.2	0.21		0.24	0.26	0.26	0.02	0.27	0.19	0.22	0.16	0.22	0.32	0.22	0.18	0.24	0.26	0.13	0.23	0.35
PSIT2	0.25	0.39	0.2	0.28	0.26	0.24	0.18	0.11	0.28	0.17	0.11	0.09	0.22	0.24		0.29	0.3	0.16	0.32	0.3	0.35	0.12	0.27	-0.02	0.3	0.08	0.1	0.48	0.23	0.29	0.23
ZT2	0.29	0.38	0.37	0.34	0.3	0.17	0.33	0.23	0.29	0.19	0.07	0.15	0.2	0.26	0.29		0.43	0.27	0.39	0.32	0.44	0.21	0.35	0.26	0.31	0.34	0.25	0.35	0.13	0.36	0.42
DBS	0.32	0.43	0.43	0.42	0.45	0.28	0.46	0.41	0.42	0.32	0.24	0.17	0.21	0.26	0.3	0.43		0.14	0.44	0.45	0.37	0.25	0.38	0.36	0.38	0.38	0.35	0.4	0.32	0.42	0.48
DBS2	0.04	0.33	0.15	0.03	0.07	-0.09	0.12	0.03	0.29	-0.08	0.17	0.16	-0.01	0.02	0.16	0.27	0.14		0.26	0.15	0.24	0.06	0.2	0.1	0.1	0.32	0.19	0.05	-0.12	0.18	0.06
DORDB	0.31	0.49	0.45	0.43	0.37	0.31	0.46	0.28	0.39	0.33	0.28	0.03	0.32	0.27	0.32	0.39	0.44	0.26		0.38	0.36	0.28	0.34	0.29	0.31	0.37	0.26	0.32	0.2	0.35	0.53
LP1	0.29	0.47	0.4	0.43	0.33	0.17	0.36	0.38	0.41	0.19	0.16	0.1	0.15	0.19	0.3	0.32	0.45	0.15	0.38		0.32	0.29	0.32	0.37	0.34	0.25	0.27	0.23	0.21	0.33	0.35
OMO1	0.32	0.41	0.41	0.3	0.33	0.26	0.41	0.17	0.34	0.21	0.13	0.12	0.29	0.22	0.35	0.44	0.37	0.24	0.36	0.32		0.2	0.27	0.26	0.29	0.26	0.22	0.29	0.15	0.35	0.36
PGRF1	0.06	0.2	0.11	0.17	0.18	0.08	0.25	0.26	0.17	0.24	0.13	0.16	0.21	0.16	0.12	0.21	0.25	0.06	0.28	0.29	0.2		0.34	0.26	0.16	0.09	0.31	0.19	0.21	0.24	0.2
PGRF2	0.22	0.32	0.3	0.36	0.33	0.2	0.33	0.22	0.3	0.3	0.29	0.18	0.13	0.22	0.27	0.35	0.38	0.2	0.34	0.32	0.27	0.34		0.41	0.38	0.37	0.36	0.38	0.36	0.19	0.42
PGRF3	0.26	0.39	0.39	0.41	0.26	0.25	0.37	0.35	0.27	0.09	0.31	0.25	0.08	0.32	-0.02	0.26	0.36	0.1	0.29	0.37	0.26	0.26	0.41		0.31	0.44	0.31	0.29	0.18	0.18	0.45
PPRO	0.24	0.27	0.38	0.26	0.25	0.25	0.31	0.29	0.18	0.1	0.1	0.15	0.2	0.22	0.3	0.31	0.38	0.1	0.31	0.34	0.29	0.16	0.38	0.31		0.33	0.26	0.33	0.19	0.21	0.33
PRI2	0.2	0.31	0.34	0.26	0.3	0.25	0.39	0.27	0.23	0.12	0.23	0.02	0.06	0.18	0.08	0.34	0.38	0.32	0.37	0.25	0.26	0.09	0.37	0.44	0.33		0.36	0.32	0.23	0.13	0.43
PRO2	0.13	0.28	0.28	0.27	0.14	0.03	0.4	0.18	0.32	0.04	0.29	0.07	0.18	0.24	0.1	0.25	0.35	0.19	0.26	0.27	0.22	0.31	0.36	0.31	0.26	0.36		0.22	0.21	0.19	0.36
SYPRO	0.43	0.37	0.29	0.39	0.32	0.35	0.46	0.26	0.24	0.19	0.21	0.27	0.18	0.26	0.48	0.35	0.4	0.05	0.32	0.23	0.29	0.19	0.38	0.29	0.33	0.32	0.22		0.25	0.3	0.45
UMTE	0.21	0.25	0.05	0.27	0.31	0.26	0.22	0.23	0.17	0.2	0.04	0	0.22	0.13	0.23	0.13	0.32	-0.12	0.2	0.21	0.15	0.21	0.36	0.18	0.19	0.23	0.21	0.25		0.24	0.24
UOMO	0.29	0.31	0.22	0.27	0.24	0.25	0.3	0.21	0.33	0.21	0.25	0.12	0.21	0.23	0.29	0.36	0.42	0.18	0.35	0.33	0.35	0.24	0.19	0.18	0.21	0.13	0.19	0.3	0.24		0.34
ZT4	0.45	0.5	0.5	0.55	0.46	0.5	0.64	0.34	0.38	0.26	0.35	0.12	0.29	0.35	0.23	0.42	0.48	0.06	0.53	0.35	0.36	0.2	0.42	0.45	0.33	0.43	0.36	0.45	0.24	0.34	

Tab. 5: Spearman's rank correlation coefficients of grades ordered by clusters based on topic weights (weak - light grey, moderate - darker grey, strong - black)

Conclusion

Inspired by the rather inconclusive results of the 2013 research into the correspondence of students' results in computer graphics subjects with those in mathematics and programming, in this paper we attempt to determine whether any structure can be observed in the students' results at all. Using cluster analysis and Spearman's correlation we found that indeed students' grades arrange subjects into meaningful groups related to subject topics. It is therefore sound to use students' grades to infer conclusions about subject composition and relation. Besides using grades for specific tasks, further research employing data mining techniques to analyse grades more deeply is worthy consideration.

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THE NEED FOR LIFELONG EDUCATION IN NON-PROFIT ORGANISATIONS

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Abstract

Professional education of adult learners presents a very significant and efficient form of systemic mediation of information and knowledge. The focus of the paper rests in the emphasis on the need for lifelong education in non-profit organisations and their consequent access to updated and quality information not only in the field of their subject-matter but also in terms of the professional organisation management, and thus helping maintain their indisputable importance in a society.

Using the data assembled in a field investigation performed among the workers of non-profit organisations in a given region, authors analyse the relation between two variables – motivation to attend the courses of life long education and the topics in demand. Along with other important factors affecting the need for lifelong learning, the obtained findings present a sound base for further research carried out even on a larger scale.

Keywords

Lifelong education, professional education, motivation to study, non-profit organisation, field investigation

Introduction

Lifelong education (learning) can be understood as an unavoidable and on-going process of personal development, which emerges through the involvement of an individual in conscious and unconscious processes of thinking and behaviour throughout life (Billett, 2010: 5). The Czech resources available, however, do not define a difference between lifelong education and lifelong learning. In certain cases, both concepts are used as synonyms. The dictionary of andragogy (Dictionary of Andragogy [Online]) combines both concepts into one – "Lifelong education / learning", and adds other possible epithets: re-current education, continuous education or permanent education. By contrast, the Institute for Lifelong Education at Mendel University in Brno publishes a journal entitled Lifelong Learning while translating the title into Czech as "lifelong education". The main message of the scientific journal is "presenting current findings from the sphere of lifelong learning and education". Both concepts are therefore obviously viewed separately.

Non-profit organisations are often perceived as synonyms of civil society (Suleiman, 2013). They can be financially supported by four main sources (Duben, 1996): by individuals, foundations, corporations and by a government on an appropriate level. Professional education in the sphere of non-profit organisation operation is necessary for its further existence. For instance, non-profit organisations performing in the sphere of social services are actually obliged to educate their workers in order to receive a particular accreditation for their action. Educational projects in non-profit organisations operating in the sphere of ecology are often aimed at practical ecological training and analysing the motivation and experience of volunteers (Haigh, 2006). Non-profit organisation workers

find the areas of lifelong education interesting; they expand their social capital and are vital for their further existence within the organisation. Based on the development of strategic management within the non-profit context, Kong (2008) argues that applying intellectual capital concept is far more effective than other concepts used in the social service non-profit sector and as such, the intellectual capital is the most appropriate strategic management concept for the non-profit sector. According to Burrell and Safi (2009), effective leaders of non-profit organisations understand that the growing of such organisations that are healthy and efficient demands consistent and planned development of new leaders. Buckmaster (1999) discusses the opportunity for non-profit organisations to enhance organisational lifelong learning. Similarly, the conducted research shows that different groups of employees of non-profit organisations have different chances for lifelong learning which are conditioned by feedback and knowledge acquisition, learning approach and communication tools and, last but not least, being couched, couching others and information acquisition (Kyndt et al, 2009) . The areas concerned are especially the so-called soft-sills, i.e. communication and presentation skills, public relations, marketing communication, the basics of efficient lobbing and many more. In the last years, there has been an increase in the interest of non-profit organisations in the education of marketing and obtaining financial and non-financial means (O'Neill, 2007). The lifelong education in a non-profit sector is of a significant importance; its workers and even volunteers participating in the non-profit organisations attend educational events at least twice, if not more times a year (Varvažovská and Jarkovská, 2012).

The paper focuses on the most important factors affecting the need for lifelong learning among the non-profit sector workers. It aims to analyse the relation between two variables, the motivation of the non-profit sector workers to attend the courses of lifelong education, and the topics of the lifelong learning courses most desired by the attendants.

Materials and Methods

For the purposes of the research, following hypotheses were stated: 1. Irrespective of an activity category, non-profit organisation workers show by far the greatest interest in courses dealing with public relations and fundraising. 2. Generally, non-profit organisation workers do not show interest in courses dealing with economic issues. 3. The highest percent of non-profit organisation workers take part in three to four lifelong education courses per year. 4. Non-profit organisation workers' main motivation to attend the lifelong education courses is a desire for their overall personal development and not only obtaining new knowledge. 5. Women show a greater interest in courses of communication skills. 6. Respondents belonging to an age group between 18 and 25 years of age are motivated by far the most by the possibility of a higher salary. The hypotheses were derived from both theoretical background of the research and authors' long-term experience in conducting courses of lifelong education.

Non-profit organisations were selected from the Pardubice Region, however later on the criterion of interest and orientation of the non-profit organisation were taken into account. The aim was to create a cohort of organisations differing in their subject of interest so that the cohort would not be inclined to homogeneity. To shield this effort, the Directory of Non-Profit Organisations in the Pardubice Region was used, dividing the organizations according to their subject of interest. The non-profit organisations were addressed by email en masse with an online questionnaire attached. The first item in the questionnaire was "the area of activity" of a non-profit organisation, which made a following distribution of the individual associations easily feasible. An aim was to elicit

such a sample of organisations that would differ in their point of interest and thus prevent the sample from inclining to homogeneity.

The objective of the field investigation was on the one hand to find out what motivated the representatives of non-profit organisations to grant space for further learning. On the other hand, the objective was also to investigate how the workers taking part in the courses of lifelong learning evaluated their efficiency themselves. A partial objective was to evaluate an economic perspective of educational events in non-profit organisations. What was of importance was also a relation between inputs (investments in further education) and outputs (an increase in work efficiency, workers' expertise) and whether willingness to invest in further education following the period of recession, generally called the economic crisis, was transformed.

To obtain contacts, the Directory of Public Non-profit Organizations of the Pardubice Region was used, containing non-profit organisations classified by both region and their focus. In the first distribution wave, the questionnaire was sent to 392 addresses in the directory. However, only few questionnaires were returned (in total 51 questionnaire were filled in, i.e. 13%). It was therefore necessary to distribute the questionnaire one more time and carry out the research again. Following the second distribution wave, 50 filled in questionnaires were returned (12.76%). The aggregate thus comprised 101 fully answered questionnaires after the two waves of distribution. The overall number of the returned questionnaires thus amounted to 25.77%. The selected non-profit organisations were addressed by email en masse, with an enclosed letter and an online questionnaire attached. Based on the results of a manual processing of the data using the SPSS statistical programme and a consequent analysis, the authors arrived at conclusions both verifying and refuting the given hypotheses.

Gender wise, of 101 respondents, the female respondents prevailed. The ratio between women and men in the sample was 59.4 % (60 female respondents) to 40.6 % (41 male respondents). Nearly half of the respondents (42.6%) were older than 45 years of age, while 33 respondents (32.7%) belonged to the age group from 35 to 44 years of age. The respondents from age groups 18 – 25 years and 26 – 34 years of age were not so numerous. Only 6.9% respondents belonged among the youngest questioned (18 – 25 years of age), with 17.8% respondents falling into the category of 26 – 34 years of age. More than 64.4% respondents (65) completed their university or college education, 7.9% completed secondary school education with a school-leaving examination, and almost one-third (27.7%) completed apprentice training with school-leaving examination. Categories with completed primary school education and secondary school education without a school-leaving examination were not represented at all. The first item on the questionnaire agenda was a non-profit organisation's "area of operation", with most of the respondents coming from non-profit organisations focusing on social services. In total, it was 30 respondents, i.e. 29.7%. Nearly one fifth of all respondents (18.8%) currently work in a sport non-profit organisation. Other categories did not reveal such high frequencies. 13 respondents (12.9%) were employed in non-profit organisations dealing with culture and art and quite a high percent – 9.9% respondents – checked the answer "other". The respondents designated their own categories for the non-profit organisations they worked for. For instance, processing applications for the EU subsidies, work with children and youth, event organisation, information and advisory services, history, the prevention of youngsters' risk behaviour, religion and health.

During the data analysis it was of great significance to find such interesting variables that would either confirm or reject deep-rooted surmises (e.g. ,the young are motivated by

money only', older employees are not willing to learn" and so on) and that would rather help confirm or refute the stated hypotheses.

Results and Discussion

Owing to a limited length of the paper, a graphic image of the findings described in the text could not be inserted; however, a table illustrating the frequency distribution of the individual answers processed by the SPSS programme is available (see Table 1 below). The results were therefore summarised and revised in a verbal commentary only.

The highest percent of the non-profit workers (19.8 %) is interested in the courses focused on management and managerial skills. One percent fewer respondents (18.8 %) expressed their interest in courses dealing with communication skills. The same frequency also appears in another category – 19 respondents proposed their own topics they were interested in: economics, work with families, professional area of social works and advisory, professional methodologies, psychology, special pedagogy, foreign languages, sociology, theology and risk behaviour of youngsters. As regards the frequency, the third highest representation was in the category of public relations (PR), marketing, and fundraising (14.9 %). Of all 101 respondents, 9 expressed their interest in courses of law and legislation. The lowest frequency was observed at the category of computer courses, IT and requalification courses.

The results of the questionnaire survey revealed that more than 60% of all respondents took part in one or two lifelong education courses per year. Rather a high frequency accounted for the possibility of three or four courses per year – 14 respondents (13.9%). 10.9% respondents attended more than four courses per year and even more respondents – 11.9% of all questioned did not attend any educational event or activity.

It was proved that most of the respondents – 39 and 39 respectively (38.6%) - were motivated by either the opportunity to gain new knowledge or by the possibility of a new personal development. Nearly 9% respondents were motivated to study by the effort to keep up with times and 8% by the effort to reach their work goals. None of the respondents mentioned as motivation a higher salary or the desire to exceed colleagues. Among "other" (other categories), the respondents included for example keeping the organization afloat or meeting new people.

Table 1 illustrates to what extent the two variables, age and motivation, affected the respondents' courses attendance. It presents the frequency distribution of the respondents' answers with respect to both their age and motivation to attend a course.

Age	Motivation						
	Opportunity to gain new knowledge	Possibility of an overall personal development	Effort to stay in a job in uncertain times	Effort to keep up with times	Effort to reach one's work goals	Other	Total
18-25	4	2	0	0	1	0	7
26-34	4	11	0	1	2	0	18
35-44	13	13	0	1	3	3	33
45+	18	13	3	7	2	0	43
Total	39	39	3	9	8	3	101

Source: from processing the data in the SPSS, by the authors

Tab. 1: The relation of variables: age and motivation to attend courses of lifelong education

When analysing and interpreting the results of the two variables relation, it became obvious that none of the 101 respondents selected the idea of a higher salary as his or her primary motivation to attend courses. Interestingly enough, 7 respondents in the 45+ age category selected as their primary motivation the effort to keep up with times. 18 respondents in the same age group were even motivated by gaining new knowledge. The same response was also obtained from the respondents of the 18 – 25 age group. The results are not very surprising; on the contrary, they illustrate a current trend of continuously increasing demands on education and technical literacy in particular, which especially older generation finds rather challenging to cope with.

Women were by far the most interested in the courses of communication skills (21.7%), while men showed interest in the area of management and managerial skills (24.4%). The results concerning the topic of economics were of interest as well - as much as 14.6% men showed interest in it while 8.3% women only. Regarding the category of PR and fundraising where, based on the hypothesis, a high percent of interest by the non-profitable organisation workers was expected in general, the results revealed that 14.6% men and 15% women only were interested in it. It is not the most frequent category for either gender and, what is more, PR courses were found on the 3rd or even 4th place in the ranking.

Respondents with university education were not satisfied with the topic selection, which was available in the questionnaire. Almost one quarter (23.1%) of university graduates selected the response "other". What was interesting was a high interest in topics such as law and legislation, which could be observed with respondents who completed secondary school education with school-leaving examination – 21.4% in total, revealed that those were the topics of the most significant interest for them. In other areas, excluding IT that was of the interest to university graduate respondents only, the categories of respondents with either completed university or secondary school education were comparable. A higher number of secondary school graduates, i.e. with school-leaving examination (18.5%) than university graduates (18.5%) were interested in management courses. The field investigation showed that secondary school graduates were in a way more ambitious than university graduates were.

As regards motivation, none of the respondents from the non-profit organisations selected the possibility of a higher salary or exceeding his or her colleagues as a primary motivation. All of this points to an essence and meaning of the work for the non-profit organisations. Observing the relation between variables revealed a current trend – older respondents (in age groups 35 – 44 years of age and 45+) were primarily motivated by the opportunity to gain new knowledge with an important factor to keep up with times in the oldest group.

The main work hypothesis, i.e. non-profit organisations workers are by far the most interested in topics of public relations or fundraising, was refuted by the research results. The issues of public relations and fundraising ended up third among other topics in the imaginary ranking. The highest percent of respondents (19.8%) declared that they were most interested in the courses of management and managerial skills, one percent less selected the topic of communication and communication skills as the most interesting for them, and the topic of public relations and fundraising ended up with four percent less (14.9%).

The hypothesis that non-profit organisations workers in general are not interested in the courses of economics was not confirmed. The research results showed that at least 10% respondents showed interest in the economic courses. A lower percent of interest was observed for the courses of IT and requalification (4 %) and courses of law and legislation

(8.9 %).
The hypothesis that the highest percent of non-profit organisation workers takes part in three to four lifelong education courses per year can also be refuted. The majority of respondents attended one or two courses a year.
On the contrary, the hypothesis that the main motivation to attend the courses of lifelong education is the desire for an overall personal development and not only gaining new knowledge, can be neither refuted nor confirmed. The results for both categories (gaining new knowledge and an overall personal development) were identical – 39 respondents expressed for them respectively. The objective was to verify how a pair of two concepts – lifelong education and learning – was perceived. While acquiring new knowledge was to lead rather to fulfilling the meaning of education, an overall personal development was to indicate the phenomenon of lifelong learning (just as it was introduced in this work). A balanced result valid for the research demonstrated that the respondents regarded both categories as equal.
Based on a quantitative research, the hypothesis that women show the greatest interest in the courses of communication skills can be accepted. However, the hypothesis that the respondents in the age group between 18 and 25 years of age are most motivated to attend further courses by an image of a higher salary can be altogether refuted. Based on the research results, the respondents in this particular age group were motivated the most by gaining new knowledge.
It is often difficult to define boundaries between non-formal and informal education. This was also demonstrated by the results of the above-illustrated research – the same number of persons selected the motivation by gaining new knowledge as well as by an overall personal development. Most adult learner educators anticipate that the major part of education is informal – which means embodied in everyday life. Therefore, it is difficult to measure it because most adults are not capable of recognizing lifetime episodes during which it occurs (Kinnair et al, 2014).
A question for further discussion is how the process of lifelong education and its informal component in particular should be measured. The authors of current studies (Kinnair et al, 2014) suggest that such research should consist of two components – structured and non-structured. The non-structured techniques would comprise keeping diaries, writing snippets, and describing those episodes when an adult learner has actually learned something. On the other hand, the structured techniques would present questionnaires or tick-off lists and standardised interviews.

Conclusion

For the confirmation or rebuttal of all hypotheses given in the paper it must be emphasised that the results of the field investigation are void for the research sample only - the non-profit organisations in the Pardubice Region – and the results cannot be generalised for workers of non-profit organisations as such. A similar field investigation could be performed in all the regions of the Czech Republic making the research even more credible and representative.
What can definitely be regarded as positive is the respondents' desire for an overall personal development. It showed that the workers of non-profit organisations are aware of their need for their self-fulfilment and for further education as a means of their personal development. They know that they need to work on themselves throughout their lives. What was further positive was the finding that financial motivation, i.e. the possibility to gain higher salary, was not selected as the most important motivation.

Whosoever would in the future aspire to repeat the field investigation carried out for the purpose of this study, they will probably face the same challenges: terminological non-uniformity (lifelong education versus lifelong learning), new approaches to the issue available mostly in foreign resources only, and impossibility to compare one's results with other findings due to the lack of contemporary research.

A current study (Kinnair et al, 2014), however, introduces an opinion that the economic crisis is slowly dying away and companies will soon start increasing their budgets for educational activities. It is obvious that the views are rather optimistic and company directors announce their intention for this year, which is to invest in further training of their staff, with the representatives of non-profit organisations sharing a similar view.

It is evident that the perspective of human abilities has undergone a significant change. The aggregate of abilities that an individual should at present have at his or her disposal are the so-called "global skills". In other words he or she should not only be qualified to perform a certain profession but he or she should also be a capable team member, analyst processing information and last but not least, an individual maximally resistant to stress. Over time, there has also been a change in the approach to supplying missing knowledge, skills and qualifications. It can be righteously argued that the topic of lifelong education is still a current and live issue. Given the transformation of a postmodern society, it is necessary for a nation to be successful in international comparison of adult population criteria. In this way, the economic efficiency of our country will grow and the social responsibility will increase.

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NOVICES' AND TRAINEE TEACHERS' PERSPECTIVES ON THE APPLICATION OF KNOWLEDGE IN PRACTICE

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Abstract

The paper focuses on two areas. Firstly, it presents the preliminary results of an international Czech and Slovak research study focused on novice teachers and their perception of higher education training, their readiness for teaching practice, as well as on the identification of problem areas novices are facing. Then, it presents the opinions of student teachers regarding their teaching practice during their university studies and on their simultaneous application of theoretical knowledge in practice. It also shows the link between the evaluation of practice and the impact of educators of future teachers upon them. The results show that students are very well equipped theoretically, but they have problems in applying this knowledge when managing and finding solutions to stressful situations. Practice is highly regarded by both groups of respondents, but the question is whether they are able to take advantage of practical experience and reflect it properly.

Keywords

Practice, higher education studies, teacher training, novice teachers, mentors

Introduction

Despite the fact that the relationship between theory and practice seems to have been to some extent an ever-present topic, it is still a current one that is widely discussed. The question is whether, for example, an increased number of teaching practice lessons for teacher trainees, which is the desire of both students and future employers, would result in their increased readiness for practice. As Solfronk (1996) states, the length of practice can result, on the one hand, in establishing a routine and mastery of it, but, on the other hand, it may lead to rigidity and immutability of performance. According to the author, the purpose of practice is performance improvement and perfecting that which can be achieved, provided that the practice is controlled, guided and accompanied by correction and its length is determined on the basis of the quality of activities rather than their quantity. As mentioned by Gavora (2008), the effect of observation of other teachers' practice (their teaching, behaviour, self-esteem), i.e. mediated experience, is one of the factors that affects the formation of perceived personal abilities and skills. However, the strongest factor, according to him, is successful teaching practice. The same findings, as to the importance of students' own experience from teaching practice and its impact on the perception of personal abilities, have also been reached in other research investigations (e.g. Rushton, 2001), since it is through practice that students get to observe an authentic environment and themselves in it as active agents. But as Wertheim and Leyser (2002) state, this also depends on the specialization and the field of study. In the application of theoretical knowledge into practice, teaching qualifications are also reflected. In Průcha's (2002) opinion, teaching qualifications, among other things, are not only what a person has acquired in the process of their studies and training but also what kind of

personality they have and what qualities they are equipped with to be able to perform in the teaching profession. Similarly, Švec (2005a) mentions that experience on its own is not enough to make a student teacher a teacher. To support greater self-awareness and increased confidence in teachers´ own ability and expertise, and a reaffirmation of their teaching style and practice some scholars suggest to use, e.g. microteaching (Donelly and Fitzmaurice, 2011) or personal learning system (Chesney and Benson, 2012).

Solfronk (1996) has dealt with the definition of teaching practice, which, according to him, is determined by four key aspects: controlled training in teaching performance; mastery of theoretical concepts that are directly linked to performance; learning and understanding of theoretical concepts; and encouraging students towards self-reflection and self-assessment. A further task of teaching practice is to contribute to the acquisition of the four basic competences of a teacher, which, according to Helus (2001, pp. 38-39), are: pedological competence, didactic competence, pedagogical and organizational competence and competence in qualified teaching self-reflection. Psychological aspects of teaching practice are further dealt with by Miňhová and Lovásová (2010). The important role of teaching practice in teacher training has been highlighted by many authors. As Šťáva (2004) states, one who understands the work of teachers as a very complex and demanding activity usually understands teaching practice as an appropriate and inseparable part of teacher education, without suppressing or questioning theoretical knowledge in specialist subject(s) as well as in pedagogy and psychology, philosophy and ethics.

For teacher training it is even more valid than for other study programmes that without a functional and possibly permanent linking of theory with practice and vice versa, the two components significantly weaken and the efficiency of study is reduced (Šimoník, 2005). The problem with the concept of theory and practice, and suitable interconnection and complementarity of theoretical knowledge and practical experience during university studies, is highlighted by Solfronk (1996, p. 283) when stating that teaching practice without a blending with theoretical concepts loses its meaning in the same way as theory does if it inherently does not result in practical activities – it loses much of its cognitive value. In terms of time and in the context of higher education, the practical component in the training can be categorized, as stated by Urbánek (2001), into three basic types: practice which precedes theory, practice which follows theory and practice with a parallel blend of theory. According to Šimoník (2005) study cannot be sufficiently effective if there is no permanent blend of theory with practice

Many students, as Švec (2005b) states, expect to be given specific advice and recommendations on how to teach and train students. At the same time they understand theory and practice as two opposing, distant and even isolated poles. They see theory as "something" redundant in their training, and they call for practical instructions telling them how to do this or that. Švec (2005b), therefore, emphasizes that some space for a certain "balancing" between theory and practice should be created. Students should have some space to explore, based on their own experience, real, practical problems in a school environment and to identify from them those that can be addressed and solved using scientific methods. Linking theory with practice, not their positioning as opposites, is mentioned also by Eraut (1994). It is necessary to get rid of a mere transfer of theory into practice – an application of theoretical knowledge – but to create new knowledge – a new understanding as a synthesis of theory and experience (Shulman's model of pedagogical reasoning and action [Shulman, 1987]).

Vašutová (2004, p. 55) states that a fundamental contradiction lies in the fact that "teacher educators require more academic training of future teachers, and employers of teachers, on the other hand, prefer more practically oriented training of teachers." This shows an evident connection with a persistent and long-expressed criticism of the lack of teaching experience during university studies of future teachers, stated equally by students, novice teachers and their employers. Knowledge transfer in a ready-made form, through definitions and abstract theories without any reference to specific contexts of school practice and personal experience of students, according to Spilková (2006), often result in superficial and formal knowledge which the student teacher is unable to use in the development of their own understanding of teaching and for practical activities. It is a mistake to take for granted the opinion that prevailed in the 1970s, mentioned by Nezvalová (2007), that academic training is crucial and teaching is simply the application of theory.

As stated by Podlahová (2002), teacher training faculties differ substantially in their forms of practice and its organization. Some faculties start with observation practice, which is carried out in blocks or continually throughout the whole semester, for one day a week at a school. In others it is a combination of observations and teaching which lasts one or two semesters, again either in blocks or continually. In the final year of studies students usually undergo either continuous complex practice, the so-called clinical semester (see Bendl and Mojžíšová for more detail, 2010), or they are placed in schools for assistantship. In the past, but sometimes even today, teaching practice is included in study plans in the second half of studies. Based on some research data it is, however, important for teacher trainees to introduce various forms of practical teaching from their first year of university studies (see Lukášová-Kantorková, 2003; Spilková et al., 2004). This effort to introduce practice from the first year of the bachelor level of education, however, often clashes with the traditional way of structuring teacher training studies. Initial teacher education in the Czech Republic and abroad, including interconnection with practice, is an issue which is analysed in detail by Průcha (2002, pp. 98-105).

The aim of our paper is to present the results of two quantitative surveys that deal with the transfer of theoretical knowledge into practice – that is to say, the interconnection of theory with practice – from the point of view of novice teachers (in the Czech Republic and Slovakia) and students of the Faculty of Education, University of South Bohemia in Ceske Budejovice.

Materials and Methods

This report presents the preliminary results of two independent research surveys. In one of them combined research was carried out (the method used was a questionnaire and a semi-guided interview). The research was aimed at defining the key competencies of mentor-teachers. The research group was formed from mentors and also from novice teachers. The questionnaire and interview for novice teachers covered three main areas. Findings in the area of novices' opinions about their professional training during their university studies were one of them. The research data also identified the main problems which novice teachers faced during their first year of working in schools. The last area focused on cooperation of novices with mentors. It was an international Czech and Slovak research project, within which the research group in the Czech Republic consisted of 148 novice teachers and in Slovakia 132 (teachers at all levels of school education – primary, lower and upper secondary). The text presents only partial results concerning quantitative

findings on the application in school practice of novices' knowledge gained during their university studies.

Other data presented below and in the context of a previous research survey came from the dissertation research of one of the authors – Garabiková Pártlová, which investigated the role of teacher trainers in the process of forming the professional competencies of future teachers. The research group, in this case, consisted of 265 students specializing in different school subjects, who were studying in different forms and at different levels at the Faculty of Education, University of South Bohemia (PF JU) in Ceske Budejovice. This was a stratified research group where respondents met the following criteria: either they were a PF JU student, a third-year student at bachelor level, or a first- or second-year student at master level of studies who had had direct experience with school practice.

The two questionnaires contained both closed questions and open ones. Furthermore, the questions for PF JU students also used scales. The data analysis was carried out using descriptive statistics through the SPSS program. In addition, for data reduction purposes exploratory factor analysis was used to get a small set of variables.

Results and Discussion

In the questionnaire for novice teachers the question regarding academic training of novices was divided into nine areas. It investigated how novices (during their first year at school) assess their readiness for school practice in different areas. From the data obtained, it is possible to draw an imaginary sequence of evaluated areas, which was determined based on the sum of the rating of "excellent" and "very good", "average" and "weak". In the Czech Republic, as well as in Slovakia, novices rated as best their training in the area of their specialist subject knowledge. Perceived as worst was their preparation to deal with stressful situations (such as discipline of students etc.). Gaining practical experience (also within their teaching practice) during their university studies was rated better in Slovakia than in the Czech Republic.

Czech Republic	Slovakia
1 expertise in specialist subject(s)	1 expertise in specialist subject(s)
2 work with ICT	2 methodology of teaching specialist subject(s)
3 methodology of teaching specialist subject(s)	3 work with ICT
4 work with textbook	4 **practical skills** (also during teaching practice)
5 assessing of pupils	5 work with textbook
6 **practical skills** (also during teaching practice)	6 assessing of pupils
7 work with integrated pupils with special educational needs	7 work with pedagogical documentation
8 work with pedagogical documentation	8 work with integrated pupils with special educational needs
9 coping with stressful situations (e.g. discipline of pupils)	9 coping with stressful situations (e.g. discipline of pupils)

Tabl. 1: University training perceived from the point of view of readiness for school practice

Within the open-ended question the respondents were allowed to add other areas that they perceive as problematic. In the Czech Republic, among other comments, the respondents often declared "lack of teaching practice" and in Slovakia "difference between theory and practice."

In both countries novice teachers expressed very similar ideas. During the first year of their school practice they faced many problems: they needed help and advice especially when working with pedagogical documentation. The least-needed help (as indicated in the questionnaires) was with improving communication when solving misunderstandings with mentors and colleagues. The largest difference was in the motivation of learners for learning activities. In the Czech Republic novice teachers are more concerned with the motivation of learners and pay less attention to the selection of appropriate teaching strategies, methods and techniques, whereas in Slovakia, it is just the opposite. Needless to say, the selection of appropriate teaching strategies, methods and techniques greatly influences the motivation of learners (see Gadušová and Vítečková, 2013).

If we take into consideration the data from the research conducted among novice teachers (N = 187) between 1994 and 1995, as presented by Kalhous and Horák (1996), 11.8 % of respondents had a better impression of working at school after starting their teaching career than their impressions of the teaching profession formed during their studies at university. Almost two thirds of novices said their impressions (65.8 %) matched their original expectations. Slightly worse impressions were described by 13.4 % of novice teachers, and only 1.6 % of novices were really disappointed. When considering what they relied on when preparing for lessons, 51.4 % of them stated a combination of written lesson plans and advice of their mentors or senior teachers, and in second place was a combination of written lesson plans and experiences gained from their teaching during university teaching practice (35.9 %). The results of higher education evaluation show that graduates of teacher training programmes have the best knowledge and skills in the subjects they specialized in, and the worst training in subject didactics. It is obvious that this result is influenced by many reasons, including a reduction and underestimation of teaching practice.

According to Podlahová (2004) the task of a novice teacher is to integrate everything they have learned and acquired at university into their teaching and to use it in new contexts or situations they haven't encountered before, or know only from their own memories as pupils or from teaching practice. It is impossible to convey within university studies and training all the kinds of situations that may occur at school (a situation may have unpredictable variations). In our opinion, which is based on one of the points stated by Podlahová (2004) it is a good idea to place theoretical pedagogical knowledge into a comparative relationship with reality and with the use of one's own critical thinking.

For novice teachers a major benefit would definitely be implementation of the requirement expressed and emphasized in the ETUCE report on Teacher Education in Europe (2008), i.e. that at least a one-year induction phase for novice teachers be introduced and that it become both the right and obligation of novice teachers in the form of consistent support and guidance by experienced mentors.

Regarding PF JU students, although they perceive their subject competences and theoretical knowledge as very well developed in terms of their subsequent application in practice (a numeric scale from 1 to 7 was used, where 1 corresponded to "no" and 7 "yes"), the obtained arithmetic mean r = 4.95 implies that students are not quite sure whether they really are able to use their theoretical knowledge in practice.

The same scale (1 to 7, negative – positive) was also used for students' evaluation of teaching practice in their pre-service education. The calculated average r = 6.13 suggests that the teaching practice carried out during higher education studies is evaluated positively. Nevertheless, the average r = 5.93 calculated from the same scale (1 – no, 7 – yes) for the further statement: "As a teacher trainee at PF JU I would like to have more

practice lessons during my studies", it is clear that students are considerably interested in increasing the number of teaching practice lessons during their studies. What is optimistic and very pleasing at the same time is also the finding – based on the arithmetic average r = 6.48 calculated for the statement: "I will do my best to permanently continue my self-education and personal development" – that teacher trainees are interested and committed to continuing self-education even after they start their teaching careers at schools.

In the years 2009-2011 Wernerová (2013) collected the opinions of teacher trainees (N = 662) on their readiness for the profession. Students were asked to write open statements expressing their reservations about their training. They were not satisfied with the way subject didactics were taught, as they felt a lack of interconnection with its use in practice, and they would also have preferred it to be more focused on analysis of subject content teaching. The most often expressed concerns were about very theoretical teaching without any beneficial overlap with practice. They felt a lack of training in the area of dealing with behavioural problems, with maintaining attention and motivation of students, and with work with learners with learning difficulties. As to the final continuous teaching practice, students reported the following unfavourable aspects in this area: disciplinary problems with learners, a lack of feedback from faculty methodology teachers, little room for self-fulfillment etc. They criticized deficiencies and weaknesses in subject didactics, and not enough lesson observations.

In connection with enabling students to carry on teaching practice at schools, as pointed out by Coufalová and Vaňková (2010), it is important to mention how demanding it is to organize (to negotiate observations and teaching schedules for practice at particular schools, to ensure the presence of departmental methodologists etc). The selection of a school, considering what Spilková (2007) mentions, has a serious impact on teacher trainees and requires systematic work with their emotions during their teaching practice. It is therefore important to choose a high quality and innovative school with enthusiastic teachers and a principal determined to support positive changes in education, so that, among other things, students can really experience previously described objectives in practice and so that they are "sucked" into debates and cooperation.

A part of the questionnaire for PF JU students, addressing their teaching practice at schools, was an open question: "What was the biggest surprise for you as a student during your teaching practice at school?" The collected data from the questionnaires were categorized, and it shows that students were mainly surprised by teachers' behaviour (towards children and colleagues), by the behaviour of children, by the large number of children in the classroom, by the demanding workload, by collaboration and communication with parents, administration etc. This corresponds with the data collected in the Czech and Slovak research aimed at novice teachers.

Subsequently, also considered was how PF JU students evaluate their pre-service preparation for "teaching practice" in relation to educators of future teachers. We asked the students another question: "How strongly do you relate your pre-service preparation for 'teaching practice' to your educators who deliver it?" The results showed that 67.55 % of the students marked number 7 on the numerical scale, which means that they attach high importance to teaching practice in their overall training for the teaching profession. At the same time these students feel a strong influence from their educators as far as this pre-service preparation is concerned, an average of 6.1. In practice this means that students regard their teaching practice as a highly important element of pre-service teacher education, and educators at this stage are considered to be an essential preparatory component. Negative opinions about the issue of practice were expressed only by 11.32

% of students; however, educators were rated by these students at an average of 5.1. This means that when reflecting on teacher educators, they did not evaluate them negatively.

Conclusion

The results of both the realized items of research show that a great importance on teaching practice is given equally by students (teacher trainees) as well as by novice teachers. Both groups of teachers (novice and future) consider the time allocated to teaching practice during university studies to be insufficient. Novice teachers in the Czech Republic and Slovakia find their weakest point to be their readiness in managing stressful situations. Here it possible to consider also situations in which students are unable to use their theoretical knowledge and apply it in specific cases. They are unable to adapt practices they were trained for during their university studies to the modified situations which real school practice brings. Similarly, another question may arise, whether students are adequately prepared in the area of teaching strategies, methods and techniques if they mention that they have problems with discipline of learners, and with their learning motivation. Again, this begs the question whether students can really apply their relevant theoretical knowledge in practice. In relation to practice it is possible to reconsider trainees' and novices' unbalanced subject and didactic competencies. It would definitely be useful to focus educators of future teachers on this area (in the context of the pre-service preparation for practice), who should be able to develop students' ability to effectively apply theoretical knowledge in practice.

However, the question is - who should do that. The academic community at universities is, on the one hand, often too scared to be involved in teaching "practical" skills so as not to be blamed that their teaching is not scientific enough and, on the other hand, there are frequent bias between the departments of education and subject departments in which them blame each other for not teaching what each of them should. The case is that subject departments blame education departments for teaching "just" educational theory (too distant from reality in schools) without any practical subject teaching applications and education departments blame subject departments in teaching "just" the subject without any educational implications. This mutual hostility and rancor often covered on conscious level but still existing, at least, on subconscious level, has subsequently negative impact on teacher training and their readiness for practical work at schools. The other problematic issue is teaching practice. Students do not have enough of it and teachers responsible for supervising will-be-teachers do not have enough time to analyze and discuss the lessons observed or taught by the trainee teachers. So where should the will-be-teachers gain practical skills of application theory into practice? This is a huge question which still waits to be satisfactorily and efficiently answered.

The results of the two research studies also show the importance of novices' support during their induction period by experienced mentors in the same way as it has been introduced in some European countries. Following the above mentioned findings, the result of Czech and Slovak cooperation will be supporting (training) material for qualified teachers with several years of school practice who want to become qualified mentors.

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TOWARDS THE ATTITUDE OF STUDENTS OF ECONOMIC AND EDUCATIONAL STUDY FIELDS

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Abstract

The attitude of university students to their studies and social condition represents one of the key information which universities need to gain for their decision making. This information can be obtained from the European survey called EUROSTUDENT V that took place in the year 2013. This paper focuses only on part of students – those of the economic and the educational study fields. The aim of this contribution is to compare attitudes of students of the economic and the educational study fields as their opinions on some of the topics can differ completely. We chose only some areas of interest (not included in the Final report of all students) that describe students' attitude to their study intensity and satisfaction with the studies.

Keywords

Economic study field, educational study field, EUROSTUDENT V, study intensity, satisfactory with study

Introduction

The competitiveness of higher education institutions (hereafter: HEIs) and university students is one of the most discussed topics in European Union and in the Czech Republic as well. Witte and Hudrlikova (2013) discussed the ranking among European universities, Flegl and Vltavska (2013) dealt with effectiveness of faculties of economics or Finardi and Fischer (2011) examined the return ability of investment in education. None of the papers investigated the students' posture. In 2013 the European survey that examined attitude and social condition of Bachelor and Master students called EUROSTUDENT V was held among European countries. This harmonized survey followed the survey called EUROSTUDENT IV which took place in 2009 and the results of which were broadly used for the competitiveness analysis of the Czech tertiary education in Fischer and Finardi (2010) and Fischer and Mazouch (2010). The Czech Republic was part of both rounds mentioned. The aim of the survey is to gather data on the social dimension of European higher education. It concentrates on the social-economic background and on the living conditions of students; moreover it investigates temporary international mobility too (MŠMT, 2013).

The behaviour and opinions of students in different study fields differ. In this paper we concentrate on two specific fields of study – economic and educational. Our goal is a partial comparison of the attitude of students from all Czech HEIs with the opinion of students studying the educational and the economic study fields.

Materials and Methods

EUROSTUDENT V was carried out by the Ministry of Education, Youth and Sports (namely the project Ipn KREDO CZ.1.07/4.1.00/33.0005) and was intended to students

from all public, both state, and 29 private HEIs. In total, students from 57 HEIs were involved in the survey. It was an online survey which lasted approximately 2 months and it was addressed to 95,177 students (each HEI had to sample every 7th student in two rounds). We acquired 6,382 responses. Several questionnaires were not filled completely or correctly, or these responses didn't fulfil the requirements from the handbook of the international organization that organized the survey among EU countries. Only 4,664 answers of all Czech students could be used for the analysis. The Final report of all students was prepared during fall 2013 and it is freely available (MŠMT, 2013). The overall analysis of students by different study field is published in the Final report that is why we concentrate on the specific areas not included in the report.

We use the standard statistical and descriptive methods. For the qualitative variables nominal or ordinal character the analysis of variance and contingency tables are used as well as chi-squared test.

Results and Discussion

There were 1,236 students of the economic field (26.5 % of all students) of study and 475 students of the educational field (10.2 %) in the dataset of all Czech students. The dataset of students of the economic study field contains 74% Bachelor students and 26% Master students. The distribution according to the qualification being studied for is approximately the same among students of the educational study field (68% Bachelor and 32% Master students). Table 1 shows information about numbers of students involved in the survey.

Gender	Age categories	All Czech students	Economic field	Educational field
Female	up to 21 years	901	264	92
	22 to 25	985	286	112
	25 to 30	413	109	65
	over 30 years	344	105	103
Male	up to 21 years	677	142	20
	22 to 25	818	187	32
	25 to 30	315	75	19
	over 30 years	211	68	31

Tab. 1: Numbers of students involved in the survey

The gender and age representation of the economic study field corresponds to all students studying at the Czech HEIs. There are 34.1% female students at the Czech HEIs and 34.6% female students in the economic field of study in the age category up to 21 years. Similar results for this age category can be found for males. On the other hand, in the educational field of study most students (male or female) come from older age categories (22 to 25 years and over 30 years). This can be caused by the requirement to complete educational degree for continuing the work as a teacher. There are 53 % students of the economic field and 41 % of the educational field Bachelors who are studying on daily basis and 20 % (21 % respectively) Master students.

The questionnaire asked students about the highest educational level of each parent. The educational background can influence the stance of a student to the study. A statistical

significance (5% level of significance) was traced between the study field of students and the educational background of their parents. Table 2 shows the portion of students who have and who do not have higher educational background of parents; this comprises all students whose parents' highest educational attainment belongs to the ISCED levels 5-8 and 0-4 respectively. The proportion of this sample corresponds to the result of educational background of all students. If we leave the educational background of parents separate for mother and father there is still a statistical significance between students divided into individual study fields and the education of each parent. 33% fathers and 29% mothers of students of the economic study field gained tertiary education (Bachelor, Master or Ph.D.). Moreover, 34% fathers and 49% mothers of these students gained A-levels. On the other hand, 25% fathers and 22% mothers of students of the educational study field gained tertiary degree and 35% fathers and 50% mothers A-levels.

HE background	All Czech students	Economic field	Educational field
Without	52	55	62
With	48	45	38

Tab. 2: Educational background, %

One of the most discussed topics is students' satisfaction with the studies. Figure 1 shows the portion of well satisfied and satisfied students in specific categories. Opinion of students from selected field of study corresponds with the opinion of all students. Students are the most satisfied with the teaching staff´s attitude and study facilities. The satisfaction with study facilities has mainly increased since the last round of EUROSTUDENT in 2009. The reason lies in the EU funding which HEIs have been mainly using for a focused and gradual improvement of their facilities and equipment.

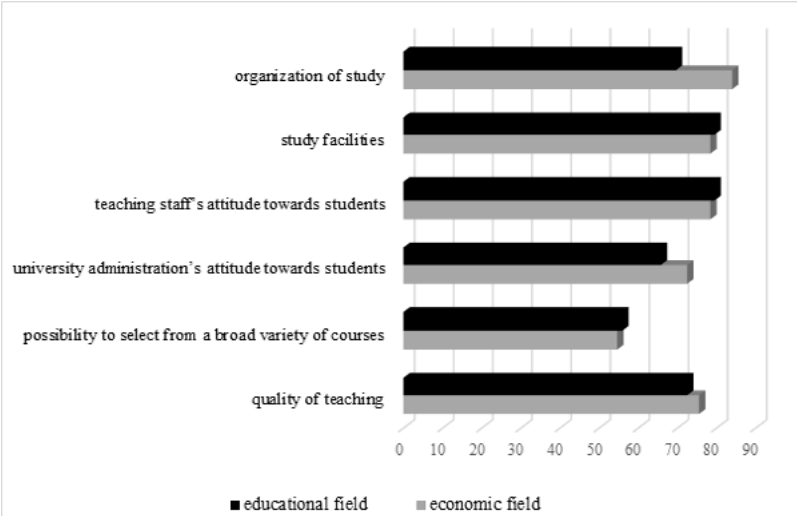

Fig. 1: Satisfaction with the studies, well satisfied and satisfied students, %

Economic activity and study intensity present a crucial part. We divided students according to their study related activities into three categories: low intensity (a student who spends

20 hours per week or less on study-related activities), medium intensity (a student who spends more than 20 hours but less than 40 per week on study-related activities) and high intensity (a student who spends exactly or more than 40 hours per week on study-related activities). Study-related activities cover taught studies plus personal study time irrespective of his/her formal status. There is a statistical significance (5% level of significance) between study intensity and students divided into study fields. Students of the economic and the educational fields of study demonstrate low and medium study intensity. They spend more time with paid job than with study duties.

Study intensity	All Czech students	Economic field	Educational field
Low	39	53	51
Medium	48	43	43
High	13	4	6

Tab. 3: Study intensity, %

On average, students of the economic study field spend approximately 12 hours per week at school, 8 hours with self-studies and 25 hours at work. It differs with the formal status of students. Full-time students of the economic study field (students on daily basis) spend 15 hours at HEI, 8 hours of self-studies and 16 hours at work. Part-time students of the same study field spend over 40 hours per week at work (on average) and less than 5 hours at HEI. However, this is not compensated with self-studies. Part-time students of the economic study field spend only 7 hours per week by self-studies. The behaviour of students of the educational field is more or less the same. In comparison with all full-time students they spend more time at HEI.

These results are connected with self-description of students. They can describe themselves primarily as students beside other activities, workforce studying alongside work and persons predominantly occupied with other duties/activities than the study. Primarily they described themselves as students. Around 30 % of all students and students of economic field are mainly working. Higher portion of working students of the educational field can be caused by the age structure.

Economic activity	All Czech students	Economic field	Educational field
I am a student besides other activities (e.g. paid job, care responsibilities)	65.7	61.4	47.2
I work and I study alongside working	28.8.	33.8	41.1
I am predominantly occupied with other duties/activities (e.g. care responsibilities) than my studies	5.5	4.8	11.7

Tab. 4: Economic activity, %

Conclusion

During the year 2013 a survey called EUROSTUDENT V took place in the Czech Republic. The aim of this survey is the examination of attitudes and social conditions of students at Bachelor and Master levels. For the purpose of this paper we chose two groups – students of the economic and the educational fields of study – from all of the students in the Czech Republic. Together they represent 36.7% of all students. The results show that students from the economic and the educational fields come mainly from families without higher education background (55%, 62% respectively). It means that their parents'

highest educational attainment belongs to the ISCED 2011 level 0 – 4. This corresponds to the educational background of all students in the Czech Republic (52% without higher education background). Students of the economic and the educational study fields are mainly satisfied with teaching staff's attitude towards students and study facilities. Moreover, students of the economic study field are very satisfied with the organization of study. Although students are satisfied with their studies they mainly belong to a group of low intensity students (contrary to overall numbers of students). It means that they belong to the group of students who spend 20 hours per week or less on study-related activities. This finding is explained by economic activity.

This paper briefly describes main areas of attitudes of students of the economic and the educational study fields. Because economic students represent a significant part of all students it is necessary to continue with deeper analysis of this specific group.

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ATTRIBUTES OF LIFELONG EDUCATION CONCEPTS IN CZECH ORGANISATIONS

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Abstract

Paper describes and focuses on one of the key factor of organisational efficiency in the area of human resources. It is employee education and necessity to develop and retain skilled employees. The aim of the paper is based on primary survey of Czech organisations to reveal attributes of lifelong education concepts. The article has been processed based on analysis of secondary sources, outcome synthesis and evaluation of primary data of a questionnaire research. The data were collected in organisations across sectors. The total number of organisations who filled the questionnaires is 211 (N=1800). The data were collected in two successive surveys focused on organisations of all the sectors (firms, public sector, NGO, banks etc.). Results identified key attributes of learning and education support. Paper and its results describe the main ways which are used by organisations in order to grow constantly and use their own potential talents and leaders.

Keywords

Education, learning, employee, organisation, development

Introduction

Education and learning in organisation are fundamentals of current and future business. The innovations and knowledge as competitive advantage is the key to corporate sustainability. The sustainability of any industry is closely linked to the manpower talent. Knowledge is one of the most important intangible assets possessed by human beings. Therefore in order to service the needs of the industry in tune with rapidly changing trends, organisations have to implement innovative learning systems and be able to match up to the expectations of the industry for knowledge support. The knowledge grows more with communication, sharing of ideas and transfer of knowledge through face-to-face communication, discussions, development programs, industry-organisation interactions (Kumaraswamy and Chitale, 2012). Organisations should align their human resource strategies, practices and processes in such a way that collaborative knowledge sharing becomes a part of the work culture and overcome the barriers to knowledge sharing. There is need to develop systems that can recognize and reward the efforts of employees who share their knowledge. This can empower collaborative knowledge sharing culture in organisations.

The aim of the paper is to test selected variables impacting organisational education and learning. Paper should reveal attributes of lifelong education concepts in Czech organisations.

Theoretical Background

Learning is individually driven and once individuals have learned some skills the next question is how the organization will incorporate procedures and assets. In other words, individual learning needs to be transformed into organisational learning (Kumaraswamy

and Chitale, 2012). Organisational learning takes place when the organization concerned addresses particular problem which the organisation should solve. Then, the problems are confronted during the learning lessons and assimilating competences that represent the collective learning of present, past and future employees. Organisational learning is described as the way the organisations build, supplement and organize knowledge and routines around their business activities and business cultures, as well as the way they adopt and develop organisational efficiency by improving the use of broad skills of their workforces (Fiol and Lyles, 1985).

Organisational learning theories provide rich perspectives on the processes that generate and change organisational knowledge. Learning provides the skills, insights and competence to perform well at work. It enables people to adopt and grow in their workplace becoming better problem solvers, more creative and innovative thinkers, more confident and proficient workers. Organisational learning can be considered as systematic behaviour to acquire capacities for dealing with the needs and challenges of organisations in competitive environments.

According to Roberts (2000) organisational education concept can be defined as having essential attributes of:

- supportive relationship;
- helping process;
- teaching-learning process;
- reflective process;
- career development process;
- role constructed by or for a mentor .

Mentoring is an intervention which supports less-experienced individuals in their development. “Mentoring” has been aligned with wider social developments as humans progress through their life stages (Garvey, 2010; Megginson and Garvey, 2007; Ragins and Kram, 2007). Learning and development are fundamental to mentoring and the apprenticeship system has always had strong ties with mentoring (Roberts, 2000). Mentorship fuses the “real world” experiences and tutelage of practicum to clients (Fullan, 2001).

The essential key elements of knowledge sharing are climate of trust and openness in the work environment where continuous learning and experimentation are well supported (Kumaraswamy and Chitale, 2012). The overall benefits of learning in organisation focused on employee fall into two main categories; career advancement and psychosocial support (Beech and Brockbank, 1999; Gannon and Maher, 2012). These professional and personal advantages are evident through more promotions, higher salaries, more job satisfaction and reduced levels of turnover (Allen et al., 2004). Learning and education have also impact on social capital and social networks (Bozionelos, 2006; Hezlett and Gibson, 2007; Singh et al., 2009). The recognition of social capital as offering valuable insights into organisational learning is built upon the premise that access to intellectual and economic capital are now more available than ever before (Hezlett and Gibson, 2007). Therefore the social capital perspective of employees and their organisations can be seen in understanding, developing and leveraging relations with others, which can further develop their career and competitive success (Singh et al., 2009).

Frye (1963) suggests that education is more than just connecting with students’ minds - it is about engaging the ‘whole person” or student. The, “whole person learning” is woven from this parallel research to align the academic, application, and aspiration aptitudes of business education curricula.

Leadership and ethics as parts of supportive relationships and helping process of education and learning dominate the business education literature. Accordingly, the premise of "whole person learning" is widely validated and can serve as a foundation for developing curricula that cultivate ethical business leadership (Carter and Donohue, 2012). This kind of studies in the business education literature draw heavily on management exemplars (Martelli and Abels, 2010; Butler et al., 2008) and skills-based coaching (Butler et al., 2008), but recognize the transcendent nature of leadership skills (Markulis et al., 2006) that are learned from pedagogical education, private enterprise, and public engagement. Whole person learning is a collaborative business education curricular/course model designed to impart ethical leadership competency. In conventional curriculum design, pedagogy is ascribed as the academic duty of teaching know-how and practicum is assigned the application duty of show-how. Instead, the proposed 'whole person learning" mentorship model provides business education instructors with a course design that aligns course pedagogy, company practices, and community principles (Carter and Donohue, 2012).

Materials and Methods

The research is descriptive and empirical in nature because the primary data were collected using the survey method through fact finding techniques such as questionnaire and interview. The data for the evaluation of current education and learning in Czech organisations has been collected in primary quantitative survey by means of questionnaire investigation. The data collection has respected the ethical aspects of research (Act No. 101/2000 Coll., on Personal Data Protection). The research contained from two successive surveys. Questionnaires were completed by 211 employees across sectors (N=1800). The method used for the collection of data was an electronic questionnaire that automatically recorded and pre-categorised respondents' answers (CAWI method) and telephonic interviewing (CATI method). The selection of a representative sample of employee population across sectors was carried out by a random selection of e-mail addresses and telephone numbers, which incorporates the advantages of multilevel random selection (Disman, 2008). The data were collected in 2013. The sample was selected solely for the purposes of the survey. Answers of respondents were categorised according to identification questions that formed the first part of the questionnaire. In the survey, the measurement was based on closed questions with one or several possible answer(s) that had been selected based on the study of literature, documents and other related surveys carried out by the following authors: Colvin (2010), Maxwell (2012), Knight (2011) and Vronský (2012). The methods used in the study were inspired by Meyer and Allen, (1991), Gosling, Rentfrow and Swann (2003), John, Naumann and Soto (2008), Anderson (2009), Michela (2007), Jablonský (2011) and Xin et al. (2011). Also, a semantic differential was applied that permitted the identification of nuances in respondents' attitudes through the questionnaire. Respondents' reactions to target statements and their attitudes to the given matter were restricted by offering a set of several statements. The extremes of the seven-point scale represented bipolar concepts of the evaluation dimension. Using a scale of 1 to 7, respondents expressed their inclination towards one of the pre-set extreme statements or, provided it was not possible to favour either of the sides, selected a median, neutral value (the median value was characterised by number 4). The scale permitted not only the specification of respondents' attitudes, but also their intensity.

The questionnaires focused on the areas of organisational support (tangible and intangible rewards, mentoring, coaching, time to learn, constructive feedback), of education and

learning, perception of support by employees, employee attitude toward education and learning, targets of education and learning and outcomes – innovations, promotions, organisational growth.

The respondents were mainly (51 %) from small organisations (till 50 employees), 24 % were from medium sized organisations and 26 % from large organisations (over 250 employees). The analysis was carried out using the Microsoft Excel and SPSS programmes. The conclusiveness of the outputs and relationships obtained were supported by the tools of descriptive statistics, for testing of results the analysis of correlation were used to review the outcomes.

To review the results, following hypotheses were sated:

H1: There is no dependence between supportive process and relationships in organisation.

The first hypothesis consists of two variables (V1 and V2)[1]: supportive process (V1) and **relationships** in organisation (V2). These variables further consisted of five parameters which individually and in totality contributed towards each performance indicator and were evaluated through the questionnaire. These parameters were support by the education and growth in the organisation, plans and goals of learning process, employees can discuss their needs, questions and concerns about learning, they can get feedback during their learning process and employees can freely discuss and exchange their opinions and ideas.

H2: There is no dependence between supportive process and teaching-learning process in organisation.

Second hypothesis consists of following two variables: supportive process (V1) and **teaching-learning process** in organisation (V2). These variables consisted of four parameters. These parameters were support by the education and growth in the organisation, plans and goals of learning process and promising employees or employees with potential are searched and recognized together with supportive management leading through education and learning process.

H3: There is no dependence between supportive process and reflective process in organisation.

The third hypothesis again consists of variables: supportive process (V1) and **reflective process** in organisation (V2). These variables again consisted of four parameters. These parameters were support by the education and growth in the organisation, plans and goals of learning process and regular feedback about learning process together with initiative in the area of project planning.

H4: There is no dependence between supportive process and career development process in organisation.

The fourth hypothesis consists of: supportive process (V1) and **career development process** in organisation (V2). These variables again consisted of four parameters. These parameters were support by the education and growth in the organisation, plans and goals of learning process and career planning and development process together with initiative of employees in the area of education and development.

H5: There is no dependence between supportive process and role constructed by or for a mentor in organisation.

Finally, fifth hypothesis consists of variables: supportive process (V1) and **role constructed by or for a mentor** s in organisation (V2). These variables again consisted of three parameters. These parameters were support by the education and growth in the organisation, plans and goals of learning process and clear role of mentor/coach in the organisation of learning process.

[1] V = variable; each hypothesis have V1 and V2

All hypotheses have always two variables. In some cases the variables further consisted of more parameters which individually and in totality contributed towards each variable and were evaluated through the questionnaire using induction and deduction. In order to test the hypotheses Spearmen's rank correlation coefficient (r) was thought to be the most appropriate test as these variables were measured on ordinal scale. The parameters were tested at 5 per cent significance.

Results and Discussion

The prepositions according to the literature review were tested. Specifically, the relationships between variables stated in the theory related to the efficient education and learning in organisations were analysed. The analysis should identify the main factors affecting the process of learning and development – the supportive process, relationships, teaching-learning process, reflective process, career development process and a role constructed by or for a mentor. To review the prepositions, hypothesis stated in the methodology were used.

Bellow in the Table 1 parameters used for construction of variables and thus hypothesis are listed.

Parametre	Spearmen's rank correlation	Acceptance	Power dependance
organisation support system – initiative in the area of education and development	0.4765	Yes	Moderate
organisation support system – initiative in the area of project planning	0.4469	Yes	Moderate
organisation support system – clear role of mentor/coach	0.4876	Yes	Moderate
organisation support system – regular feedback about learning and development process	0.6642	Yes	Strong
organisation support system – employees with potential are searched and recognized	0.4241	Yes	Moderate
organisation support system – supportive management leading through learning process	0.5117	Yes	Strong
organisation support system – plans and goals of learning process are composed	0.4453	Yes	Moderate
organisation support system – career planning and development process	0.3551	Yes	Moderate
organisation support system – free discussion and exchange of opinions and ideas	0.4419	Yes	Moderate

Tab. 1: Parameters regarding education systems in organisation

As it is possible to see in Table 1, all parameters correlate with organization of education in the organisation. Therefore it is possible to evaluate the hypotheses.

The first parameter of H1 supportive process is positively correlated at 5 per cent level of significance with all the three parameters of relationships. The second parameter of supportive process is also positively correlated at 5 per cent significance with all the three parameters of relationships. Therefore V1[2] and V2[3] are associated and H1 is rejected.

The same situation occurred in testing of the rest of the hypotheses. V1[2] and V2[3] are

[2] variable 1 – stated and described in the methodology

[3] variable 2 – stated and described in the methodology

associated, because their parameters are positively correlated at 5 per cent significance. Hypotheses H2, H3, H4 and H5 are rejected. It is possible to summarize that all tested variables are associated with support of education and learning in the Czech organisations. The results gained from analysis of Czech organisations support the attributes presented by Roberts (2000). Thus it is possible to consider mentioned system as systematic behaviour to acquire capacities for dealing with the needs and challenges of organisations in competitive environments. The premise of "whole person learning" according to (Carter and Donohue, 2012; Martelli and Abels, 2010; Butler et al., 2008) has been validated and can serve as a foundation for developing curricula that cultivate business education. The results also support the heavy role of management exemplars, as stated by Martelli and Abels, 2010 and Butler et al., 2008.

Conclusion

Paper analysed possible approaches to employee development in organisations. Research outcomes identified attributes and practices in business learning. Those attributes of support of employee learning and education are relationships, teaching-learning process, reflective process, career development process and role constructed by a mentor. Paper and its results describe the main ways which are used by employees and organisations in order to grow constantly and use their own potential talents and leaders.

Based on the results of the paper, following recommendations can be stated: (1) identify and overcome barriers for knowledge sharing through fostering effective relationships, (2) willingness to participate on the learning process of the employees need to be enhanced, (3) introduction of reflective process and career development process by the management of the organization towards effective knowledge sharing and (4) role of mentor and coach is crucial in efficient organisational learning.

The paper reviewed approaches to employee and organisational learning practices in the Czech Republic. Results of the paper can be taken into account in further analysis and in organisation of adult education.

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DESIGNING DIAGNOSTIC TESTS IN CZECH FOR YOUNG MIGRANT LEARNERS

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Abstract

The number of migrant children attending Czech primary schools has been increasing. A child's level of communicative competence in a second language, i.e. the language of instruction, is expected to play an important role in the child's progress at school and his/her integration into (school) society. Until 2010, a child's level of communicative competence in Czech was not measured with a professionally developed instrument and as a result there was a lack of information in this area.

Thanks to a set of diagnostic tests in Czech developed since 2010, pupils, their parents, teachers and schools, as well as researchers and the general public, can obtain information about migrant children's communicative competence in Czech. This paper describes the methodology used to develop the diagnostic instrument, notes several difficulties the test designers encountered and discusses possible solutions to these issues.

Keywords

Common European Framework of Reference for Languages (CEFR), Czech for foreigners, diagnostic test, language testing, proficiency test, young learners

Introduction

The number of migrant children who attend primary schools and whose language of schooling differs from their first language (L1) has been growing steadily in most European countries. This growth has increased the interest in second-language (L2) instruction for young learners and in the assessment of young learners, including L2 testing.

Despite this recent development, literature and research on testing young migrant learners remain limited. Therefore, there was a general belief that designing diagnostic tests for migrant children at Czech primary schools would enable the researchers to gather data on, for example, the level of migrant children's communicative competence in L2, i.e. in this case in Czech. There was also a general hope that thanks to these tests, it would be possible to measure the pupils' progress in L2, and that the results would help pupils, teachers and the school to identify the fields in which pupils need further instruction, since diagnostic tests are 'used to identify learners' strengths and weaknesses [and] ... are intended primarily to ascertain what learning still needs to take place' (Hughes, 2007, p. 15). For the aforementioned reasons, the project to design diagnostic tests for pupils at Czech primary schools was much welcome.

Hughes (2007) suggests that proficiency tests may serve as diagnostic tests, but it depends on the exact purpose of diagnosis. However, in the Czech context, using an existent proficiency test for young learners would be impractical, if not impossible, as the only proficiency test in Czech designed for young learners is the Czech Language Certificate Examination for Young Learners (CCE–A1 for Young Learners and CCE–A2 for Young Learners). First, this examination is subject to a fee; second, it is available only at A1 and

A2 levels according to the Common European Framework of Reference for Languages (CEFR, Council of Europe, 2001); third, it would be too time-consuming, and, thus, impractical to use these examinations as a diagnostic test at multiple levels at primary schools. For these reasons, a pilot version of a tailor-made diagnostic test for primary schools was introduced in 2010. Since this pilot stage, the diagnostic testing is still going on to the present day.

The test designers had to follow a number of steps to ensure that the product, i.e. the diagnostic instrument, would be of top quality in terms of its validity, reliability, and impact, but they equally had to make sure of its practicality. Therefore, the main steps they took to construct the test involved designing the test specifications and assessment criteria, moderation of tasks/items, conducting pretesting and expert reviews, and making revisions of the test based on an analysis that followed the pretesting and reviews (Alderson, Clapham and Wall, 2005; Bachman and Palmer, 1996). At the same time, the test designers had to take into account the specific aspects of testing young learners, such as the test-takers' short attention span, social and emotional growth and the fact that their cognitive abilities are still developing (Hughes, 2007; McKay, 2008).

The paper aims at showing what theoretical construct underlines the diagnostic test and how the test was developed including its revisions. As it would be beyond the scope of this paper to deal in detail with all the stages of the test development, only the revisions based on reviews are introduced. On top of that the author of this paper was named the internal expert responsible for reviewing especially the test materials including test specifications, test versions, and assessment criteria and, thus, can document the review process.

The methodology of the test development is summed up in the chapter on Materials and Methods and introduces mainly planning the diagnostic instrument and assembling it. Whereas during the pretesting quantitative data were collected, piloting and reviews helped to collect qualitative data. After describing the diagnostic test, expert reviews are summarised and it is discussed which points of the reviews were accepted, which not and why. Examples are given if relevant. Although these revisions are shown on a concrete material, we hope they will be of interested and use in practice for other test designers.

Materials and Methods

The process of test construction consisted of a number of steps (for stages in the test developments, see Alderson, Clapham and Wall, 2005; ALTE, 2011; Davis, 1990; Weir, 1990). The first step was to identify the need for a diagnostic test for migrant children at Czech primary schools. At this stage, it was suggested that the test should be split in two according to the age of test takers or, more precisely, the grade they are in: one test would be for pupils in the lower grades of primary school, and another one would be for those in the upper grades of primary school. This division would allow the test to be sensitive to the test-takers' level of cognitive development and their attention span and would make it possible to use test techniques and topics better suited to the specific age group.

The next step, which can be referred to as the planning stage, focused on a number of basic considerations, such as the purpose of the test, who would use the results and how, how many test-takers were expected, when the test should be ready, who would be responsible for each stage of test provision, etc. (ALTE, 2011). It was also necessary to decide what model of communicative competence would be used and how individual language skills and/or competencies would be defined. Because the diagnostic test was meant to be linked to the CEFR, or, to be more precise, the corresponding language portfolios, as the external framework, it was the model of communicative competence introduced in the CEFR that

was selected.

During the design phase, decisions about the test content and format had to be made. The construct of each tested language skill was specified and the test specifications were written. The CEFR was used as an external reference for determining levels of communicative competence. However, it should be emphasised that the CEFR is designed for adult learners. Thus, the test designers decided to base the subskills, content, competencies and abilities on the Can Do Statements in the relevant language portfolios, namely the European Language Portfolio for Learners Up to the Age of 11 (Nováková et al., 2001) and the European Language Portfolio for Learners aged 11 to 15 (Perclová and Marešová, 2001).

The test for the lower grades is for pupils enrolled in 3rd, 4th or 5th grade at a primary school (i.e. children approximately between the ages of 8 and 11). Grades below the 3rd one are not covered as the pupils may not be (fully) literate in their L1 in the 1st and 2nd grade. The format of this diagnostic test is described in detail in Table 1, while Table 2 shows the format of the diagnostic test for upper grades, i.e. from the 6th grade to the 9th grade, for children approximately between the ages of 11 and 15. (Note that the amount of time allotted to individual subtests is only a suggestion and pupils should be allowed to work at their own pace.)

Level	Subtest	No. of tasks	No. of points	Time (in mins.)
A1	Listening	3	15 (5 + 5 + 5)	10
	Reading	3	15 (5 + 5 + 5)	12
	Writing	2	15 (6 + 9)	10
	Speaking	1	15	3
A2	Listening	3	15 (5 + 5 + 5)	15
	Reading	3	15 (5 + 5 + 5)	18
	Writing	2	15 (6 + 9)	15
	Speaking	1	15	5

Tab. 1: Format of the diagnostic test for lower grades

Level	Subtest	No. of tasks	No. of points	Time (in mins.)
A1	Listening	3	15 (5 + 5 + 5)	5–6
	Reading	3	15 (5 + 5 + 5)	10
	Writing	2	15 (5 + 10)	10
	Speaking	1	15	3
A2	Listening	3	15 (5 + 5 + 5)	8–10
	Reading	3	15 (5 + 5 + 5)	10
	Writing	1	15	10
	Speaking	1	15	4–5
B1	Listening	2	15 (5 + 10)	12–14
	Reading	3	15 (5 + 5 + 5)	15
	Writing	1	15	15
	Speaking	1	15	4–5

Tab. 2: Format of the diagnostic test for upper grades

The test techniques include multiple choice questions (questions with 3 alternatives for the lower grades and with 4 alternatives for the upper grades; and for some tasks at the

lower-grade level pictures are used as alternatives), matching, short answer questions, and open tasks to test productive skills.

The cut score for each subtest was set at 60%. If the test-taker does not pass, s/he does not proceed to take the diagnostic test at the next level. While this procedure gives rise to the need to provide immediate correction, it ensures that the test-takers do not have to sit a test at a level that considerably exceeds their communicative competence.

After specifying the constructs of the skills, the content and format of the test, the test specifications were reviewed by an expert in language testing and a few amendments were suggested. Then the first version of the test was drafted and reviewed by an internal expert. Most of the suggested changes were accepted and implemented; some could not be accepted for practical or other reasons.

Then the test was piloted on native Czech speakers in the same age group as the intended test population in order to identify any weaknesses, for instance, relating to the clarity of the illustrations, ambiguity or insufficiently clear instructions, layout problems, etc. After making further revisions based on the review and piloting, the actual version of the test was designed. The next step involved pretesting, after which weak test items were rejected or reviewed. An edited version of the test, along with related materials such as test specifications and criteria for assessing productive skills, was submitted for external expert review. The reviewers were experts in teaching L2/foreign language to young learners and the methodology of teaching young learners, in language testing, or in the methodology of teaching Czech to foreigners.

As is apparent from the stages of test development described above, there were several rounds of revisions of the test. These changes were made on the basis of a) expert reviews, b) piloting, and c) pretesting and are discussed in the following chapter.

Results and Discussion

In 2013, external expert reviews were introduced besides internal reviews that comprised a number of rounds. The external experts whose remarks contributed considerably to the quality of the diagnostic test were dr. Jitka Cvejnová, dr. Linda Doleží, Kateřina Hlínová, and dr. Svatava Škodová. All the reviewers work in the field of Czech as a Foreign Language and enjoy experience in teaching Czech for foreigners. Their other fields of interest include methodology (Cvejnová), language testing (Hlínová), teaching young learners (Doleží, Škodová), and writing teaching materials (Hlínová, Škodová). However, before sending the test materials to the external experts, internal reviews were made.

The first round of revisions were made after the internal reviews and piloting. These changes mainly concerned the amount of time allotted for individual subtests, but also the order of the subtests. For practical reasons, the only subtest that cannot be handed in before the time limit set for it expires, i.e. Listening, was placed first. This change allows the pupils to work at a quicker pace if they wish to and hand in any of the subsequent subtests early. At this stage of the test development it was evident that it would be more beneficial at some test levels to introduce one writing task instead of two. When asked to perform two writing tasks at the A2 and B1 levels, a large number of test-takers provided less language material than when they were asked to do one writing task.

Piloting helped the authors identify test tasks or items that pupils hesitated over because, for instance, the illustration was not clear enough or was too complicated or because it did not correspond to their knowledge of the world or a particular situation. Such tasks or items were revised or even rejected and illustrations redrawn. A detailed track of the internal expert reviews was kept in the form of comments, suggested changes, and

reports. Similarly, all steps of the revisions can be documented thanks to storing all the test versions and identifying in them the revisions made as well as the reasons for these changes. Such a detailed documentation helped to build the validity argument.

The second round of revisions was done after expert reviews carried out by the four aforementioned experts. The changes concerned test specifications, rating criteria, and actual tests. Moreover, it was suggested that further materials such as a description of the administration process and a detailed script for the interlocutor be developed. The revised and newly developed test materials were sent to the external reviewers for another review. Like in the case of revisions based on the internal expert review, a detailed documentation was kept, including the comments why a suggested revision was or was not accepted.

The main change made to the test format based on the expert reviews was to abandon 'yes/no' items. On one hand, these items were originally chosen because pupils are familiar with this test technique, as it is often used in text books, and because it is not too demanding for pupils in these age groups (especially those in first grade) and their level of cognitive development. On the other hand, as the experts pointed out, this test technique may be less reliable given that there is a 50% chance of getting the correct answer by guessing. Although the results of the diagnostic testing during the first years of the project did not indicate much guessing to have occurred, the test designers decided to accept the experts' objections.

However, it was not easy to select an alternative test technique that would be suitable for the pupils and at the same time would contribute to variety of test techniques and would be practical in terms of length and time. So short answer questions were presented. At the basic user levels, i.e. A1 and A2, this technique was introduced mainly for reading, and in order to minimise an overlap with the writing skill the required answers are one-word and can be copied directly from the text without any grammatical changes. Moreover, here mistakes in spelling and grammar that do not lead to misunderstanding are not assessed. In Listening, other test techniques such as multiple choice questions and matching were preferred whenever possible.

One of the reviewers pointed out that in some subtest, the construct may be underrepresented on a particular subskill overrepresented. Her comment lead to re-analysing the text types and subskills tested in each task. This analysis and the following revision helped to ensure that the test is linked to the external framework. In the tasks where the reviewer's claim proved valid, test specifications and, thus, revisions were made.

It should be also emphasised that besides piloting and pretesting, the experts in teaching young learners helped to estimate the amount of time to allot to the individual subtests and the length of the pauses in Listening. They also identified topics or even (albeit only a few) tasks that seemed inauthentic or of no interest or relevance to children in the test's target age groups.

Large-scale pretesting in the third round of revisions helped the authors to identify items which do not discriminate well and/or have too low or too high facility values. These items were reviewed or substituted. However, since they often were drawn from a specific, larger text, which could be altered only to some extent, in many cases it was impossible to make substantial changes.

To sum up, there were two, in some cases even three internal reviews. All these reviews were done by one expert, namely the author of this paper. After implementing the revisions based on these reviews as well as on piloting, the test materials were sent to four external experts. Their reviews contributed considerably to the quality of the diagnostic test since they pointed out a number of areas in need of improvement, such as dropping the 'yes/

no' items although these are commonly used in teaching materials for young learners and young learners' assessment. They helped to increase the validity of the test by, for instance, identifying tasks causing construct underrepresentation or overrepresentation. They also helped to strengthen reliability by, for example, their suggestion to omit 'yes/no' items.

Conclusion

The diagnostic test for migrant children attending Czech primary schools has been used since 2009, although until 2014 only at selected primary schools. The instrument provides useful information and feedback for pupils whose L1 is different from the language of schooling, and provides the same for their parents, teachers, schools, researchers, and the general public, and it ensures that appropriate steps can be taken to help integrate the child in the education process and (school) society.

The team that designed the diagnostic test has been consistently working on its improvement. A number of revisions were made after the piloting, pretesting, and expert reviews were carried out, and the most important changes are described in this paper. They concern both the test specifications, including the test format, text types, test techniques, and actual tests. Based on some of the experts' recommendations, further materials such as a detailed script for the interlocutor are being developed.

Despite all the work carried out on the project so far, further work in the field of diagnostic testing is necessary – for example, developing a detailed record of each pupil's results in the diagnostic test that can be used by his/her teacher(s) and the school and would include recommendations on areas the pupil needs to work on further and/or other suggested steps for making the pupil feel comfortable in the education process and at school. This record could also be used for a more detailed evaluation of the pupil's productive language skills, which would further increase the value of such a document.

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REVISION OF COURSE SETTINGS IN MULTIMEDIA IN ECONOMIC PRACTICE STUDY FIELD

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Abstract

In 2014 the first graduates of the Bachelor study field of Multimedia in Economic Practice will enter the labour market. This is the opportunity to investigate how properly the study plan of this field is settled. As this study field represents something new in the group of economic study programs this contribution presents main ideas of the study field and the settings of its creation. Moreover, this paper focuses on the relevance of the subjects included in the study plan according to the prospective professions of graduates. We examined the relevance of three specific examples from the point of view of students and academic staff as well. From the results one can find out that some of the courses need to be removed from the study field and on the contrary several subjects have to be more specified in the next accreditation.

Keywords

Applied informatics, multimedia, multimedia in economic practice, study field

Introduction

The bachelor study field of Multimedia in Economic Practice was being prepared at the Faculty of Informatics and Statistics at the University of Economics in Prague after 2009 and it has been accredited in the summer of 2011. In September 2011 first students were admitted to the study. A significant part of students will graduate in June 2014 as the first graduates of this field ever. The study field is accredited within the study program of Applied Informatics. This establishment is based on the principle that the creation of multimedia is perceived as the creation of communication tools. It means encoding of information, messages and knowledge. This theoretical approach is applied and used as a basic tool for the explanation of the principles. The principles used in teaching of Multimedia in Economic Practice are based on theory of multimedia learning (Mayer, 2009, Mayer and Moreno, 2003), theory of communication (Craig, 1997, Rothwell, 2009) including dual coding theory (Paivio, 1986) and multimedia practical description of Tai Vaughan (Vaughan, 2008).

The moment just before graduating of the first full run of the study field is an opportunity for a review and verification of reaching the goals and expectations of the study field creators (author is one of creators of this study field) and teachers focused on future students' occupation. In this paper we want to verify whether Multimedia in Economic Practice effectively meets their professional status. It means whether a student is ready for entering into practice immediately after the bachelor level of study. This verification process should answer the question what knowledge and skills are actually missing in the program or unnecessary. Areas of knowledge and skills that students should acquire and operate are reflected in the construction of the study plan, which was carefully compiled in relation to the current requirements of practice and expert advice. Therefore, we want to

verify whether the actual setting fits the vision of future knowledge and skills of graduates. This knowledge and skills should be completed for the selected occupation profiles that the creators of the study field set as the goal at the beginning of the formulation. At first, we surveyed university data and thereafter we prepared a survey among students asking for their opinion of the courses, their future occupation and relevant practice. Based on the results we can analyse which courses in the study field are more and less useful or completely useless for a future student's occupation. Moreover, we can investigate whether students are motivated to continue their studies at any of the similar or different master study programs.

Motivation to form the study field

The motivation for the development of the study field was based on public demand among university students, secondary school graduates and employers. This trend relates to digitalization and subsequent availability of multimedia resources to a wide range of users. Herewith, multimedia, which used to represent a closed area of a narrow group of professionals equipped with financially demanding resources, opened towards participation of a wider group including semi-professionals and amateurs. They now face a substantially lower barrier to their use or input into the production of multimedia communications.

The requirements of employers came especially from the field of advertising agencies and companies operating television or radio broadcasts. Their demand has defined the need for new specialists able to work and understand various different types of multimedia tools at the same time. In context with savings and production efficiency, the overlap is a competitive advantage and enables flexibility of both the worker and the organization that employs them. This fact was confirmed by associate teachers of journalism at the Faculty of Social Sciences (Charles University) who observed the trend that a reporter due to attempts on saving is forced to operate both the camera and video production and post-production process.

Study plan and profile of the graduate

Multimedia in Economic Practice teaches information especially in the areas of analysis, conception, design and processing of multimedia content for the realization of functional communication. The study field is based on soft systems methodology and theories of information, communication, knowledge, and multimedia learning. Hereby it defines procedures for effective multimedia production. From the point of view of specific implementation multimedia is further taught according to practices of each sub-area (typography and word processing, graphics, photographs, video, sound, animation).

Graduates are able to analyse the communication objectives of the company and to propose appropriate use of multimedia (VŠE, 2011). That means creatively design, implement, or provide various multimedia tools for the specific needs of corporate communication. Graduates are be able to implement these tools either on their own or competently choose an outsourced company and judge the suitability and quality of the selected solution afterwards. This general description is explained by the overview of the study plan and a list of professions which aspire to in their working life.

Expected occupation of a graduate

A graduate can find employment in management and administration. If a graduate tends deeply to one of the specific multimedia disciplines they have a chance to become a professional in the field with knowledge overlapping to other related areas. In practice,

the graduate and their work will be more flexible and independent from the structure of the organization or subcontractors. We revised the list of examples of positions from the profile of graduates (VŠE, 2011) and we divided the list in two groups depending on how much personal effort beyond studies is required.

Occupations performance of which does not require student's additional independent activities beyond the study:

- Account Executive, Account Manager (project manager at an advertising agency)
- Marketer, buyer, project manager or PR client-side communication expert
- Strategic / media planner for communication campaigns
- Project manager, executive producer, production manager in advertising, production and post-production companies
- Production manager ensuring realization of multimedia work, runner director
- Creative, art director, creative director, idea maker (creator and creative concepts processor)
- Processor of internal corporate multimedia (photo and video documentation, creating simple graphics)
- Webmaster

Occupations performance of which requires student's personal interest and work beyond the study:

- 2D / 3D graphics maker (creator and processor of graphic design, visualization)
- 2D / 3D graphics animator (creator processor and graphic jingles for video, animated commercials or basic visual effects)
- Typesetting of documents, printed or outdoor advertising (processor of text, graphics and photos)
- Graphics and typesetting maker for the digital environment (banners, websites, social networks)
- Reporting, product or advertising photographer
- Digital video production maker or assistant, occupant in television or movie companies
- Web designer, director and evaluator of websites
- Audio production and post-production company or advertising or recording studios occupant
- Multimedia journalist in the service of the company or other organization (internet portal, government, local cable TV)
- Coder and programmer of the website or user interface programs and applications (requires completion of education in programming)

Materials and Methods

The aim of the survey was the examination of the meaningfulness and structure of courses taught in relation to the prospective profession of graduates, their previous experience and success in their studies. We acquired 71 answers from the survey from which 50.7 % represents male students and 49.3 % represents female students. 59.2 % of students involved in the survey already have some work experiences in the jobs related to the studies.

As we mentioned in previous chapter graduates can be employed in different types of occupation related to the multimedia. We distinguished these occupations into 11 groups according to the content of the future job. For the purpose of this paper we chose three different groups which represented different work position and different opinion of the

students. Results are based on the comparison of the students and creators of the study field opinions of the relevance of subjects contain in the study plan. The questionnaire contains questions about the students' opinion of the relevance of all obligatory subjects from the study plan. As one of the authors is creator of the study field his information of the relevance of the subjects was used. We state 5 as the most relevant and 1 as irrelevant. Figures 1 to 3 contain mean values for each subject.

Results and Discussion

The first group represents managing administrative positions. As an example we choose Marketer, buyer, project manager or PR client-side communication expert.

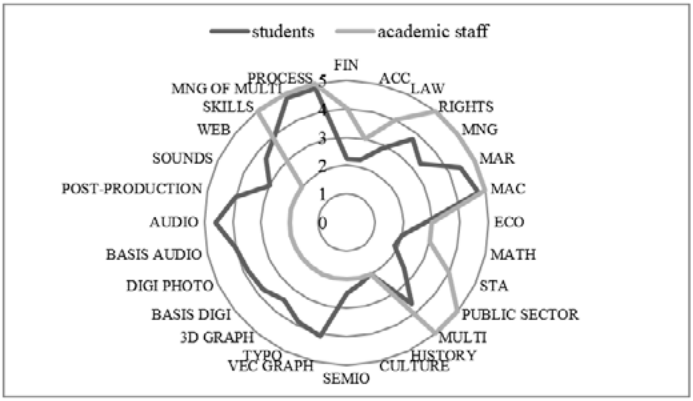

Fig. 1: Marketer, buyer, project manager or PR client-side communication expert

Note for all graphs: FIN – Corporate Finance, ACC – Accounting, LAW – Law, RIGHTS - Copyright and Industrial Property Rights, MNG – Management, MAR – Marketing, MAC – Marketing Communications, ECO – Economics, MATH – Mathematics for Economists, STA – Statistics, PUBLIC SECTOR - Public Sector and Financing in Area of Multimedia, MULTI - Introduction to Multimedia Theory, HISTORY - History of Art and Modes of Aesthetic Experience, CULTURE - Cultural Politics, Local and Regional Culture, SEMIO - Multimedia Semiotics, VEC GRAPH - Basics and Applications of Vector Graph, TYPO - Computer Typography and Typesetting, 3D GRAPH - Applications of 3D Graphics, BASIS DIGI - Basics of Digital Photography and Editing Bitmap, DIGI PHOTO - Digital Photography and Bitmap Editing, BASIS AUDIO - Basics of Audiovisual Communication, AUDIO - Audiovisual Communication, POST-PRODUCTION - Audiovisual Post-production, SOUNDS - Sound and Multimedia, WEB - Web Design and User Interfaces, SKILLS - Presentation Skills, MNG OF MULTI - Management of Multimedia Projects, PROCESS - Communication and Creative Processes

Fig. 1 shows different opinion on the relevance of the subject for the future jobs among students and academic staff representing creators of the study field. This result was expected and also announced by experts from the advertising industry participating on teaching the study field. Student, who wants to work as a marketer or PR in multimedia, needs to gain significant economic and management knowledge which are supplemented with the creative subjects. However, students enjoy these practical subjects that is why they consider them as relevant for their perspective practise. Conventional students´ misunderstanding of multimedia creation is that the core lies in creativity and originality. Professionals in this field focus much more on economic insight and knowing the field, which generates correct tasks for future creations of multimedia content by specialised

external agencies. Professions group named Marketer, buyer, project manager or PR client-side communication expert is instituted for dealing with the economic factors, communicating the tasks and ordering the multimedia creation from external subjects, not for making them themselves.

Fig. 2 describes the most wanted job among students however not everyone can do that. This occupation is based on very deep professional and personal skills. One can see that the opinion on subjects relevance of creators of the study field coping the opinion of students. Only exceptions represent subjects Cultural Politics and History of Art. As these two courses are very descriptive and students are creative they do not consider subjects as relevant. Conventional students´ approach is that they want to create, rather than to learn. In the case of Cultural Politics creators of study field and teacher of the course concluded that this course is not perfectly suitable for the study field. Its function was to establish the point of view on media including the regional and cultural aspects. The malfunction occurred because of its strong focusing on material cultural heritage and its animation. It did not come as essential information for multimedia creation. A discussion had started about superseding it by course Local and regional sociology, which reflects the human behaviour in connection with geography more. In the case of the course History of Art the creators of the study field found that students´ perspective of creational processes in past should work as the essential best practices. We can admit that this kind of course may be unpopular because of its descriptive style of historical content and because of implemented philosophy part about working of aesthetics but unpopularity does not mean irrelevancy.

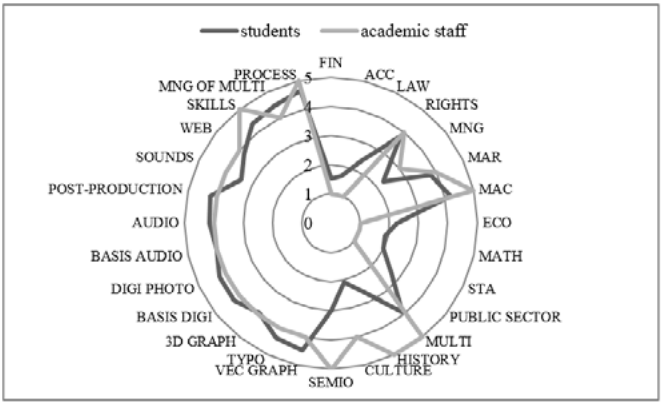

Fig. 2: Creative, art director, creative director, idea maker (creator and creative concepts processor)

The final example represents groups of graphic designers, photographers and webmasters. They should produce static media outputs. From the results (Fig. 3) one can see that the opinion of students and creators of the study field is roughly the same. The only differences (excluding Cultural Politics and History of Art which are not successful among all students of the study field) represent subjects as Basics of Audiovisual Communication, Audiovisual Communication and Audiovisual Post-production. These subjects belong to dynamic media that is why they are irrelevant for static media positions. Nevertheless, students consider them as relevant as they enjoy lectures. We can explain this by connection of creating static and dynamic multimedia content in many aspects (e.g.

pictorial contents or production process). In many cases they are both made in the same software of development tools. During the career of this group of professions many of the participants gain the experience with use of their work in animations, web applications or movies. Some of them would change the specialisation and keep creating dynamic content. Some of them will turn back and continue with static content. The conclusion is that students´ understanding of these courses as relevant is sign of wanted professions overlap that we consider as very useful for their future work.

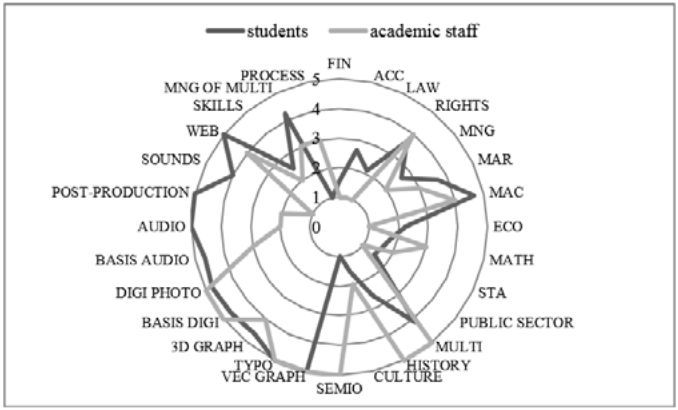

Fig. 3: Graphics and typesetting maker for the digital environment (banners, websites, social networks)

Results of the survey show that the profile of a graduate (VŠE, 2011) urgently requires a modification. In particular, an alteration of the structure of courses which fulfil the profile is necessary. Results of the survey demonstrated that better students' knowledgeableness of the core of less popular courses needs to be ensured. The generally relevant courses should implement the intersections with various areas into other courses. Students ought to understand the courses' importance, usefulness and see their interconnection. Creators of the study field want to increase the intensity of the analytical subjects (e.g. Statistics, Demography). As we already mentioned the substitutions of some courses is important. Students pointed out that the course of Cultural Politics, Local and Regional Culture is irrelevant to their study field. Since the creators have no arguments for retaining this course in the study plan (VŠE, 2011) it will be replaced by the course of Local and Regional Sociology in the new accreditation. Moreover, courses focusing on the language skills and work with text materials will be added to the study plan. The final important finding represents the students' willingness to combine different multimedia fields. This is confirmed by the trend of assigning tasks which expect the students to draw not only from a narrow specialized field but from various areas of multimedia simultaneously (e.g. in the course of Sound and Multimedia the visual part of the task, which relates to and develops the sound record, has to be submitted as well).

Conclusion

Every compiler of the study field wants to create study plan that fulfils the requirements of future employers of the graduates and in the same way that accomplishes the expectation of students. As the first graduates of the Multimedia in Economic Practise study field will

look for jobs according their knowledge academic staff of the study field wanted to find out if their study plan was built in relevance to the students and their expectations.
From the results of the survey within students of the study field we found out that (in general) if a course is popular by its contents students find the course more relevant to their prospective professions without connection to occupation requirements for skills and knowledge. In contrary if a course is not very popular among students they marked it as irrelevant. Course focused on culture studies provided by Department of Arts Management was found irrelevant by students. After the discussion with its teacher we decided to remove this course from the study plan in next accreditation. Conceptual oriented courses are hard to get for students as they are used to learn practical skills. It is necessary to bring conceptual courses close to the practice.

Acknowledgement

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MATHEMATICS-1 EXAM SUCCESS RATE AT THE FACULTY OF BUSINESS AND ECONOMICS OF MENDEL UNIVERSITY FROM 2008 – 2012

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Abstract

The paper is concerned with the exam results of Mathematics-1, a first-year Bachelor's course at the Faculty of Business and Economics of Mendel University in Brno [FBE MENDELU]. Since 2008, it has been taught by teachers from the Department of Statistics and Operational Research with exams carried out in the form of eLearning tests. According to the study plan, it is required for all students studying at the FBE. As such, it is intended for fresh secondary-school graduates and some of them may use it as a revision of secondary-school mathematics. The primary data was taken from the information system of MENDELU from 2008 to 2012. Evaluated was the success rate for the Mathematics-1 exam as such and in view of the overall success rate at the faculty. Several working hypotheses were formed and subsequently tested. The independence of the observed variables was tested by a chi-square test.

Keywords

Statistical research, mathematics, university, eLearning

Introduction

E-teaching is a new method used in education. Its purpose is to make access to study materials easier for the students, test the knowledge they acquire, and offer interactive ways of communication. In addition to electronic study materials presented on a web server, it also offers the students continuous evaluation tools with automatic grading. In the case of eLearning integrated into an information system, it is possible to make the registration for other courses conditional on the test results. Generally, eLearning is mainly intended for two major user groups – teachers and students (Šedá, Tyllich, 2014). The advantages of integrating eLearning into an information system and its use at universities are listed below:

- it adds another study-aid;
- the environment is prepared for introducing combined (distance) part time study;
- improved testing efficiency, study materials etc. distributed in the existing traditional courses;
- improved use of ICT and awareness of the ICT tools in the educational process.

The efficiency of the use of information and communication technologies for tertiary education is addressed in a paper by Novotná, Kříž, and Luhan (2012). It says that the development of information and communication technology affects life at universities and colleges in the Czech Republic. Moreover, according to the authors, effective use of ICT tools is becoming one of the key competencies for success in the future. The authors draw on research conducted at universities focused on the application of mathematical and statistical methods to practical problems.

Hassan et al (2012) look at the issue of eLearning from a different angle. Their publication

is about the use of eLearning for part-time study, particularly, about the evaluation of mathematical eLearning materials for students.
The paper, Study Success In Mathematical Subjects, by Kučera, Jindrová, and Vydrová, (2013) is concerned with assessing and comparing the study results in courses based on the knowledge of basic mathematical methods and techniques, i.e. focused on statistics and operations research. It was proved, that the type of secondary school from which a student graduated has no impact on the study results in the observed courses.
The aim of this paper is to evaluate the success of students of the Faculty of Business and Economics, Mendel University in Brno [FBE MENDELU] in the Mathematics-1 course.

Materials and Methods

Since 2008, eLearning tests have been used for exams in Mathematics-1. This course is taught at the department of statistics and operational research (before 2008, mathematics at the FBE was taught by the department of mathematics at a different faculty). According to the study plan, this first-year Bachelor's course is taught in the winter semester and is intended for recent secondary-school graduates. The aim of the course is to provide the students with the required level of mathematical knowledge, skills, and logical thinking, teaching them how to use mathematical tools to describe and solve models of real-world problems. For some students, parts of the course may just serve as revisions of mathematics taught at the secondary school.
Course curriculum – Mathematics-1:

- Linear algebra – vector spaces; matrices; determinants; systems of linear equations; matrix algebra.
- Calculus of functions of one variable – functions; properties of functions; limits of functions; continuous functions; derivative of a function; applications of derivatives; sketching graphs of functions.

Course outcomes – Mathematics-1:

- General competences – ability to apply the knowledge in practice, problem solving skills, ability to work independently, basic general knowledge, basic computational skills.
- Field related competences:
  - Students can describe the properties of functions, sketch the graphs of functions, and, reversely, determine the properties of a function from its graph.
  - Students will learn about the properties of matrices and determinants and operations over them necessary to solve linear-programming problems.
  - Students can apply operations over matrices and determinants to solving systems of linear equations and matrix equations.
  - Students can calculate the derivative of a function to determine its maximum and minimum values.
  - Students can to calculate limits and derivatives of functions of one variable and interpret these results using graphs of such functions.

Taking 60 minutes, the exam consists of an eLearning test with 10 questions. Only students having attended at least 75% of the seminars and obtained 12 out of a maximum of 25 points from a preliminary eLearning test written at seminars are eligible for the exam. To pass the exam, a student must obtain a minimum of 25 out of 50 points in the exam test.
The data for a subsequent analysis were obtained from the information system of Mendel University in Brno. Analyzed was the success rate for the Mathematics-1 eLearning exam. In addition, students were monitored to determine their overall success rate during their

entire study at the Faculty of Business and Economics.
Today, we hear ever so often that students' knowledge of mathematics is being degraded. However, students who have decided to study at a business-oriented university might be expected to be equipped with at least the basic knowledge of mathematics, which is essential for them. No doubt, an economist should be able to recognize and interpret the basic graphical outcomevs. Also, economists often have to work with limit values to find the minima and maxima requiring differentiating skills, etc.
The mathematics student numbers are shown in Fig. 1. Until 2010, we see a slight decrease with a subsequent upturn.

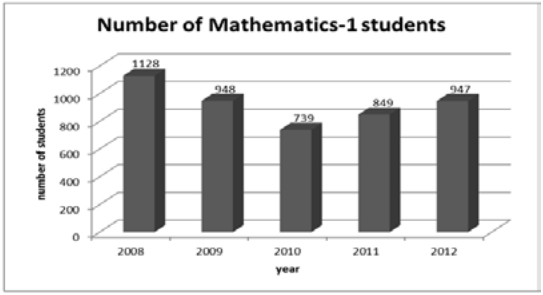

Fig. 1: Number of Mathematics-1 students from 2008 to 2012

Relative frequencies were used to test statistical hypotheses. Both single- and multistage sorting was used to test various question combinations for independence. To test independence in a table χ^2, test is used. The testing statistic is $\chi^2 = \sum_{j=1}^{s}\sum_{i=1}^{r}\frac{(n_{ij} - n'_{ij})^2}{n'_{ij}}$ with degrees of freedom. If the value of this statistic calculated is greater than the critical quantile value ($\alpha = 0.05$), the independence hypothesis is rejected and the existence of a relationship may well be assumed. In addition to the χ^2 test, the paper also uses simple and multiple-sample testing of relative frequencies. The testing statistic for testing relative frequencies is:

$$U = \frac{p_1 - c}{\sqrt{\frac{c(1-c)}{n}}} \quad \text{and} \quad U = \frac{p_1 - p_2}{\sqrt{\frac{(n_1 p_1 + n_2 p_2)(n - n_1 p_1 - n_2 p_2)}{n n_1 n_2}}}. \qquad (1)$$

For further details, see (Hindls, 2003).

Results and Discussion

Looking at Tab. 1 and Fig. 2, we can draw conclusions about our first working hypothesis:

- The percentage of students failing Mathematics-1 exam grows every year.

In order to evaluate the success of the Mathematics-1 students, a statistical analysis of the primary data was performed. The results for each year are shown in Fig. 2.

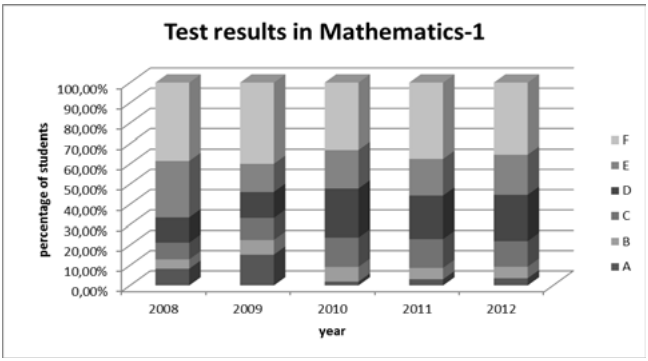

Fig. 2: Test results in Mathematics-1 from 2008 to 2012

It is obvious (Fig. 2) that the most frequent grade is F, which means fail. This grade also includes students that, having not received credit for the seminar, were not eligible for the exam. Only a small percentage of students achieve grade A. A significant shift is only seen in 2009.

The first working hypothesis is based on the widely discussed assumption that the quality of students is becoming worse every year. Apparently, this is due to the large amount of students and the overall deteriorating level of knowledge of mathematics.

The fact that, last year, about 20% of students failed the state-controlled secondary-school-leaving exam (maturita) in mathematics corroborates this. It is, therefore, excellent news that the Ministry of Education, Youth, and Sports (MEYS) has granted the proposal by the Association of Czech Mathematicians and Physicists and is considering pilot optional tests in mathematics. Higher education institutions are still not taking the state-controlled secondary-school-leaving exam seriously. For this reason, it is suggested that, within 14 days, students choosing this type of exam will have an opportunity to take a stricter optional test in mathematics to obtain a special certificate. Each secondary school may set its own number of points required for a student to be admitted without entrance exam. Apart from providing the students with better motivation, this would make the project more meaningful. (MEYS, 2014)

From Tab. 1, it is evident that the above assumption was not met. The hypothesis was surprisingly rejected. The testing has confirmed the fact that the percentage of students who cannot fail the Mathematics-1 exam (grade F) is approximately the same. No evidence was found of a significant difference between years for failing students. The biggest difference can be seen between years 2009 and 2010 where a single conclusive testing statistic value of $U = 2.88$ with a p-value of 0.004 was computed. Using the test of independence to determine the dependencies between the student grades distribution and the years, we find that, with $\chi^2 = 320.455$, the p-value less than 0.001. Thus, we can say that, in the observed years, these exam grades are unequally distributed. Next, we also tested grades other than F to find that, in 2009, a significantly higher number of A's could be proved. Also, a significantly smaller percentage of D grades were found in the years 2008 and 2009 with the E grade numbers being different, too.

	A	B	C	D	E	F
2008	94	52	93	139	315	435
2009	145	69	101	122	132	379
2010	14	54	107	178	141	245
2011	26	48	121	181	154	319
2012	34	54	120	215	188	336

Tab. 1: Results from the course – Mathematics-1

The next working hypothesis is:

- More than 60% of students failing the mathematics exam fail to finish their studies at the university.

In reaction to the above-mentioned ongoing discussion in the media about the need for a state-controlled secondary-school-leaving exam in mathematics and the generally declining students skills, we wanted to find out whether the students' mathematical skills somehow correlate with the number of students successfully completing their university studies. Note that at, at the MENDELU FBE, Mathematics-1 is a required course in all study branches.

In 2008, 1128 students studied mathematics, of which 435 students failed the exam. Of these 435 students, 371 had not completed the study. If we look at students who had succeeded in mathematics but did not make it to graduation, we find only 175 students (32.05%) in this particular year.

When testing our second working hypothesis, we find that the testing statistic is $U = 3.792$ with a p-value of 0.00007. For 2008, we have shown that more than 60% of students, who have not completed their studies have also failed the first-year mathematics exam. For the subsequent years, the test had very similar outcomes. In 2012, the percentage of students was even greater than 70. It might be worth noting that, at the FBE, there are about 40% of dropouts.

Next, we decided to test the following working hypothesis:

- Of the students with not completed studies, at least 75% failed the Mathematics-1 exam.

As teachers of this course, we have been led to this conclusion by the fact that every year we face the problem whether to include the course in the study plans of both the winter and the summer semesters. Primarily, it is only designed for the winter semester.

To justify opening the course for the summer semester, too, we were trying to find out for what percentage of students, there would be a point in also including the course in the summer semester. The below Tab. 2 shows the percentage of the dropout students failing the Mathematics-1 exam.

The test proved that the percentage is clearly greater than 75% for all years except 2010. For 2010, the p-value was not greater than 5% until the hypothesis that the percentage of students is greater than 73%. We have shown that it is not necessary to open the course.

	Percentage of dropout students who failed the Mathematics-1 exam at FBE MENDELU
2008	85.29%
2009	84.17%
2010	77.55%
2011	82.76%
2012	81.55%

Tab. 2: Percentage of dropout students who failed the Mathematics-1 exam

Conclusion

This paper aims to evaluate the success rate of students of the first-year Mathematics-1 Bachelor's course. The course exam consists of an eLearning test and, since 2008, it has been taught at the Department of Statistics and Operational Research. The exam results were being monitored from 2008 to 2012.

The mathematics student numbers in each year are shown by the diagram Fig. 1. The exam results are then depicted by Fig. 2. It is apparent that the most frequent grade is F for fail. In most years, grade A is achieved by only very small percentage of students.

Our first working hypothesis was that the percentage of students fail the mathematics exam grows every year. It was based on the assumption that the logical thinking of students is worsening year by year and that fail rate in the state-controlled secondary-school-leaving exam fail rate is biggest in mathematics. Surprisingly, the hypothesis was rejected. Therefore, we may conclude that the percentage of students failing the Mathematics-1 exam is approximately constant.

For further research, it would surely be interesting, if students were divided into groups by their FBE study branches, that is, Economic Informatics, Economic Policy and Administration, and Business and Management to see whether the Mathematics-1 exam success rates are different.

The next working hypothesis was that more than 60% of students not succeeding in the mathematics exam also fail to complete their studies at the FBE. We wanted to see if the mathematics skills somehow relate to the dropout numbers. For 2008, tests showed that, indeed, more than 60% of the dropout students have failed the exam in Mathematics-1, which is a required mandatory for all the study branches.

The tests for the subsequent years brought the same results with the 2012 student percentage being markedly greater than 70%. We also consider important the information that the FBE dropout rate is about 40%.

In the next considerations, we made a working hypothesis that, of the dropout students, at least 75% had not succeeded in the Mathematics-1 exam. This was suggested by the ongoing discussion whether to open the course both for winter and summer semesters. Being primarily designed for the winter semester, the question is whether it is appropriate to open the course in the summer semester, too.

From Table 2, it is obvious that this is not really necessary. It was found that the percentage of dropout students who failed to complete the course is greater than 75% for all years except 2010. It was proved that, in 2010, the percentage of students was greater than 73%.

Finally, we conclude that the quality of mathematics skills is not good at business-oriented universities either. A study by authors Kučera, Jindrová, and Vydrová (2013) has brought

similar conclusions. Therefore, we welcome the efforts of the Ministry of Education, Youth, and Sports to introduce pivot optional tests in mathematics. The students would then have the option of taking an additional stricter mathematics exam within 14 days after the ordinary one to receive a special certificate. The universities would then set their own limits for student with such certificates to be admitted without entrance exam. This would also link success at the school-leaving exam with the admissions at universities encouraging students to study mathematics harder.

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