Efficiency and Responsibility in Education

12th International Conference

Proceedings

Czech University of Life Sciences Prague
Faculty of Economics and Management
Department of Systems Engineering

2015

Czech University of Life Sciences Prague
Faculty of Economics and Management

Proceedings of the 12th International Conference

Efficiency and Responsibility in Education 2015

4th - 5th June 2015
Prague, Czech Republic, EU

Editors:	**Igor Krejčí, Martin Flégl, Milan Houška**
Cover:	**Roman Kvasnička**
Technical editors:	**Jiří Fejfar, Roman Kvasnička**
Publisher:	**Czech University of Life Sciences Prague** **Kamýcká 129, Prague 6, Czech Republic**
Issue:	**100 copies**

Publication is not a subject of language check.
Papers are sorted by authors' names in alphabetical order.
All papers passed a double-blind review process.

ISBN 978-80-213-2560-9
ISSN 2336-744X

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Table of Contents

SURVEY OF TEAM ROLES DEPENDENCY ON VALUE PORTRAITS

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Abstract

Values are an important feature for every one of us. Everyone has his or her characteristic values which consequently determine a total nature of society. In the process of socialisation these values are transferred from one generation to another maintaining the main features of society. Switching from social to professional standing, we can find certain connection between a value orientation and professional role in a work team.

The paper deals with research survey whether there is a mutual relation in value portraits of the respondents and in their team roles categorisation. The survey was performed using questionnaire methods Portrait Values Questionnaire (PVQ) and Belbin team roles. Data analysis stems from one-dimensional and multi-dimensional analysis. It concerns especially a survey analysis of data and respondents' roles, and the testing of two-dimensional features dependencies using contingency tables. Research results show that the dependency between value portraits of respondents and their team role categorisation can be expected.

Keywords

Belbin team roles, Portrait Values Questionnaire, pilot research, project team.

Introduction

A well-composed team is essential for the success of an organisation or project. The first step for team composition is forming which can be based on the assessment of character qualities and temperament of future team members. In professional experience Belbin roles (Belbin 1981; Belbin 2010) are often used to estimate roles of individual future team members. While for the determination of character qualities Portrait Values Questionnaire (PVQ) (Schwartz et. al, 2001) is applied. However, the use of both approaches for a more detailed recognition of a future team is uncommon.

Belbin roles were not originally theoretically or empirically derived (Belbin, 2010), but are an artificial construct certified by experience. As Sommerville and Dalziel (1998) claim in conclusion to their research, Belbin team roles (Belbin 1981; Belbin 2010) distinguish potential team members from a viewpoint of character on the basis of common personality factors. Belbin roles however cannot be unequivocally distinguished as regards orientation, i.e. extrovert and introvert. Other research which proves the applicability of Belbin roles (Belbin 1981; Belbin 2010) for creating efficient teams is submitted by Henry and Stevens (1999). In their research, both authors reach conclusion that it is not suitable to construe tea with role duplicity. On the contrary, the most productive teams had for example one leader only. Similar conclusions are always affected by a researched group of respondents and cannot be generalised. Quantification and expansion of Belbin roles is discussed in e.g. Water, Water and Bukman (2007), although Belbin roles are rather more frequently grasped qualitatively for management needs (e.g. Launonen and Kess,

2002). Other works, e.g. Popescu (2014), examine precisely the relationship between intercultural competence and efficiency of PM in intercultural situations.
Schwartz et. al (2001) successfully verified Portrait Values Questionnaire on selected studies in different cultures (e.g. Vecchione et al, 2015). Bardi and Schwartz (2003) use it for uncovering motivational conflicts where relations between values and behaviour show similar structure, while motivation is essential for a team role. Rehakova (2006) compares results of the Czech population's Portrait Values Questionnaire in context with other results in the European Union countries and concludes that there exist great differences among individual countries. Value portrait describes character of individuals without possible generalisation in terms of population or for comparison between different populations. The verification of team roles and value portraits is often performed for training purposes in students' education or in students' team formations. In recent years, the teaching of project management in the Czech Republic has undergone a considerable development. For example, Šviráková (2014) uses system dynamics models in her teaching, where a team member's character and role can be a significant variable.
Based on a pilot study, the aim of the paper is to verify a hypothesis on possible specification, i.e. person categorisation into team roles following value portraits. The output of the paper is the verification of the bond between Belbin team roles and Portrait Values Questionnaire.

Materials and Methods

Data for this pilot research were obtained from the research performed on the Master's degree students of study areas Personal Management (PRM) and Public Administration and Regional Development (PARD) at FEM, CULS Prague. The research was performed with the help of two questionnaires survey. The distribution and collection of the questionnaires was performed electronically using an online application available at the following web addresses: http://projects.czu.cz/tymrole/; http://projects.czu.cz/hodnotoveportrety/. Acquired data were stored in a common database (data matrix). The questionnaire surveys were supplemented by identification questions (gender, age, domicile, form and area of study, etc.). Results of both questionnaire surveys were combined into one data matrix. Matching was performed upon an agreement with an email address of a respondent.
Value portraits and team roles can be measured by different methods. For the purpose of our research a methodical apparatus was based on the method of eliciting value orientations using Portrait Values Questionnaire (PVQ (Schwartz et. al, 2001)) and team roles questionnaire based on Belbin (1981, 2010).

Portrait Values Questionnaire

The author of Portrait Values Questionnaire (PVQ) is S. H. Schwartz (Schwartz et. al, 2001). It is a universal and generally respected method applied above all in the European Union which through this method every two years finds out values in different fields of social research. PVQ consists of 21 verbal statements of various persons classified into 10 value portraits. The respondents expressed a statement which best depicts similarity with a mentioned person. 6 – very similar to me; 5 – similar to me; 4 – similar to me a little only; 3 – similar to me little; 2 – not similar to me; 1 – not similar to me at all. A numerical value of a variable for a particular respondent is given by an arithmetic mean of numerical values which respondents stated for items (statements) which Schwartz divides into 10 portraits (Rehakova, 2006; Schwartz et. al, 2001):

- Self-Direction – characterised by independence on mind and freedom of acting,

further creativity and curiosity. Autonomy and independence as well as control are necessary.
- Stimulation – versatile, exciting life, stimulation, excitement, novelty, and life challenges.
- Hedonism – pleasure, delight and sensual joy of self-indulgence. A need for delight, self-indulgence, pleasure.
- Achievement – success, recognition, personal accomplishment, personal accomplishment based on the demonstration of abilities in comparison with others.
- Power – influence, power, social status, prestige, control or domination over people and sources.
- Security – own risk, harmony and stability of an individual and security of society and relations.
- Conformity – self-control or self-discipline in acting, in pleasure, behaviour etc., everywhere where it is possible that the activity of an individual can interfere with or threaten others and can violate the expectation of society and norm. Conformity, respect for parents, elders.
- Tradition – tradition, respect, devotion and acceptance of habits and ideas offered by traditions or religion, modesty, accepting fate, revering traditions.
- Benevolence – profit of people we are in an everyday contact with. Protect and increase the prosperity of those we often meet. Friendship, love, loyalty, benevolence, responsibility.
- Universalism – justice, respect, tolerance and care for the good of all people and nature, social justice, equality, peace worldwide, environment protection.

Team roles questionnaire

For the respondents' classification into team roles a questionnaire of team roles based on Belbin (1981, 2010) was used. The questionnaire consists of seven question sections in total. In each section respondents circle such statements that best describe them. One, two or more statements can be circled. The circled statements are then assessed by points so that ten points are divided among them in each section. The points are further counted up and on their basis the respondents receive their team profiles, divided into 9 roles (Belbin 1981; Belbin 2010):

Name	Behavioural description	Typical features	Positive qualities	Allowable weaknesses
Chairman (Co-ordinator)	Guiding and controlling leader, knows the members‘ abilities well	Calm, self-confident, controlled	A capacity for treating and welcoming all potential contributors on their merits and without prejudice. Strong sense of objectiveness	No more than ordinary in terms of intellect or creative ability
Shaper	Demanding, coercing, confrontational leader, pushes for members to excel	Highly strung	Drive and a readiness to challenge inertia, ineffectiveness, complacency or self-deception	Proneness to provocation, irritation and impatience
Plant	Innovator and problem solver, the “idea” member	Individualistic, serious-minded, unorthodox	Genius, imagination, intellect, knowledge	Up in the clouds, inclined to disregard practical details or protocol
Resource Investigator	Contact person for resources external to the team, brings resources into the team	Extroverted, enthusiastic, curious, communicative	A capacity for contacting people and exploring anything new. An ability to respond to challenge	Liable to lose interest once the initial fascination has passed
Monitor-Evaluator	Analyses, evaluates proposed solutions and choices	Sober, unemotional, prudent	Judgment, discretion, hard-headedness	Lacks inspiration or the ability to motivate others
Company Worker (Implementer)	Implements agreed upon plans	Conservative, dutiful, predictable	Organizing ability, practical common sense, hard-working, self-discipline	Lack of flexibility, unresponsiveness to unproven ideas
Team Worker	Facilitates team functions, mediates issues within the team	Socially oriented, mild, sensitive	Ability to respond to people and to situations, and to promote team spirit	Indecisiveness at moments of crisis
Completer-Finisher	Focuses on details and meeting deadlines	Painstaking, orderly, conscientious, anxious	A capacity for follow-through, perfectionism	A tendency to worry about small things, a reluctance to “let go”
Specialist	Passionate about learning in their own particular field	Single-minded, self-starting, dedicated	Provides knowledge and skills in rare supply	Contributes only on a narrow front, dwells on technicalities

Tab. 1: Team roles (Belbin 2010)

To analyse the questionnaire surveys tools of one-dimensional and multidimensional analysis were used. The basic analysis of individual values of variables is derived from a data survey analysis which was in case of quantitative variables aimed at the acquisition of basic characteristics (mean, determinant deviation, variation coefficient etc.). Regarding quantitative variables the analysis was based on tables of frequency distribution.
Multidimensional analysis was based on the testing of two-dimensional dependencies

of features. While analysing categorical data dependency we proceed from combined classification based on two variables (features) and the detection of so-called conditioned frequencies distribution for both variables. The acquired frequencies are depicted in contingency tables of frequency distribution. Every dimension of a table corresponds with allocation to categories based on a particular qualitative (non-numerical) feature. The research of dependencies was based on Chi-square of mutual independence. If conditions of Chi-square test were not met, an exact Monte Carlo test was applied. The construction of dependency intensity measures was derived from the calculation of Cramer's contingency coefficient V which gains values from <0;1> interval. It gains 0 values provided variables are statistically independent. The assessment of this coefficient is derived from the following scale: < 0.3 week dependency, 0.3 to 0.5 medium dependency, 0.5 to 0.7 high dependency, and > 0.7 very high dependency.

For the test of statistical hypotheses using Chi-square test and a consecutive analysis the level of significance $\alpha = 0.05$ was used. Practical implementation of statistical analysis tools was performed using MS Excel and statistic software SPSS version 22.

Results and Discussion

In total, 207 respondents took part in the questionnaire survey, however, as was already mentioned, they were asked to fill in 9 questionnaire surveys. On the basis of data matrix check, it was discovered that two questionnaires were filled in partially only and could not be paired. These questionnaires were discarded from the follow-up survey and a final data matrix contained 198 respondents. Identification questions revealed that 36.5% men and 63.5% women participated in the survey. 69.8% were PRM students, while the remaining part (30.2%) was PARD students. More than a half, 55.4%, were high grammar school graduates, 29.3% graduated from business academy and the last 15.3% graduated from other types of high schools. Most respondents (46.7%) have a permanent address in Prague; other more frequent groups of respondents are from the Central Bohemia (20.5%), Liberec region (11.5%) and Hradec Králové region (10.9%). Other regions were represented by less than 10% among the respondents. As was already mentioned, for the purpose of the research data from two questionnaires were combined. The following text describes a simple analysis of partial roles and portraits of the respondents. Consequently, we will focus on mutual relations stemming from the classification into team roles and value orientations.

From mean scores values for individual roles and value orientations we can assume how individual types are represented in selection aggregates. Tab. 2 shows that among team roles the most preferred one is that of *Team worker* and *Company worker*. On the contrary, roles the respondents identify the least are the role of *Plant* and *Resource investigator*. This may result from the fact that the questionnaire survey was performed among students who yet lack practical experience in such roles. The team roles displaying the highest variability among the respondents (tab.2) were that of *Plant*, *Shaper and Monitor-Evaluator*. Focusing on characteristics for value portraits, the table (Tab.2) shows that the highest mean values belong to the portrait of *Benevolence* and *Hedonism*. The least preferred values are *Power*, *Conformity* and *Achievement*.

In the next part of the paper we will concentrate on a multidimensional analysis of relations among selected indicators, whose aim is to certify or refute the hypothesis of possible specification – person's allocation to team roles based on value portraits. For the purpose of further analysis all quantitative variables were encoded and consequently, dependencies were calculated.

The testing of the hypothesis was performed between respondents' allocation to team roles and value portraits. The fooling tables present proven dependencies between observed indicators only.

		Basic descriptive characteristics		
		Mean	Determinant dev.	Variation coeff.
Team role	Plant	3.989	3.489	87.465
	Resource investigator	3.921	2.356	60.086
	Chairman	8.574	4.265	49.743
	Shaper	6.892	5.647	81.935
	Monitor-Evaluator	6.217	4.985	80.183
	Team worker	11.106	5.214	46.947
	Company worker	12.222	4.892	40.026
	Completer-finisher	6.954	3.894	55.996
	Specialist	8.248	3.846	46.629
Value portrait	Universalisms	5.004	0.728	14.548
	Benevolence	5.124	0.614	11.982
	Conformity	3.989	1.127	28.252
	Tradition	4.059	1.256	30.943
	Security	3.954	1.225	30.981
	Power	3.789	1.258	33.201
	Achievement	4.402	0.998	22.671
	Hedonism	4.892	0.854	17.457
	Stimulation	4.781	1.568	32.796
	Self-direction	4.356	0.924	21.212

Tab. 2: One-dimensional analysis of acquired data

Team role / Value portrait	p-value	Cramer's contingency coefficient
Company worker / Conformity	p = 0.000	0.389
Company worker / Stimulation	p = 0.000	0.522
Company worker / Security	p = 0.008	0.547
Specialist / Power	p = 0.014	0.465
Team worker / Achievement	p = 0.035	0.254

Tab. 3: Proven dependencies

Due to a low number of respondents (with regard to pilot survey) the aggregation of team roles to three groups was initiated. The aggregation was based on recommendation from the research performed by Belbin and the team of his colleagues (Belbin 1981; Belbin 2010). It concerns *roles oriented towards action – Shaper*, *Company worker*, *Completer-finisher*; *roles oriented toward people – Chairman*, *Team worker*, *Resource investigator*; and *roles oriented toward mind – Plant*, *Monitor-evaluator*, and *Specialist*.

Team roles / Value portrait	p-value	Cramer's contingency coefficient
Roles oriented toward action/ Power	p = 0.002	0.702
Roles oriented toward people/ Achievement	p = 0.012	0.589
Roles oriented toward action/ Security	p = 0.029	0.324

Tab. 4: Proven dependencies after aggregation

Proven dependencies after aggregation well demonstrate the possibility of relation between team roles and value portraits. *Roles oriented toward action* are related to value portraits *Power* and *Security*, which can be explained as a need to exercise influence and social status, control and dominance over people and sources. Influence and social status should be natural components of the role *Shaper*. Control and dominance over people and sources is vital for the role *Completer-finisher*. It can therefore be expected that gaining influence and dominance over people and sources without orientation toward action within a team is impossible. Another proven relationship is the relation between *roles oriented toward people* and value portrait *Achievement* which can be expressed as a personal performance and recognition by others. It is impossible to imagine either of the two without cooperation with others and interaction with other team members. *Chairman* or *Team worker* is oriented at achievement; it can be expected that without orientating toward others or at cooperation in a team achievement cannot be reached.

Conclusion

The paper describes a pilot study performed on a smaller sample of respondents. The respondents were selected among the last year students of Master's study. Data from both questionnaires (BELBIN; PVQ) were obtained electronically and statistically evaluated. The performed pilot research showed that under certain factors it is possible to find agreement in one's value orientation and professional role in an organisation or project. The research further proved dependency of roles after aggregation according to orientation and several value portraits. The relation between individual roles orientation and value portraits can be expected thanks to motivation factors since values for each individual determine his or her behaviour (Bardi and Schwartz, 2003). Further research will be focused on the verification of pilot survey findings performed on a representation sample of students and it will be extended to the analysis of relations with indicators regarding respondents' structure (age, gender education, etc.).

Acknowledgements

The authors gratefully acknowledge the support from the Faculty of Economic and Management, Czech University of Life Sciences, via IGA grant, no. 11170/1312/3139.

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MISTAKE ANALYSIS OF THE LINEAR PROGRAMMING TASKS IN OPERATIONS RESEARCH COURSE

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Abstract

Linear programming is a group of tasks forming part of operations research. It is part of operation research methods taught at the Faculty of Economics at VŠB-Technical University of Ostrava. Knowledge of the field of operation research is part of the second year of study at VŠB-TU Ostrava. The goal of this paper is to identify the most common mistakes students make, which cause difficulties in their exams. Students can solve linear programming tasks by using a graphical or software solution. The main groups of mistakes are sorted there as criteria. Students should focus on them during their preparation for this testing. The Pareto diagram methodology is utilized in the evaluation of main groups of mistakes. Differences between the software solution and the graphical solution are revealed there.

Keywords

Evaluation, experiences, knowledge, linear programming, operations research, students

Introduction

Operation research is a form of team work whereby a group of experts work together to resolve a complex problem that could be of an economic, technical, organizational, or military-strategic nature (Baňařová and Moravcová, 2003). Operations research provides many possible problem-solving methods applicable in a wide spectrum of situations. (Bazsová, 2014a). It is a course which is taught at almost all Economics faculties, not only in the Czech Republic, but throughout central Europe. It is either included in other courses or taught separately. There are many classification group problems. Řezáč (2009) claims, there are 12 groups of tasks in Operations Research. Římánek et al (2002) recognizes two main groups of methods: those for the analysis systems and their surrounding and models of the main subsystems. Linear programming is a group of tasks which is part of the above group. Anderson, Sweeney and Williams (1988:124) claim that 'one of the most important areas of linear programming deals with multi-period planning applications such as production scheduling'. It helps managers to plan production efficiency. Teachers monitor students´ ability to apply the theoretical basics. The Operations Research Course is an obligatory course at the Faculty of Economics at VŠB-Technical University of Ostrava. Students´ ability to solve production problems are tested here. The examination should demonstrate whether students are able to solve the problems commonly faced in management practice at a managerial operational level. Students must apply a wide knowledge of theory, concepts and methods in the Operations Research Course. They should be able to search for and use information required to solve a defined problem. They should recognize the goal of the company in the production problem, the constraints connected with queue limitations, and other requirements. They must make decisions individually and responsibly in a familiar context. Nowadays it is also very common

to use a software support in teaching economic courses and to develop knowledge by stressing the creation of applications. Students must use specific software when solving linear programming tasks (Bazsová, 2014a). An efficiency assessment of students was used by Baňařová, Chytilová and Zapletal (2014). The authors provided an assessment of the same course at the same university - Operations Research – but in a different way. Evaluation of the course was based on an examination. Data Enveloped Analysis was used. Another approach to this problem connected with efficiency and effectiveness was taken by Hančlová, Baňařová and Němec (2014). The authors evaluated e-testing in the examination, using statistical tools.

The efficiency of linear programming teaching was enhanced by Bartoška, Fejfar and Jarkovská (2011). He demonstrated the value of system diagrams. Students´ results were compared by using various tests – some by applying analytical methods, others by applying system diagrams.

The goal of this paper is to identify the most common mistakes which create difficulties for students in examinations. There are a number of main groups of mistakes which students make and should focus on during their preparation for this examination. A Pareto diagram is utilized in the evaluation of these main groups of mistakes. A Pareto diagram was also used to evaluate quality at the Faculty of Economics, VŠB-Technical University of Ostrava. Students were asked to evaluate the specific course they had attended there (Bazsová, 2014b).

Materials and Methods

The students participating in this exploration and the operations research course are in their second year of study at university. They take four examinations during a semester – graphs, network analysis, linear programming and input-output analysis. The research will be focused on the third examination – linear programming. Students can complete the test by using special software or graphical methods. The minimal points required are seven, with maximal points at 15. If a student fails to achieve seven points, they must repeat the examination. Should the student be unsuccessful after a second attempt, the subject must be repeated.

The teacher makes a decision regarding options for displaying solutions. Students are informed about the most important criteria in the evaluation process. These criteria were also applied in this survey. For efficiency, it is important that a mathematical model be formulated. This model has its own structure based on defining decision variables and defining constraints, which are connected with limited (bounded) queues, and which must be available for concrete production. Students should also know the objective function of this problem, reflecting the goal the company is pursuing in connection with its production. The second criterion is the transforming of it into a canonical form. The third requirement is the ability to create a dual model. The fourth criterion involves creating a Simplex Table. The fifth criterion involves displaying feasible solutions using specific software. The sixth criterion involves writing up both results – the optimal and the dual optimal solutions. The seventh criterion involves interpretation of the solution achieved. A further evaluation is the demonstration of the graphical solution. Students draw a graphical situation of the model and find the optimal solution by means of graphical representation of the situation (criteria five and six). The list of criteria for these two test options is shown in the table 1 and 2. The exploration in this survey, by means of a Pareto diagram, identifies the difference between these two methods of testing. They will be compared in this survey.

Criteria	Definition of criteria
K1	Defining of the mathematical model, identifying of variables
K2	Canonical form and defining of slack variables
K3	Dual model compilation
K4	Simplex table formation and determine the key element
K5	Listing of all feasible solutions
K6	Finding and listing of the optimal solution
K7	Economic Interpretation of these two models

Tab. 1: Definition of Criteria using the Software Solution

Criteria	Definition of criteria
K1	Defining of mathematical model, identifying of variables
K2	Canonical form and defining of slack variables
K3	Dual model compilation
K4	Simplex table formation with determining the key element and the base
K5	Graphical solution displaying, feasible solution, marking of the optimal solution
K6	Listing of the optimal solution of these two models - primal and dual
K7	Interpretation of the optimal solution of both models

Tab. 2: Definition of Criteria by Using the Graphical Solution

The Pareto diagram is a useful tool for quality evaluation. It is named after Vilfred Pareto, the Italian economist who explored wealth allocation (Blecharz, 2011). It was first used by J.M. Juran, who discovered that most problems regarding quality are caused by minor factors (5-20%). To create a Pareto diagram, it is necessary to create a cumulative number of deficiencies and a cumulative number of deficiencies as a percentage. The diagram is composed of two charts – a histogram and Lorenz curve (Noskievičová, 1996). Absolute frequencies of occurrence of a particular negative effect are marked on the main axis. They are sorted from the highest value to the lowest. On the secondary axis, deficiencies are represented as a percentage. We can identify the most useful minority of causes which contribute to the overwhelming majority of results. The most important deficiencies have a value of 80%. It is necessary to analyse this first main group of deficiencies. We can discover and analyze the vitally important minority by using a Pareto diagram.

Results and Discussion

There were 558 students in the winter semester of the academic year 2014/15. In total, 419 successfully received a credit and 107 did not. Students had two attempts to pass the examination in linear programming. Both terms were announced in advance. The second attempt wrote 253 students. Students made 313 mistakes in the software solution and 336 mistakes in the graphical solution in the first term. The students´ mistakes in examinations are listed in descending order. The table below is an example of a table created according to the Pareto analyse in tab. 3.

Criteria	Number of mistakes	Cumulative mistakes	Relative mistakes
K1	79	79	25,24%
K6	62	141	45,05%
K7	52	193	61,66%
K5	41	234	74,76%
K4	38	272	86,90%
K2	21	293	93,61%
K3	20	313	100,00%
Total	313		

Tab. 3: Number of mistakes by the software solution – first term

As we can see, Pareto diagrams in fig. 1 and 2 show that the vital minority is concentrated in the criteria K1, K6, K7 and K5 when students were tested by using software support. These mistakes show students that it is important to devote more attention to preparing for these examinations, particularly on the creating of the mathematical model; on the listing of the most optimal solution of both models – primal and dual; and on the interpretation of the optimal solution. The main groups in which students made mistakes were the mathematical model and the finding of the graphical solution.

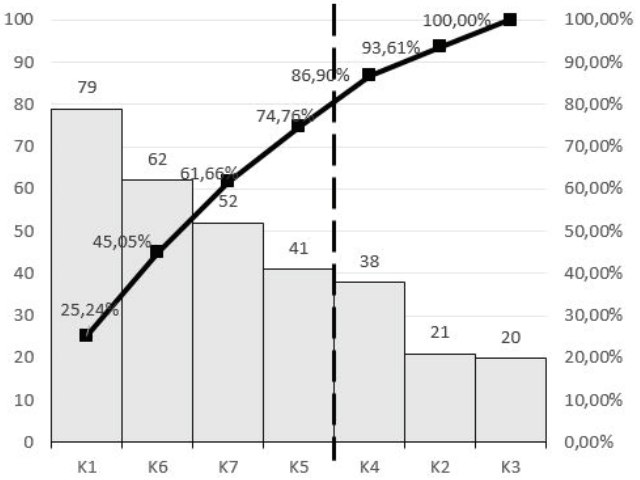

Fig. 1: Mistakes in the software solution – first term

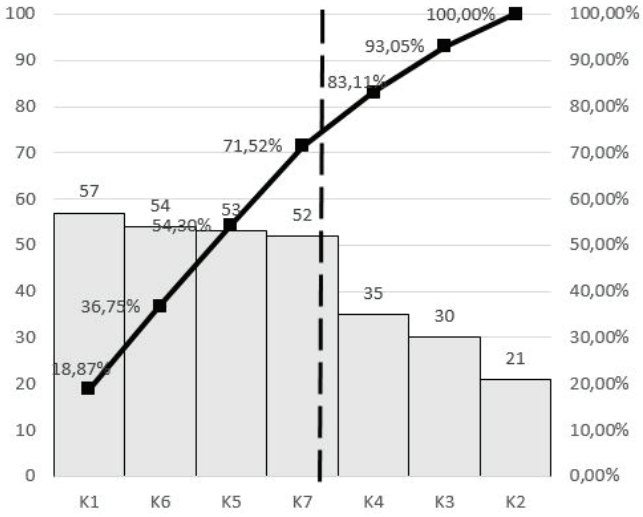

Fig. 2: Mistakes in the software solution - second term

Figures 3 and 4 show that most students´ mistakes are concentrated in criteria K1, K5, K7, and K6 when using the graphical solution. A positive consideration is that mathematical model creating is not a priority in the second term (see fig. 4).

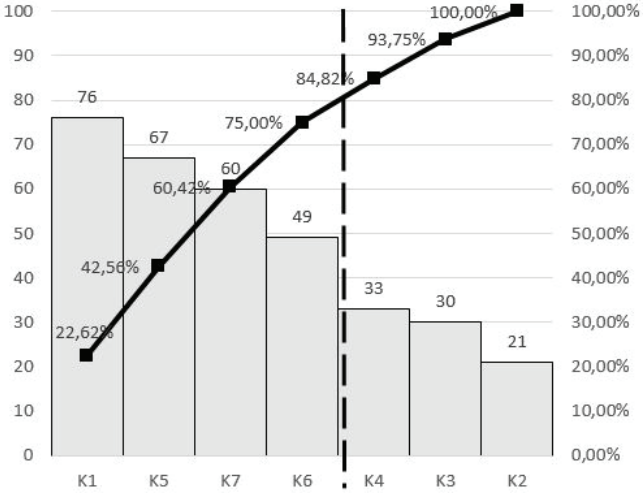

Fig 3: Mistakes in the graphical solution – first term

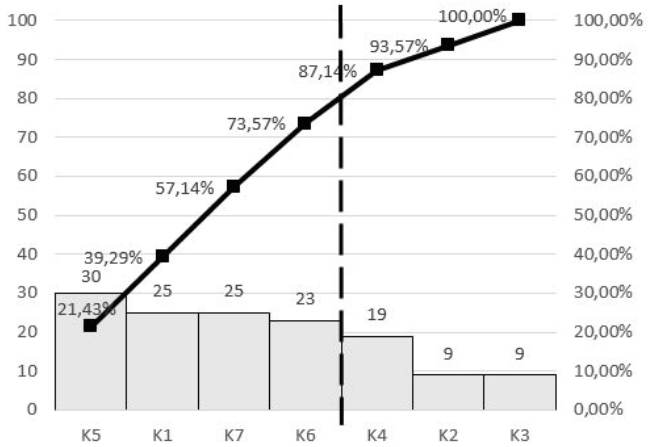

Fig 4: Mistakes in the graphical solution – second term

When comparing the first and the second terms, we can see a declining trend in most difficult criteria K1in the software solution (see tab. 4). Criteria K3 and K5 have increasing trend. When comparing mistakes in the graphical solution, more mistakes were indicated in the first term (see tab. 5). The total number of mistakes in the second term decreased (see tab. 4 and 5). Pareto diagrams show that the mistakes of students are concentrated in the criteria K1, K5, K6 and K7. These criteria are connected with their logical thinking.

	1. Term	2. Term	Difference	% Difference
K1	79	57	22	- 28
K2	21	21	0	0
K3	20	30	10	+50
K4	38	35	3	-8
K5	41	53	12	+29
K6	62	54	8	-13
K7	52	52	0	0
Total	313	302		

Tab. 4: Differences between the first and second test - the software solution

	1. Term	2. Term	Difference	% Difference
K1	76	25	51	-67
K2	21	9	12	-57
K3	30	9	21	-70
K4	33	19	14	-42
K5	67	30	37	-55
K6	49	23	26	-53
K7	60	25	35	-58
Total	336	140		

Tab. 5: Differences between the first and second test – graphical solution

If we compare the results, which were presented in 2014 by the authors Hančlová,

Baňařová and Němec (2014) with the results obtained in this investigation, we can identify some common elements, but also differences. Regarding the common elements, we can say that both had the same pattern, ie. the same course - Operations Research. The investigation by authors Hančlová, Baňařová and Němec (2014) was conducted to measure the effectiveness and efficiency of the students in the test form of electronic testing using open source platforms (Moodle). Investigations in this paper are focused only on the area of linear programming and on solving a continuous example of the tasks of production planning. For comparison with the contribution of Hančlová, Baňařová, Němec (2014) the Facility index *(FI)*, which evaluates the complexity of the issues, is an interesting one. When the level of $FI < 30$, six issues were identified as less demanding in the field of linear programming. Questions relating to criteria such as the definition of basic variables were computed with a value of *FI 24%,* which is labeled as less demanding issues. For $FI > 90$ no case of linear programming as demanding was identified. In terms of comparison, it is also an important standard deviation *(SD)*, which evaluates the variability of response of the students. *SD* indicator was very high on issues relating to job specifications (52%), with the dual task solution (58%) and also on issues relating to the simplex table (52%). The survey used a Pareto chart, showing that the simplex table is not difficult. The investigation showed the most difficult for students was to formulate mathematical model, find feasible solutions and the optimal solution.

Both investigations show that the written examination and final examination of linear programming are difficult for students, particularly on issues which require logical thinking.

For the next research it would be interesting to measure the dependence between the knowledge text and the time for the accuracy of the answers in the linear programming tasks in tests. A similar investigation was brought by Rauchová and Houška (2013) using the statistical means such as arithmetic mean, median and standard deviation in measuring students' performance after learning time by solving the specific group of tasks in Operations research – graph theory. They investigated the performance of 41 students divided into two groups at the Czech University of Life Sciences Prague.

Conclusion

The results proved the importance and usefulness of Pareto diagrams. They showed where the students´ mistakes lay. The research revealed that the main mistakes of students are found in the defining of the mathematical model; the listing of all feasible solutions; and the economic interpretation of the primal and dual models in both tests. The declining tendency between the first and second examinations demonstrated their improved preparedness for it.

Acknowledgements

This paper was supported within Operational Programme Education for Competitiveness – Project No. CZ.1.07/2.3.00/20.0296.

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PUBLIC EXPENDITURES ON EDUCATION – COMPARISON OF EU STATES

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Abstract

Education plays the key role in economic development. In the European Union, everyone emphasizes the fact that education should be a priority for all the countries in order to deal with the current economic situation. Our findings show a declining trend in public expenditures in terms of the total government expenditure. Public expenditures (% of GDP) are increasing. It means that other than budgetary sources are used. The decreasing pupil-teacher ratio in nearly all the states is a positive aspect. What is negative is the long-term decreasing value of expenditure per student in tertiary education which together with the increasing number of students might have a negative impact on the quality of education. At the same time, we were unable to prove any strong relationship between the total public expenditures on education and economic growth.

Keywords

Education, public expenditures, economic development, EU

Introduction

A welfare state is considered one of the positives of the modern European civilization. Education is an essential part of the welfare state. However, there is a serious decline in public expenditures especially in Europe, as many authors argue that deterioration of public expenditures can improve economic growth (Ramos and Roca-Sagales, 2008). Marattin and Salatti (2014) brought into consideration another opinion, namely that it depends on the type of expenditure.

It is generally agreed that education is one of the main elements of economic growth (Kwon and Koo, 2014; Mekdad, Dahman and Louaj, 2014; Gylfason, 2000), especially because a human capital represents one of the highest expenses in any business (Soukup and Sredl, 2009). An investment into the human capital accumulation in early childhood can be seen as a stage for productive education in the late childhood (Abington and Blankenau, 2013). In the poorest countries, education is considered the only way to reduce poverty (Jung and Thorbecke, 2003). Some authors also argue that public expenditures can contribute to the economic growth and promote equity (Tanzi and Chu, 1998; Sylwester, 2002). It is also necessary to mention that public expenditures influence economic growth more than private ones (Beraldo, Montolio and Turati, 2009). Another problem is the quality of education. Wang and Sunny Wong (2011) claim that the quality of education is the key element to foreign direct investment and through it to economic growth. Kolman, Rymesova and Michalek (2012) and Rymesova (2012) also emphasize the importance of the quality of education. Benos and Zotou (2014) have analysed 57 studies and concluded that majority of authors found a positive impact of education on growth but the effect itself is not homogenous

Most of the developed countries are facing ageing of their population. Hand in hand with this phenomenon, there is a very high number of dependency burdens in the developing and the least developed countries. A decline in labour force in the next decade is the negative aspect of the formal ones. One of the solutions to this problem is to improve the quality of education together with the increase in spending on education (Annabi, Harvey and Lan, 2011). Alternatively, massive public expenditures on education can cause a peculiar situation regarding the intergenerational issue (Arvate andand Pereira Zoghbi, 2010; Cattaneo and Wolter, 2009). Kurban, Gallegher and Persky (2015) have made a different statement, i.e. that ageing of the population has risen per-pupil education spending.

Education can be considered as a form of public goods distinguished by being non-excludable and non-rivalrous. For different levels of education we can apply different conditions on public goods. Primary education should reflect the necessity for further levels of education. In most of the states, this level is being financed by the local or central government. The situation with secondary and tertiary education is different. Financing tertiary education in particular differs across countries. We cannot expect that all sectors of education would be financed in the same way and especially, for example, agricultural education in the developed countries, where we are witnessing the decline of this sector of economy (Prochazka, Smutka and Steininger, 2011; Clark, Thomson and Smutka, 2011). However, most countries' constitutions include the following: "education should be guaranteed to everyone". Even the European Union states that education should become more open and should reflect the European citizens 'needs.

The aim of this paper is to compare public expenditures on education in the European Union with respect to the original EU 15 and the new EU states. The main hypothesis is that there is no difference between old and new member states with regard to public expenditures on education.

Materials and Methods

This is a comparative study which should compare the level of public spending on education in the EU member states. For the purposes of this paper, the EU 28 has been taken into consideration. The analysis has been conducted for years 1999 – 2011. We are conscious of the inadequate time period – especially its end. Unfortunately, the latest data in the field of education which we can compare for most of the countries are not available after the year 2011. Whenever data are available, we will use the newest data.

Mostly descriptive and comparative statistics and data visualization are used for comparison. The public expenditures on education and their impact are empirically analysed.

The difference between old and new member states has also been compared. The T-test was used to compare the mean of the variables between old and new member states for each indicator.

The data are derived from several sources, especially from the UN – UNESCO database, the OECD library and Eurostat. This is necessary as this paper is part of the research which compares this phenomenon at regional level. Owing to this, not only Eurostat data were used. However, there is a substantial difference between different data sources (even though the description of the dataset is the same).

Results and Discussion

The relative size of the public sector varies across the countries. The size differs from

20 % to 60 % (measured in terms of GDP consumption). Education is one of the most demanding sectors of economy (after the social system). Compared to the social expenditures, spending on education can easily be cut down in the national budget, especially when public finance is unsustainable. However, this solution is not generally accepted. This is based on whether or not the level of public spending on education has an impact on the economic situation, which has been argued for the last decades. There is no simple answer to this problem. Different authors use different approaches and data.

Public expenditures on education

Public expenditure on education (% of GDP) is the first used indicator. According to the UNESCO Institute for Statistics (UIS Glosary): "Public expenditure (current and capital) includes government spending on educational institutions (both public and private), education administration as well as subsidies for private entities (students/households and other private entities)".

In this case, no significant changes have occurred during the monitored period (Fig. 1). The level of public expenditures on education varies from 2.8 % GDP (in case of Romania, 2000) to 8.81 % GDP (Denmark, 2010). The median level for all the monitored states was oscillating around 5.26% GDP. There is a significant difference between the monitored countries. Concerning Denmark, the level of expenditure on education is much higher than in the rest of the world. Cyprus is another outlier (2008 and 2009). Until 2009, the median level had been increasing; however, there was an extensive decrease in 2011. This is a negative aspect. This situation simply copies the economic situation in the whole EU because in 2011 there was a decline in the EU general government total expenditure (% of GDP).

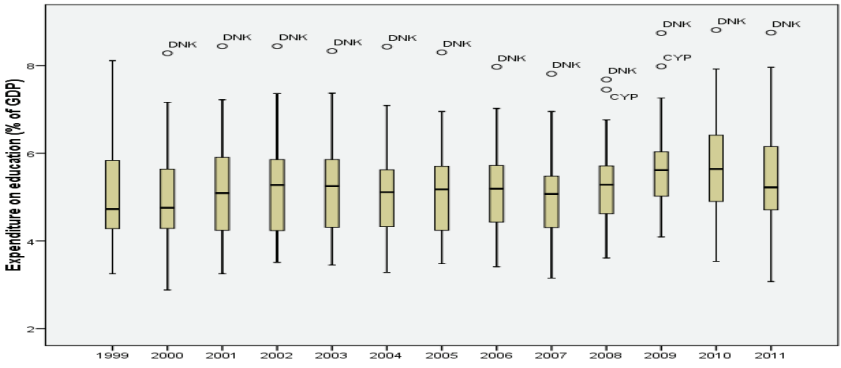

Fig. 1: Expenditure on education (% of GDP)

First of all, public expenditures on education were compared. H0 - there is no difference between old and new member states. The analysis was conducted in two steps. Firstly, the mean of the whole dataset (all years in one file) was compared. The results of the Levene´s test assume that variances are approximately equal. The results of equality of the mean show that the null hypothesis can be rejected, since the p-value equals 0.01. It can be concluded that public expenditures on education between old and new member states vary.

Then, the situation between "old and new" member states was compared in different years. Concerning this, we can say that the mean was lowest in 2000. The highest level of

the mean was reached in 2009 – again in both groups. In this regard, it can be assumed that the group variance is equal for all the selected years. The findings show that in nearly all the chosen years (except for 2009 and 2010) there is no difference between old and new member states. In general, there were only two years when it cannot be proved that the level of spending of public expenditures on education is the same between both groups. This concerns years 2009 and 2010. In these two years, the null hypothesis cannot be accepted and it may be concluded that the mean difference between these two groups is statistically significantly different. This might be due to an impact of an economic crisis. In this regard, another interesting factor appeared – for the following year 2011, there is no difference between these two subgroups. These results are surprising as there is a significant difference between the whole dataset.

Based on these findings, a correlation between economic growth and expenditure on education was conducted for each of the selected groups, however, no difference between the groups has been found. The relation between the growth rate of GDP and the growth rate of expenditure on education (%) of GDP (as a dependent variable) was also analysed, however, no significant relation has been discovered. For further analysis, it would be useful to conduct statistical analyses within and between the groups to find out what causes this difference.

Government expenditures on education

Secondly, we used general government expenditures (% of GDP) in comparison with public spending on education (% of government expenditure).

According to the UNESCO Institute for Statistics (UIS Glossary): "General government expenditure on education (current, capital, and transfers) is expressed as a percentage of total general government expenditure on all sectors. (It includes expenditure funded by transfers from international sources to government. General government usually refers to local, regional and central governments."

Nearly all the European states emphasize the importance of education for economic growth. Therefore we would expect an increase in public spending on education during the economic crisis as a response to it to boost economic growth.

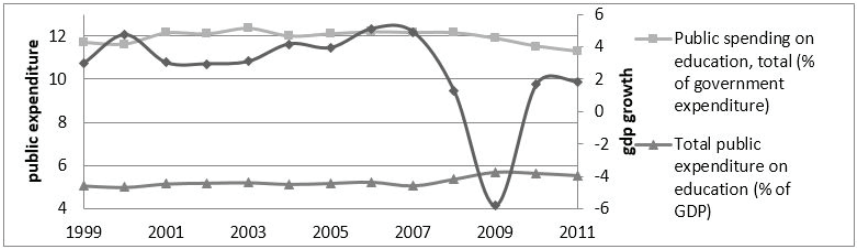

Fig. 2: Comparison of average public spending in EU

The situation in most of the EU countries is different (figure 2). Since 2007, we have witnessed an annual decline in educational spending as a part of government expenditure. This decline is most visible between years 2008 and 2009 and has a declining tendency. This might be connected with the GDP decline that year. This is in contrast with an increase of general government expenditures in the monitored years. Between 2008 and 2009, general government expenditures increased by 3.8 percentage points. When we compare the trend between public spending on education (% of government expenditures

with the total public expenditures on education (% of GDP), we will discover the opposite trend. Total public expenditures on education have increased since 2007. It means that other than budgetary sources are being used.

Based on the previous findings, it might be suggested that the situation would be similar to the previous one. The null hypothesis: H0 - there is no difference between old and new member states. The same procedure was used as in the previous case. First of all, the whole dataset was tested. The whole dataset has equal variances. The results of equality of the mean show that the null hypothesis can be rejected, as the p-value equals .009. It may be concluded that government expenditures on education differ between old and new member states.

In 2001, 2002, 2003 and 2004 equal variances are assumed. Equal variances for the remaining years cannot be assumed. In all the selected years, the null hypothesis may be accepted and it may be concluded that there is no difference between both groups.

These results are highly different. However, this corresponds with the results of the previous part. The only question is what factors play the key role in this case. The next step in the research should be to find the factors that influence this.

Expenditures on education at different levels of education

Primary education is compulsory in all the analysed states. It is considered a public benefit. In this case, it must be provided and also financed by the government. All the European states have different ways of financing primary education (municipalities, regions, states).

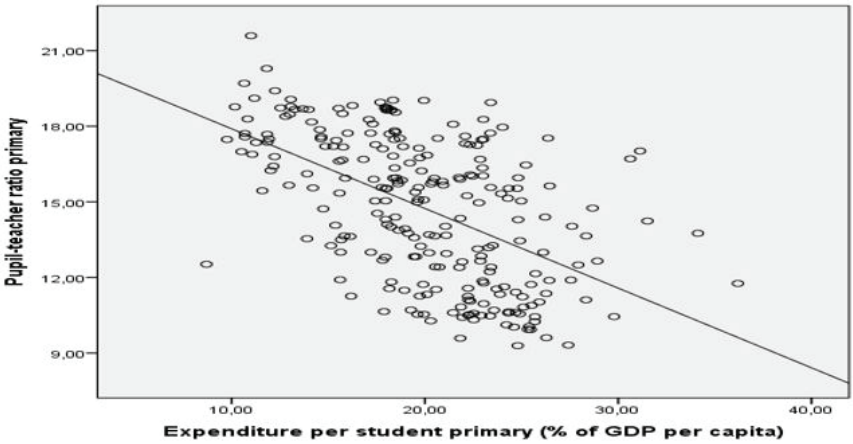

Fig. 3: Dependence of pupil-teacher ratio on expenditure

The figure 3 displays the relationship between expenditures per primary student with the pupil-teacher ratio between 1999 and 2011. There is a correlation between expenditure per primary student and the pupil-teacher ratio. High pupil-teacher ratio indicates insufficient finances in primary education. The median is 14.75. The maximum was 21.58 pupils per teacher in 1999 in Ireland, minimum 9.26 in 2010 in Luxembourg. There is positive development, as the pupil-teacher ratio indicator has a declining value during the whole monitored period. However, we cannot prove any significant relationship between the above mentioned variables in the monitored period.

All the above mentioned indicators only describe the quantitative aspects of the education

system; however, it is also vital to measure the qualitative aspect, as it plays the key role in human development. One of the qualitative indicators could be the PISA score. The aim was to analyse the influence of a quantitative indicator (money spent) on a qualitative indicator. The PISA results from 2009 and 2012 were used. Since the PISA score is measured every three years, an average of expenditure from years 2006 – 2008 and 2009 – 2011 has been calculated, which should have an impact on the PISA score in the following year.

There were two indicators of expenditures: Annual expenditure on public and private primary educational institutions per pupil/student and expenditure per student (% of GDP per capita). A very strong correlation between the level of the PISA score and annual expenditures on public and private educational institutions per pupil/students have been discovered. This result documents the influence of proper financing of education, which can lead to better teaching results.

The structure of expenditures per student (primary, secondary, tertiary) as a percentage of GDP per capita differs across the countries. In the whole EU, the average value of expenditures per primary student was slightly increasing until 2009 (Fig.4). This may have been influenced by a different age structure of population and the decreasing number of pupils attending primary schools. There is no statistically significant difference between old and new member states.

Secondary education expenditures increased significantly between 2007 and 2008 by six percentage points at the European level and again, there is no statistically significant difference between old and new member states.

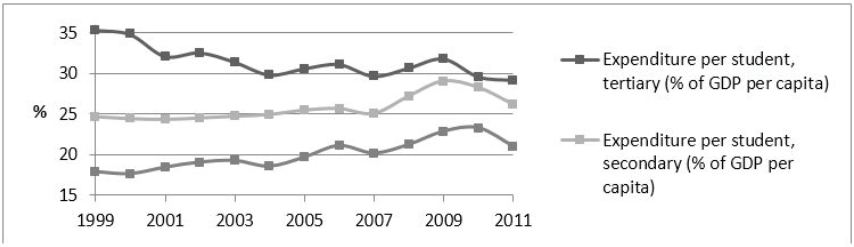

Fig. 4: Expenditure per student, (% of GDP per capita)

Compared to the above mentioned findings, tertiary education expenditures have been showing a declining tendency for the last 13 years (except 2009). However, this might be affected by the economic decline. This trend is in contrast with the increasing number of tertiary students over the last decade. In 2002, 17.8 million students studied at public and private tertiary institutions. In 2011, the number reached over 20 million students. After putting the two factors together, it might be concluded that there is less money available per tertiary student.

There seems to be a statistically important difference in spending on tertiary education between old and new member states. In general, old member states spend a higher proportion of their GDP on education compared to the new member states.

The above is connected with another interesting factor that has appeared during the last decade, namely focusing on scientific excellence only without taking the educational side into consideration. Most countries have focused on the improvement of their research which can be measured very easily (the number of papers, citations), although real teaching is deteriorating.

We can see one problem related to tertiary education and it is its measurement. There is no system for assessing the level of knowledge students have acquired over their studies. Several years ago, OECD introduced the AHELO system which should test students and university performance globally. The problem this system encountered was unwillingness of majority of the countries to apply it, because of the fact that it could point to the weaknesses of the current system of financing.

Some authors (Agasisti, 2014; Sopek, 2012; Obadic and Aristovnik, 2011) used for example DEA method to measure the efficiency and equity of education. Their results mostly show that there is no difference in the monitored time period. However, none of these measurements consider the qualitative point of view. Hanusek and Woesmann (2008) pointed out the importance of cognitive skills in economic development. This is true particularly because it is the human capital that drives our economic growth. While Breton (2011) and Fonchamnyo and Sama (2014) also mentioned the stage of the development which is important in considering its influence on economic growth. Laurini and de Carvalho Andrade (2012) also stress the importance of the quantity of schooling. That corresponds to the increasing number of students.

Conclusion

This paper analyses the expenditures on education from different points of view. One of the analyses takes into consideration the difference between old and new member states. For most of the indicators, there are statistically significant differences between old and new member states. On the one hand, there is a demand for high-quality education which will have a positive impact on economic growth and, consequently, highly qualified workers would attract foreign capital, on the other, most countries have problems with deficit in public finances and financing other government services. The new member states should increase their funding for tertiary education, otherwise they will not be able to compete with the old member states. The global economic crisis has hit most of the economically developed countries and its influence on the educational sector can be illustrated by the decreasing expenditure per student at all levels of education. However, due to insufficient data (no data after 2011), the impact of the economic crisis, which started at the end of 2008, cannot be fully analysed.

Acknowledgements

This paper was supported by Grant Agency of the Faculty of Economics and Management, Czech University of Life Sciences Prague no. 20151031.

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THE ANALYSIS OF FACTORS INFLUENCING AN INFORMATION SECURITY AWARENESS OF STUDENTS

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Abstract

This paper deals with identification of factors that influence the formation and keeping information security awareness of students in university environment. The effort of educational organizations to improve students' awareness of information security does not often have the desired effect. This problem is important. Creating awareness of information security requires more than providing information about the risks and proper behaviour. Students must be able to understand the issues and must be willing to follow certain rules of conduct. This problem is also part of the general education of university students. A research model was set up. It includes chosen institutional, individual, and environmental constructs. The model was empirically tested. The results show that "Perceived group norms" and "Perceived certainty and severity of sanctions" are the most influential factors that mostly influence information security awareness of university students.

Keywords

University information resources, information security education, information security awareness, PLS-SEM

Introduction

One of the objectives of IT departments of educational institutions is to avoid information security incidents caused by students. Generally, internal employees pose a great threat, rather than external attacks (Guo et al., 2011; Warkentin and Willison, 2009). Internal employees are responsible for most information security incidents. These incidents are result of misuse or errors caused by employees and also intentional damage (Siponen and Vance, 2010; Beranek and Knizek, 2012, Beranek, 2015).

Every educational institution provides rules for students which use university computers, software and communication infrastructure (Beranek and Remes, 2010). These rules determine what behaviour is permitted or prohibited to students in the field of information security practices, as well as subsequent sanctions if the prohibited conduct happened. However, students often use some tricks to rationalize their behaviour violations, such as neutralization techniques (Siponen and Vance, 2010; Volek and Alina, 2013). In addition, students` benefit-cost calculate or rational choice processes may also lead to the ineffectiveness of sanctions (Hu et al. 2011). Many students always "do not do what they are supposed to do" when working with university information assets. This problem corresponds to the situation of internal employees in enterprises (Furnell and Rajendran, 2012).

The important role of information security awareness is widely recognized. However, the factors that influence the acquisition and growing awareness of information security are not very well known (Bulgurcu et al., 2010). In this paper, we try to understand student`s information security omission behaviour. We examine what factors influence the behaviour of students in the area of information security, and why.

Materials and Methods

Disciplines, such as psychology, are dedicated to understanding, explanation and prediction of human behaviour. Especially, undesirable employee behaviour is potentially destructive or harmful to both the organization and its members (Lawrence and Robinson, 2007). Two theories which are suitable for this study have been found. The theory of planned behaviour and social cognitive theory were chosen to predict and explain human behaviour in information security area. In addition, perceived group norms, self-regulatory efficacy, and fear or perceived certainty and severity of sanctions as environmental factor are other variables that could explain some of this behaviour.

The influence factors and hypotheses definition

Theory of planned behaviour

Theory of planned behaviour was developed in 1988 by Ajzen (1991). This theory proposes a model which can measure how human activities are conducted. It predicts the occurrence of certain behaviour, assuming that behaviour is by design. A key part of this theory is the behavioural intention. Behavioural intentions are influenced by the attitude, what is the probability that the behaviour will have the desired effect and subjective assessment of the risks and benefits of this result. Theory of planned behaviour has been widely used in the investigation of ethical behaviour and decision information system of the individual in accordance with the security rules (Hazari et al., 2009; Lee et al. 2004; Leonard et al., 2004). Theory of planned behaviour consists of five constructs, which together represent actual control over the behaviour of people (Bada and Sasse, 2014): Attitudes - refer to the degree to which a person has a favourable or unfavourable evaluation of the behaviour of interest. It entails a consideration of the outcomes of performing the behaviour. Behavioural intention - refers to the motivational factors that influence a given behaviour where the stronger the intention to perform the behaviour, the more likely the behaviour will be performed. Subjective norms - refer to the belief about whether most people approve or disapprove of the behaviour. It relates to a person's beliefs about whether peers and people of importance to the person think he or she should engage in the behaviour. Social norms and Perceived behavioural control are the other constructs.

We assumed that the behavioural intentions (intention to information security omission behaviour) of students and their behaviour (workplace deviance), in accordance with the information security requirements, will be influenced by attitudes and subjective norms of students. We propose therefore two following hypotheses here:

H1. Subjective norm will negatively affect intention to information security omission behaviour.

H2. Attitude will positively affect intention to information security omission behaviour.

Perceived group norms

A group norm is defined as established rules that determine acceptable and unacceptable behaviour in a group (Levi, 2011). Several studies have been conducted on the perception of group norms in different organisational settings, however, the findings of these studies is mixed. Kivlighan, Kivlighan and Cole (2012) conducted a study to examine the interaction effect of commitment on the relationship between group members' absence norm and group member's absence for the next academic session. The study found that frequency of other group members absence is significant predictor of group member absence in the next academic session. Every group norms regulate the behaviour of its

members (Parks, 2004). Hence, we propose the following hypothesis:
H3. Perceived group norms will positively affect intention to information security omission behaviour.

Fear - perceived certainty and severity of sanctions
To make the desired behaviour easier to achieve, it may often help the change of the environment. Environmental factors reflect the physical environment such as the workplace, and the technology, but also the economic factors. One of the important persuasion factors is the fear of sanctions that may follow after the some misuse of information system or other information security breach. In this study, this factor has two inseparable elements, certainty of sanctions refers to the probability of being punished, and severity of sanctions refers to the degree of punishment which comes after information system misuse. Perceived certainty of sanctions and perceived severity of sanctions were both negatively associated with the intention to engage in deviant behaviour in the workplace such as stealing from an employer or information system misuse (Nagin and Pogarsky, 2001). Hence, the following hypothesis is proposed:
H4. Perceived certainty and severity of sanction will negatively affect intention to information security omission behaviour.
Self-regulatory efficacy
Bandura's (2003) self-efficacy theory may provide insight into the moderating role of self-regulatory efficacy on the effects of formal controls and perceived group norms on workplace deviance. The stronger individual's self-efficacy beliefs to resist peer pressure the less likely he or she will engage in deviant behaviours. From managerial perspective, it can be argued that organisational formal control and perceived group norms alone are not sufficient to reduce the occurrence of deviant behaviour in the workplace because, according to Ackroyd and Thompson (1999), individuals are creative people who will likely find ways on how to beat the formal system. Hence, the following hypothesis is proposed:
H5. Self-control will moderate the relationship between intention to information security omission behaviour and workplace deviance.
The last hypothesis has the form:
H6. Information security omission behaviour will positively affect workplace deviance.

Research methodology

The partial least squares (PLS) technique of structural equation modelling, which uses a principle component-based estimation, was used for the analysis. The approach is suitable for validating predictive models, particularly those with small size samples (Chin, 1998). The primary research question of this study is: what are the factors that cause that students do not comply with information security rules? We suggested a conceptual model to help answer this research question, see Figure 1.

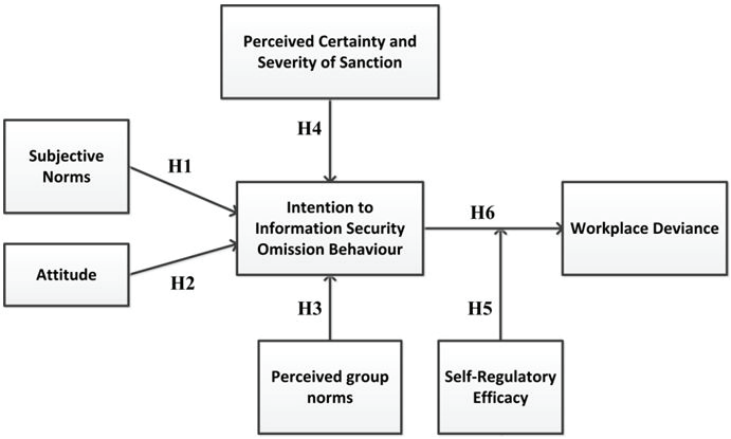

Fig. 1: Research model

This study examines the relationships between the four possible determinants concerning information security awareness with the intention to information security omission behaviour and workplace deviance with self-regulation efficacy as a factor with moderating role. To determine the theory of planned behaviour constructs of attitude and subjective norm, original constructs described by Taylor and Todd (1995) and Herath and Rao (2009) were modified. Original items and five point scales were adapted for adherence to the principles of information security. Self-efficacy use measures adapted from Compeau and Higgins (1995), Workman et al. (2008). Measures for perceived group norms were taken from Elek et al., (2006). The constructs concerning fear, i.e. perceived certainty and severity of sanction, were measured using four misuse scenarios. Scenarios were chosen because they are considered to be the best way to respond to sensitive issues (Nagin and Pogarsky, 2001). These scenarios were adapted from Harrington (1996) and Paradice (1990).

Results and Discussion

Data for this study was obtained through questionnaires (see a sample on the Figure 2), which we have posed to students studying the specialization Computer Science in various classes. We addressed 32 respondents. The age of respondents was 20-27 years. Respondents were evenly divided by gender. They all believed that they had good knowledge of the use of computers.

Construct (Source)	Items
perceived certainty and severity of sanctions (Nagin Pogarsky, 2001) (strongly disagree … strongly agree)	F1: I believe that students computing activities are monitored by my organization. F2: I believe that my university reviews logs of employees' computing activities on a regular basis. F3: I believe that my university conducts periodic audits to detect the use of unauthorized software on its computers. F4: I believe that my university actively monitors the content of visited web pages. F4: I believe that my university actively monitors the content of my downloaded files.

Fig. 2: A sample of the questionnaire

The specific tool that was used for questionnaires evaluation was SmartPLS 2.0 (PLS-SEM. 2014). PLS supports two measurement models: (a) the assessment of the measurement model and (b) the assessment of the structural model. The structural model

presents information about the path significance of hypothesised relationships using the path coefficients (β) and R squared (R^2). An examination of the structural model indicates that the model explains 71 percent of the variability in behaviour intention ($R^2 = 0.71$) and 43 percent of the variability in behaviour ($R^2 = 0.43$). Chin (1998) notes that R^2 values of 0.71 and 0.43 for the percentage of variance in a model are substantial and moderate, respectively. The R^2 shows the percentage of variance in the model to give an indication of its predictive power.

Further, an assessment of the measurement model of the six main constructs was estimated using: internal consistency, convergent validity, and discriminant validity. Hair et al. (1998) or Stastny et al. (2011) suggested that item loadings of 0.5 are adequate for these indicators. The composite reliability for each of the study's constructs was above the recommended level of 0.7, indicating the internal consistency of the data. Fornell and Larcker (1981) recommended that the average variance extracted (AVE) criterion be used to assess convergent validity. These researchers suggested that an AVE value of 0.50 is acceptable, as it indicates that a latent variable is able to explain more than half of the variance of its indicators, on average. Convergent validity was examined using the average variance extracted measure. Intention, Subjective Norms, Perceived group norms and Perceived Certainty and Severity of Sanction cleared suggested 0.5 benchmark with scores of 0.54, 0.56, 0.61 and 0.59, respectively. Unfortunately, two constructs fell short: Attitude generated an AVE score of 0.45, while the score for Self-Regulatory efficacy was 0.43.

In addition, each of the six hypotheses was examined using *t*-tests (31 degrees of freedom). This is an indication of path significance levels. Four of the hypotheses were supported, while two were not. *H1* is supported at the 0.05 level (*t*-value = 1.89, $\beta = 0.103$), suggesting that Subjective norms does influence Intention to Information Omission Behaviour. *H3* is supported at the 0.001 level (*t*-value = 4.15, $\beta = 0.409$), suggesting that Perceived Group Norms control does influence Intention to Information Omission Behaviour. Also, *H4* is supported at the 0.001 level (*t*-value = 4.99, $\beta = 0.720$), suggesting that Perceived Certainty and Severity of Sanction negatively affects Behavioural Intention. *H6* was also supported at the 0.001 level (*t*-value = 5.25, $\beta = 0.73$), suggesting that Intention to Information Omission Behaviour positively affects Workplace Deviance. *H2*, and *H5* were not supported, suggesting that, in this situation, Attitude do not influence Intention to Information Omission Behaviour (*t*-value = 0.509, $\beta = 0.034$) and Self-Regulatory Efficacy do not moderate the disposition to Workplace Deviance (*t*-value = 0.082, $\beta = 0.098$).

Conclusion

The aim of this research was to find out why students decide not to comply with information security principle when using computers and information systems in university information environment. The conducted research also shows that students' awareness of information security is small. However, such upbringing is an important part of general education of students at the present time.

In this study, we concluded that constructs Perceived group norms and Perceived certainty and severity of sanctions have the greatest impact on students' behaviour. Also construct Subjective norms has impact on proper students' behaviour. It follows that individuals with positive views will more likely adopt the proper behaviour, than individuals who just do not care. Additionally, a small positive effect of attitude shows that this construct can be influenced by perceived norms of students' group. More research is needed to understand the role of attitude.

Greater influence of perceived group norms and perceived certainty and severity of sanctions suggests that students tend to rely more on external factors, i.e., on opinions of others. These factors could be corrected through training and educational program focused on the importance of individual actions in complying with information security rules.

This research examines the model designed to explain why individuals do not follow the rules of information security in organizations. Model, while imperfect, explains 71 percent of the variance in behavioural intention to comply the principle of using computers and 43 percent of the variance of the true behaviour of comply with information security rules. However, many questions remain to be examined. For example, the sample consisted only of students studying computer science studies. The sample will be extended by a more representative cross-section of individuals. Other variables that could affect the complying with the rules of information security should be explored, for example culture and risk perception factors, ways of communication or some other social factors. These issues will be addressed in future research.

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SELFTEST ANALYSIS FOR THE IMPROVEMENT OF EDUCATION PROCESS

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Abstract

The paper focuses on the improvement of the e-learning self-tests using its analysis by difficulty index and discrimination index. The main goal of this paper is to analyse the self-tests used for the course Applied Mathematics for Informatics at the Czech University of Life Sciences, and to assess quality of self-tests using the students' results from the academic years 2012/2013, 2013/2014 and 2014/2015. The quality of self-tests was proved; only the Self-tests 1 should be adapted in order to adjust its impact. The paper proposes proper modification of self-tests, learning materials and classroom activities to improve the efficiency of the education process.

Keywords

Education process, self-test, score, difficulty index, discrimination index

Introduction

Education means that the knowledge, skills, values, beliefs and habits are transferred from one group of people to the other group by various ways such as discussion, teaching, training, or research. Education frequently takes place under the guidance of teachers, but students may also educate themselves. The educational efficiency is influenced by many factors, mainly whether the student has clearly clarified objectives of his study, whether he is able to motivate himself and whether consultations and other support for studying is available, whether the student has the ability to classify himself, ability and opportunity to compare his study results and goals (Dewey, 1997).

One of the frequently used forms of study support at universities, which has improved the teaching–learning process, is usage of the information and communication technology (ICT) in education (Escobar-Rodriguez and Monge-Lozano, 2012), e.g. implemented learning management system – e-learning system (Poulová, 2010). E-learning system encourages active student participation in classes (Teasley and Lonn, 2011) and it provides a dynamic approach to traditional teaching methods (Novo-Corti, Varela-Candamio and Ramil-Díaz, 2013; Davis and Surajballi, 2014). Internet e-learning support allows students to access the necessary study materials in various forms, which are located in the network and which students use for both the study with teachers and for self-study (Clark, Mayer, 2011).

Important part of the e-learning support are self-tests. They represent the kind of knowledge testing, which allows simple and quick way to verify the students' knowledge by computer generated tests consisting of a few selected questions. Students answer the test questions in the electronic form. Finally, immediately after the completion of the self-test students receive the results. This quick mapping of students' knowledge is the main advantage. Students learn from their mistakes and can focus following studies on the part they failed in. Self-tests are also very helpful for teachers because they can see where their students show lack of the knowledge and which knowledge has to be improved.

The system of students' testing through a self-test complements e-learning educational materials and creates a complete package of e-support for education. Such e-learning system allows students not only to read and study e-learning materials (lectures, materials for exercise and others), but also to test their knowledge. Self-tests can be analysed in different ways and based on this analysis the state of knowledge of students can be determined and if needed education process or self-tests can be adapted.
The aim of this paper is to analyse self-tests used for the subject Applied Mathematics for Informatics (AMI) at the Czech University of Life Sciences. The students' results of self-tests from the years 2012 to 2015 have been analysed and the changes in self-tests, learning materials and classroom activities to improve the efficiency of the education process are proposed.

Materials and Methods

Description of the self-tests and exam-tests

Student attending the second year of study at the Faculty of Economics and Management Czech University of Life Sciences in full-time and combined studies have the subject Applied Mathematics for Informatics (AMI) is in the curriculum of the programs System Engineering and Informatics.
The content of AMI contains introduction to Linear algebra and Vector space, Linear optimization models, Transportation models, Decision theory and Game Theory models and Multi-criteria models. The main topics of the subject are covered in the lectures and seminars, model definitions and steps of algorithms are highlighted during the teaching. The subject AMI is organized in 2-hour lecture and 1-hour tutorial per 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:

- Self-test 1 - Linear algebra,
- Self-test 2 - Linear programming – Simplex algorithm,
- Self-test 3 - Linear programming – Postoptimization,
- Self-test 4 - Distribution problems,
- Self-test 5 - Decision-making theory and Game theory,
- Self-test 6 – Multi-criteria decision-making.

Students fill in self-tests in the learning management system. Moodle.czu.cz which allows students to access not only the self-tests themselves, but also to the necessary study materials which are available in the e-learning system and can be used for study.
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 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 credit and be allowed to take the final exam. Some students received enough credit without taking the sixth self-test.
For the analysis of self-tests, the scores of self-tests have been collected from the Moodle.czu.cz system for the last 3 academic years (2012/2013, 2013/2014, 2014/2015) and from all students, regardless of the number of attempts. Together we have analysed results of 767students (220 students of the year 2012/2013, 242 students of the year 2013/2014 and 285 students of the year 2014/2015).
The self-test analysis is based on the average number of attempts and average self-test score, number of students which have to pass the sixth self-test to receive a credit and on the difficulty index and the discrimination index.

	Number of students	Number of attempts					
		Self-test 1	Self-test 2	Self-test 3	Self-test 4	Self-test 5	Self-test 6
2012/2013	220	283	406	488	363	323	177
2013/2014	242	348	476	566	341	349	191
2014/2015	285	336	507	521	398	385	313

Table 1: Number of students and number of attempts of the self-tests in three years

The Difficulty Index

The difficulty index of the test questions is found to be one of the most useful and most frequently reported analyses (Taib and Yusoff, 2014). It is a measure of the proportion of students who answered the question correctly; therefore it is frequently called the *P-value*:

$$P = \frac{B_{sum}}{B_{max}} \quad (1)$$

where B_{sum} is a total number of obtained score of all students;
B_{max} is maximal possible amount of score.

The difficulty index can range between 0.0 and 1.0. The higher value indicates that a greater proportion of examinees responded to the question correctly. The index of difficulty of a suitable question lies in the closed interval [20%, 80%] (Škoda, Doulík, Hajerová-Müllerová, 2006).

The Discrimination Index

The discrimination index distinguishes between the good and bad students. The students are ranked according to their scores and than divided into two equal groups (better and poorer).

$$ULI = \frac{N_U - N_L}{0.5\ N} \quad (2)$$

where N_U is the number of students from better group who answered the question properly;
N_L is the number of students from poorer groups who answered properly;
N is the total number of students.

The possible range of the discrimination index is from -1.0 to 1.0; however, if a question has the discrimination index below 0.0, it suggests a problem. A negative discrimination index indicates that the test is measuring something other than what the rest of the test is measuring.

The values of the discrimination index and the difficulty index have to be interpreted together, because there is a relationship between them. If an item has a very high (or very low) *P-value*, the potential value of the discrimination index will be much smaller than if the item has a mid-range *P-value*. The test questions are suitable if the difficulty index is from [30%, 70%] and the discrimination index is greater than 0.25. If the index of difficulty lies in the intervals [20%, 30%] or [70%, 80%], the discrimination index has to be greater than 0.15 (Škoda Doulík, Hajerová-Müllerová, 2006).

Results and Discussion

Analysis of self-tests results

Firstly, we analysed the number of students and number of attempts of answering self-tests. Number of attempts differs from the number of students, because each student can

repeat the self-test up to five times. The Table 1 and Fig. 1 show similarity in average number of self-test attempts during the analysed years. The Self-test 3 required the highest number of attempts for completion. The Self-test 6 required the lowest number of attempts for completion due to the fact, that some students could receive the credit, if they had enough points before taking this test. The lower number of attempts in the Self-test 1 can be explained by students not having enough experience with self-testing.

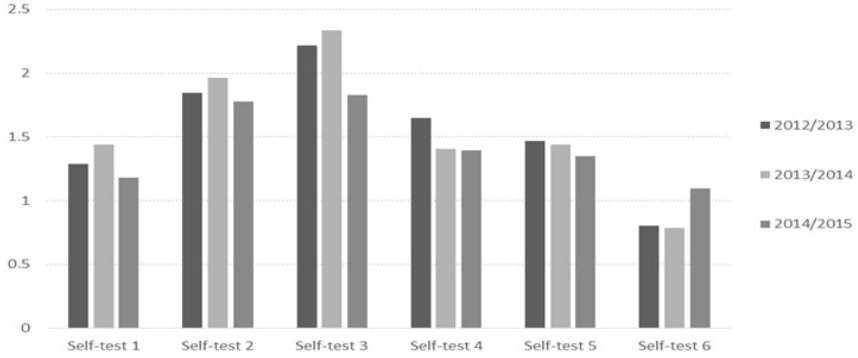

Fig. 1: Average number of attempts of self-tests

The analysis of the average number of points from each self-test and each year is the next step. The Fig. 2 shows, that the average score of each self-test has been slightly increasing over the years, which is in contrast with exam results during the same academic years (Brožová, Rydval, 2013, 2014).

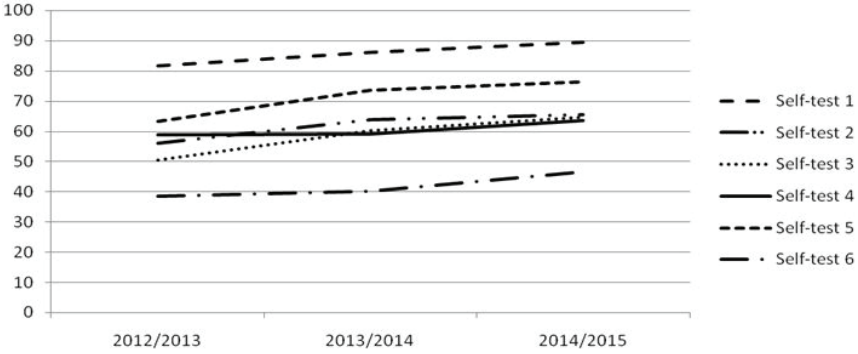

Fig. 2: Average Score of Self-tests

The students achieve significantly higher average number of points from the Self-test 1. One reason can be that the topic of the first self-test is linear algebra, which students are familiar with from high school, and the second reason may be that students use MS Excel for checking the correctness of calculations during filling in this self-test. Passing the Self-test 1 is therefore an easy way to get a high score. Contrary to the Self-test 1 students achieve a significantly lower average score in the Self-test 6. This is largely due to the fact that the last topic Multi-criteria decision-making is discussed in the last lecture and it is partly practiced during the last seminar only. The second reason may be that some of the students had already met the credit prerequisites after taking the first five self-tests and they only filled in the Self-test 6 out of curiosity.

The values of the difficulty index for the second to the sixth self-test are in the interval [30%, 80%], so the difficulty of these tests is designed well (Fig. 3). The first self-test is much simpler, as already stated, the difficulty index is between 80% and 90%. The Self-test 6 is conversely more difficult, but its difficulty index is greater than 0.3, so this test is also adequately created.

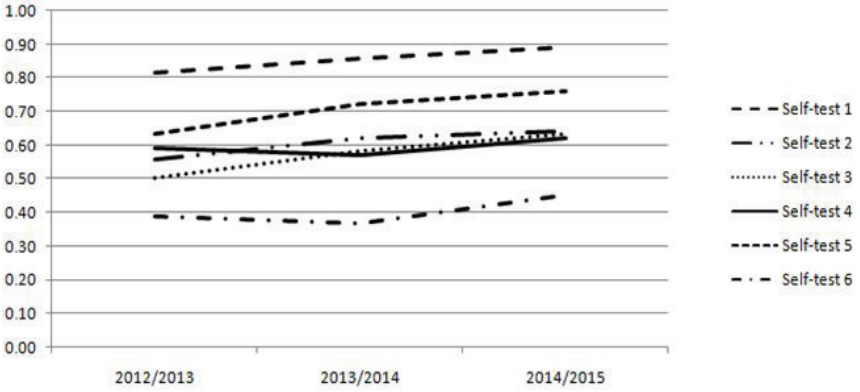

Fig. 3: Difficulty Index of Self-tests

Value of difficulty index replicates the average score achieved by students because the maximum number of points for each self-test is 100.The higher the value of this index is, the greater number of students achieved higher score in this self-tests. Significantly higher value of difficulty index occurs again for the Self-test 1and the lowest value for the Self-test 6.

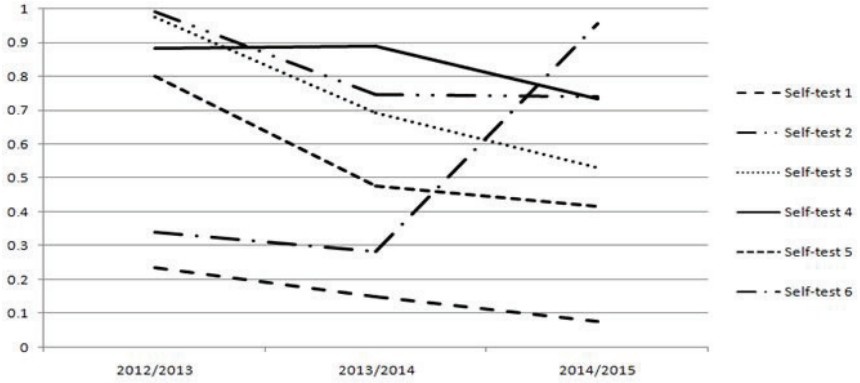

Fig. 4: Discrimination Index of Self-tests

The discrimination index is greater than 0.25 for all self-tests except for the Self-test 1 (Fig. 4). A notable exception to this trend is generally very low value of the discrimination index of the Self-test 1 and big difference of the discrimination index value of the Self-test 6 between the academic years 2013/2014 and 2014/2015. The discrimination index of the Self-test 1 is not greater than 0.15, the reason is (as just stated) that this test seems to be easy for students.

The trend of increasing average score corresponds to a decreasing of the value of the discrimination index. Gradually decreasing value of the discrimination index indicates

decreasing of the self-test ability to distinguish between the more and less successful students. This could indicate an increasing level of students' knowledge and understanding of areas and topics of AMI. However, this trend does not correspond to deteriorating student performance in exams (Brožová, Rydval, 2014). Overall, the low value of the discrimination index of the Self-test 1corresponds to a small difficulty of this test.

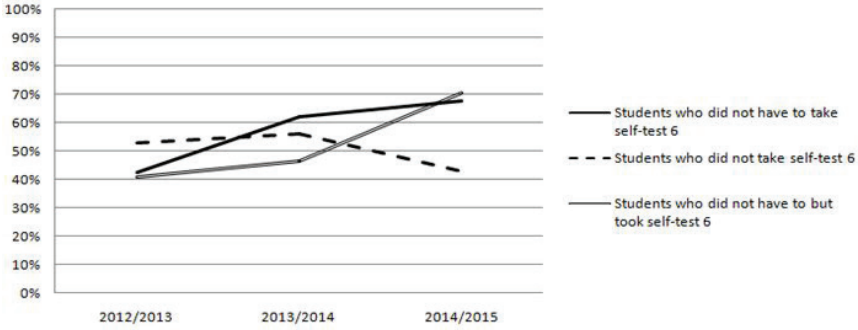

Fig. 5: Self-test 6 – relative number of students in three categories

As mentioned above, the increasing value of the discrimination index of the Self-test 6 can be also explained by the fact that 360 points is enough for the credit and many students achieved this number of points already after taking the Self-test 5. Therefore, they do not have to take the Self-test 6. We can assume that students who do not complete the Self-test 6 are rather successful students because they got the required number of points after taking the first five self-tests. Percentage of students who do not complete the Self-test 6 is shown in Fig. 5 and it corresponds to a decreasing percentage of students who completed the Self-test 6. However, Fig. 5 also shows that many students who do not have to complete the Self-test 6 complete it anyway, and therefore it is also answered by successful students.

Proposal for improving self-tests for the subject AMI

Based on the above analysis of the self-tests we can propose the following recommendations for improving the effectiveness of the educational process and conditions for obtaining the credit for the course AMI. The important changes have to be made with two exceptional tests – Self-test 1 and Self-test 6.

The Self-test 1 – Linear algebra contains mainly calculation of matrix operations and solution of system of linear equations. To increase the difficulty and the discrimination ability of this self-test is necessary to include also other parts of Linear algebra, for instance the theory of Vector space and its basic vectors is really important. Theoretical questions can be more difficult and complex to show students the possible examples and questions in the final exam. The difficulty of the self-test can also be increased by altering the types of examples of multiple-choice, for example, with the example with written answer.

The scores of the Self-test 6 – Multi-criteria decision-making and mainly the number of students who completed this test shows necessity to change the conditions of this course and set the completion of the Self-test 6 as an requirement for obtaining the credit. It would mean to adapt the content of the seminary, practice Multi-criteria decision-making and so on, but time available allows only a limited extent. Therefore, it is again necessary to place greater emphasis on self-study.

Current self-tests consist of three types of questions, e.g. Multiple Choice Question,

Numerical Question and Calculated Question. We suppose that improving their quality and the discrimination ability can be reached also by implementing other question types as True or False Question, Matching Question, Cloze Questions, Short Answer Questions and Essay Question. These types can be mainly useful for testing of the theoretical and methodical knowledge.

The necessary task is to analyze the individual test questions and based on that to decide about removing inappropriate questions, and extension, updating and improving remaining questions.

The emphasis on self-study in our university also represents necessity to extend the portfolio of Moodle learning materials by extensive practice-oriented examples.

Discussion about the effect of self-tests on students' knowledge

E-learning clearly promotes the participation of students, increases their motivation and improves their competence and thus their performance in terms of qualifications as Novo-Corti, Varela-Candamio and Ramil-Díaz, (2013) show in their research. So the quality of the self-tests is very important, it has to be checked and continuously improved.

As Clark, Mayer, (2011) point out, e-learning and self-tests have a positive influence on students' knowledge. This paper in the similar fashion shows that the trend of increasing average score corresponds to a decreasing of the value of the discrimination index. This could indicate an increasing level of students' knowledge and understanding of topics of subject AMI. Taib and Yusoff (2014) use difficulty and discrimination index to predict students' examination performance and found out that decreasing value of the discrimination index indicates decreasing of the self-test ability to distinguish between the more and less successful students.

Students with the MOODLE e-learning are more confident in self-studying and better understanding of the course contents (Chen et al, 2014). However, this trend does not correspond to deteriorating student performance in exam results (Brožová, Rydval, 2014). The same idea of no dependence between Moodle self-test and exam results was proved in study of Popelková and Kovářová (2013).

Conclusion

The paper is focused on the improvement of the e-learning tests using self-tests analysis by difficulty index and discrimination index. In this paper the self-tests used for the course Applied Mathematics for Informatics at the Czech University of Life Sciences has been analysed according to the collected scores of self-tests from the Moodle.czu.cz system for the last 3 academic years (2012/2013, 2013/2014, 2014/2015). Based on this analysis it is evident that the average score of each self-test has been slightly increasing over the years. The trend of increasing average score corresponds to an increasing value of difficulty index and to a decreasing value of the discrimination index. The decreasing value of the discrimination index indicates decreasing of the self-test ability to distinguish between the more and less successful students. Although this may be due to an increasing level of students' knowledge, it would rather be due to the similarity of the tasks solved during the seminars and the test questions. Improving their quality and the discrimination ability may be based on the implementation of such question types which are mainly useful for testing of the theoretical and methodical knowledge.

Based on the self-tests analysis above the important changes have to be made only in two exceptional tests – the Self-test 1 and the Self-test 6. In order to increase the difficulty of the Self-test 1 it is necessary to include also other parts of Linear algebra and make the theoretical questions more difficult and complex. In order to increase the number

of students who complete the Self-test 6, setting the completion of the Self-test 6 as a condition for obtaining the credit should be sufficient and of course it is necessary to place greater emphasis on self-study.

Generally it can be pointed, that self-tests represent a good way to evaluate students for the credit, but it is necessary to test not only practical calculations but also theoretical knowledge. It is important to test the quality of self-tests question, to increase the number of test questions and also of used question types.

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GRADUATION THESES AND EFFECTIVE ACTIONS PREVENTING PLAGIARISM

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Abstract

The paper is focused on the current problems of plagiarism. One of the biggest problems currently reflected is plagiarism in final thesis not only at home but also abroad. The main objective of this paper is addressing anti-plagiarism activities at the Department of Informatics. E-courses are used as support for teaching. The theme is narrowly focused on the process of final theses from the beginning until the final adjustments. The assets of the e-course are compulsory for students. According to the results obtained, these activities significantly eliminate plagiarism at the Department of Informatics. The paper contains a graphical results evaluation of the survey on the subject.

Keywords

Graduation theses, plagiarism, originality, analysis, e-learning support

Introduction

Plagiarism is an illegal usage of someone´s published and unpublished ideas, formulations, knowledge, results of research or other results of creative work, as well as illustrations, tables, photos etc., without any reference (Stephen, Rosenwasser, 2013; Skalka et al., 2009). Plagiarism in its most ponderable form is considered as a submission of a completed work underwritten by „new authors", sometimes in another language. This applies to any stage of research, writing or publication of work, both in pressed and electronic versions. Elaboration and defending the graduation theses (GT) is one part of the State exam. GT in all forms of acquisition of academic qualification represents the culmination of studies and according to the Higher Education Act it forms a necessary prerequisite of termination of the study and acquisition of the particular degree. Another part is usually Final state exam, which is a verbal manifestation of the knowledge acquired by the student during the study. In 2011 a polemic arose on the intention of the Ministry of Education to enact the fact that higher education should be terminated merely by defending the GT. Arguments of civil servants from the Ministry of Education stood like this: final state exams do not make any sense, since students just memorize for them and they forget most of the content. Moreover, teachers have to make effort to examine them, which is wasting the time and exemption from the final state exams would enable students and teachers concentrate on a serious quality of GT. Students should not be tested twice for the same content of education (Pravda, 2015). Part of the public and Members of the Parliament argued that state exam is the only element of the state and public supervision, which exists. Cancellation of state exams could make the quality of university education worse, while the reform of higher education should primarily represent a system change from the inside.

Slovak Rectors Conference expressed their opinion that in the highly-developed countries of European Union (initial 15 states) and USA the concept of state exam is not known. The

Conference even attracted the attention to the fact that state exams in the form they are passed by students are in contradiction to the principles of Bologna Declaration. There is a trend in developed countries that students have to only defend the theses to accomplish their studies. If Slovakia allows cancellation of the state exams, it would advance towards education in well-advanced countries more. On the contrary, according to Koucký (2012) the problem is that changes happened to foreign schools in the 60s of 20th century are happening to our school now and very quickly. Furthermore, he stated that academic education was historically based on imprescriptible ethical standards, which, however, cease to be in force in up-to-date *mass factories producing degrees*. Fast acquisition of university degrees without the traditional accomplishment of studies by the state exam served as a public survey in Slovakia (Pravda, 2011), which brought the following results (Fig. 1).

Should the study be accomplished merely by defending the graduation thesis?

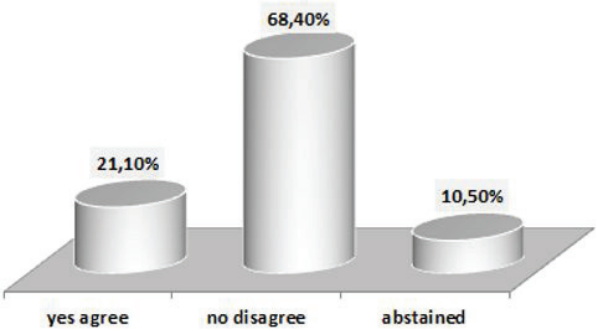

Fig. 1: Accomplishment of university studies by defending th GT / the public

Results of the survey were surprising. Only 21.10% claimed cancellation of the state exams, 68.40% were against cancellation and 10.50% abstained. In the sense of the extending responses, mainly from among students, we expected results of the opposite character (Sita, 2012; Krčmárik, 2011). To compare the results of the public, the issues of defending the GT to the students of the Department of Informatics (DI) were submitted. The range of answers was enlarged in details by two marginal scales. The option of abstaining from the chance to declare the opinion was not offered. The opinions of students and the results acquired are presented in Fig. 2.

Results have brought the following evaluation: 26.09% *fully agree* only with the defending of GT, *agree for the most part* – 26.09 %, *both agree and disagree* with the statement – 30.43%, *a small portion of agreement* showed 17.39% and no student expressed opinion to only disagree with defending the GT. Contrary to the public opinion, the opinions of students diametrically diverge. Mainly the statement *No - disagree*, where the public opinion reached 68.40%, while the student´s opinion - 0%. The question, concerning who belonged to the group of respondents representing the public opinion, arises? What age average represented the examined sample of respondents?

Should the study be accomplished merely by defending the GT?

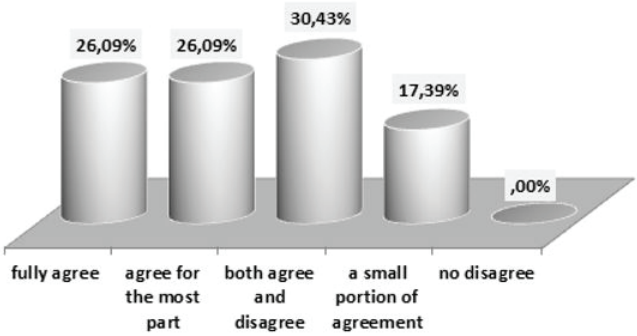

Fig. 2: Accomplishment of university studies by defending the GT / students of DI

Materials and Methods

Half of April every year for university students is a busy period. Their obligation is to submit GT and accomplish their studies. Submission of GT is relatively a simple process, when compared to the process of its creation. GT moves automatically through the Academic Information System (AIS) to the Central Register of GT (hereinafter referred to as CRGT) and then to the server with the particular software, which performs the originality check. In our conditions this system has been active for the fifth year already. The software evaluates originality, the percentage conformity with the documents contained in the CRGT and returns it to the CRGT. Nowadays, as stated by experts, there are about 6 mln documents (except for GT), which can be verified and compare with the text in GT (active only after April 2010). Gradually, the checking system has been complemented by other documents forming parts of GTs. If a student copies older works, there is a problem to reveal plagiarism. Higher education institutions take their share since they have not sent their GTs from the period before 2010 to the system yet. Neglecting the creation of GT in the long term, minor interest of students in the study, or students´ full-time jobs being performed parallel with their studies, support proliferation of plagiarism, as seen from the results of the survey carried out by IPPHEAE (Fig. 3) and also to other deception focused on acquisition of a complete GT, thus obtaining university degree.

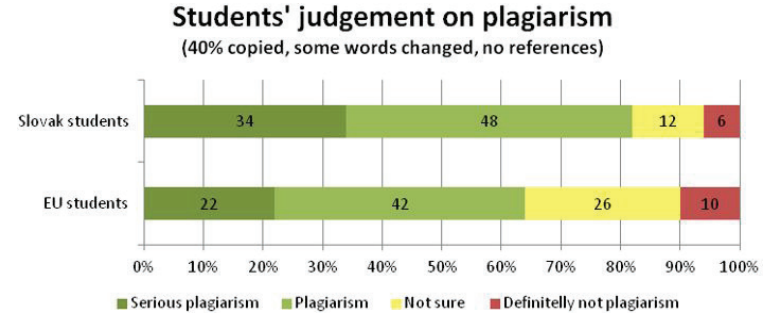

Fig. 3: Plagiarism policies in Slovakia[1]

[1] Foltýnek, T. (2013). Plagiarism policies in Slovakia. Report.

Submission of GT into CRGT applies to all Slovak higher university institutions. Having sent the complete GT, student should electronically send it to the local depot of GTs. From there, GT is moved to CRGT. Servers check 75 thousands of students´ works for one academic year, and sometimes it happens that they find an undesired conformity. Some percentage results from legal quoting from other sources; however, there are some works which exceed the acceptable percentage. As informed by the expert (Kravjar, 2014), if there is more than 30% of conformity in the GT, this is the exclamation mark for pedagogues. For the whole period of existence of the system, 13,000 works have exceeded the 30% limit. However, it is not a bad result when assessed in consideration of 300,000 submitted works (GT). It is rather exceptional to find zero conformity.

Survey on plagiarism at DI

We were interested in getting to know whether our students (DI) also belong among well- informed and are aware of illegal actions in the area of plagiarism. The item was submitted to students in their final phase of elaboration of their GT.

I am aware that plagiarism is punishable:

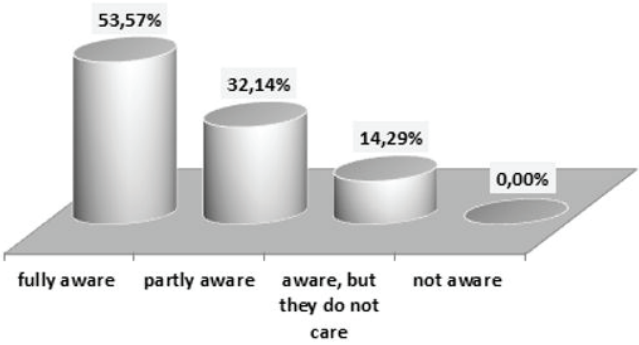

Fig. 4: Punishable in terms of plagiarism

53.57% of students were fully aware that plagiarism is illegal, 32.14% answered that they are partly aware, 14.29% students are aware of illegality of plagiarism, but they do not care. No student answered that he/she is not aware of illegality of plagiarism. Our results confirm the fact found by the research within the international project carried out by IPPHEA2. It was focused on the prevention of plagiarism, anti-plagiarism policy, tools of revealing plagiarism and protection of copyrights. Slovak students reached the highest awareness of plagiarism from among university students in 27 countries of EU. This perfect placing was reached just thanks to the existence of the Slovak Anti-plagiarism Programme ANTIPLAG, CRZP and the System of revealing plagiarism at Slovak higher education institutions. It has been operated in The Slovak Centre of Scientific and Technical Information. According to the declaration of the Slovak Ministry of Education, ANTIPLAG was awarded the prestigious European prize for innovation last year (MINEDU, 2014).

In other European countries other similar systems are in operation, however, they are not obligatory. In the Czech Republic antiplagiarism system has been active since 2004. The project Theses.cz, in operation since 2006, represents the system for revealing plagiarism

[2] Impact of Plagiarism Policies in Higher Education Across Europe

among GTs. It serves for engaged higher education institutions as the national register of GTs and the depot for works revealing plagiarism. In Poland there are two institutions established to deal with the issues of plagiarism – Ethical Chamber in the Polish Academy of Science, and the Committee for Proven Procedures. Higher education institutions in Austria struggle against plagiarism in an isolated way. It is not impossible that they plan to adopt a system measure, but the time horizon is not yet known. As stated by Kravjar, there is no official information available from Hungary and Ukraine. However, he states that in these countries there is not any official obligatory system to fight plagiarism.

Originality check can be practically carried out on three levels. The first is the tutor, the second one is the examination panel, for which there is the protocol available on originality check. This accrues from the amendment of the Higher Education Act effective after September 1, 2011, when final and qualification theses started to be made public. In several countries public control exists. For example, at the German internet page: vroniplag.de, or at the Polish internet page antyplagiat.pl, volunteers gather information on plagiarism, as well as the particular plagiarists (Kravjar, 2011; Getting, 2013).

Awareness that plagiarism streaks, is not a secret, but a public fact. Semester works, bachelors´ and masters´ theses, but even dissertation and inaugural dissertation theses can be bought. Very often pedagogues themselves stand behind the plagiarism, this way increasing their income. A perfect example can be found at the internet page: www.napisemezavas.sk, which offers a team of university educated experts from the practice with long-term experience in publication, who can guarantee the result of required quality. This is claimed by the owner of the page. He states his university degree both in front and behind his name. No wonder that plagiarism is not a problem for common students. It is possible to find politicians and also highly positioned state officers both at home and abroad who used someone texts, but even complete works as their own ones. Recourses are usually nought. In Slovakia, several names of public agents are connected with plagiarism.

Plagiarism, however, is nothing else than misappropriating against the mission of academic education. The ability to create, think, offer new ideas and solutions, use one´s own creative potential trails away. Students, in the spirit of the slogan all you can find in web, do not create, but compile (Feik, 2010). Today, it is not a problem to open the following web-pages: www.diplomovky-bakalarky.eu/, bazar.sk/, eseminarky.sk, diplomkybezprace.sk and simply use their services. The price for elaboration of a single page is approx. 10 to 17 Euro. Similar offers can be found not only on our Slovak domains. Services of the above mentioned type are offered also by the pages like: ivoryresearch.com, diplomkyaseminarky.cz, paperhelp.org, sushiteri.com/master-thesis-paper-writing-service/ and many others.

Originality of GT and involving one´s own potential, was another issue which attracted us in the statements of our students. Whether they have ever used the offered services on the web and made their obligations easier is presented in the next Fig. 5.

In the item presenting the question concerning copying the texts into GT, there is an interesting comparison. Results presented in Fig. 4 prove that 3.57% students admitted to copy the whole GT, 17.86% confess that copied one half of the text, 42.86% students admit copying a quarter of their GT, while 35.71% students claim that they created their GT themselves, without copying any texts. In our opinion, the result is disputable. At the same time it proves that in the previous statements (Fig. 4), students were not so frank and did not realize that copying full texts or half-texts is considered exceeding the upper limit of toleration of texts copying which at the same time proves plagiarism. Another question is whether students listed all authors used in their bibliography and in the body of the GT.

I let my GT be elaborated by the firm / private person as a commission:

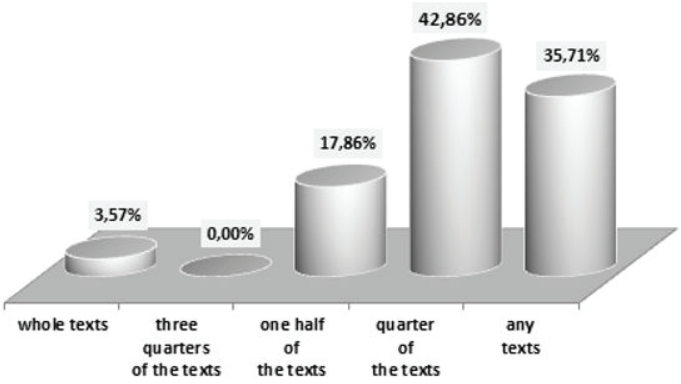

Fig. 5: Elaboration of GT as an order

I am aware that I copied ...% text into my GT:

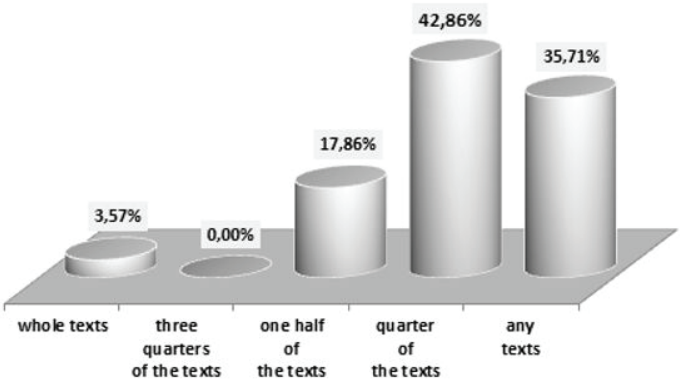

Fig. 6: Copying texts into GT

Effort of the DI to improve the quality of GT and prevent plagiarism

Creation of final works is a long-term and demanding process for anyone who has not got a natural *writer´s* talent. It is not easy to transform ideas into a written form despite the fact that many startle by rhetoric. Creative writing of a professional text is a problem for the majority of students. The bone of contention has become also the ability to observe the logical sequence, observing standards and typographic rules. Great problem seen in practice is looking up the relevant professional sources, mainly in English language. 18 months[3] is not a short period for proving the skill of writing and simultaneously engage the knowledge acquired by the study and natural self-study – at least for the *responsible* students. Elaboration of a 30 – 50 pages long document (according to the level of GT) requires a huge dose of inspiration, creativity and self-discipline. Unless the student studies continuously and puts off creation of GT, he would be under a considerable stress. The most appalling problem of text creation becomes mainly the theoretical part of GT, in

[3] The period from obtaining topic GT, after handing over the finished GT to CRGT

the current analysis section of GT. It is because the student broods over the essence of the work only a little, although it gives the written text stringency, good readability, velocity and style. To know the topic essence is the standard of fair writing.

E-learning and support of creation of original graduation theses

The aim of workshops, which have been a part of the academic year at the DI for long and have brought positive results, is to avoid the above mentioned circumstances. They offer assistance to students upon designing, preparing and continuously creating their GT. LMS Moodle has long been used for the support of the academic subject using the e-learning form at the DI.

One of the conditions deciding on the adequate quality of GT is its structure. The structure presumes with regard to the extent of GT adequately, logically and clearly divided professional text and correct formulation of titles of individual chapters. First chapter as a standard deals with the analysis of the current state in the issues being dealt with. It introduces the reader into the investigated topic. The aim of elaboration is to look up, gather, filter and summarize the knowledge of experts from various sources. The second chapter represents the aims of GT. Besides the main goals, student should elaborate partial goals in details which subsequently navigate him to further logical gradation of creation of subchapters. Submitted concept is the content of the subject Bachelor´s work seminar 1 (SBP1). SBP1 is taught in 4th semester of bachelor´s studies. Passing the subject is conditioned by elaboration of seminary work, the content of which represent the above mentioned requirements. If a semester is standardly 13 weeks long, it is expected that student should manage the particular theoretical part at least by 80%. Recommended number of pages, during the continuous writing of GT, represents 3-5 pages per week (Albert et al, 2011). If there is a condition for reaching credits to elaborate 7-10 pages of professional text per semester, such tempo could be ideal for a student. Therefore, it is adequate to expect that effectiveness of the subject SBP1 has its substantiation. An inevitable condition of submitting the seminary work is the check and continuous consulting with the tutor. These is a guarantee that the student should not part with the topic and the tutor should have surveillance of the gradual structure of the GT.

In semester 5, Bachelor´s work seminar 1 is followed by Bachelor´s work seminar 2 (SBP2). Its aim is to finalize the analysis of the current state, quotations in the professional text, along with the correct list of bibliographic references. Impact is put on strict observance of international standards. Writing professional text is focused on the chapter which contains methodology part of GT (description of the procedure of GT, i.e. practical output). Quality of GT is underlined by the quality of its appearance, design, formal and typographic layout. Formal viewpoint is to a great degree influenced by the first sight, lucidity and readability. In conclusion of SBP2, great attention is devoted to the elaboration of abstract. Its specific character of stylistics must be observed by the student (international standards).

In semester 6 student has to attend the seminar Bachelor´s work and seminar (BPS) where is guided to write results of evaluation of the practical part of GT. He/she must also master final corrections of the formal aspect of writing GT. The end of semester is devoted to the design, creation of the structure and content of presentation in the presentment programme. Student has to present the elaborated presentation in front of the whole group of students who by their "healthy criticism" help correcting both the verbal and non-verbal expression of every student. The meaning of the stated preparation is an effort to partially degrade the exam fever and manage the stress from the real GT defending in front of the examination

panel. For external students studying at the DI apply the same conditions for passing the above mentioned subjects as for the daily students. Positive results obtained from the practice prove that state exams need not necessarily be traumatizing for the students. Diploma seminar is realized in the conditions of the DI based on an individual attitude of the student. If the student took Bachelor´s seminar seriously already in the first degree of the university study, there is no reason for worrying about failing at the elaboration of the GT at the second grade of university studies to criminalize.

Conclusion

Plagiarism of GT is very serious and topical issue. This topic in this time addressed different experts from different fields who on basis of prevention can help the authors with the formal side of GT.

In this paper we introduced the experience aimed at the prevention of plagiarism in the development of final theses. Specifically targeted e-courses are used as a support for the attendance form of teaching Seminar for graduation thesis 1, 2, 3. Their applications during three semesters give good results. Students gain knowledge in the field of plagiarism. They learn to quote and write cited authors in scientific text consistently. They learn typographic rules when editing professional documents. Carried survey was anonymous and it covered 79 students. The aim was to get students not to copy answers and respect copyrights when creating their GT.

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STUDENTS´ INTEREST IN SETTING UP A BUSINESS AND EDUCATE THEMSELVES

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Abstract

This paper has been elaborated on the basis of a detailed survey, which was conducted in the bachelor´s and master's degree study programme Business Administration at the Faculty of Economics and Management of the Czech University of Life Sciences Prague. 166 bachelor´s degree students and 131 master's degree students participated in the survey conducted in January 2015. The paper introduction briefly summarises the state of higher education in the Czech Republic and the present position of economic professions in the labour market. The subject of this paper is to find connections between choosing the Business Administration field of study and the students´ intention to set up their own business, namely with regard to the size of their domicile and sex. In connection with accounting, the survey to determine the relation between certified courses in accounting and taxes and the students´ intention to set up their own business was conducted.

Keywords

Accounting, business administration field of study, certified courses, economics fields of study, employment, students

Introduction

The tertiary education level implies the potential of all-round development of a society, which is true for any country or continent. The reason is that education has its irreplaceable role both for the development of an economy and for stability and cohesion of a society as a whole as well as for the development of better quality of life of each member (Koucký, Bartůšek and Kovařovic, 2007).

The amount of expended financial means on tertiary education is related to the fact that in 2012 only 19 percent of the adult population obtained tertiary education in the Czech Republic compared to the OECD, where the average was 32% (OECD, 2014).

In connection with the results of a recent survey concerning the employment rate of university graduates, there is a clear demand for graduates of engineering and natural sciences. If we proceed from the aforementioned facts which claim that competitiveness of a society as a whole is based on knowledge and innovations, so exactly these branches of study meet those requirements. Despite the mentioned partial conclusions, applicants for university studies are still mostly interested in the humanities, namely in law and economics fields of study (Koucký and Bartůšek, 2015).

With respect to the Czech University of Life Sciences Prague (CULS), the survey shows that the unemployment rate of CULS graduates is 6.2% (the average unemployment rate of university graduates is 4.8% in the Czech Republic), of which 4.4% is the unemployment rate of graduates from the Faculty of Economics and Management (FEM) (the average unemployment rate of graduates from economics universities is 4.9 % in the Czech Republic). The unemployment rate in the period of 0-5 years after university graduation

is discussed here. With regard to the unemployment rate, the Faculty of Economics and Management of CULS has ranked eleventh (11th) out of twenty (20) monitored faculties of economics in the CR (Koucký and Bartůšek, 2015).

Employers reflect the situation on the labour market in the course of recruitment process for individual positions. This suggests that obtaining a university degree is no longer a definite safeguard against the negative effects of unemployment increase after the economic recession arrival in 2009, and does not guarantee a privileged position on the labour market for its holders to the same degree as before (Čermáková, Navrátilová and Stárová, 2013).

In the case of the Faculty of Economics and Management, it would be appropriate to analyse the current trends among applicants for university studies and make efforts primarily to continuously improve the quality level of teaching and its control. The recommendation mentioned can also be corroborated by the results of the mentioned survey, which shows that in 2010 economists markedly had the highest salaries. However, over the following three years, economists belonged to the group of employees whose salaries decreased most on average. Economists also have to accept jobs which are less qualification-demanding and do not require a university degree. It can be assumed that in such a situation, the quality of education and students´ readiness for a successful entry into the labour market will significantly influence the competitive ability of graduates from the Faculty of Economics and Management. In this connection it must be noted that universities are limited by the impossibility to flexibly change accredited study plans according to the current demand in the labour market. Resolving the mentioned situation places increased demands on the management of universities when creating offers of extension study beyond their study plans. Building the good reputation of the Faculty should be borne in mind, because it can ultimately be the factor that decides whether the graduate will be hired for a particular job by the employer or not. Brand building of any organization in the current competitive environment is considered to be a valuable asset and a key factor for success (Urbancová and Čermáková, 2015; Urbancová, 2014). Based on the research, Helm (2011) also concluded that the pride of students and their satisfaction with the course of their studies and with their completed work influence a good reputation of the faculty.

A university-educated economist should have extensive knowledge of accounting. The reason for this is the fact that an accounting information system as a primary source of economic information is used in subsequent organizational processes as an instrument for decision making and management of the organization. Zhang and Liang (2011) emphasize that the important role of financial information in the economic management makes it necessary for universities to strengthen the education of accounting in the process of cultivating talents of economic management.

Essential objective of the paper is based on the profile of a student studying Business Administration at the Faculty of Economics and Management of CULS, where it is stated that "the field of study prepares students for a career in business activities". Two main aims have been defined in this article. The **first aim** is to find out the students´ intention to set up their own business after graduating from university, namely in connection with the size of domicile and sex of students. Under this aim a partial aim to assess the following working hypotheses has been set:

H1: The students´ intention to set up their own business is related to the size of their domicile.

H2: The students´ intention to set up their own business is related to sex.

The significance of accounting results from the aforementioned requirements for competencies of university-educated economic staff. In connection with the difficulty to change the accredited study plans, the paper **second aim** is to verify the need for further education of BA students in accounting and taxes beyond the accredited study plans, namely by completing paid professional courses. In this context, the relation between the students´ willingness to participate in courses and their intention to set up a business is also assessed. The survey results will form a basis for giving recommendations to organize certified courses, in which students would be interested. The partial aim is to assess the following working hypothesis:
H3: The students´ willingness to pay for certified courses provided by the Department of Trade and Accounting depends on the students´ intention to set up their own business after completing their studies

Materials and Methods

Within the presented research, two groups of students of the Faculty of Economics and Management of CULS were examined. These were the bachelor´s degree students of the Business Administration (BA) field of study at FEM and the follow-up master´s degree students of the same field. The reason for the choice of BA was the fact that this chosen field of study has most accounting courses taught. The research was based on the questionnaire survey. Questionnaires were submitted to students of the bachelor´s and master´s degrees separately. 166 respondents answered the questionnaire in the bachelor´s degree study (117 females, 49 males) and 131 respondents completed the questionnaire in the master's degree study (116 females, 15 males).
Data obtained in the survey are presented by simple description and the selected data were statistically processed. The authors tested i) relationships between selected variables and ii) differences between tested proportion and hypothetical proportion. To test relationships, the data were organized using contingency tables. Then the authors employed the Chi-square test of independence.
To test the hypotheses, there was a computed statistic test and the maximum probability of the first type error (p-value). The p-value was then compared with the significance level alpha (0.05). If the p-value was less than the significance level, then the null hypothesis about independence (Chi-square test) was rejected. The analysis was carried out using IBM SPSS.

Results and Discussion

The survey results show that of the total number 154 students, which accounts for 51.85%, have an intention of setting up their own business after graduation. However, it can also be inferred from the data that the students´ determination to set up their own business decreases with the higher degree of study. 62.05% of bachelor´s degree respondents plan to set up their own business and only 38.93% of master´s degree respondents want to have their own business. This finding is also confirmed by Kim, Aldrich and Keister (2006), who have stated that people with higher education, but not the highest one, might show higher entrepreneurship.

Working hypothesis 1: The students´ intention to set up their own business is related to the size of their domicile.

Number of population	Intention to set up their own business		Total
	Yes	No	
Fewer than 500 inhabitants included	15	20	35
501 – 2,000 inhabitants	20	31	51
2,001 – 5,000 inhabitants	13	9	22
5,001 – 10,000 inhabitants	14	12	26
10,001 – 50,000 inhabitants	24	23	47
50,001 – 90,000 inhabitants	3	3	6
90,001 inhabitants and above	65	45	110
Total	154	143	297

Tab. 1: The relation of the students´ intention to set up their own business depending on the number of population in their domicile

Based on the contingency table, the Chi-square test of independence was used to test dependence between the intention to set up their own business and the size of their domicile. The value of the test criterion of Chi-square test is 7.228 and p-value is 0.3. At the significance level of 5% the null hypothesis of independence cannot therefore be rejected. It has not been proved that the intention to set up their own business is linked to the size of domicile. The result of the statistical survey is not in accordance with the results of the research called Global Entrepreneurship Monitor (GEM) of 2006, when Lukeš and Jakl (2007) reported that there is evident general trend when the rate of entrepreneurship is also increasing with the size of domicile. Naturally, the fact that students from large towns are more determined to set up a business can also be read from absolute figures in Table 1.

Working hypothesis 2: The students´ intention to set up their own business is related to sex.

Sex	Intention to set up a business		Total
	Yes	No	
Female	66	51	117
Male	37	12	49
Total	103	63	166

Tab. 2: The relation of the students´ intention to set up their own business depending on the students´ sex (association table, bachelor´s degree students only)

Sex	Intention to set up a business		Total
	Yes	No	
Female	42	74	116
Male	9	6	15
Total	51	80	131

Tab. 3: The relation of the students´ intention to set up their own business depending on the students´ sex (association table, master´s degree students only)

The results in tables 2 and 3 clearly show that more men than women want to set up

their own business after graduation. The survey results correspond with the findings of Bosma and Amoros (2014) that more men than women conduct business in the vast majority of countries in the world. In this respect, Lukeš et al. (2013) add that women more face a whole range of obstacles in comparison with men. 2.6 times more men than women were engaged in a new entrepreneurial activity in the Czech Republic in 2011. Compared to 2006 the gap between men and women in entrepreneurial activities widened Lukeš and Jakl (2012b). In this connection, Lukeš and Jakl (2012a) have stated that new entrepreneurial activities of students increased in 2011 in comparison with 2006 from initial 4.2% to 6.6%.

Interesting survey results have been obtained in the cases when the education degree was taken into consideration. The reason for higher proportion of students with the intention to set up their own business after their graduation in the bachelor´s degree study can be a different distribution of students by sex, when women predominated in the master´s degree study (89%) and whose intention to set up their own business was lower. Relations between the students´ intention and sex were tested separately. Based on table 2, the test criterion of Chi-square test (5.350) and p-value (0.021) were received. At the significance level of 5%, the null hypothesis of independence can be rejected. In case of master´s degree students (table 3) the null hypothesis of independence (alpha=0.05) cannot be rejected, the test criterion of Chi-square test was 3.163 and p-value was 0.075.

As mentioned above, the BA field of study has most accounting courses taught. Thus, the authors were interested in the fact whether accounting had played a role in the choice of the BA field. The BA field of study has been chosen because of accounting by 211 respondents, which accounts for 71.04 %. It can be stated that the master´s degree students attach greater importance to accounting than the bachelor´s degree students. The BA field of study was, inter alia, chosen because of accounting courses by 83.21% of the master´s degree respondents and by 61.45% of the bachelor´s degree respondents.

When comparing responses of bachelor´s degree and master´s degree students, there was a marked difference in the question concerning their interest in paid certified courses in accounting and taxation that would go beyond the scope of their studies and which would be provided by the Department of Trade and Finance. Given a certain professional ambivalence and also possibilities of a follow-up study, the bachelor´s degree students´ interest in these courses was significantly lower (52%) compared with master´s degree students (82%).

Working hypothesis 3: The students´ willingness to pay for certified courses depends on the students´ intention to set up their own business after completing their studies.

Intention to set up a business	Willingness to pay for courses		Total
	Yes	No	
Yes	58	45	103
No	29	34	63
Total	87	79	166

Tab. 4: The relation of students´ willingness to pay for certified courses depending on their intention to set up their own business (bachelor´s degree students only)

Intention to set up a business	Willingness to pay for courses		Total
	Yes	No	
Yes	41	10	51
No	67	13	80
Total	108	23	131

Tab. 5: The relation of students´ willingness to pay for certified courses depending on their intention to set up their own business (master´s degree students only)

The relation between the willingness to pay for certified courses and the students´ intention to set up their own business was tested separately for bachelor´s degree and master´s degree students. In both cases the null hypothesis of independence at the alpha level of 5% cannot be rejected, therefore it cannot be claimed that the willingness to pay is dependent on the intention to set up a business. Based on table 4 and 5, the test criterion of Chi-square test (1.656, respectively 0.243 for table 5) and p-value (0.198, respectively 0.622 for table 5) were computed.

There is an assumption that due to the impossibility to change study plans of individual fields of study more flexibly, the offer of certified courses at the Faculty could be one of the possibilities how to extend the portfolio of accounting and tax knowledge of graduates from the Faculty of Economics and Management before commencement of their employment. An alternative is to consider the appropriateness of including new courses in the area of accounting and taxes into the existing study plans in their future re-accreditation. It is highly likely that enhancing their professional qualifications while studying would subsequently enable students to apply for higher positions.

Conclusion

Based on the BA student profile, the students´ interest to set up a business after graduation was examined. That was confirmed particularly in the bachelor´s degree of study, which may be related to the dominance of women in this degree of study. As a matter of fact, women showed lower willingness to set up a business. The dependence of the intention to set up a business on the size of domicile has not been proved. Furthermore, the survey has confirmed that accounting plays an important role, namely more considerably for the master´s degree students, when students choose the BA field of study.

Graduating from university is no longer unequivocally directly related to a smooth entry into the labour market on a work position that would correspond with the field of study. The FEM of CULS should place emphasis on the quality of teaching and further development of students´ knowledge, which would make their employment after graduation easier. One of the possibilities could be the offer of certified courses which would be a follow-up to their study and which would also broaden their knowledge gained in the course of study; alternatively, the possibility to include other courses in the future reaccreditation of the BA field should be considered. The obtained survey results have confirmed that students are interested in this possibility of further education. The dependence between the willingness to participate in paid courses and the intention to set up a business has not been proved in any degree of study.

Acknowledgements

This contribution is a follow-up to the project of University – wide internal grant agency (CIGA), number 20141002 - Human resources branding using the new strategic trends in organizations in the Czech Republic.

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SPATIAL REGIONAL DEPENDENCE OF ATTAINED EDUCATION

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Abstract

Since the education is an important factor of the current EU's growth strategy and it also has an impact on the income or on the growth of the individual regions, plays the analysis of the educational attainment a crucial role. This paper deals with the spatial analysis of attained education levels (upper secondary or tertiary education) in 35 NUTS2 (Nomenclature of Units for Territorial Statistics) regions of V4 (Visegrad Four) countries in order to assess the impact of location on the above mentioned attained education levels in 2012 and 2013. Positive spatial autocorrelation was detected by global Moran statistic for both analysed years. Concerning the local Moran statistics, positive spatial autocorrelation was identified for some Czech and Hungarian regions and negative spatial autocorrelation for one Hungarian region (2012), one Czech region (2013) and one Slovak region (2013). According to our spatial analysis spatial randomness was proved for Polish regions.

Keywords

Educational attainment, Moran´s *I,* spatial analysis, spatial weight matrix

Introduction

Europe 2020 (European Commission, 2010) is the EU's growth strategy for the decade 2010 – 2020 which puts forward the following three mutually reinforcing priorities:

- smart growth: developing an economy based on knowledge and innovation,
- sustainable growth: promoting a more resource efficient, greener and more competitive economy,
- inclusive growth: fostering a high-employment economy delivering social and territorial cohesion.

According to this strategy, the EU Commission is proposing five measurable EU targets for 2020 - for employment; for research and innovation; for climate change and energy; for education; and for combating poverty. Each member state has translated targets into its own national targets. The above mentioned targets are not independent but strongly interrelated. For example, higher educational levels help employability and progress in increasing the employment rate helps to reduce poverty. Education can be therefore seen as an important factor closely associated with economic development and people's welfare. It is commonly known that the levels of attained education regionally differ; this paper will be therefore focused on analysis of the attained education levels with regards to spatial regional dependence.

Nowadays, spatial analysis has become an important tool in studying social science data with geographical features. It helps us identify spatial patterns and distribute resources more effectively. In recent years, many economic studies have presented analyses that involve relationship between variables observed across countries or regions and the interest in statistical modelling of spatial variables has been greatly stimulated. Many

studies and developed spatial methods and models are related to the economists of "New Economic Geography" – NEG (Krugman, 1991). The models of NEG enable the spatial analysis of economic data by analysing problems as regional convergence, regional concentration of economic activities and adjustment dynamics. Majority of the new quantitative analyses concentrated on these issues accents the spatial interaction between analysed observations, and also the fact that the geographic location does matter for a region's performance.

There have been published some studies dealing with the spatial regional analysis of education problems. Concerning the lack of space, we can mention e.g. Rodríguez-Pose and Tselios (2007) who visualised and described the educational attainment and inequality distributions and also tried to detect patterns of global and local spatial autocorrelation, using the European Community Household Panel dataset for 102 regions over the period 1995-2000. Umar, Ismail and Eam (2014) presented the spatial analysis of educational distribution and regional income disparities in Nigeria. Wang (2012) performed a spatial analysis of educational inequality in China. Also Ahmed (2011) dealt with spatial inequalities in education and income in Pakistan. Several chapters of the handbook of Fischer and Getis (2010) also dealt with the spatial analysis of educational attainment and its relationship e.g. to the income or to the growth.

The purpose of this paper is to perform a spatial analysis of attained education levels (upper secondary or tertiary education) in 35 NUTS2 (Nomenclature of Units for Territorial Statistics) regions of V4 (Visegrad Four) countries and to answer the question of how location affects the above mentioned attained education levels. The average country values of population aged 25-64 with upper secondary or tertiary education attainment for the period 2008-2013 are graphically depicted on the Fig. 1. It is clear that the average values for individual V4 countries differ, the highest values were recorded for the Czech Republic and the Slovak Republic, followed by Poland and the lowest values were recorded for Hungary. However the regions in terms of whole countries we don't consider to be appropriate units for spatial regional analysis, we therefore chose the 35 NUTS2 regions as spatial units for our analysis. The rest of the paper is organized as follows: section *Methodology* deals with methodological issues concerning the global and local indicators of spatial autocorrelation and the choice of spatial weight matrix. Section *Empirical results* presents results based on local Moran's *I* statistic in order to study the spatial autocorrelation of the attained education levels in 35 NUTS2 regions of V4 countries. The paper closes with concluding remarks.

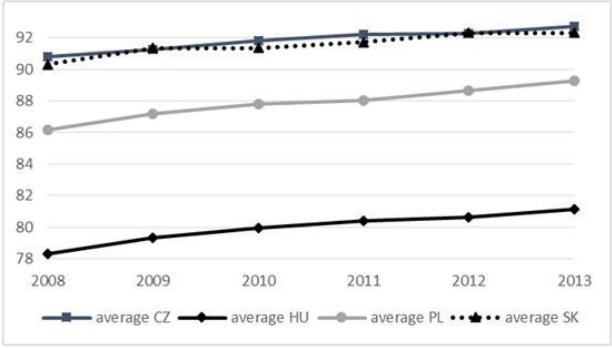

Fig. 1: Population aged 25-64 with upper secondary or tertiary education attainment

Methodology

At the beginning of analysis it is important to answer the question if there is a spatial autocorrelation or not. In case that the answer is "not", the traditional non-spatial models and methods can be used. But if spatial autocorrelation is present, it is inevitable to take this fact into account.

Global and Local Indicators of Spatial Autocorrelation

The spatial autocorrelation can be in general viewed as a fact that one observation in region *i* depends on other observations at regions *j* ($j \neq i$) and can be measured by various different spatial autocorrelation statistics. One of the most frequently used statistics is the Moran's *I* (Moran, 1950). This statistic enables us to study the global spatial autocorrelation of the variable we are interested in. In addition to the global spatial autocorrelation measurement, LISA (Local Indicators of Spatial Association) has been suggested to further analyse local spatial patterns (Anselin, 1995).
Global Moran's *I* statistic is defined by the following formula (Viton, 2010):

$$I = \frac{N}{\sum_{i=1}^{N}\sum_{j=1}^{N} w_{ij}} \frac{\sum_{i=1}^{N}\sum_{j=1}^{N} w_{ij}\left(x_i - \bar{x}\right)\left(x_j - \bar{x}\right)}{\sum_{i=1}^{N}\left(x_i - \bar{x}\right)^2} \tag{1}$$

where x_i represents the underlying variable for region i, $\bar{x}$ denotes the sample mean, N is the number of regions in the data set and w_{ij} are the elements of spatial weight matrix **W** of dimension $N \times N$. Since the specification of the weight matrix **W** plays a crucial role in spatial analysis, we will deal with this issue in next subsection of the paper. The theoretical mean of Moran's *I* is under the null hypothesis of no spatial autocorrelation given by $E[I] = -\frac{1}{(N-1)}$. The value of Moran's *I* approaching 0 indicates the absence of spatial autocorrelation, i.e. that the location does not have influence. In case that $I > -\frac{1}{(N-1)}$ we can speak about positive autocorrelation, which means that similar values of observed variable tend to cluster in space (*high-high*, *low-low*). On the other hand, if $I < -\frac{1}{(N-1)}$, there is a negative autocorrelation, which implies that different values are clustered in the space (*high-low*, *low-high*).
The traditional Moran's *I* statistic provides us a measurement of the global spatial autocorrelation; however, it fails to capture the local spatial pattern. Local indicators of spatial autocorrelation, such as local Moran's *I*, have been suggested to compensate for the local measurement (Anselin, 1995). The local Moran's *I* statistic could be calculated as below (Feldkircher, 2006):

$$I_i = \frac{(x_i - \bar{x})}{\frac{1}{N}\sum_{k=1}^{N}(x_k - \bar{x})^2} \sum_{j=1}^{N} w_{ij}(x_j - \bar{x}) \quad (2)$$

where all variables are defined in the same way as discussed in global Moran's *I* statistic.

Spatial Weight Matrix

The specification of the weight matrix is a crucial point since the choice of spatial weights can significantly influence the results of analysis. There are various possibilities how to specify the spatial weight matrix **W**. The simplest and most commonly used is the contiguity matrix **W**. Besides this specification we can meet with the distance-based weights, combination of contiguity and distance, etc. (for some other schemes see e.g. Getis, 2010).

The contiguity matrix **W** is usually a binary one made up of ones for contiguous neighbours and zero for all others. It means that first of all it is necessary to define which regions *i* and *j* are contiguous neighbours, i.e. to decide which elements of matrix **W** will be non-zero. There are various possibilities how to define the contiguous neighbours. We can speak about contiguous neighbours if two regions have a common border of non-zero length, in such a case the value of one is assigned or the contiguity can be defined analogously as in the game of chess – the rook case, the bishop case and the queen case. By convention the *i*-th observation is not considered to be a neighbour of itself and therefore the diagonal elements of the matrix **W** are set to zero. Concerning the contiguity matrix **W**, it is important to mention the row-standardized form of it, the advantages and limitations of which are described e.g. in Getis (2010), Viton (2010).

Another approach how to consider the contiguous neighbours is to use the distance-based weight matrix **W** based on distances between regions or travel time between regions. E.g. if we assume that a spatial relationship is descending in strength with increasing distance from any given site, then the matrix **W** will express that nearby areas are weighted more highly than sites that are far from one another (Getis, 2010). Popular is also the inverse distance matrix using the distance cut-off point (Feldkircher, 2006). In the construction of the weight matrix **W** it is important not to strictly follow some mechanical rules, but to consider neighbours in context of the practical problem being analysed. In practical applications also the spatial analysis software can be used to construct the weight matrices (see e.g. Getis, 2010, Viton, 2010).

Empirical results

The spatial analysis in this paper was done for population aged 25-64 with upper secondary or tertiary education attainment for 35 NUTS2 regions of V4 countries (Czech Republic – 8 regions, Hungary – 7 regions, Poland – 16 regions and Slovak Republic – 4 regions). In order to evaluate trends in education attainment, the observed years were 2012 and 2013 (last two years of published statistics). The main purpose of the analysis was to find out if the region location does matter, i.e. if the regions geographically close to each other tend to share similar education levels. Also we dealt with the existence of spatial clustering of educational levels. The data were retrieved from the web page of Eurostat (http://ec.europa.eu/eurostat/) and the whole analysis was carried out in the software GeoDa (Geographic Data Analysis) which can be downloaded for free from the web page https://geodacenter.asu.edu/software/downloads. The corresponding shapefile (.shp) for Europe was downloaded from the web page of Eurostat (http://ec.europa.eu/eurostat/web/

gisco/geodata/reference-data/administrative-units-statistical-units) and thereafter only V4 countries' 35 NUTS 2 regions were selected in GeoDa (corresponding map see Fig. 2). In the first step the spatial weight matrix **W** was specified. We used the contiguity weight matrix of queen's case definition of neighbours (no region was isolated) and thereafter the global Moran's *I* statistics (1) were calculated to assess the global spatial autocorrelation. In order to know how spatial autocorrelation varies over the analysed regions it followed the calculation of local Moran's *I* statistics (2).

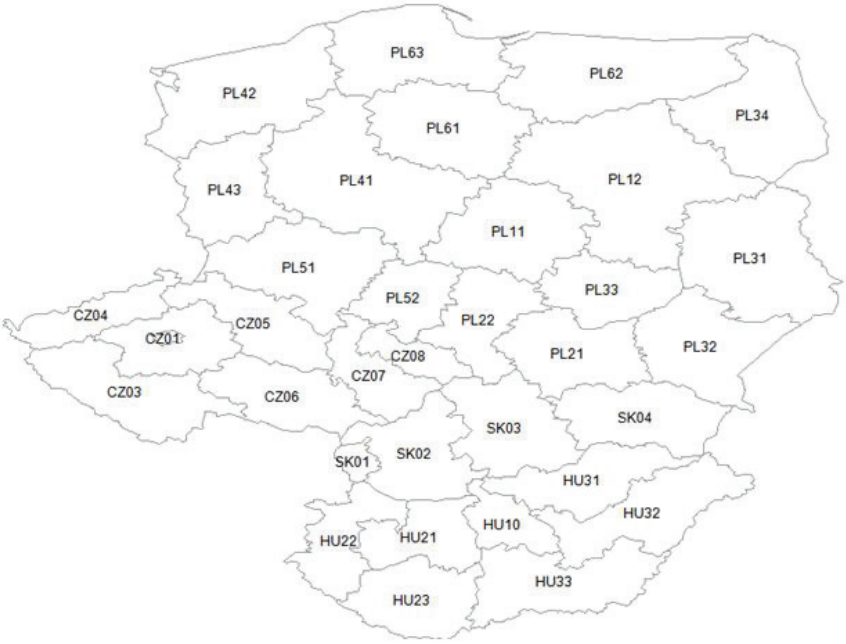

Fig. 2: V4 countries' NUTS 2 regions

The Moran scatterplots are graphically depicted on the Fig. 3 – for the year 2012 on the left and for the year 2013 on the right. The calculated values of global Moran's *I* statistics 0,4411 and 0,4521, respectively indicate the positive autocorrelation, since under the assumption of no spatial autocorrelation $E[I] = -\frac{1}{(35-1)} = -0,029$. Both these scatterplots are divided into four quadrants (see Fig. 3), each of which corresponds to a different type of spatial association. While the upper right quadrant (*high-high*) and the lower left quadrant (*low-low*) represent regions with positive spatial association, the upper left quadrant (*low-high*) and the lower right quadrant (*high-low)* represent regions with negative spatial association.

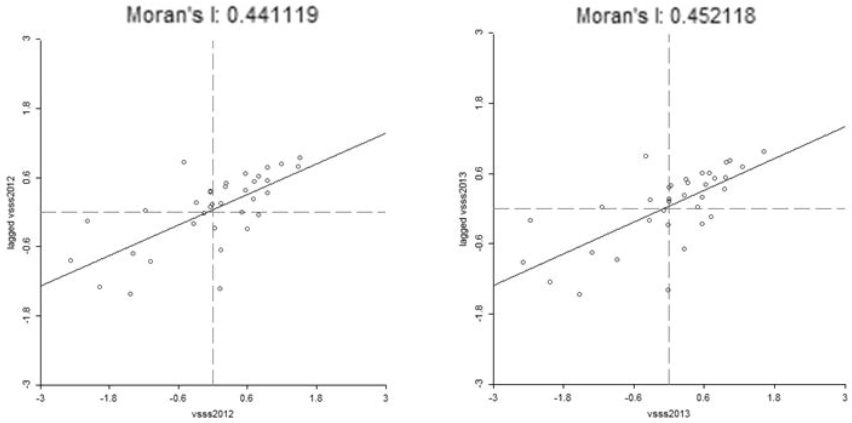

Fig. 3: Moran's I statistics for 2012 and 2013

Local spatial analysis was based on the local Moran statistic (2), visualized in the form of significance and cluster maps. The significance map shows the locations with significant local Moran statistics for various p values ($\leq 0,05$). Due to the insufficient space we present only cluster maps for both observed years. Using the software GeoDa we mapped the LISA clusters which show the significant locations colour coded by type of spatial autocorrelation (see Fig. 4).

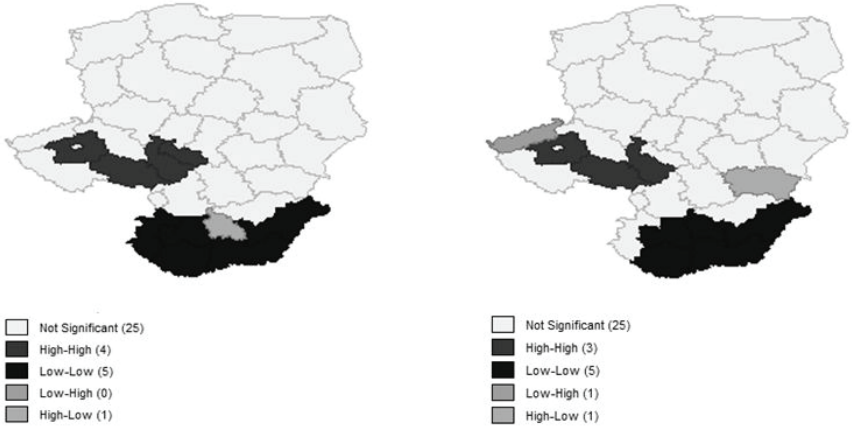

Fig. 4: LISA Cluster Maps for 2012 and 2013

In 2012 three spatial correlated clusters with following types of relationship were identified: *high-high* (CZ02 Stredni Cechy, CZ06 Jihovychod, CZ07 Stredni Morava and CZ08 Moravskoslezsko), *low-low* (HU21 Közép-Dunántúl, HU22 Nyugat-Dunántúl, HU23 Dél-Dunántúl, HU32 Észak-Alföld and HU33 Dél-Alföld) and *high-low* (HU10 Közép-Magyarország). The situation in 2013 slightly changed and there were detected all four types of relationship: *high-high* (CZ02 Stredni Cechy, CZ06 Jihovychod and CZ07 Stredni Morava), *low-low* (HU10 Közép-Magyarország, HU21 Közép-Dunántúl,

HU23 Dél-Dunántúl, HU32 Észak-Alföld and HU 33 Dél-Alföld), *low-high* (CZ04 Severozápad) and *high-low* (SK04 Východné Slovensko). Regions with *high-high* and *low-low* relationships indicate the similar level of upper secondary or tertiary education attainment as their neighbours, while regions with the *low-high* and *high-low* relationship indicate different level of upper secondary or tertiary education attainment from their neighbours.

Conclusion

Positive spatial autocorrelation was detected by global Moran statistics for both observed years and these results were confirmed by local Moran statistics for 9 regions in 2012 and for 8 regions in 2013. This means that regions geographically close to each other tend to have similar attained education levels. Regions with positive spatial autocorrelation are located in Czech Republic and Hungary. Significant negative autocorrelation (*high-low*) was detected for one Hungarian region (2012) and one Slovak region (2013) indicating higher levels of attained education in comparison with neighbouring regions. Quite interesting information for the government gives also the significant negative autocorrelation (*low-high*) for one Czech region (2013) pointing out the lower level of education than in neighbouring regions. As it is clear from the cluster maps, surprisingly the regions of Poland perform spatial randomness. The educational attainment has an important effect on the growth of the individual regions and consequently on the growth of the countries. Therefore it is important to take into account regional inequalities when a local government implements regional educational policy. Therefore obtained results could be used as a support tool in decision making of EU authorities in order to distribute its limited resources more effectively to encourage less developed regions, e.g. through grants, structural funds and special educational projects to increase the educational attainment and motivate young people for further studies. On the other hand, the results of spatial analysis could be helpful in forming of new educational institutions which can contribute in case of positive spatial autocorrelation to the higher educational attainment level in neighbouring regions. It is also clear that more educated people will contribute to higher regional economic growth. Further study improvement could be seen in enlargement of data set to the all EU countries. Accordingly, it could be interesting to analyse relationships of the educational attainment to the income or to the growth of the regions.

Acknowledgements

This work was supported by the Grant Agency of Slovak Republic – VEGA grant No. 1/0285/14 "Regional modelling of the economic growth of EU countries with concentration on spatial econometric methods".

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ARE RESULTS OF APPLICANTS EXCELLENT IN MATHEMATICS AND IN ENGLISH AS WELL?

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Abstract

Our article analyzes entrance exam results in "Mathematics" and "English" at the University of Economics, Prague (the UEP). The article represents a partial output of the analysis of study prerequisites for economic studies. Using identified anonymized data obtained from documents submitted for the admission procedure and entrance exam results, we calculated the basic statistical characteristics of the files and analyzed the time series for the years of 2010 – 2014. This article formulates work hypotheses concerning entrance exam results in "Mathematics" and "English" and tries to find a correlation between these results. When processing the data, we had to accept the formulated null hypotheses based on the T-test.

Keywords

Correlation, English, examination, Mathematics

Introduction

The drop in the population curve in the Czech Republic is currently reaching the lowest values and therefore, the lowest number of students are applying to universities. In compliance with this fact, the Ministry of Education, Youth and Sports is changing its science and research policy and support of university education in the Czech Republic. This drop in the number of students (Fiala, Langhamrova, 2009) then leads to fewer educational institutions, which will consequently result in their shortage once the number of students increases (Maryska, Doucek and Novotny, 2012; Hanclova, 2011). As expected, the number of students who could enter the tertiary education sector has dropped since the year 2012. (Kunstova, Rezankova, 2012; Polackova, Svatosova, 2013) Due to the limited space of this article, we present only the results of the basic admission procedure analyses. Our goal is thus to analyze the English and Mathematics exam results of students applying to the UEP during the years of 2010 – 2014 and their correlation.

The proposed models and analyses are mostly based on the study (Psacharopoulos, 1995), the experience of the UEP from prior projects with a similar topic (Scholleová, Mikovcová, 2011; Fischer, Finardi, 2010 ; Smutny, Nedomova, Mikovcova, 2014) and the research of education systems in European countries (Maryska, Doucek, 2011), (Ala-Mutka, Punie, Redecker, 2008; Rodic, B. et al, 2012).

Problem Formulation

As part of the surveys performed at the Faculty of Informatics and Statistics, we focus on a relatively specific area – the analysis of entrance exam results and the analysis of exam results of the students of the University of Economics, Prague during their studies. These analyses support the solution of the key problems that we are currently dealing with, such as in particular whether or not the knowledge tested (Mohelska and Sokolova, 2014) in

the entrance exam corresponds with the knowledge necessary for studies, whether or not there is a correlation between entrance exam results and regular exam results and whether or not there is a correlation between the type of university or nationality and entrance or regular exam results. In this article, I will focus on a correlation between Mathematics and English entrance exam results and successful studies at the UEP.

For the purposes of our survey, we formulated the following hypothesis: Students with at least good English entrance exam results have at least good Mathematics entrance exam results.

- H1: For the entire University of Economics, Prague;
- H2: For the Faculty of Finance and Accounting (FFA);
- H3: For the Faculty of International Relations (FIR);
- H4: For the Faculty of Business Administration (FBA);
- H5: For the Faculty of Informatics and Statistics (FIS).

We also analyzed a correlation between Mathematics entrance exam results and English entrance exam results, using a classification similar to that of the above mentioned hypotheses but referred to as C1-C5.

Term "at least good" means in our point of view results higher than the lowest allowed value that is acceptable for the passing of the exam. In our case "at least good" can be expressed as a number higher or equal 50% of point from exam (entrance, standard).

Material and Methods (Data Collection)

The central data systems of the University of Economics, Prague were our basic source of data. These systems contain data about all applicants as well as about the study results of all applicants who then became UEP students.

In this article, we analyze in detail only a data group showing English entrance exam results and Mathematics entrance exam results, compare these results and try to find the answer to the question whether or not there is any correlation between entrance exam results. We also perform the analysis with respect to individual faculties contained in the data file.

Each faculty of the UEP has its own entrance exam and can choose how it will be carried out or may even remove it. The following two basic approaches are used at the UEP:

- Students are accepted based on the entrance exam (or the entrance exam may be removed in view of high school grades);
- Students are accepted based on the SCIO test results.

Two faculties of the University of Economics, Prague (the Faculty of Economics and the Faculty of Management) are not included in the analysis due to the unavailability of data. The Czech Republic passed Act No. 101/2000, on the protection of personal data. Therefore, we anonymized all processed data at multiple levels. We anonymized all information that could lead to the identification of a specific student. We removed the information about an applicant's first and last name, birth certificate number and identifier in the study information system. None of the additional information obtained from primary systems made it possible to identify an applicant or student.

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 (MacLennan, Tang, Crivat, 2009). These were exported from the central database systems of the University of Economics, 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. Evaluation of the data was based on the use of the Microsoft Excel 2010.
Because some data samples was too large for analysing in Microsoft Excel, we used an additional tool for advanced statistical analysis - free software environment "R". We imported data samples to R from csv format. By R we cross-checked results obtained from Excel and mainly performed a correlation analysis which could not be simply proceeded in MS Excel tool. Obtained results we exported back to MS Excel, where we could make a final tables with results.

General Data Characteristics

The data file with entrance exams currently includes 103,829 records that we have been collecting since the year 2010. Each record provides information about the admission procedure result of one student. If a student took the entrance exam in several years or filed several applications to the University of Economics, Prague, he is then included in the data file several times. The most key attributes in the data file include gender, field of study, faculty, type of study, entrance exam result and information about whether or not a student passed the entrance exam and was accepted.

Results and Discussion

We mentioned in the introduction and the problem formulation that we would analyze a correlation between Mathematics entrance exam results and English entrance exam results. We also defined several hypotheses that apply to these two subject-matters in the entrance exam.
This part is divided into three sections:

- Description of Mathematics entrance exam results and English entrance exam results;
- Analysis of a correlation between Mathematics entrance exam results and English entrance exam results by faculty;
- Proof/refutation of the formulated hypotheses.

Analysis of Mathematics Entrance Exam Results and English Entrance Exam Results

Tab. 1 shows that the number of points that applicants to the University of Economics, Prague achieved dropped considerably during the past five years. They dropped from more than 67 points to current 56 points, which means an about 5% drop in points a year, i.e. approximately three points. The median value dropped as dynamically as the average value.

Year	Avg	Median	Modus	Min	Dev	Var	Skewness	Kurtosis
2010	67.23	70.00	100.00	5.00	23.73	563.17	-0.42	-0.77
2011	61.32	60.00	60.00	5.00	23.42	548.61	-0.16	-0.86
2012	61.85	62.00	100.00	5.00	23.73	562.94	-0.18	-0.86
2013	56.78	55.00	50.00	5.00	23.42	548.31	-0.01	-0.85
2014	56.25	55.00	50.00	0.00	28.98	840.06	0.00	-0.90

Tab. 1: Aggregate statistics of Mathematics results, source: authors

Very interesting is, however, the modus values indicating that entrance exam parameters are not very well set up. These are also proven by the frequency histogram in Fig. 1. The

horizontal axis is devoted to the number of points from exam and vertical axis is about number of applicants during the whole investigated period (2010 - 2014) that gained defined amount of points from exam.

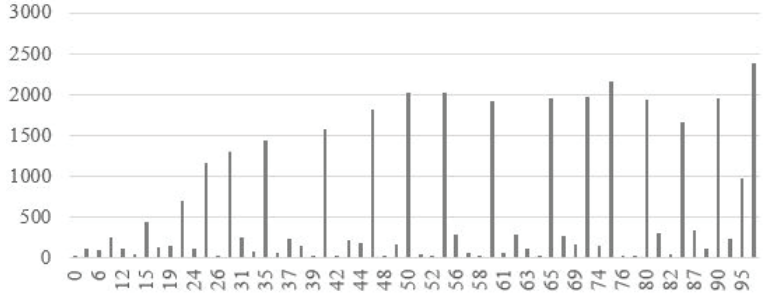

Fig. 1: Frequency of points achieved in the Mathematics entrance exam, source: authors

The aggregate characteristics of the English entrance exam show much better results as compared to the Mathematics entrance exam. Tab. 2 clearly shows that entrance exam results do not practically change with time and remain constant between 66 to 69 points. The median as well as the modus are similarly static.

Year	Avg	Median	Modus	Min	Dev	Var	Skewness	Kurtosis
2010	67.79	70.00	78.00	14.00	17.76	315.27	-0.41	-0.58
2011	66.27	68.00	78.00	11.00	17.61	310.09	-0.34	-0.57
2012	67.04	68.00	80.00	4.00	17.20	295.77	-0.36	-0.55
2013	68.25	70.00	80.00	15.00	17.11	292.88	-0.43	-0.53
2014	68.89	70.00	80.00	17.50	16.90	285.64	-0.44	-0.50

Tab. 2: Aggregate statistics of English results, source: authors

However, compared to Mathematics, the frequency histogram indicates that the English entrance exam is set up correctly, see Fig. 2. The horizontal axis is devoted to the number of points from exam and vertical axis is about number of applicants during the whole investigated period (2010 - 2014) that gained defined amount of points from exam.

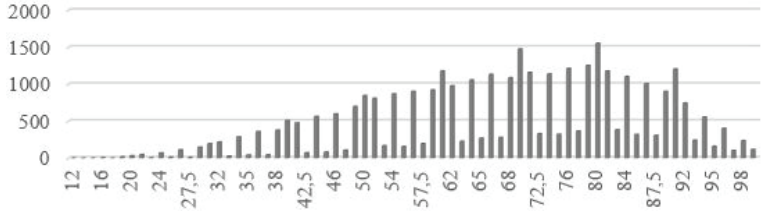

Fig. 2: Frequency of points achieved in the English entrance exam, source: authors

Analysis of a Correlation between Mathematics Entrance Exam Results and English Entrance Exam Results

Tab. 3 shows a correlation between Mathematics entrance exam results and English entrance exam results with respect to the entire file of all data (C1) and by faculty (C2-C5). With the exception of the FIS (C5), the identified values indicate a medium strong

correlation between both exam results. The correlation coefficient for the FFA, the FIR and the FBA as well as for the entire university is 0.47 – 0.56. The highest correlation value was identified in applicants to the FIR. The lowest correlation value was identified in applicants to the Faculty of Informatics and Statistics. Based on the identified values, we can say that there is a correlation between the results and that a student successful in Mathematics can be expected to be successful in English as well and vice versa.

Assessment questions	Correlation index
C1	0.4832
C2	0.5653
C3	0.4830
C4	0.4783
C5	0.3655

Tab. 3: Correlation between English entrance exam results and Mathematics entrance exam results, source: authors

Proof/Refutation of the Formulated Hypotheses

The last part of this article focuses on the proof/refutation of the five formulated hypotheses. The data files were analyzed, using the t-Test: Paired Two Sample for Means. This article presents only t-Tests results with a significance level of 0.05. The t-Test for the entire data file of all students, who took both the Mathematics and English entrance exam, provided the results shown in Tab.4. As Tab. 4 indicates, the hypothesis was accepted since the P value (one-tail and two-tail) is less than t Critical (one-tail/two-tail) at significance level of 0.05. By performing the t-Test, we discovered that P(T<=t) two-tail was 0, which is less than t Critical, so this parameter also confirms that the acceptation of the null hypothesis was justified.

t-Test: Paired Two Sample for Means	English	Mathematics
Mean	68.197	61.083
Variance	292.491	576.204
Observations	34 143	34 143
Pearson Correlation	0.483	
Hypothesized Mean Difference	0.000	
Df	34 142	
t Stat	60.509	
P(T<=t) one-tail	0.000	
t Critical one-tail	1.645	
P(T<=t) two-tail	0.000	
t Critical two-tail	1.960	

Tab. 4: t-Test for Mathematics and English variables, source: authors

The F-test for the entire data file of all students, who took both the Mathematics and English entrance exam, by faculty provided the results shown in Tab.5 and 6. As these tables indicate, the hypothesis was accepted for all faculties since the P value (one-tail and two-tail) is equal to 0, which is less than the set significance level of 0.05 and variances in both groups are not identical. By performing the T-test, we discovered that P(T<=t) two-tail was 0 (again less than t Critical), which also confirmed that the acceptation of the null hypothesis was justified. A very interesting finding is the variance equal to 641 in the case of the FIR, while in the case of the FBA and the FIS the variance was 506 and 532.

t-Test: Paired Two Sample for Means	FFA		FIR	
	English	Mathematics	English	Mathematics
Mean	66.187	63.065	72.972	61.016
Variance	314.052	568.943	244.940	641.892
Observations	9 992	9 992	9 998	9 998
Pearson Correlation	0.566		0.484	
Hypothesized Mean Difference	0.000		0.000	
Df	9 991		9 997	
t Stat	15.512		53.309	
P(T<=t) one-tail	0.000		0.000	
t Critical one-tail	1.645		1.645	
P(T<=t) two-tail	0.000		0.000	
t Critical two-tail	1.960		1.960	

Tab. 5: t-Test for Mathematics and English variables, FFA and FIR, source: authors

t-Test: Paired Two Sample for Means	FBA		FIS	
	English	Mathematics	English	Mathematics
Mean	67.938	61.598	63.102	56.271
Variance	270.716	532.487	305.230	508.217
Observations	9 191	9 191	4 962	4 962
Pearson Correlation	0.478		0.368	
Hypothesized Mean Difference	0		0	
Df	9 190		4 961	
t Stat	28.972		21.027	
P(T<=t) one-tail	0.000		0.000	
t Critical one-tail	1.645		1.645	
P(T<=t) two-tail	0.000		0.000	
t Critical two-tail	1.960		1.960	

Tab. 6: t-Test for Mathematics and English variables, FBA and FIS, source: authors

Conclusion

We analyzed the data obtained from the entrance exams to the University of Economics, Prague. Our goal was to analyze the number of points in Mathematics and English achieved by the students applying to individual faculties.

Based on the performed analysis of the English and Mathematics entrance exams, we reached the following conclusions:

- The number of points in Mathematics achieved by applicants are dropping with time, and this drop is permanent and significant and represents three points each year on average. The analysis also discovered unsuitable parameters of the Mathematics entrance exam.
- Contrary to Mathematics results, the number of points in English achieved by applicants remains constant and amounts approximately to 67 points.
- The correlation analysis has proven a medium to medium strong correlation between English entrance exam results and Mathematics entrance exam results with respect to all faculties of the University of Economics, Prague that were analyzed.
- Based on the hypothesis analysis using the F-test and the T-test, we found out that all null hypotheses (H1-H5) formulated in the introduction of this article were accepted.

Acknowledgements

Paper was processed with contribution of long term institutional support of research activities by Faculty of Informatics and Statistics, University of Economics, Prague.

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THE ROLE OF AN ONLINE SOCIAL NETWORK IN INFORMAL LEARNING

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Abstract

Online social networks have changed a way of information sharing among people. The possibility of online participation, immediate feedback, sharing opinions or photos makes online social networks very popular. Students use online social networks also to share knowledge related to school learning e.g., knowledge related to their school assignments, seminar papers, school team projects and more. Students build social learning relations, and this process is also reflected in the interactions and relationships in an online social network. Online social network has more capacity to disseminate information than conventional educational web platform and it is particularly suitable for communication among members of school class. Our paper deals with the research of the educational information sharing processes on online students' informal social networks (i.e., processes of informal learning taking place on online social networks). The results can be used to enrich the whole educational process and improve the quality of communication among students, and among students and teachers.

Keywords

Informal learning, interaction, social capital theory, social network analysis

Introduction

Online social networks enable effective communication among friends and other people who may come from other countries and cultures (Lytras and Ordonez, 2011). Social interaction is a process in which people act and react to the other people around them (Baym and Jones, 1995). To use this features, online social networks created on the Internet infrastructure are ideally designed. Social relations have adapted remarkably quickly to new technologies in many areas: friendly relations (various online social networks like Facebook), professional relationships (for example LinkedIn), communication (for example Twitter), etc.

Education belongs to one of the most important human relationships. New information and communication technologies allow students to have access to many information sources on the Internet or to use various online educational systems. Students use Internet application enabling and supporting various online social network interactions, e.g. Facebook (Facebook, 2014) as mentioned above. Students also use online social networks for informal cooperation in training, negotiation, for discussion, for peer review and mentoring. In this sense, students interact, transmit instructions for mastering their seminar papers, share knowledge necessary for passing examinations, etc. These communication activities can help students to manage certain university courses, to process their individual school assignments and other. On the other hand, students can also share for example pieces of information learned from various Internet sources that do not conform to the curriculum. Such information can negatively influence the activities

of students in different school subjects, or encourage students to plagiarism and other negative phenomena.

We still do not have enough experience and we are not fully aware of the extent and implications of the development of new technologies in education area. Particularly with regard to online social networks and the role they play in learning process of students (Boyd and Ellison, 2007). Therefore, it is particularly important for the education community to understand the implications of using social media by students. It is important to explore the functioning of social networks, the ways of sharing of information, and generally the ways of interaction in them, and primarily to learn about their influence on educational processes.

In this paper, we try to answer some of these questions. We deal with processes ongoing on students' online informal social networks which are connected with school learning. The knowledge of the functioning of these networks and their influence on forming and sharing of knowledge concerning education processes can help to design strategies to exploit the potential of online social networks and reduce prospective risks.

The primary objective of this study is to understand to what extent students will communicate information concerning to the chosen university course, how students will evolve their relationships when exchanging pieces of study information, how students' learning community will develop during their study of some particular course.

The rest of the text is structured as follows: The next section deals with educational and social networks hypotheses proposed in this paper; Section Results and Discussions describes experiments conducted with the intention to study the processes ongoing on online network and discuss the achieved results. Section Conclusions presents some evaluations of reached results and future lines of work.

Materials and Methods

Not many papers were published until present in the area of relation between online social networks and teaching. Also, these papers deal predominantly with the problem of direct integration of online social networking into education process, i.e., how online social networks can enhance educational learning process through implementing an official platform (official online social network) as a tool where users can interact with each other and share experiences, challenges, results, materials, comments, documents, etc. (Greenhow, 2009). The knowledge of the possibilities how to incorporate online social network to education process is very useful. Educational online social network can help to share experiences among students and can improve the effectiveness of the whole educational process (Moran et al, 2011; Beranek and Remes, 2013). The influence of social networks in educational practice was also studied by Greenhow (2011), Sandoval-Almazan et al, (2013), Koles and Nagy (2012) and by others.

In various areas of educational research, researchers also explored social networks with focus on their internal dynamics of processes ongoing in them (Akkerman and Bakker, 2011; Hommes et al, 2012; Rienties et al, 2013). They explore why some students or groups actively seek to expand their social network groups, while others are primarily focused on their own internal group. The consistent finding is that there is a big impact (positive and also negative) of formal and informal social networks (Daly et al, 2010; Hommes et al, 2012). At the same time, not every student benefits equally from these social networks, as some students have an important position in a social network (De Laat et al, 2006; Moolenaar et al, 2010), or they are intermediaries between the various groups (Bohle et al, 2011; Daly and Finnigan, 2010b; Rienties et al, 2010), while others have limited number or even no links.

Research question

Based on our theoretical framework, we have formulated further research: we assumed that 34 students, who participated in the university course E-business, would develop significant new learning ties as well as friendship links after three months of working and learning together during three month of the course duration. We supposed that these ties would be reflected within students' activities on social networks on the Internet (exchange of information, adding friends and others).

It was expected that the learning processes within the study group would affect the relations in this social group. Relationships in the group can tend to strengthen and compact social network can be created. On the other hand, some relation can also be split and new relations can be established. Students will continue to maintain and develop their relationships with their other contacts that do not belong to "learning" social group. We assumed that this dynamic would be possible to trace on students' online social networks on the Internet. The following research questions were formulated: 1. What is the extent of communication and exchange of learning knowledge on online social network within for example a specific course? 2. Will some "study leaders" appear on online social network? Can we recognize them? Are these "study leaders" also leaders in real social relationships? 3. How are these relationships influenced by the usage of communication technology? 4. To what extent are these online social relations affected by background of students (e.g., the high school from which students come)? 5. To what degree are influenced these social relations by demographic factors (e.g., gender, location, cultural background) and other issues?

Research methodology

We contacted 34 students with questions concerning the use of online social networks in informal learning relationships, exchanging information, sharing information and learning more. These students, participants of our research, attended our university course E-business. The average age of 34 participants was 22.6 years, (range 20-26 years) and 72 % were women. Participants said that they have basic knowledge of informatics and use Internet and online social networks on every day basis.

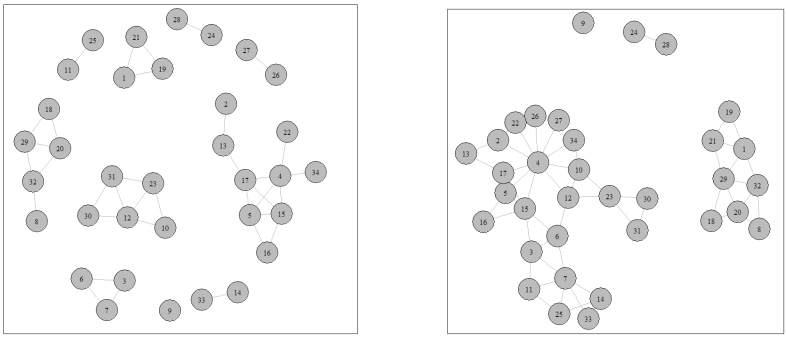
At the beginning of the course, we asked students questions concerning their relationships, learning processes etc. We used a methods of network analysis described for example in (Daly et al, 2010, Hernandez et al, Nanclares, 2012). Then after students had worked together for almost three months we repeated our inquiry. A list of the names of 34 participants was provided, and students responded to a series of questions concerning the exchange of information and forming relationships within online social networks. Questions were formulated like: "I learned from", "I worked a lot with" and "My best friend is". We have tried to formulate questions rather checkbox way. The reason for using the checkboxes rather than Likert scales response 1-5 (i.e., to measure the relative strength of a tie) was that the majority of participants worked with a limited number of participants, and so asked them to evaluate the 34 participants was considered too labour intensive for the respondents. Participants were asked to name their network contacts, frequency of contact (such as strength indicator) and type of relationship. A response rate of 84 % was established for the open and closed SNA questions. Some missing answers were replaced by the transposed results from other participants who indicated their relations to the respondents who did not respond these questions. This approach is commonly done in SNA research (Neal, 2008). All calculations were based upon the 34 participants.

We performed some preliminary research that showed that the majority of respondents

(296 respondents – students and teachers) discussed issues of teaching at online social networks, see Fig. 1 (Drlík, 2014). Students mostly used Facebook for these purposes as they use it for their daily online social interactions.

Results and Discussion

Firstly, the graphic analysis was conducted to determine the total social network structure and to identify any patterns of development subgroups, as recommended by Wassermann and Faust (1994). We applied further basic statistic exploratory methods on our network data.



a) **b)**

Fig. 1: Online social network at the beginning of the course (a) and after almost three months of duration of the course (b)

The relationships in the student's group are presented in the social networks on Fig. 1. The first network (a) was constructed at the beginning of the course E-business, the second one after almost three month of duration of the course (b). The structure of the social network corresponds to questions for example: "On online social network, I am in contact with", "Through online network, I learned mostly from", "Through online network, I asked a lot from", etc.

Fig. 1(a) shows whom the single students consider as friends within the examined group of students taking part in the course E-business at the beginning of the course. Some participants are on the outer edge and this friendship network is not well connected. One participant even has no friends. This structure corresponds to the fact that students participating in this course were from more study specializations taught on our faculty (specializations management, business, economical informatics). Student also came from more years of study. The social network structure presented on Fig. 1(a) is in agreement with this students' educational background.

Fig. 1(b) shows the network after almost three month of duration of the course. Students began to collaborate together through personal contacts and this was also reflected in the activities in online social networks. It is seen on Fig. 1(b) that the new bonds formed among students on online social network (adding of new friends, exchange of information among more students, etc.). The network is more interconnected. Communication took place especially with students who were competent and suggested solutions to the assignments. Student no. 9 did not engage into any "working group" in the classroom. The reason was that he came from another faculty. During the entire course he did not built any "learning" relationships with other students.

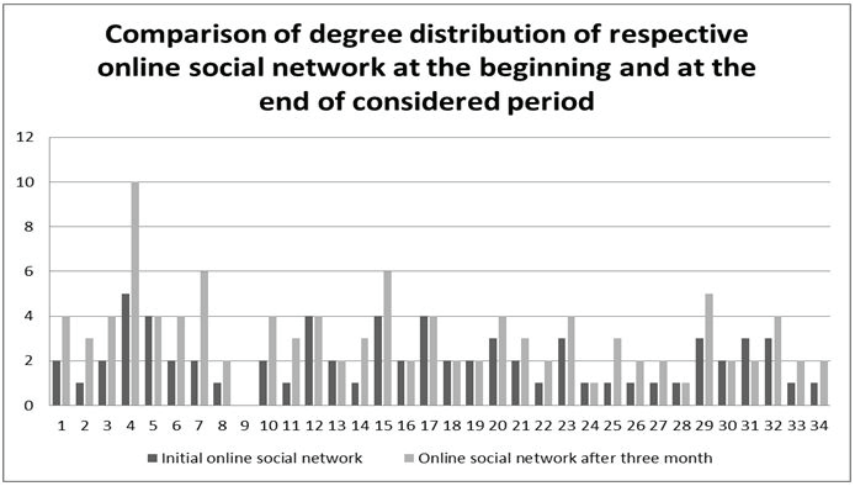
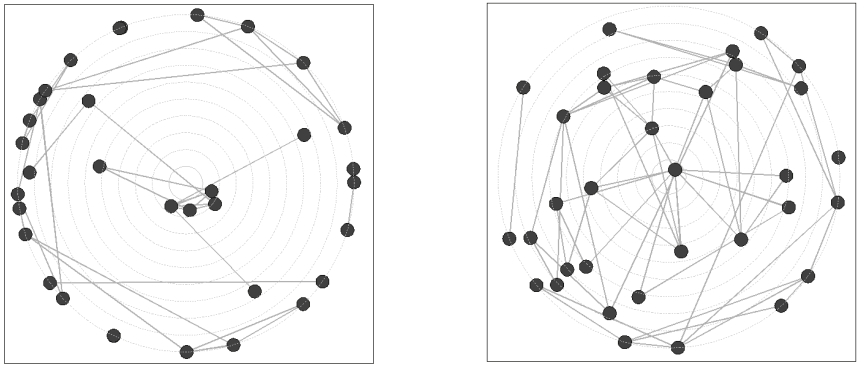


Fig. 2: Distributions on vertex degree at the beginning of the course and after almost three months of duration of the course

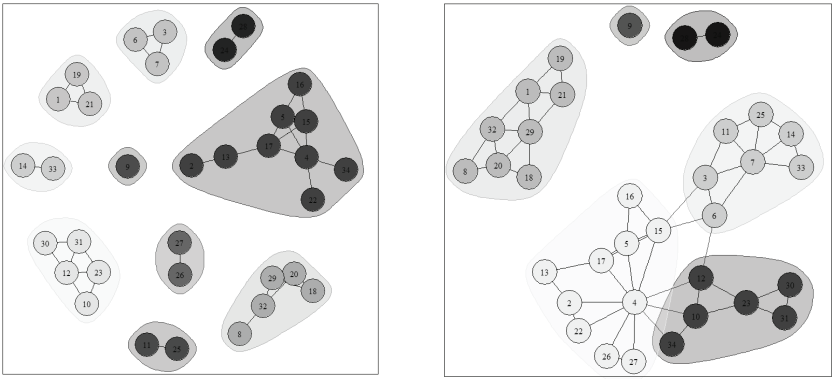
The comparison of the node degree is visible on Fig. 2. The number of links increased considerably after three months of taking a course. We tested the difference of relationship links pre and post course with the help of simple paired *t*-test. The result was $t = 0.007423$. Therefore, we reject the null hypothesis of equality of means of both samples containing data about relationship links at the beginning and after the course.

The eigenvector centrality measure for online social network at the beginning of the course Fig 3(a) and after almost three months of duration of the course (b) was calculated. This measure expresses the "status" or "prestige" of the node in the network. Interesting development of students' learning relationship can be recognized on Fig. 3(a) and Fig. 3(b). As students increase their number of links the "prestige" of some students rises. This manifests itself by changing student's position in the graph of eigenvector centrality toward the centre (Fig. 3(b)). It is valid especially for students who can cope very well with course assignments.



a) **b)**

Fig. 3: Eigenvector centrality measures for online social network at the beginning of the course (a) and after almost three months of duration of the course (b)



a) b)

Fig. 4: Partitioning of online social network at the beginning of the course (a) and after almost three months of duration of the course (b)

Fig. 4 presents partitioning of online social network at the beginning of the course (a) and after almost three months of duration of the course (b). Partitioning demonstrates a "cohesiveness" with respect to the underlying relational patterns.

We can see on Fig. 4 how subgroups within a social group develop during attending the course. At the beginning (Fig. 4(a)), subgroups are small, they correspond to the fact that students come from various study groups and classes. However, students study together the chosen university course and they become more connected (Fig. 4(b)). Larger subgroups are created. This is also reflected on online social network.

We also investigated the extent to which students have developed and maintained their learning relationships. The results of questioning show that the students had contact or dialogues with the use of online social network an average of 21.3 times.

The results of our study are mostly in conformity with the research which has been performed on official social networks included directly in education process (Rienties et al, 2013; Rienties et al, 2013). The difference is that we watched more subgroups and dynamics on informal social network. However, further research is needed.

Conclusion

As highlighted by recent research (Akkerman and Bakker, 2011; Rienties and Nolan, 2014), informal learning processes and their influence on the formal education are often ignored.

We have constructed a model to express the structure and the number of linkages among the group of students that they have formed during their study of some chosen course. However more in-depth research is to be performed to be able to know more about this type of informal learning on online social networks like the relative importance of these linkages (in terms of impact on shared information on their study), the exact type of information that is shared, influence of technology and other.

The limitation of this study is that this study only takes into account social interaction within the one chosen course E-business. It would be interesting to determine whether the internal connections remain active after the end of the course, and learning ties after some time.

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CAD VISUALISATION IN ENGINEERING EDUCATION

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Abstract

Computer aided teaching of mechanical design using tools for modeling and simulation reflects current demand of industrial practice for knowledge and intellectual skills of technical schools graduates. In addition to strict technical requirements on results of the design engineering tasks like digital models of virtual prototypes, one of the observed parameters is also a visual impression.
Designing applications allow to use a wide range of visualization methods and application of procedures of industrial design in creating design solutions. In addition to creating outputs for subsequent phases of the product lifecycle management, this area represents also a motivational tool for students of engineering disciplines and is a refinement of strict technical requirements for the processes of engineering. Influence of implementing visualization in ongoing and final phase of design is a part of the research survey among students of engineering and information engineering fields of technical schools.

Keywords

Computer Aided Design, graphics, industrial design, virtual prototype, visualization

Introduction

Use of tools for modeling - CAD (Computer Aided Design) (Fořt and Kletečka, 2007) and Simulation - CAE (Computer Aided Engineering) (Samuel, Stevenson and Weeks, 2008) in teaching engineering subjects is an integral requirement of industrial practice for increasing professional competence of students and graduates of engineering fields. The aim of teaching methods using support of these instruments is to increase pupils' knowledge in the field of engineering design and improve their intellectual skills in applying the acquired knowledge for solving design engineering tasks (Kropáč, 2002). The starting point for the deployment of applied information technologies are current trends in the general IT competencies of the current generation of students at all levels of schools and the possibility of increasing the achieved level of these competencies (Dvořák and Jehlička, 2012).
An important factor in teaching are also pupils' attitudes and motivation to study engineering design in the field. One way of implementation may be visualizations on digital models of components and assemblies created in CAD systems, or displaying the results of analyzes and simulations, performed via CAE tools. Aesthetic and functional importance of visualization allows by using photorealistic visualization to assess the appearance of the proposal in the chosen environment. Visualizations of simulations and analyzes are tools for comprehensible presentation of quantitatively and qualitatively assessed parameters of selected digital models elements created in the virtual environment of a particular instrument (Aukstakalnis and Blatner, 1994).

Visualization of virtual prototypes

The visual presentation of data design can be further divided by purpose:

- Working visualization of the model.
- Final visualization of the model.

A specific case is the visualization of measured models, results of analyzes and simulations. Visualized interpretation of the results of these processes may be a part of the ongoing work on the model and the final presentation as part of a comprehensive documentation of the virtual prototype.

All listed kinds of visualizations are gradually implemented during the design and creation of virtual prototype. CAD and CAE systems used in industrial practice and teaching at schools offer a wide range of visualization tools for the presentation of static and animated scenes and at the same time tools for capturing visualizations, converting them into general image or video formats, and the possibility of subsequent use in creating presentations and documents related with the preparation of complex data of the proposed product.

Working visualization

Working visualizations are carried out during modeling of the proposed component and are of particular significance for creating a visual perception of this model. They also facilitate the selection of objects for further modeling and analytical operations. Types of shading model can be classified as one of the basic working visualizations. Shaded model with visible edges is typically used in normal 3D modeling environment. The presented model creates the spatial perception of the object and it allows to identify and select objects according to their type for the subsequent modeling operations, especially in this case, according to their edges and surfaces. Shaded display of an identical model is shown in the left part of Fig. 1.

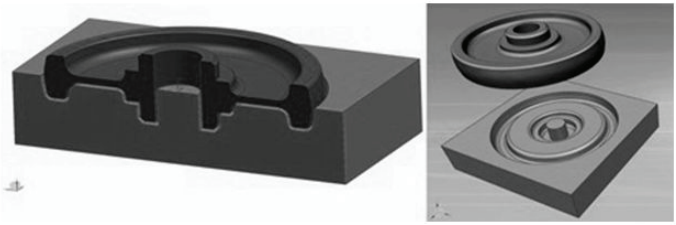


Fig. 1: Shaded display of a part and an in cross section and material disintegration of the assembly

An effective case in a practical modeling is to display of a part in a cut by one or more user-defined planes. The sectional view is especially important while working in the context of an assembly, or for work on a model that has a cavity, or when its complexity complicates the display of hidden objects. Collisions of components in selected locations can be identified and their size can be assessed by the section view of a model. A specific case of visualization work is the analysis of the consistency and curvature of surfaces. The points on a surface with distinctive curves on surfaces can be identified through a simple visualization tool and these locations can be edited by using modeling operations as needed. Example of curved surfaces with reflectivity analysis is in the left half of Fig. 2. A very specific case is the analysis of a surface chamfer mainly applied in the design of model castings, stampings and tools for the carrying out of technological operations for their implementation. For example, to evaluate negative chamfers is one of the conditions

for the smooth distribution of mold and removing the cast by the production of a part. Sample analysis of chamfer casting is in the right half of Fig. 2.

Fig. 2: Analysis of reflection and chamfer areas to assess the consistency of geometry

Final visualization

The final visualization is used to create an effective visual aesthetic perception of a proposal (Kolesár, 2004). In some cases, it is a requirement for assessment of a photorealistic output to assess the real appearance in a specific environment by the functional purpose of the real product. The final visualization model is usually not very comfortable for the conduct of subsequent modeling operations. But it can be applied during work to assess the overall appearance of the design, or individual parts for the decision on subsequent modeling process. This procedure is applied mainly in models of components and assemblies, which will have a functional and aesthetic importance in a real situation. The basic means of the final visualizations is the assignment of appearance of a specific material to a component, including the appropriate level of gloss. This case is also important for the presentation of interim and final data to other participants of the project, to increase comprehensibility and clarity related to the strategic importance of the proposed product. Sample kits with assigning colors according to materials can be seen in the right half of Fig. 1. Lighting of the model from specific directions and by optional intensity can be defined to increase the level of realistic appearance of the model, including displaying relevant shadows of the individual objects on a model. The final visualization of virtual prototyping can be done by placing a colored model to the environment according to functional classification in real traffic. This enables with a high degree of realism to assess the appearance and aesthetic proposal in the context of real environment, as shown in Fig. 3.

Fig. 3: The final visualization of the model in a defined environment

Industrial design

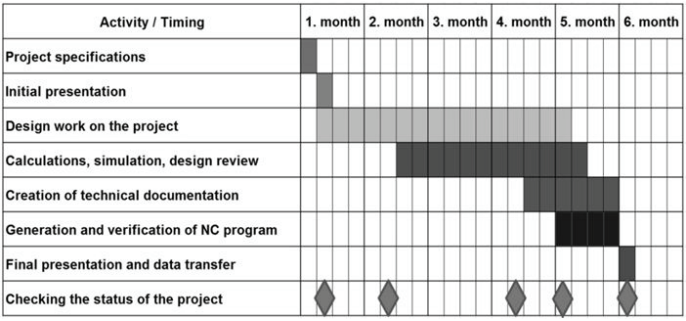
Very specific area for application of visualizations by the use of tools for modeling and simulation is the issue of industrial design. Environment of modeling tool allows different levels of the final visualizations, enabling assessment of the virtual prototype in a real environment. Features of fine art together with technical elements are also applied by the creation of a model. Creating graphical output with coloring material effects, lighting and placement in a real environment enhances the aesthetic perception of the subject, especially for virtual prototype, which are visible by their real function. Modeling tools can be also used for visualization of any artistic elements, and non-technical subject. Fig. 4 shows an example of identical variations in the CAD model, where different degrees of visual effects are applied. The output can be in the form of a graphical picture for format poster printing or for electronic possibly web presentation. Interactive CAD options allow the creation of dynamic scenes presenting tour of a virtual object in the role of an observer and also the automatic insight into the hidden parts of the model. Elements of virtual reality can be applied (Aukstakalnis and Blatner, 1994). Current attention is focused on multimedia and their use for the transmission of information, product presentations and training. Graphical outputs, static and dynamic, form an important starting materials for the use in the generated multimedia outputs.

Fig. 4: Phase of object visualization in the CAD environment using graphic

Visualization in educational projects

Using visualization tools while working on educational projects of virtual prototypes is a part of the activities specified in the assignment of specific tasks (Shigley, Mischke and Budynas, 2010). Ongoing work visualization are applied while modeling components and assemblies, and are particularly important for effective orientation in a virtual graphical interface of the used CAD tool. Visualization analyzes and simulations are used primarily to assess models and their possible optimization. The final visualization is used to create presentations for the introduction of project output, mainly in the form of still images exported into common formats. By a dynamic image capture, you can create movies with representation procedures to achieve specific modeling and simulation results of the solved educational projects.

An example of a schedule of a virtual prototype educational program is shown in Tab. 1. The task can be solved in a team or individually with a reasonable extent (Zhou, 2012). It includes all necessary activities implemented in practice by equivalent projects.



Tab. 1: Schedule of an educational project of a virtual prototype design

Materials and Methods

The survey carried out to verify the status of visualization methods and procedures in the stages of creating digital models was a part of a long-term research of using tools for modeling and simulation in teaching engineering subjects. Students of engineering and information engineering fields at secondary schools and colleges completed a questionnaire after finishing the project oriented education. Items of the questionnaire were aimed at identifying attitudes towards the use of CAx technologies in education and intention to use CAx technologies in professional life and everyday private life. This survey, presented eg. in (Dvořák and Jehlička, 2012), focusing on pupils' attitudes to deploy tools for modeling and simulation in solving educational projects, demonstrates the popularity of visualization techniques together with the creation of 3D models.

Questionnaire items focused on the popularity of CAx processes were a part of the survey where pupils could scale by assigning the importance to mentioned activities. The research included a total of 84 students who completed education with a CAD and CAE tool, and then participated in solving the long-term educational project. There is a direct link with the use of specified categories of applications in the research. The evaluation questionnaire phase of the research was carried out by the methods of descriptive statistics with graphical representations of selected results. Visualization methods that the research refers to, are a part of the functionality of the used applications and do not represent any additional procedures such as modeling scenes for example through the graphic libraries in the development environment of a programming language. However, the created models can be also a starting point for advanced modeling techniques of graphic scenes. Solved educational projects of students, who were respondents of the research, were aimed primarily at creating technically functional solution verified through simulation. Related to visualizations, an area was determined for design in terms of functional-aesthetic design.

Result and Discussion

Research survey of popularity of key activities was carried out in connection with the deployment of educational projects of the listed structure. The results of the research conducted with 84 students of engineering and information-engineering fields are shown in the graph of Fig. 5. It is necessary to consider the results pertaining to the implementation of visualizations as very important, the visualizations, that are for 3D modeling of a lower importance, and this factor can be used, for example, to motivate

students in the course of the project. However, in addition to teaching importance, this activity is thus important for the exchange of information both within the development and technical preparation, and from the point of view of the presentation of the product before the completion of development.

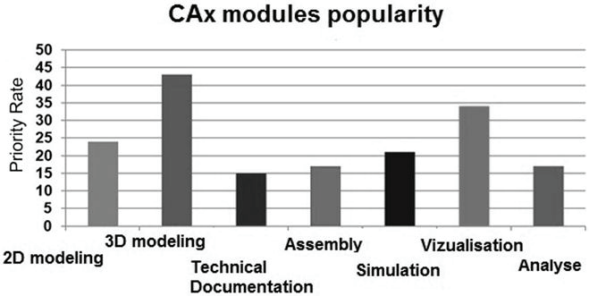


Fig. 5: Results of the research of the activities popularity within the solving educational project

Conclusion

Implementation of technical visualizations and animations in teaching engineering design is a tool for increasing the level of knowledge and at the same time increasing pupils' motivation to study and professional achievement in the field. Working and final visualizations carried out in a virtual environment of an engineering tool for modeling and simulation are important for effective orientation in a digital model of the design and implementation of effective graphical output for the presentation of development data, as graduates will present their work in a professional field of practice.

The survey results demonstrate the importance of visualization techniques in the interim and final stages of creating a digital model both in terms of a popularity of individual activities, and in terms of importance for the achievement of quality outputs of the completed solved problems. The inclusion of visualization teaching and the requirement on interim and final visualization of virtual prototype digital data is therefore effective.

The importance of integrating technical visualizations to didactic system of engineering design can be assumed from the above findings.

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TRAINING EFFICIENCY IN SMALL AND MEDIUM-SIZED ENTERPRISES IN THE CZECH REPUBLIC

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Abstract

The paper focuses on the approach to evaluation of training efficiency in small and medium-sized enterprises in the Czech Republic. The main objective is to evaluate, based on the results of the quantitative survey (n = 235), the use of training measurement and evaluation methods and related aspects in small and medium-sized enterprises in the Czech Republic in the period from 10/2012 to 06/2013. A partial objective is to test dependencies between selected qualitative features. The results revealed that only 34.3% of small and medium-sized enterprises systematically evaluate training efficiency. The survey results showed that enterprises' approach to training depends on the size of the enterprise, the sector in which the enterprise operates, the existence of an HR department and an HR strategy. An important factor determining the evaluation of training efficiency in small and medium-sized enterprises is an existence of an HR department.

Keyword

Efficiency, human resource management, small and medium-sized enterprises, survey, training

Introduction

The development of human resources represents a key factor of success of each and every enterprise (Umble, Haft and Umble, 2003) and a valuable source to achieve a competitive advantage (Brand and Bax, 2002; Waiganjo, Mukulu and Kahiri, 2012; Bakan, Ersahan, and Buyukbese, 2013; Sheehan, 2014), therefore it is necessary to train and develop employees (Pahuja and Dalal, 2012; Popescu and Ratiu, 2012). Employee training and development is a continuous process, which has a positive effect for both the employee and the entire enterprise (Magableh, Kharabsheh and Al-Zubi, 2011; De Saá-Pérez, Díaz-Díaz and Ballesteros-Rodríguez, 2012). According to Hansson (2007), the provision of enterprise training is largely determined by enterprise-specific factors such as human resource management practises. Due to the global economic crisis a number of enterprises were forced to streamline their business processes and review their training investments and their return (Eurofound, 2011). The emphasis is therefore placed primarily on the efficiency of training programmes and their benefits for employees in relation to work performed by them as well as for employers with respect to increasing their competitiveness (Cekada, 2010; Staňková and Drdla, 2012; Vnoučková, 2013). In a number of enterprises inefficient across-the-board training programmes were replaced by individual plans of personal development and career plans developed based on the analysis of real training needs in the given enterprise.

The paper focuses on the efficiency of training in small and medium-sized enterprises (SMEs) in the Czech Republic, since they represent an important sector of its market economy. Small and medium-sized enterprises (up to 250 employees) form a significant

group of employers in the Czech Republic since they employ 60.9% of employees out of the total number of the work force and represent 99.83% of the overall number of active business entities in the Czech Republic (Ministry of Industry and Trade of the Czech Republic, 2014). According to the Czech Statistical Office (2013b), the segment of small and medium-sized enterprises in the Czech economy is, in the long-term, dominated by very small enterprises employing a maximum of nine people, which represents one third of all jobs and one fifth of the overall amount of added value in the economy. These enterprises, however, were the most affected by the 2008 economic crisis. With regard to the fact that small and medium-sized enterprises are important employers in the Czech Republic, attention will continue to be paid to the level of human resource management in these enterprises. Their advantages include in particular relative flexibility, their ability to quickly respond to changing conditions, a relatively high ability of workforce absorption and an ability to fill the gap in the structure of business relations between large enterprises (Czech Statistical Office, 2007). On the other hand, there are also some disadvantages: more difficult access to capital, information and knowledge, lower ability to eliminate the consequences of external factor fluctuation in the preliminary stage of their development and less hesitation when dealing with redundancies (Czech Statistical Office, 2007). The main objective of the paper is to evaluate the use of training measurement and evaluating methods and related aspects in small and medium-sized enterprises in the Czech Republic in the period from 10/2012 to 06/2013. A partial objective is to test dependencies between selected qualitative features that relate to the issues examined.

Materials and Methods

In the period from 10/2012 to 06/2013 a questionnaire survey was conducted focusing on the training efficiency measurement and evaluation in small and medium-sized enterprises in the Czech Republic. 235 enterprises from both the private and public sectors took part in the questionnaire survey. Enterprises were selected randomly. The majority of enterprises that participated in the survey come from the private sector (72.3%) and operate in the national market (70.2%). 71% of enterprises are from the tertiary sector, 23% of enterprises are from the secondary sector and 6% of enterprises are from the primary sector. 57.4% of the enterprises surveyed have less than 50 employees, 42.6% of these enterprises have 50 to 249 employees. The structure of enterprises is shown in Table 1.

Economic sector	Primary	Secondary	Tertiary	Total
Small enterprises	6	20.7	73.3	100
Medium-sized enterprises	6	26	68	100
Area operated	Private		Public	Total
Small enterprises	80.7		19.3	100
Medium-sized enterprises	61		39	100
Size of the market	National		International	Total
Small enterprises	76.3		23.7	100
Medium-sized enterprises	62		38	100

Tab. 1: Structure of enterprises in percentages

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 enterprise. The data have been processed by means of descriptive statistics using the Microsoft Excel

2013 and the IBM SPSS Statistics 22. Testing was done by Pearson's Chi-Square Test in association and contingency tables. The level of significance was set at 0.05. To interpret the strength of Cramer's V, a scale according to De Vaus (2002) was used.

Results and Discussion

The results of the survey have shown that 70.6% of responding enterprises carry out employee training. In absolute figures, this means 166 enterprises of the selected sample (235). Out of the total number of enterprises, this refers to 61.5% of small enterprises and 83% of medium-sized enterprises. The results reveal that medium-sized enterprises invest more effort in employee training and the evaluation of its efficiency than small enterprises. The results obtained are in compliance with the outcomes of the Czech Statistical Office (2013a) which show that approximately three-quarters of enterprises invested in employee training even through the financial crisis. Although these were primarily enterprises with more than 500 employees, in the category of small business the share was 63%.

Despite the fact that 70.6% of responding enterprises train their employees, only 34.3% of them systematically evaluate the efficiency (by methods of training efficiency evaluation) of their employee training. In absolute figures, this means 57 enterprises of the selected sample (166). Out of these enterprises 43.9% (25) are small enterprises and 56.1% (32) are medium-sized enterprises. To evaluate training efficiency, these enterprises most frequently review the following: assessment of development plan goals fulfilment (56.1%), employee's reactions immediately after training (56.1%), informal feedback from direct superiors and employees involved in the training process (57.9%), records of the overall number of days of training per employee (42.1%), observation during work (28%) and measuring work performance before and after training (7%). The application of training efficiency evaluation methods in enterprises according to the size of the enterprise are presented in Table 2.

Methods of training efficiency evaluation	Small enterprises*	Medium-sized enterprises*	SMEs**
Assessment of development plan goals fulfilment	37.5%	62.5%	56.1%
Employee's reactions immediately after training	50%	50%	56.1%
Informal feedback from direct superiors and employees involved in the training process	48.5%	51.5%	57.9%
Records of the overall number of days of training per employee	45.8%	54.2%	42.1%
Observation during work	56.3%	43.7%	28%
Measuring work performance before and after training	50%	50%	10.5%

** % from SMEs, ** % from all SMEs that carry out employee training*

Tab. 2: Methods of training efficiency evaluation according to the size of the enterprise

The willingness to undergo training and personal development is very important, since the aim of all enterprises is to recruit the best employees. The goal of the recruitment is to hire candidates who not only have the necessary skills, knowledge, abilities, experience and personal characteristics, but also the motivation for further development. Enterprises continue to develop and therefore it is essential for employees to develop as well. In enterprises monitored employees are willing to be trained. However, courses have to be

recommended by their employer (53.6%). In 37.3% of enterprises the initiative is on the part of employees who select training courses themselves. In 8.4% of enterprises employees are not willing to be trained, nevertheless they take part in the course if proposed by their employer. Their personal motivation to be trained, however, is low. In 0.6% of enterprises employees try to avoid training courses. The employees' willingness and initiative to be trained according to the size of the enterprise is shown in Table 3.

Willingness and initiative to be trained	Small enterprises*	Medium-sized enterprises*	SMEs**
Employees are willing to be trained but courses have to be recommended by their employer	51.7%	48.3%	53.6%
Employees select training courses	45.2%	54.8%	37.3%
Employees are not willing to train – they only participate in courses recommended by the employer	57.1%	42.9%	8.4%
Employees try to avoid courses	100%	0	0.6%

** % from SMEs, ** % from all SMEs that carry out employee training*

Tab. 3: The employees' willingness and initiative to train according to the size of the enterprise

Monitoring current trends and development in their specific area of business is necessary in present situation, which is characterised by dynamic changes. The results of the survey have shown that the majority of small and medium-sized enterprises (61.4%) identify areas in which employees need to be trained based on trend monitoring; 28.3% of enterprises use intuition and 10.2% of enterprises do not focus on these issues. The identification of areas of training according to the size of the enterprise is illustrated in Table 4. The results presented reveal that small enterprises often identify areas of training intuitively, while medium-sized enterprises follow current trends.

Determining of training areas	Small enterprises*	Medium-sized enterprises*	SMEs**
Based on trend monitoring	48%	52%	61.4%
Intuitively	57.4%	42.6%	28.3%
We do not focus on these issues	41.2%	58.8%	10.2%

** % from SMEs, ** % from all SMEs that carry out employee training*

Tab. 4: The identification of areas of training according to the size of the enterprise

For the purpose of determining dependencies between selected features, Pearson's Chi-Square Test on the independence of features was conducted. To interpret the strength of Cramer's V, a scale according to De Vaus (2002) was used. The results of the test are presented in Table 5.

No.	Null hypothesis	Asymp. Sig.	Decision	Value of Cramer's V	Strength of the relationship
1	Enterprises' approach to training is not dependent on the size of the enterprise.	0.000	Reject the null hypothesis	0.234	Low
2	Enterprises' approach to training is not dependent on the sector in which the enterprise operates.	0.004	Reject the null hypothesis	0.190	Low
3	Enterprises' approach to training is not dependent on the market in which the enterprise operates.	0.627	Do not reject the null hypothesis	-	-
4	Enterprises' approach to training is not dependent on the existence of an HR department.	0.015	Reject the null hypothesis	0.158	Low
5	Enterprises' approach to training is not dependent on the existence of an HR strategy.	0.024	Reject the null hypothesis	0.148	Low
6	A systematic evaluation of training efficiency is not dependent on the size of enterprises.	0.253	Do not reject the null hypothesis	-	-
7	A systematic evaluation of training efficiency is not dependent on the sector in which the enterprise operates.	0.279	Do not reject the null hypothesis	-	-
8	A systematic evaluation of training efficiency is not dependent on the market in which the enterprise operates.	0.379	Do not reject the null hypothesis	-	-
9	A systematic evaluation of training efficiency is not dependent on the existence of an HR department.	0.03	Reject the null hypothesis	0.168	Low
10	A systematic evaluation of training efficiency is not dependent on the existence of an HR strategy.	0.093	Do not reject the null hypothesis	-	-
11	The identification of areas of training is not dependent on the existence of an HR strategy.	0.006	Reject the null hypothesis	0.247	Low

Tab. 5: The results of the qualitative characteristics test

6 out of 11 tested null hypotheses were rejected and 5 null hypotheses were accepted. The results of the Chi-square Test have revealed the following:

1. Enterprises' approach to training depends on the size of the enterprise. 83% of the responding medium-sized enterprises focus on training. As far as small enterprises are concerned, it is only 61%, i.e. the bigger the size of enterprise, the more attention management pays to the area of training.
2. Enterprises' approach to training depends on the sector in which the enterprise operates. Training is organised by 84.6% of responding enterprises from the public sector and by only 65.3% of enterprises from the private sector, i.e. enterprises from the public sector dedicate more effort to the area of training.
3. Enterprises' approach to training does not depend on the market in which they

operate, i.e. it is not important whether or not the enterprise operates on the national or international market.

4. Enterprises' approach to training depends on the existence of an HR department. 82.5% enterprises that have an HR department established organise training while only 66.3% enterprises without an HR department train their staff.
5. Enterprises' approach to training depends on the existence of an HR strategy. 77.7% enterprises with an HR strategy in place train their employees. An HR strategy is a long-term plan designed to achieve goals in the area of human resources and human capital management and development in the enterprise. HR strategy covers a number of areas, among them the enterprise's approach to the training of its employees. Enterprises that have an HR strategy in place therefore pay more attention to the training of their employees compared to enterprises without an HR strategy.
6. The systematic evaluation of training efficiency does not depend on the size of the enterprise, the sector or the market in which enterprise operates or the existence of an HR strategy.
7. The systematic evaluation of training efficiency depends on the existence of an HR department. 46.2% of enterprises with an HR department evaluate the efficiency of training, while only 28.9% of enterprises without an HR department do the same.
8. The identification of areas of training depends on the existence of an HR strategy. 72.4% of enterprises with an HR strategy identify the areas of training based on trend monitoring.

Human resources are one of the most important sources of competitive advantage and higher performance for enterprises (Bakan, Ersahan and Buyukbese, 2013). Many small enterprises encounter serious human resource problems, while at the same time these human resources play an important role in developing and sustaining their competitive advantages (Brand and Bax, 2002). Therefore employee training is one of an enterprise's priorities, in particular in those enterprises that wish to keep up with the times and succeed in the market. The results of the survey have shown that medium-sized enterprises invest more effort in employee training and the evaluation of its efficiency than small enterprises. Nevertheless 65.7% of enterprises do not evaluate benefits of organised training and invested finances. According to Tichý (2015), a typical training programme generates only 15% of participants who successfully apply new knowledge and skill in practice. 70% of the causes of training and development activities failures become evident only after the training programme; the training programme as such only accounts to 10% of such causes (Tichý, 2015). Despite the fact that effective employee training and development are important factors for enterprises success, most enterprises fail to evaluate the impact and return on training investments that they could and should (Brinkerhoff, 2005).

Conclusion

The paper focused on the evaluation of training approaches and efficiency in small and medium-sized enterprises in the Czech Republic, since small and medium-sized enterprises represent 99.83% of the total number of active business entities. Therefore it is important to take them into account. The results of the survey have shown that medium-sized enterprises invest more effort in employee training and the evaluation of its efficiency than small enterprises. Despite the fact that 70.6% of responding enterprises train their employees, only 34.3% of them systematically evaluate the efficiency of their employee training. The results of the survey have also shown that enterprises' approach to training depends on the size of the enterprise, the sector in which the enterprise operates,

the existence of an HR department and HR strategy. Enterprises' approach to training does not depend on the market in which they operate. The systematic evaluation of training does not depend on the size of the enterprise, the sector or market in which enterprise operates or the existence of an HR strategy. The systematic evaluation of training does, however, depend on the existence of an HR department. Compared to enterprises without an HR department, small and medium-sized enterprises that have an HR department monitor trends and subsequently use this knowledge in their activities – including training – more frequently, which corresponds to the current trend. HR managers should be able to consider the strategic development of the enterprise, follow current trends and put through the necessary changes.

Acknowledgements

This paper is a research project of the Czech University of Life Sciences Prague and has been made possible due to the support of the Internal Grant Agency (IGA) of the Czech University of Life Sciences Prague, registration no. 20141047 - Evaluation of selected HR management activities in organisations in the Czech Republic.

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QUALITATIVE AND QUANTITATIVE ANALYSIS OF EFFICIENCY IN EDUCATION OF NEGOTIATIONS

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Abstract

This paper presents results qualitative and quantitative analysis of efficiency in education of negotiations. Negotiations were tested on repeated economic laboratory experiments with information asymmetry. They were designed to test a model of reverse combinatorial auctions on the case of providing financial support to polluters. Students played the role of managers of polluting entities seeking to gain maximum support in the auction when bidding pollution reductions. The experiment was carried out prior to teaching the principles of negotiation and repeated after teaching these principles. The experimental results are compared with the first-best solution calculated by assumption of knowledge of information about projects' minimal supports. The efficiency results were analyzed by Qualitative Comparative Analysis (QCA) and Data Envelopment Analysis (DEA).

Keywords

Economic laboratory experiments, questionnaires, Qualitative Comparative Analysis (QCA), Data Envelopment Analysis (DEA)

Introduction

Very important means of achieving consensus in group decision making are negotiation processes (Raiffa, 1985). Negotiation problems are studied using a number of theoretical approaches and findings of the application areas of 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. Laboratory experiments have been used to evaluate performance in a wide variety of institutions (Davis and Holt, 1993). Experiments provide an inexpensive way to examine various economic policy proposals. Experimentation may allow identification of proposals that are unlikely to be effective, and this can shift the burden of proof for policy proposals that exhibit results in the laboratory.

In the paper combinatorial auctions are proposed for laboratory experiments for testing efficiency in education of negotiations. Combinatorial auctions are those auctions in which bidders can place bids on combinations of items (Cramton, Shoham and Steinberg, 2006). The reverse combinatorial auction model was used for an example of public supports granted to individual and coalition projects reducing environmental pollution. The rest of the paper is organized as follows. The section 2 presents qualitative and quantitative instruments for analysis. A design of the laboratory experiment is presented in the section 3. Results of analyses and discussions are presented in the section 4. The last section summarizes results of analyses.

Materials and Methods

Efficiency in education of negotiations was tested on repeated economic laboratory

experiments (Fiala, 2012). The data for analysis were based on questionnaires. The efficiency results were analyzed by Qualitative Comparative Analysis (QCA) and Data Envelopment Analysis (DEA).

Laboratory experiments and questionnaires

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. The systematic evaluation of economic theories under laboratory conditions is a relative recent development (Douglas and Charles, 1993). 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. Incentivize subjects with real monetary payoffs is considered as one of the fundamental rules of laboratory experiments.

After the laboratory experiments, the students participated in the survey, which was to identify factors influencing the efficiency of using the principles of negotiation. The questionnaire that has been used in our survey has the following structure:

1. Information related to the negotiator itself
   - understanding the negotiation principles (whole – partly - little – nothing),
   - understanding the experiment assignment (whole – partly - little – nothing),
   - perception of others in the group as teammates (yes - partially - no),
   - perception of others in the group as opponents (yes - partially - no),
   - time to negotiate (long - reasonable - short),
   - importance of financial incentives for thorough consideration of strategies (high - partial - low - no).
2. Information related to the group of negotiators
   - understanding the experiment assignment in the whole group (whole – partly - little – nothing),
   - group work (good - average - bad),
   - data sharing on costs of projects (yes - no),
   - data sharing with a maximum investment (yes - no),
   - perception of other groups as opponents (high - partial - low - no).

Qualitative comparative analysis

Qualitative Comparative Analysis (QCA) is a technique, originally developed by Charlie Ragin (1987). QCA is used for analyzing data sets by listing and counting all the combinations of variables observed in the data set, and then applying the rules of logical inference to determine which implications the data supports.

In the case of categorical variables, QCA begins by listing and counting all types of cases which occur, where each type of case is defined by its unique combination of values of its independent and dependent variables. QCA can determine which descriptive inferences or implications are empirically supported by a data set. The method attempts to ensure that all possible combinations of variables that can be made across the cases under investigation are considered

In QCA's next step, inferential logic of Boolean algebra is used to simplify or reduce the number of inferences to the minimum set of inferences supported by the data. This reduced set of inferences is termed the prime implicants by QCA adherents. To establish that the prime implicants or descriptive inferences derived from the data by the QCA method are causal requires establishing the existence of causal mechanism using another method such as process tracing, formal logic, intervening variables, or established multidisciplinary knowledge.

By formalizing the logic of qualitative analysis, QCA makes it possible to bring the logic and empirical intensity of qualitative approaches to studies that embrace more than a handful of cases. Boolean methods of logical comparison represent each case as a combination of causal and outcome conditions. These combinations can be compared with each other and then logically simplified through a bottom-up process of paired comparison. These minimization procedures make multiple comparisons of configurations through computer algorithms. The goal of the logical minimization is to represent the information in the truth table regarding the different combinations of conditions that produce a specific outcome. There is possible to make contextual analyses with QCA-methods (Denk and Lehtinen, 2014).

For our analysis, we used the software fs/QSA suitable for fuzzy sets (Ragin, 2006). A conventional "crisp" set is comparable to a binary variable with two values, 1 and 0. A fuzzy set permits membership in the interval between 0 and 1 while retaining the two qualitative states of full membership and full non-membership. It is up to the researcher to specify procedures for assigning fuzzy membership scores to cases.

Data envelopment analysis

The first DEA model was developed by Charnes, Cooper and Rhodes (1978). Various technical aspects of DEA can be found in Cooper et al. (2000). Since the first paper, a large number of theoretical articles and applications of DEA have been published.

Suppose there are n decision making units each consuming r inputs and producing s outputs and (r, n)-matrix X, (s, n)-matrix Y of observed input and output measures. The essential characteristic of the CCR ratio model is the reduction of the multiple input and multiple output to that of a single "virtual" input and a single "virtual" output. For a particular decision making unit the ratio of the single output to the single input provides a measure of efficiency that is a function of the weight multipliers (u, v). The relative efficiency of the decision making unit P0 is given as maximization of the ratio of single output to single input to the condition that the relative efficiency of every decision making unit is less than or equal to one. The formulation leads to a linear fractional programming problem.

$$\begin{aligned} &\frac{\sum_{i=1}^{s} u_i y_{i0}}{\sum_{j=1}^{r} v_j x_{j0}} \to \max \\ &\frac{\sum_{i=1}^{s} u_i y_{ih}}{\sum_{j=1}^{r} v_j x_{jh}} \le 1,\ h = 1, 2, \ldots, n \\ &u_i, v_j \ge \varepsilon,\ i = 1,2,\ldots,s,\ j = 1,2,\ldots,r. \end{aligned} \tag{1}$$

If it is possible to find a set of weights for which the efficiency ratio of the decision making unit P_0 is equal to one, the decision making unit P_0 will be regarded as efficient, otherwise it will be regarded as inefficient. Data Envelopment Analysis was performed by Banxia Frontier Analyst software.

Experiment design

Reverse combinatorial auction model was used for an example of public supports granted to individual and coalition projects reducing environmental pollution (Fiala and Šauer, 2011). The model was used to calculate the first-best solution of the problem at knowledge of information that is in practice usually dispersed among actors (projects). The results of this calculation were then used to compare with the results obtained in the repeated implementation of the proposed experiment.

For economic laboratory experiment was designed to model a region with 10 polluters in 5 groups labeled A, B, C, D and E (Fiala, 2012). This designation indicates the economic sense to prepare a coalition projects. It is theoretically possible to create $2^n - 1$ coalition, which for our case $n = 10$ polluters meant 1023 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, 10 individual projects were worked out (A1, A2, A3; B1, B2; C1, C2, C3; D1 a E1) and 9 coalition projects (A1-A2, A1-A3, A2-A3, A1-A2-A3; B1-B2; C1-C2, C1-C3, C2-C3, C1-C2-C3), total of 19 projects. For each of the projects have been set following parameters:

- pollution reduction in project implementation dE_i, $i = 1, 2, \ldots, 19$,
- minimal external supports for effective projects $Pmin_i$, $i = 1, 2, \ldots, 19$.

Overview of the individual and coalition projects with parameters is given in Tab. 1.

Environmental objective of the experiment was set so that all polluters will reduce the volume of pollution exactly by dE_i given in Tab. 1. They may do so through individual or coalition projects and will attempt to win public support of $Pmin_i$ or higher. Groups of students in courses Decision theory and Environmental economics and policy at the University of Economics in Prague were engaged as economic subjects in laboratory experiments. Students played the role of managers of polluting entities seeking to gain maximum support in the auction when the bidding pollution reductions. The role of authorities offering support played teachers in the both courses.

Project number	Project	Pollution reduction dE_i	Minimal support $Pmin_i$
1.	A1	90	30
2.	A2	40	30
3.	A3	100	50
4.	A1-A2	130	35
5.	A1-A3	190	70
6.	A2-A3	140	60
7.	A1-A2-A3	230	60
8.	B1	30	20
9.	B2	40	60
10.	B1-B2	70	50
11.	C1	50	20
12.	C2	40	40
13.	C3	80	60
14.	C1-C2	90	50
15.	C1-C3	130	70
16.	C2-C3	120	70
17.	C1-C2-C3	170	100
18.	D1	70	60
19.	E1	60	10

Tab. 1: Projects with parameters

Results and Discussion

The paper is a continuation of the author's contributions to the conference ERIE 2012-2014. Progress in the research can be observed in this series. The paper (Fiala, 2012) analyzes the basic model of laboratory experimental combinatorial auctions and its use in education. The next step was testing education of basic negotiation principles by laboratory experiments (Fiala, 2013). Finding the optimal coalition structure is very important. Efficiency of coalition structure formation is analyzed (Fiala, 2014). In this new paper, qualitative and quantitative analysis of efficiency factors of education in negotiations are performed. This negotiation is carried out in laboratory experimental combinatorial auctions. Principles of negotiations and auctions are often tested by laboratory experiments (Davis and Holt, 1993). A novelty in this paper is to test combinatorial auctions. Pollution reduction by using the proposed approach is beneficial. The combination of qualitative and quantitative analyzes of efficiency in education of negotiations is also an advantage.
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. These conflicting pressure conditions complicate negotiations. Negotiation in our experiment is based on a combination of cooperative and non-cooperative approaches. 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).

The survey data was analyzed by QSA method using fs/QSA software. For bivalent answers (yes - no), binary variable with two values, 1 and 0, were used. For multilevel answers, membership in the interval between 0 and 1 is used. They are determined certain implications based on survey data.

The most important implication for the negotiator itself: whole understanding the negotiation principles and whole understanding the experiment assignment (including perception of others in the group as teammates and opponents also) mean success for the negotiator (Fiala, 2013). These matters are the responsibility of the teacher in the classroom. Financial incentives play a very small role for thorough consideration of strategies. Time was not limited factor for negotiations.

The most important implication for the group of negotiators: whole understanding the experiment assignment in the whole group and high perception of other groups as opponents mean success for the group. Data sharing is counterproductive. This means a better outcome for the group, but also reduces yield for negotiators itself.

The experiment was carried out prior to teaching the principles of negotiation and repeated after teaching these principles. Each experimental group has 10 negotiators. Experiments were repeated with eight groups before teaching negotiation principles and the same number after teaching the principles.

Table 2 provides a comparison of results obtained after negotiation teaching in different experiments with the first-best solution (* identification of supported project in the experiment, - identification of project for which was not presented a support request). Table 2 shows that the structure of selected project for support was fully consistent in 2 cases with the first-best solution. In other cases there have been some deviations from the optimal coalition structure, but not essential ones.

The first-best solution was calculated by assumption of knowledge of information about projects' minimal supports. Experimental results were based on real requested supports. Combinatorial auction model was used for these calculations. The results of the groups were compared according to their similarity with the optimal structure obtained by the first-best solution. Seven of the eight groups (87.5 %) had the better or the same structure after teaching negotiations. Difference between the required support and the minimal support represents surplus for subject acquired in the negotiations. Individual negotiators are evaluated according to this surplus. Support gets only 50 percent of the proposed applications (4 groups of 8 groups). Average surplus for individuals is 5,625 before teaching and 13,125 after negotiation teaching.

Data from laboratory experiments were analyzed by DEA method in some models. We present a model for groups where inputs are inspired by the results of qualitative analysis and outputs respect the success of the group and individual negotiators.

Inputs:

- understanding the experiment assignment in the whole group (level variables),
- perception of other groups as opponents (level variables).

Outputs:

- percentage of compliance with the optimal structure,
- total surplus for the group.

Efficient units are groups E2, E3, E4 and E6 which were also selected for the support. DEA models have multipurpose utilization, for example for analyzing the development of efficiency of groups. In this case, however, we have a small number of groups. It would be also possible to analyze the efficiency of individual negotiators but this would require more space for presenting.

Project number	Project	**First-best solution**	E1	E2	E3	E4	E5	E6	E7	E8
1.	A1	**30**	60*	30	40	40	60	40	45*	34
2.	A2	**30**	35*	-	40	50	70	33	40	35
3.	A3	**50**	60*	50	60	80	51*	70	70	60
4.	A1-A2	**35**	100	60	40	60	70*	60	70	59
5.	A1-A3	**70**	155	-	80	90	90	100	120	90
6.	A2-A3	**60**	130	-	150	100	90	85	80*	80
7.	A1-A2-A3	**60***	195	75*	75*	120*	240	110*	150	100*
8.	B1	**20**	50	45	100	40*	30	30	49	30
9.	B2	**60**	65	80	115	70*	70	60	70	90
10.	B1-B2	**50***	90*	50*	110*	120	80*	70*	90*	70*
11.	C1	**20***	25	28	40*	28*	100	20*	40*	40
12.	C2	**40**	60*	44	55	45	100	60	60	50*
13.	C3	**60**	81	70	70	90	80*	62	80	100
14.	C1-C2	**50**	112	-	100	69	150*	70	115	110
15.	C1-C3	**70**	95*	-	85	85	170	89	140	130*
16.	C2-C3	**70***	144	-	85*	89*	150	85*	125*	150
17.	C1-C2-C3	**100**	170	140*	135	130	300	120	180	200
18.	D1	**60***	75*	70*	100*	60*	80*	60*	70*	100*
19.	E1	**10***	45*	13*	60*	10*	10*	25*	50*	60*
	Total support	**270**	520	348	470	417	521	370	500	510

Tab. 2: Comparison of experimental results and the first-best solution

Conclusion

Experiments have shown a very good usability of reverse combinatorial auction model for the preparation of economic laboratory experiments in coalition negotiations with dispersed economic information between subjects. Laboratory experiments can then well test certain hypotheses with the support of that model. Efficiency in education of negotiation principles were analyzed by qualitative and quantitative analytic instruments. The efficiency results were analyzed by Qualitative Comparative Analysis (QCA) and Data Envelopment Analysis (DEA). A combination of these methods brings a powerful instrument which complements the benefits of both approaches. Some implications of education efficiency were verified.

Acknowledgements

The research project was supported by the grant No. 13-07350S of the Grant Agency of the Czech Republic and by Grant No. IGA F4/54/2015, Faculty of Informatics and Statistics, University of Economics, Prague.

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ACADEMIC INBREEDING IN THE CZECH REPUBLIC

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Abstract

This paper aims to analyse the phenomenon of academic inbreeding, which is widely discussed in Czech academia. In this paper the inbreeding coefficient for economics associated professors is calculated and the relationship between inbreeding and productivity is studied. Furthermore, inbreeding anticipations among Czech PhD students are researched. We used two unique datasets: firstly data based on the DOKTORANDI 2014 survey was used; secondly a special dataset of Czech associate professors was set up for the aim of this study. The Broaden inbreeding ratio among Czech economic associated professors is 49%. Further results show that 59% of Czech doctoral students tend to inbreed. As for economics PhD students, the anticipated inbreeding ratio reaches 70%.

Keywords

Academic inbreeding, associate professors, doctoral studies, DOKTORANDI 2014 survey

Introduction

Academic inbreeding has been mentioned and studied since the beginning of the 20th century. Various definitions of academic inbreeding are used. Most often it is seen as a *recruitment practice in which universities hire their own graduates as faculty directly after doctoral graduation* (Horta et al. 2011). According to the broader definition (e. g. Horta 2013a), academic inbreeding means a *four-line career structure*, defined as bachelor's, masters's, PhD and post-gradual appointment at the same higher education institution (HEI).

There is a broad consensus on the harmfulness of academic inbreeding. Inbred members are thought to lack the brought outlook necessary for academic achievement (McNeely 1932). Inbreeding has been blamed for damaging scientific effectiveness and productivity, limiting the exchange of scientific knowledge and the talent pool (Inanc and Tuncer 2011) because inbred students are too loyal to their university so they do not question established knowledge (Horta et al. 2011). According to the critics, inbreds tend to prefer internal information exchange to communication with other institutions (Horta 2013b). Inbreds tend to lack collegiality as they need to excel in their own institution (Gonzales et al. 1995).

Despite these frequently mentioned harmful consequences of inbreeding, it is still a widespread phenomenon. Horta et al. (2010) quotes studies in which inbreeding in Spain is as high as 95% and it reaches 80% in Portugal. In Turkey inbreeding is in excess of 50% (Inanc and Tuncer 2011) and it is extremely high at the top US universities. While the inbreeding ratio at an average US university is less than 20% (Horta et al. 2010), at Harvard Law School or at Yale Law School it exceeds 70% (Eisenberg and Wells 2000). Various reasons for academic inbreeding can be found. Blanke and Hyle (2000) mention (i) geographical factors (ii) the dominant position of top universities and (iii) the inability

of the department to admit that any outsider could be better than their in-house student. Furthermore, it is (iv) administratively easier to hire an in-house student (McGee 1960) and (v) the post-graduate researcher is familiar with the environment (Horta et al. 2011).
Academic inbreeding is also considered to be a problem in Czech academia. Czech public HEIs are inward looking with a high level of inbreeding (OECD 2014, p. 111). Inbreeding is also widely discussed among Czech academics at conferences (e. g. Červinková 2011). Kouba et. al noticed that the inbreeding ratio in the Czech political science is above 66%, being the greatest in the biggest departments as Masaryk university and Palacky University, where it reaches 91% (Kouba et al. 2015). Despite the huge criticism of inbreeding in the Czech academia, there is no published research on the seriousness of this phenomenon in the Czech Republic.
The aim of this paper is to discuss the inbreeding among the Czech economics associated professors as well as prospects of Czech academia in terms of inbreeding among the new cohort of Czech PhD students studying various (not only economic) field. High quality data from the survey DOKTORANDI 2014[1], as well as our original dataset of the Czech associate professors at economics faculties, were used. The rest of the paper is organized as follows. First, we introduce the data and the statistical methods we used. We then present the results of our analysis. Firstly, the inbreeding coefficient for economics associated professors is calculated and the relationship between inbreeded faculties and their productivity is studied. Secondly, we analyse inbreeding anticipations among Czech PhD students. Finally, the inbreeding anticipations among the economics PhD students are researched.

Materials and Methods

Our research is based on two datasets. The first dataset covers the academic career of 159 associate professors of the economics faculties at public universities. We have concentrated on associate professors as their academic career has a clear three- or four-line structure and their CVs are easy to find on the websites of their departments (in comparison to the assistant professor). Our dataset covers predominantly associate professors who are holders of a PhD title instead of the former Czech equivalent CSc. (*candidatus scientiarium*), because the PhD holders finished their three-tiered higher education after the Velvet revolution during the subsequent boom of economics education in the Czech Republic and so their academic career faithfully reflects the recent situation at their faculties. The external associate professors, as well as members of other than economics departments (e.g. language centres), were excluded. One specific weakness of this method lies in the fact that not all Czech associate professors from all Czech economics faculties could be included as not all their CVs are published. On the other hand, this method is less subjective and more extensive than using interviews and it does not suffer from the low response rate typical of questionnaire surveys. The datasets consist of 92 men and 67 women from fourteen universities, and it covers in total 19 faculties or departments (see the table 1).

[1] This survey was carried out in the Czech Republic within the project IPN KREDO CZ.1.07/4.1.00/33.0005.

Abbreviation	HEI	n
CZU	Czech University of Life Science Prague	10
VSE	University of Economics, Prague	33
MZLU	Mendel University in Brno	20
VSB	Technical University of Ostrava	7
ZCU	University of West Bohemia	11
UJEP	University of J. E. Purkyně	11
SUO	Silesian University in Opava	9
UPCE	University of Pardubice	7
MU	Masaryk University	13
TUL	Technical University of Liberec	6
VUT	Brno University Of Technology	7
UK	Charles University	6
UTB	Tomas Bata University	14
JCU	University of South Bohemia in České Budějovice	5

Tab. 1: Faculties and sample size

For every associate professor the information for their bachelor degree $(i = 1)$, master's degree $(i = 2)$ and PhD degree $(i = 3)$ were encoded into the relevant dummy variable $\boldsymbol{D_i}$. If he or she graduated $\boldsymbol{i-th}$ with degree at the same faculty where they now work as an associate professor then $\boldsymbol{D_i = 1}$, otherwise $\boldsymbol{D_i = 0}$. If he or she studied a five-year master's degree, then $\boldsymbol{D_1 = D_2}$. An individual inbreeding coefficient $\boldsymbol{ibc_i}$ was subsequently calculated for each associate professor:

$$\boldsymbol{ibc_i} = \frac{1}{3}\sum_{i=1}^{3}\boldsymbol{D_i}\,. \tag{1}$$

The individual inbreeding coefficient assumes values from 0 (no inbreeding) to 1 (absolute inbreeding). Individual inbreeding coefficient reflects share of the degrees earned by the appropriate associate professor at the same faculty where he or she works now. Subsequently, the inbreeding coefficient $\boldsymbol{IBC_j}$ for every school was calculated as:

$$\boldsymbol{IBC_j} = \frac{1}{\boldsymbol{n}}\sum_{i=1}^{\boldsymbol{n}}\boldsymbol{ibc_{ij}}\,. \tag{2}$$

$\boldsymbol{n}$ being the number of associated professors included in the school subset. This coefficient reflects the inbred ratio of faculty associate professors. If $\boldsymbol{IBC = 0}$, than all the associate professors earned all their degrees at different faculties. If $\boldsymbol{IBC = 1}$, than all the associate professors earned all their degrees at the same faculty where they work now. Research productivity of the faculty was estimated as the average amount of RIV points[2] per one academic worker. Data on both the RIV points and academic workers were taken from Jablonský (2013).

The second dataset is based on the survey DOKTORANDI 2014 which was carried out in 22 public, 2 state and 2 private HEIs in spring 2014. The questionnaire was sent to more than 24

[2] RIV points measure the quality of publications (Jablonsky 2013).

thousand students with a response rate of approximately 15%. The final data set consists of 3 283 observations (for more information, see the research report Fischer and Vltavská 2014). For the purpose of our analysis, the dataset was narrowed down to 1445 observations, which cover students who want to continue in their academic career after completing their PhD.

A subset of $n = 101$ covering economics students was also created. The anticipated inbreeding ratio was calculated as the ratio of PhD students intending to stay at their faculty even after earning their PhD degree to the all PhD students.

We used statistical software STATISTICA 12 to perform standard methods of descriptive statistic, an analysis of variance, and t-tests (Budíková et al. 2010).

Results and Discussion

Associate professors and inbreeding coefficient

The broaden inbreeding ratio among Czech associate professors *IBC* is 49%. The *IBC* for men is slightly higher than the *IBC* for women (53% compared to 45%), however, this difference did not prove to be statistically significant at the probability level of 5%. The highest inbreeding ratio (above 80%) was observed at VSE and UK, the lowest (below 20%) at UJEP, ZCU and SUO (see tab. 2).

The Pearson's correlation coefficient between the productivity (estimated as RIV per academic worker) and inbreeding coefficient is positive and strong ($\rho = 0.59$). This result does not support the hypothesis for the negative effect of academic inbreeding in terms of research and productivity. On the contrary, it is in line with dominance theory (Blanke and Hyle, 2000).

	IBC	RIV p. c.
University of Economics, Prague	0.88	43
Charles University	0.83	103
Technical University of Ostrava	0.76	29
Masaryk University	0.62	33
Czech University of Life Science Prague	0.57	28
University of South Bohemia in České Budějovice	0.53	49
Mendel University in Brno	0.48	49
Brno University Of Technology	0.45	24
Technical University of Liberec	0.44	25
University of Pardubice	0.24	50
Tomas Bata University	0.19	35
Silesian University in Opava	0.18	24
University of West Bohemia	0.12	8
University of J. E. Purkyně	0	5

Tab. 2: Inbreeding coefficients and productivity

If the narrow definition of inbreeding is calculated (concentrating just on the school where the associated professor took his or her PhD), the inbreeding coefficient growths to 55% (see tab. 3). These results are influenced by the fact that some faculties did not have accredited doctoral programs when their associate professors were doing their PhD.

There is very strong relationship between both the narrow *IBC PHD* and broad *IBC* ($\rho = 0.9$). As fig. 1 clearly depicts, the narrower inbreeding coefficient is higher for all HEIs except for ZCU, SUO, UPCE, TUL and JCU. The Pearson's correlation coefficient between the productivity and narrow inbreeding coefficient is again positive and strong ($\rho = 0.6$).

	IBC PhD
Charles University	1.00
University of Economics, Prague	0.88
Technical University of Ostrava	0.86
Mendel University in Brno	0.85
Czech University of Life Science Prague	0.70
Masaryk University	0.69
Brno University Of Technology	0.57
University of South Bohemia in České Budějovice	0.40
Technical University of Liberec	0.33
Tomas Bata University	0.29
University of Pardubice	0.14
Silesian University in Opava	0.11
University of West Bohemia	0
University of J. E. Purkyně	0

Tab. 3: Inbreeding coefficients – PhD inbreeding

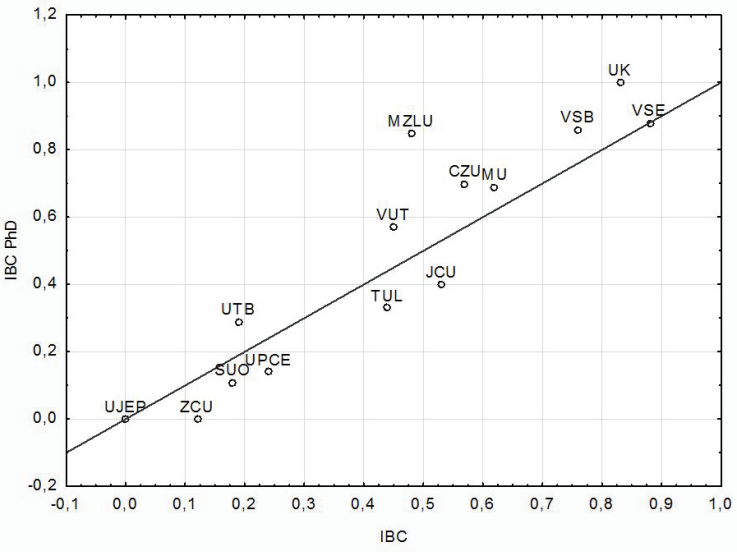

Fig. 1: The relationship between narrow and broad inbreeding coefficient.

PhD students and inbreeding anticipation

59% of all students (regardless of the field of study) tend to stay in the same institution even after gaining their title. Again, there is no significant difference between men (59.5%) and woman (58%). An inbreeding coefficient above 90% is at CZU, ZCU and VSB, on the other hand the lowest ratio (40%) is found by students of the University of Defence. A significantly higher inbreeding ratio can be seen for full-time students (62%) compared to part-time students (53%). Students who evaluate their chances of success in reaching their PhD title tend to stay at the same institution significantly more often than students who are not sure if they will succeed (60% compared to 38%). The greatest inbreeding tendency can be seen among Law students and the lowest among Art students (fig. 2).

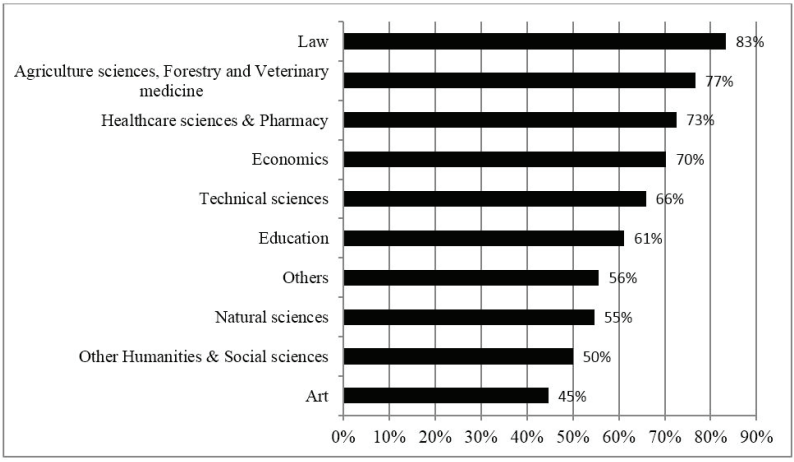

Fig. 2: Inbreeding anticipation among PhD students according to field of study.

Inbreeding among economics PhD students

The anticipated inbreeding ratio among economics PhD students is 70% (see fig. 2), which is slightly above the average IBC. Due to the low sample rate for individual HEIs, it is not possible to compare this anticipated IBC with all associate professor's IBCs. Nevertheless, the IBC for five HEIs can be calculated (fig. 3).

There is no statistically significant difference between the anticipated inbreeding ratio of men and women. On the other hand, there is a giant difference between students who evaluated themselves as the best (IBC is above 70%) and students who evaluated themselves as the worst ($IBC = 0$).

If the PhD student would be willing to enrol in his or her HEI again, he or she is more likely to stay at the same institution tends to inbreeding significantly more than a student who would change the HEI (78% IBC compared to 16% IBC). Similarly, more active students who participate in conferences tends to become inbread more often than other students ($IBC = 74\%$ in comparison to $IBC = 47\%$).

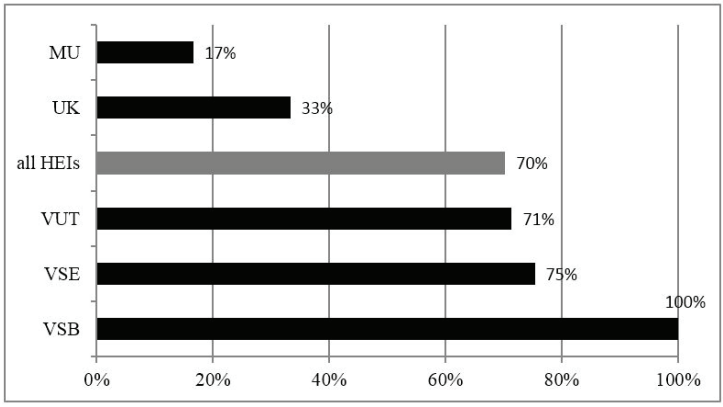

Fig. 3: Anticipated IBC among economics PhD students.

Conclusion

This paper is the first to attempt to estimate the inbreeding coefficient at Czech economics faculties as well as among PhD students of all fields of study. We found that there is a high inbreeding ratio among the associate professors at economics faculties. Nevertheless, the broad inbreeding coefficient of 55% is lower than the inbreeding coefficient at Czech departments of political sciences[3] published by Kouba et al. (2015). Also, Czech PhD students tend to stay at the same institution (academic inbreeding), which is in line with OECD assumptions.

Despite the relatively high inbreeding ratio in Czech academia, we cannot consider the question of inbreeding's potential harmfulness as trivial. We proved that Czech faculties with the highest inbreeding coefficient belong also to the most productive in terms of RIV points per academic worker. Our paper, therefore, did not fully exhaust the issue of academic inbreeding which should be the subject of further studies.

Acknowledgements

This work was written thanks to the Institutional Support to Long-Term Conceptual Development of the Research Organisation of the Faculty of Informatics and Statistics of the University of Economics, Prague and was supported by the project of No. MUNI/A/1223/2014 funded by the Masaryk University.

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DOCTORAL BRAIN DRAIN FROM CZECH ACADEMIA

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Abstract

The aim of this paper is to examine determinants of Czech doctoral students' brain drain from academia and to analyse opinions and attitudes of doctoral students who do not intend to stay in academia. We used a unique dataset based on the survey DOKTORANDI 2014 which was carried out in 26 higher education institutions in the Czech Republic. We have found that more than 25% of students intend to leave academia. This means a huge waste of scarce resources in terms of both public finance and human capital. The results show that 54% of leaving students want to exit academia because of exogenous factors, especially financial problems. The original role of doctoral studies appears to be substantially weakened, which could translate into the future labour market problems.

Keywords

Doctoral studies, DOKTORANDI 2014 survey, professional doctorates, z-test, ANOVA

Introduction

Doctoral studies and the PhD title are the integral part of the Czech three-tiered system of higher education. According to the Council of Higher Education Institutions of the Czech Republic (CHEI), the goal of doctoral studies is to prepare students for (i) a lifelong career as a researcher or educator in the domestic or foreign academic system or for (ii) a professional or executive career in other areas (e.g. industry or government), in which the scientific results will be used and discussed with the scientists (CHEI 2005). The importance of doctoral studies is stressed by national educational strategies as well as international organisations. Doctoral graduates are considered to be key players in research and innovation (OECD 2013, p. 94), which is the result of a modern political concept of the "knowledge economy" (though this concept is unfounded in terms of economic theory). Governments support doctoral studies to promote economic growth through the higher education (Cyranoski et al. 2011). This effort has led to an increase in PhD students and PhD holders in the population. Between 1998 and 2008 the number of science doctorates grew at rate of approximately 40 % per annum (Cyranoski et al. 2011). Similarly the number of Czech students more than doubled from 2001 to 2013 (MEYS 2014).

There is a clear motivation for graduate students to enrol in doctoral studies. Similarly to other university degrees, a doctorate used to be seen as the premise of higher chances on the labour market, a higher starting salary and certain social prestige. Such expectations are in accordance with the *Population and Housing Census 2011*. This census uncovered that citizens with a doctorate created only 0.8% of the economically active population in the Czech Republic. Using the ISCO classification, 70% of the Czech PhDs work as professionals (31% of them as teaching professionals, 13% as science and engineering professionals, 11% as legal, social and cultural professionals and 10% as health professionals), 12% of the Czech PhDs worked as chief executors, senior officials and legislators and 10% worked as technicians and associate professionals (CZSO).

The results of the US Census Bureau suggest that PhD holders earn 900 thousands USD more than master-degree holders over their working life (Day and Newburger 2002). However, the significant boom in doctoral studies has resulted in a devaluation of the PhD title. According to Stehlik (2011), a PhD is no longer an elite qualification; completing a doctorate does not automatically translate into a higher salary and position. Schmidt (2010) raises the question of a "doctorate myth" which says that PhD holders enjoy higher starting salaries, ignoring the opportunity costs of doctorate studies. He mentions that doctoral students are earning a lower salary for three or four years of their studies which is translated into the lower lifelong earnings. This was illustrated in the case study of the *Spolchemie SG Graduate Program,* according to which the starting salary of a PhD graduate is only 1000 CZK higher than other graduates' salaries (Spolchemie 2014). The growth of PhD holders raises the question of the absorptive capacity of the labour market (Auriol 2010, p. 11). Although the unemployment rate of PhD graduates is somewhat lower and employment higher (ibidem), PhD holders seem to be over-qualified and over-educated with no opportunity to apply their higher learning (Stehlik 2011), which in turn has led to a waste of the human capital resources. As Zhao noticed, a master-degree holder's individual demand for PhD studying programs can be driven also by the lack of job opportunities in the labour market (Zhao 2010). To put it simply, difficult labour market conditions encourage students postpone their labour market entry. This is then translated into the growth of PhD graduates and worsening conditions for PhD holders on the labour market, which is mainly the market of higher education institutions (hereafter: HEIs). These conditions make students start to think about escaping the field of academia. However, a PhD is not consistent with what is needed by people, organisations, industries and societies in the knowledge economy as its research questions are developed by identifying gaps in a theoretical literature, not particular problems which arise in the workplace (Banerjee, Morley 2013). Great expectations (both for master-degree holders as well as governments) in the OECD countries are then being replaced by the even greater disillusions. In Anglo-Saxon countries the boom of professional doctorates reflects this problem (ibidem). Professional-doctorate holders also earn 1.9 million USD more than master-degree holders over their working life (Day and Newburger 2002).

While this discrepancy is widely discussed abroad, Czech research does not cover it at all. There are just a couple of papers dealing with PhD students (e.g. Flégl et al. 2014a or Flégl et al. 2014b). Two main reasons for this ignorance can be deduced. Firstly, the boom of tertiary education, and consequently the growing numbers of students, has forced the demand for new lectures, so there was need for the PhD students who participated in teaching. Secondly, Czech researchers had for a long time missed high quality data covering the attitudes of the Czech PhD students.

The aim of this paper is to full this gap and present the relationship between a PhD student's motivation to enrol in a doctoral program and their disillusionment which encourages them to leave academia. High quality original data from the survey DOKTORANDI 2014[1] was used. 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, determinants of brain drain from academia are discussed. Secondly, we analyse the opinion and attitudes of leaving students. Finally, we end with some concluding remarks.

[1] This survey was carried out in the Czech Republic within the project IPN KREDO CZ.1.07/4.1.00/33.0005.

Materials and Methods

Our research is based on the survey DOKTORANDI 2014, which was carried out in 22 public, 2 state and 2 private HEIs in spring 2014. The questionnaire was sent to more than 24 thousands students with response rate of approximately 15%. The final data set consists of 3 283 observations (for more information, see the research report Fischer and Vltavská 2014). For the purpose of our analysis, we narrowed the data file down to 873 respondents who do not want to continue in their academic career (27% of all respondents). This data file was further narrowed down to $n = 662$ observations because there was not enough information for the other 211 respondents. Two key questions were chosen for our analysis: *1) Why did you decide to study doctoral studies?* and *2) Why are you thinking about a non-academic career?* Five main groups of respondents were subsequently created from these questions (table 1).

Group	Reason for doctoral studies	Reasons for non-academic career	n
finance-driven	interested in academic career	financial reasons	97
practically-oriented	interested in academic career	interested in applied science	73
title-attracted	prestige, doctoral degree	financial reasons	52
discouraged	interested in academic career	disappointment in academia	51
job-driven	interested in academic career	lack of jobs in academia	33

Tab. 1: Five main groups of respondents

We used the statistical software STATISTICA 12 to perform standard methods of descriptive statistic, an analysis of variance and a z-test for population proportions (Budíková et al. 2010).

Results and Discussion

More than one half (54%) of students who want to exit the academia enrolled for a PhD because of their interest in an academic career. The prevailing reasons for almost one fifth (19%) of those leaving was to gain the prestige, enhance their qualifications and personal development, and to get the PhD title (which is in accordance with the signalling theory of human capital, Spence 1973). The lack of jobs on the labour market was the main motive for the PhD study of another 10% of students. The remaining 17% enrolled in the PhD for other reasons (e.g. to continue in their final thesis or to take advantage of foreign mobility).

The determinants of brain drain

More than one quarter (27%) of students who enrolled for PhD because of their interest in the academic career are leaving for financial reasons, 21% for their interest in a practical job, 14% because of their dissatisfaction with academic life, bad relationships at their departments or the pressure for publications, 9 % of PhD students are not going to continue in academic career because of the lack of jobs in academia and other 9 % already have a good job. The remaining 20% want to leave academia for other reasons (e.g. because of their family or as they do not want to teach).

Very different points of view can be detected in the decision making of students who enrolled for a PhD because they could not find job on the labour market. The greatest proportion (38%) is leaving for financial reasons, but 31% due to dissatisfaction with academic life (that is more than two times more often than in the case of students who were attracted by an academic career). Another 11% are leaving because of their interest

in a more hands-on job practical life and 9% because of the lack of jobs in academia. The remaining 11% of students have other reasons, e.g. they already have a good job, they want to set up a family or the dislike teaching.

Even the exodus of PhD students who were attracted by the prestige of PhD title is determined mainly by financial reasons (41%), however, 17% of them want to leave academia as they already have a good job. Only 8% of them are dissatisfied with their academic career.

Opinions and attitudes of leaving students

Most of the leaving students would enrol in doctoral studies again. According to the analysis of variance and Scheffé's test, a significantly different group is the group of discouraged students. Slightly more than one third of them (37%) would began by studying doctoral studies again (fig. 1) and 45% of them would never study for PhD again. This is an even greater loss because discouraged students most often rate themselves as the best students (41%) and they are more willing to start their career in foreign country than other students. When asked for their reasons for leaving academia, discouraged students often replied[2]:

"I dislike the inflexibility of academia and its conservative procedures."

"I do not like the need to constantly write proposals for grants, as your further research depends just on acceptance or rejection of them and your future is so uncertain. In addition, you spend most of your time on administrative activities, not on your research."

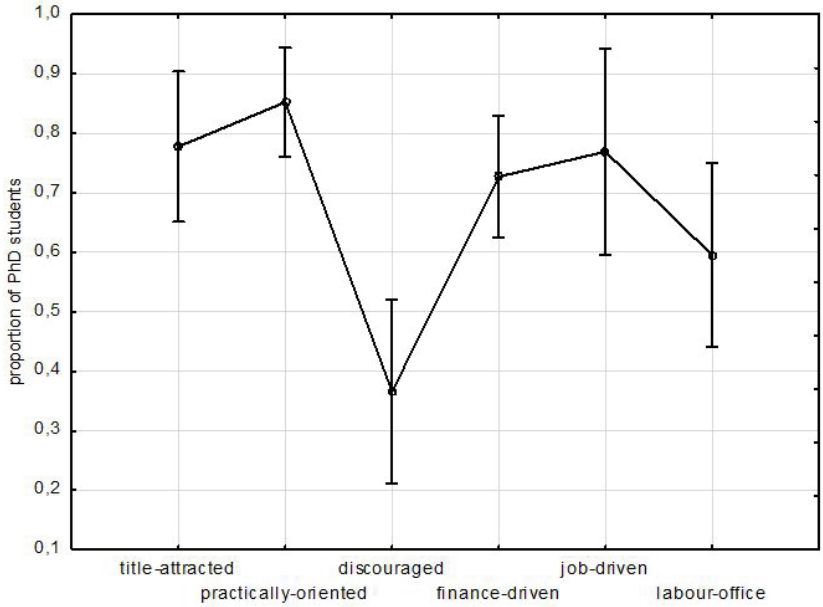

Fig. 1: Would the PhD students start their study program again? The proportion of students who answered "Yes"

Practically oriented students view their labour market chances as good or very good significantly more often than other students. According to the z-test for population proportions, they would also enrol in the PhD study again more often than rest of the

[2] For the aim of this paper, the representative full answers of respondents of DOKTORANDI 2014 survey were chosen.

students. These practically-oriented students are driven by the desire to see their ideas applied in practice:

"I would like to work on the transfer of research into practice."

"I do not want to lose the contact with the real world."

"I think that even university teachers should have practical knowledge and experience."

When compared with the rest of students, the financially-driven are most interested in the commercial sector. Almost ¼ of them claimed that they wanted to leave academia just because of money already during their first year of study. Only 6% of them consider themselves as students who belong to the worst third of students. Financially-driven students often explained their intended departure from academia in the following way:

"I could not earn enough to live in academia, or it would be connected with too much income uncertainty, which would be hardly suitable for a dignified life and starting a family."

Job-driven students consider their labour market chances worse than the rest of students and they are extremely reluctant to leave for the foreign labour market. Nearly ¼ of those who perceived the lack of jobs in academia as a problem are in their first year. Most of them (25%) are students of humanities and social sciences and 15% are students of pedagogical science. They explain that they would like to stay in academia however there is too many doctorate students and a lack of suitable jobs in academia. According to Scheffé's test, the job-driven students are not very interested in working in the commercial sector compared to other groups of leaving students. Just 42% of them would like to work in the commercial sector as they prefer the public sector (fig. 2).

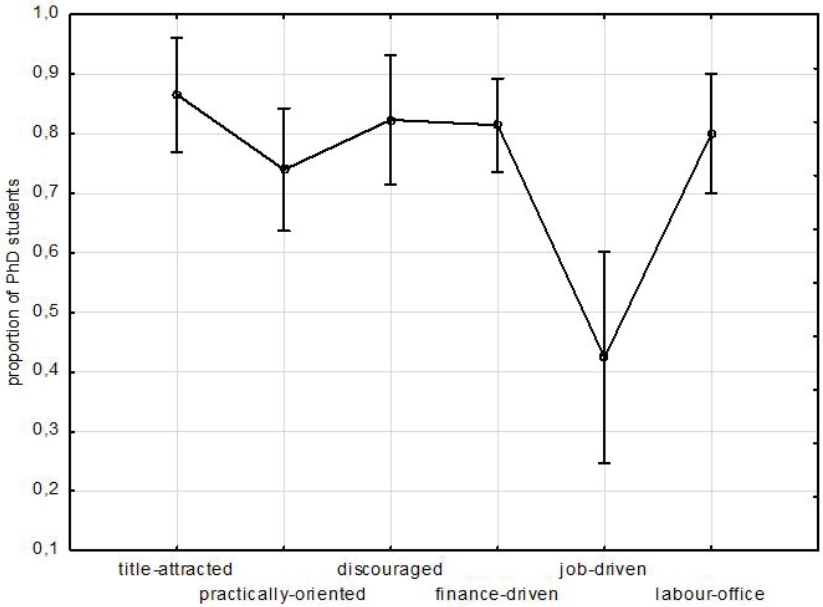

Fig. 2: Proportion of students who want to change their academic career for the commercial sector

Conclusion

In this paper the determinants of PhD students' brain drain, their opinions, and attitudes were presented. More than one quarter of students intend to leave Czech academia and means a great waste of resources not only in terms of public finance, but also in terms of human capital. The problem of the PhD brain drain from academia should be divided in two different subsets:

1. Students who would like to stay in Czech academia but exogenous factors make it impossible for them. This is the case for 54% of leaving students and this represents nearly 15% of all Czech PhD graduates included in the survey DOKTORANDI 2014. The exit of these students signifies a real brain-drain as those students are often highly interested in their field of study and they do want to devote their career to research and development. The prevailing motive for their exit is financial problems. These students would stay in academia if they could earn the same money as in the commercial sector or if they did not have to face the great uncertainty connected to getting grants approved and the publication process.
2. Students who are practically-oriented and who enrolled in a PhD programme because they wanted to enhance their qualifications to increase their value on the labour market. These students do not need standard academic knowledge for their future career and their PhD studies results in their over-qualification on the labour market. This represents a waste of resources which could be limited by the introduction of professional doctorates which are available in Australia, the United States or the United Kingdom. According the Czech employers, 28% of PhD graduates do not need work training (compare with 4% of master-degree holders and 1% of bachelor-degree holders). However, this is the result of their work experience, not of their knowledge, that they gained during the doctorate studies (NUOV 2009).

The Bologna three-tiered system of higher education tends to weaken the original role of doctoral studies (see Dvořáková and Smrčka 2013). Such an ineffective use of human capital and HEI's budgets affects (i) the discount life-long welfare of PhD-holders who escaped Czech academia, (ii) the gap between theoretical and real human capital that can positively influence economic growth and (iii) Czech public finance, as a great deal of the young population who mechanically enrol in doctoral studies without intention or possibility of staying in Czech academia contributes to the growing number of economically inactive people who postpone their entry into the labour market. It is the aim of future research to find solutions for this academia brain drain and to limit the painful waste of scarce resources.

Acknowledgements

This work was written thanks to the Institutional Support to Long-Term Conceptual Development of the Research Organisation of the Faculty of Informatics and Statistics of the University of Economics, Prague and was supported by the project of No. MUNI/A/1223/2014 funded by the Masaryk University.

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JUSTIFICATION OF UNIVERSITY FUNDING IN THE CZECH REPUBLIC

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Abstract

This article evaluates university funding from the budget of the Ministry of Education, Youth and Sport in the Czech Republic. For this purpose budgets from years 2011 and 2012 are taken into consideration. We adapt approach that was primarily used for funding justification in the North Rhine-Westphalia region in Germany. We apply this approach on 26 higher education institutions in the Czech Republic. Results indicate that in 30.08% of cases in 2011 and in 23.08% in 2012 the funding changes are not justifiable, i.e. in 14 cases the higher education institutions were over-funded from the perspective of the applied method.

Keywords

Data Envelopment Analysis, budget, funding, higher education

Introduction

The public higher education in the Czech Republic has undergone a significant development within the last two decades. The first decade in 2000 can be described as a period of enlargement of the higher education. This enlargement resulted in enormous growth of enrolled students, study programmes, faculties, and establishment of new higher education institutions (HEIs). However, this development was not viable for another decade, mainly due to problems with funding of the system. From this reason, in 2011 Ministry of Education, Youth and Sport (MEYS) announced a shift from quantity to quality. The current and future development is primarily based, among others, on the Strategic Plan for the Scholarly, Scientific, Research, Development, Innovation, Artistic and Other Creative Activities of Higher Education Institutions (Strategic plan) valid for the period 2011-2015 (MEYS, 2010).

As a result of this shift, MEYS prepared structural changes in the funding system of HEIs. Nowadays, three main priorities drive the public higher education: *Quality and relevance*, *Openness*, and *Efficiency and financing* (MEYS, 2010). Regarding these priorities, MEYS focuses on harmonising numbers of enrolled students according to the demographic development in the Czech Republic. On the other hand, HEIs should increase the cooperation with business and their role in Life-long learning. MEYS also declared a necessity of changing funding rules for public HEIs. These changes lead to gradually diminishing weights of input parameters (number of students) in favour of output and quality parameters (such as quality research outputs and employment of graduates).

Since 2011, we can observe continuous drop of funding based on number of enrolled students (bachelor and master) and study programmes (in this article we always refer to this part of the budget). In 2010, MEYS allocated to this part 19.77 billion CZK, 19.12 billion CZK (-3.3%) in following year and 17.76 billion CZK in 2012 (representing -10.2% with regard to 2010). This significant drop resulted, on the one hand, in a higher competitiveness in the Czech higher education, and, on the other hand, to a necessity for

efficient distribution of MEYS funding (support of quality). Therefore, we can analyse whether the funding redistribution, after the shift in 2011, followed the necessity of efficiency distribution, i.e. we can justify the correctness of this redistribution. Tab. 1 summarizes shares of all 26 HEIs in the Czech Republic in the overall MEYS budgets between 2010 and 2012.

HEI	Share in 2010 funding	Share in 2011 funding	Diff in share 2011/2010	Change of funding (thousands CZK)	Share in 2012 funding	Diff in share 2012/2011	Change of funding (thousands CZK)
AAAD	0.46%	0.49%	0.03%	6271.13	0.48%	-0.01%	-2598.74
AFA	0.35%	0.36%	0.01%	1796.59	0.37%	0.01%	2352.85
APA	1.35%	1.40%	0.05%	9340.17	1.43%	0.03%	5104.48
BUT	7.04%	6.73%	-0.31%	-58854.51	6.82%	0.09%	15494.90
CP	0.46%	0.52%	0.07%	12922.44	0.59%	0.07%	11871.75
CTU	8.45%	8.30%	-0.15%	-28018.58	8.46%	0.15%	27501.92
CULS	5.54%	5.47%	-0.07%	-13513.04	5.58%	0.11%	20142.91
CUNI	16.77%	17.01%	0.24%	45350.32	17.01%	0.01%	1241.56
ICHT	2.24%	2.15%	-0.09%	-16664.42	2.10%	-0.06%	-10017.38
ITB	0.24%	0.36%	0.12%	22982.96	0.53%	0.17%	30998.17
JAMPA	0.76%	0.76%	0.00%	-56.58	0.78%	0.03%	4511.14
JEPU	2.49%	2.53%	0.04%	8293.71	2.47%	-0.06%	-11108.01
MENDELU	3.40%	3.26%	-0.13%	-25395.55	3.21%	-0.05%	-9593.86
MUNI	11.29%	11.37%	0.09%	16673.09	11.41%	0.04%	6392.36
PU	5.78%	5.91%	0.14%	25952.58	6.00%	0.09%	15927.16
SBU	3.42%	3.22%	-0.20%	-38559.14	3.42%	0.20%	36178.29
SUO	1.63%	1.71%	0.08%	14968.08	1.71%	0.00%	441.67
TBU	3.49%	3.52%	0.03%	5109.52	3.43%	-0.09%	-16391.66
TU	2.50%	2.53%	0.04%	7158.19	2.30%	-0.23%	-41664.11
UE	3.64%	3.80%	0.16%	30953.08	3.78%	-0.02%	-2726.47
UHK	1.75%	1.77%	0.02%	3663.51	1.84%	0.07%	12598.73
UO	2.50%	2.55%	0.05%	9712.98	2.46%	-0.09%	-16350.39
UP	2.84%	2.64%	-0.19%	-36929.54	2.83%	0.19%	32971.57
UVP	1.57%	1.57%	0.00%	-252.68	1.40%	-0.16%	-28816.39
UWB	4.20%	4.20%	-0.01%	-1475.74	4.05%	-0.15%	-26225.16
VSB-TUO	5.87%	5.86%	-0.01%	-1428.56	5.53%	-0.33%	-58237.29

Tab. 1: HEIs annual share in funding from MEYS budget, 2010-2012 (own calculation on data from MEYS (2015))

Efficiency analysis in higher education

Efficiency analyses of higher education institutions (HEIs) have been very popular during the last two decades. We can distinguish between two main streams: 1) analyses using non-parametric approaches, such as Data Envelopment Analysis (DEA), and 2) analyses based on parametric methods, such as Stochastic Frontier Approach (SFA). Analyses mainly investigate either education or research efficiency of HEIs. Moreover, analyses differ according to a measured level, i.e. comparing universities (Abbott and Doucouliagos, 2009), faculties (Furková, 2013), departments (Johnes and Johnes, 1995) study programmes (Flégl, Tichá, and Stanislavská Kvasničková, 2013). See Emrouznejad,

Parker and Tavares (2008) and Worthington (2001) for more details on the efficiency measurement methodology and its applications.

Most importantly, Data Envelopment Analysis applications has also been recently used for evaluations of funding system of higher education institutions. Fandel (2007) use DEA method for efficiency analysis of universities funding in the North Rhine-Westphalia region in Germany. Tochkov, Nenovsky and Tochkov (2012) estimate technical and cost efficiency of Bulgarian HEIs with regard to public funding and Yaisawarng and Ng (2014) use DEA model to verify whether the Chinese education reform had a positive impact on a research performance of selected Chinese universities. Sexton, Comunale and Gara (2014) propose an efficiency-based mechanism for state funding of universities to eliminate wasteful spending.

The aim of this article is to justify funding of 26 HEIs in the Czech Republic from the budget of Ministry of Education, Youth and Sport. For this purpose, we use Data Envelopment Analysis approach. The article is divided as follows: in the first part we briefly introduce Czech higher education and methods of efficiency analysis. The second part specifies the used data, structure of the model and explains the DEA methodology. The third part describes achieved results followed by a discussion. We conclude the article with possible directions for the future research.

Materials and Methods

Analysed sample

The analysed sample includes all 26 public HEIs in the Czech Republic, including four HEIs of Arts (Academy of Performing Arts in Prague, Academy of Fine Arts in Prague, Janáček Academy of Music and Performing Arts in Brno, and Academy of Arts, Architecture and Design in Prague). The main funding of these HEIs went from the budget of MEYS. Therefore, we use the official MEYS statistics of funding from 2009 to 2011 (MEYS, 2015). Moreover, we use the official Universities' Annual Activity Reports that include statistics of academic personnel, enrolled students, graduates and doctoral students.

Model structure

The model structure follows directly the model proposed by Fandel (2007). We can use the same structure, from several reasons: First of all, similarly as in the North Rhine-Westphalia region, a huge majority of funding in the Czech Republic is distributed according to indicators related to students. During the years 2011 and 2012, 80% of the MEYS budget was distributed according to number of enrolled students, study programmes and number of absolvents (MEYS, 2015). Second of all, even though MEYS budget consists of many different budget parts, we are still able to distinguish budget parts that directly finance enrolled students at HEIs. Last but not least, all indicators used in Fandel´s model are published every year in the Czech higher education either by MEYS or by HEIs themselves. So there is no problem with missing data.

As a result, the MEYS funding related to enrolled students at HEIs is considered as the first input of the DEA model (FUNDING). Regarding the specific budget parts we include into this funding support related to the number of enrolled students, scholarships for students (including PhD students), funding for the development of HEIs, and development programmes and institutional development plans (all parts include investment and capital funding). In general, there is no consensus whether to use external funding as an input or as an output in performance analysis. Some funding directly relates to the basic HEI´s

operations, such as funding of enrolled students, or scholarships. Therefore, this funding should be considered as input. On the other hand, external funding that HEIs attract due to their academic and/or research results can be considered as an output. This external funding can include funding from private and governmental research grants. In our case, we use funding as input as it directly relates to basic HEIs´ operations.

Taking into account that most of the funding from the MEYS budget is redistributed according to number of enrolled students. Thus the second input reflects number of bachelor and master students (STUDENTS). Students represent an input in the system of higher education, as graduates usually represent an output. However, no consensus whether to use students as input and output exists (Worthington, 2001). In addition, we can sum bachelor and master students together because MEYS finances both equally, i.e. there is no difference between bachelor and master funding in the Czech higher education.

The last input of the model relates to academic personnel (PERSONNEL), which is undoubtedly an input of the HEIs educational and research activity. In the Czech higher education, we are not able to distinguish between academics used only for teaching and, on the other hand, those only used for research. A huge majority of academic personnel is used for both activities at the same times. However, we do not include personnel of libraries, university restaurants and residences, and other campus workers.

On the other hand, the number of bachelor and master graduates is considered as the first output of the model (GRADUATES). This output represents the teaching activity of the HEIs. The second output refers to a research activity, which is evaluated according to number of doctoral students (DOCTORATES). We would alternatively replace this indicator by doctoral graduates. However, not only doctoral graduates produce research outputs of HEIs. A significant part of the research activities relates to all doctoral students, i.e. to education of future academics.

The descriptive statistics of the inputs and outputs divided by both analysed years is summarised in Tab. 2. We can observe that the average funding decreased during the analysed period. Descriptive statistics also shows decreasing tendency of academic personnel and number of enrolled students. Drop of enrolled students went along with the shift in the orientation from quantity to quality in the Czech higher education in 2011. As a result, we could expect that this drop will be followed by the drop of graduates around 2014 and 2015.

	Inputs			Outputs	
2011	FUNDING	PERSONNEL	STUDENTS	GRADUATES	DOCTORATES
Min	68,104.00	43.53	304.00	43.00	0.00
Max	3,250,957.00	3,528.64	42,721.00	7,965.00	7,798.00
Mean	735,239.00	629.69	12,421.00	2,805.54	988.31
SD	721,028.27	699.23	10,852.57	2,323.29	1,604.26
2012					
Min	65,687.00	58.16	297.00	56.00	0.00
Max	3,021,582.00	3,527.91	41,935.00	8,063.00	7,633.00
Mean	683,082.58	594.20	12,185.04	2,796.92	958.23
SD	671,240.31	681.24	10,645.83	2,290.28	1,574.18

Tab. 2: Descriptive statistics of inputs and outputs of DEA models, 2011-2012 (own calculation)

Data Envelopment Analysis

Data Envelopment Analysis (DEA) is a method of evaluating the efficiency of a set of Decision-Making Units (DMUs) that convert multiple inputs into multiple outputs. Outputs and inputs can be of various characters and a variety of forms, which can be difficult to measure. If we suppose variable returns to scale, the so-called BCC model (Banker, Charnes and Cooper, 1984) should be used. The linearized BCC model is defined as following:

$$\begin{aligned} &\text{Max} && \sum_{r=1}^{s} \mu_{ro} y_{rj} + \mu_{*o} \\ &\text{subjected to} && \sum_{i=1}^{m} v_{io} x_{ij} = 1 \\ & && \sum_{r=1}^{s} \mu_{ro} y_{rj} + \mu_{*o} - \sum_{i=1}^{m} v_{io} x_{ij} \le 0, \quad j = 1, \ldots, n \\ & && v_{io}, \mu_{ro} \ge 0, \quad \mu_{*o} \in R \end{aligned} \tag{1}$$

where o refers to the evaluated DMU, μ_{ro} are the multipliers of the outputs, v_{io} are the multipliers of the inputs, y_{rj} is the output r of DMU j, and x_{ij} is the input i of DMU j, with $j = 1, \ldots, n$. The variable μ_{*o} indicates where the observed DMU finds itself, can be negative, zero or positive (i.e. increasing, constant or decreasing returns to scale).

Results and Discussion

For the purpose of the funding justification, we use the variable returns to scale (VRS) model. As the HEIs do not operate in a separate environment, we cannot expect that increase or reduce of input-output structure of a HEI would not influence the rest of the HEIs. The other HEIs are not able to take over the teaching and research activities of other HEIs due to the allocation problem of students and personnel. Therefore, we use the BCC DEA model. Further, we chose the input orientation of the DEA model because the main concern is to justify funding from MEYS budget. We analyse how the funding, along with academic personnel and enrolled students, is used for teaching and research activities. Therefore, an inefficiency of a HEI indicates over-funding resulting in a high level of academic personnel and high number of enrolled students.

The results of the funding justification are summarised in Tab. 3. Symbol (+) indicates that a particular HEI was not over-funded, while (-) indicates over-funding. We get these indicators according following rules:

- If the funding decreased compared with the previous year, but HEI reached efficiency 100%, then this HEI is not over-funded and the drop of funding is justifiable (+).
- If the funding decreased compared with the previous year and HEI reached efficiency <100%, then this HEI is not over-funded and the drop of funding is also justifiable (+).
- If the funding increased compared with the previous year and HEI reached efficiency 100%, then this HEI is not over-funded and the growth of funding is justifiable (+).
- If the funding increased compared with the previous year and HEI reached efficiency <100%, then this HEI is over-funded and the growth of funding is not justifiable (-). The growth of funding was not reflected by an appropriate growth of outputs.

	2011		2012	
	VRS	Funding	VRS	Funding
AAAD	81.33%	-	100.00%	+
AFA	100.00%	+	100.00%	+
APA	86.12%	-	97.69%	-
BUT	100.00%	+	100.00%	+
CP	100.00%	+	100.00%	+
CTU	85.77%	+	93.00%	-
CULS	100.00%	+	100.00%	+
CUNI	100.00%	+	100.00%	+
ICHT	100.00%	+	100.00%	+
ITB	100.00%	+	100.00%	+
JAMPA	100.00%	+	100.00%	+
JEPU	66.62%	-	73.96%	+
MENDELU	83.51%	+	92.83%	+
MUNI	100.00%	+	100.00%	+
PU	90.13%	-	98.13%	-
SBU	79.68%	+	87.15%	-
SUO	96.29%	-	100.00%	+
TBU	100.00%	+	100.00%	+
TU	79.05%	-	88.11%	+
UE	100.00%	+	100.00%	+
UHK	95.74%	-	86.57%	-
UO	84.22%	-	85.56%	+
UP	81.25%	+	80.02%	-
UVP	68.20%	+	73.56%	+
UWB	90.96%	+	92.53%	+
VSB-TUO	92.05%	+	100.00%	+
Average	90.80%		94.20%	

Tab. 3: Overview of efficiency analysis justifying MEYS funding, 2010-2012 (own calculation)

We can observe that in 8 cases (30.08%) the change in the MEYS funding in 2011 is not justifiable. For example, the share of Academy of Performing Arts in Prague (APA) increased by +0.05% (+9.34 mil. CZK) on budget funding in 2011 (Tab. 1), however, its efficiency is only 86.12%. Therefore, the growth in the funding was not reflected by appropriate efficiency. Contrary, Czech Technical University in Prague (CTU) gained lower funding by -0.15% (representing -28 mil. CZK), however, this decrease is justifiable due to the inefficiency 85.77%. In total, the average efficiency of all HEIs was 90.80% in 2011.

Similarly, in 2012 the funding changes are not justifiable in 6 cases (23.08%). Comparing the previous year, we observe improvement by approximately 7%. These changes are not justifiable in case of Academy of Performing Arts in Prague (APA), Czech Technical University in Prague (CTU), University of South Bohemia in České Budějovice (SBU), University of Hradec Králové (UHK), University Olomouc (PU), University of Pardubice (UP). In all these cases the increase of funding (Tab. 1) was not reflected by appropriate growth of the outputs. Fewer unjustifiable cases in 2012 result to a growth of the average efficiency of all HEIs up to 94.20% (Tab. 3).

Discussion

We practically illustrated that in more than 20% of the cases the funding from the MEYS budget cannot be justifiable. A growth of funding for some HEIs was not reflected by appropriate performance. Therefore, MEYS should focus more how its funding is distributed. If we consider decreasing trend in funding of input parameters (such as number of enrolled students) in favour of output and quality parameters, then we can consider performance-based funding. Sexton, Comunale and Gara (2014) propose an efficiency-based mechanism for state funding of universities to eliminate inefficient operations and provides incentives to eliminate wasteful spending. Our model indicates that roughly 85 million CZK is not justifiable in 2011, respectively 130 million CZK in 2012. Even though it represented only 0.45% and 0.73% of the MEYS budget, it would have covered, for example, the whole budget of College of Polytechnics (CP), or Institute of Technology and Business in České Budějovice (ITB) and most of the HEIs of Arts.

On the other hand, we must admit that funding of HEIs is a very complex system. The model used in this article includes only a few relevant indicators. Complex system requires a complex solution, or a complex evaluation. Other indicators can be used, such as graduates´ employment rate or research publications (Abbott and Doucouliagos, 2009; Furková, 2013; Johnes and Johnes, 1995). We can then talk about performance-based funding distribution. In addition, a simplification of the funding system is desirable. Thus we can be able to refer and explain the unjustifiable spedning.

Conclusion

The Czech higher education changed its orientation from quantity to quality in 2011. As a consequence, MEYS declared changes in the funding system of the Czech public higher education. Since 2011 the funding related to enrolled students and study programmes has been decreasing in favour of financial support of quality research and graduates. This resulted in higher competitiveness among HEIs and in a pressure for higher performance and efficient spending. Therefore, we tried to analyse whether the funding of HEIs from the MEYS budget was redistributed well.

For this purpose we analysed years 2011 and 2012, i.e. two years after the significant shift in the system orientation. We used input-oriented BCC DEA model for funding justification of 26 HEIs in the Czech Republic. Results indicate that in 14 cases the higher education institutions were over-funded. We can then conclude that MEYS could have redistributed its funding better in favour of better performed institutions. Future research can expand this initial analysis covering longer period of time, as well as to analyse spending in research part of the MEYS budget.

As we understand the applied methodology has its limits. The next step of our research will also analyse delays between change of input and its impact on outputs. We admit that change of funding at the beginning of the year cannot significantly influence the number of graduates in June. Therefore, we should focus on moving inputs. Despite this criticism, we must understand the changes of inputs as a continuous flow and the efficiency measurement as an analysis of discrete decision-making. Moreover, the future research will also focus on the fact that funding per enrolled student differs at various fields of study. Majority of analyzed HEIs have variety of different faculties and study programs and thus the impact of the various coefficients of economic demandingness is minimized. We cannot neglect this fact and we must prove whether it has or it has not a significant impact on the analysis.

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MENTOR TRAINING PILOT: CASE STUDIES

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Abstract

Mentoring is one of the most important guidance practices for novice teachers starting their professional career in teaching. Compared to some other countries' school policies, in Slovakia no complex mentor training programme for mentor support has been developed so far. The authors' interest in mentors' roles has been reflected in a recent research on mentors' competences. One of its results was a set of training materials intended to support mentors' development. The aim of the paper is to present qualitative data from a mentor training pilot in which usefulness and quality of a selected number of tasks were tested. In two case studies, the paper presents the ways in which the seminars were run and describes the reactions of the participants to the tasks, presents their opinions and suggestions regarding mentor training.

Keywords

Mentor, mentor training, novice teacher, pilot seminar, training task

Introduction

The competence of teachers and ways in which to improve their practice has been the focus of a variety of initiatives across Europe. Much of this has concentrated on the production of explicit indicators for teacher quality (Strong, 2011; Sclafani, 2009; Zumwalt, & Craig, 2005), in terms of competence, standards (Fisher, 2005; Houston, Dengerink, Fisher, Koster, & McIntyre, 2002; Koster, & Dengerink, 2008), learning goals and outcomes, and key qualifications (Darling-Hammond & Youngs, 2004; Common, 2005; Standards, 2005). The importance of career-long updating and development for practising teachers has been recognized (Cochran-Smith, 2003; Danielson, 2007; Key, 2010) and practising teachers have become increasingly involved in the training of new entrants (Malá, Müglová, Hockicková, 2013; Beginning, 2003) to the profession in many countries. To support this movement the European Commission has developed the Common European Principles for Teacher Competences and Qualifications (Common, 2005). Teachers Matter (OECD, 2005) also recognizes and stresses the need for more attention to be given to the needs of those beginning their careers in the profession. However, there is no common focus on the specific needs of novice teachers or the concomitant needs of those who will induct and support them in schools, i.e. mentors. In several EU countries mentors have become a valued and integral part of the pre-service training of teachers (Skaniakos, Penttinen and Lairio, 2014); in a few countries, they are also involved in the induction and support of new entrants to the profession.

Mentor roles are largely defined by the particular context within which they are performed, ranging from informal to highly formal arrangements (Lomnický & Predanocyová, 2013; Janssens, 2012; Cambridge, 2014). Accordingly, the purposes of mentoring programmes vary greatly, manifesting themselves in a wide divergence of practices and interpretations of the mentoring role. In the context of induction support programmes for teachers, an

emphasis is placed to a large extent on modelling good practice, providing guidance and support, monitoring progress and assessing competence against pre-determined criteria. In addition, mentoring also incorporates a pastoral dimension which manifests itself in the counselling aspect or providing novice teachers with individualized, emotional support at critical points in their personal and professional development as teachers. The complexity of the role gives an indication of the tensions inherent, often resulting in conflicting demands made upon mentors in their endeavour to act in a nurturing, protective and guiding capacity while simultaneously having to perform the role of objective assessor. Mentors are confronted with the challenge of establishing a trusting, friendly relationship with their mentees on the one hand, but, on the other, must not allow this to interfere with professional judgments made about their mentees.

In Slovakia, novice teachers' professional induction is legislatively guaranteed. This issue has already been dealt with in Decree No. 42/1996 *on the further education of teaching staff* in § 4. At present, Act No. 317/2009 *on teaching staff and professional employees* officially introduces the role of mentor-teacher, and the position of novice teacher is addressed in § 28. In the Act, the function of mentor is briefly defined together with the manner of their appointment and definition of the job position of a mentor-teacher or professional employee as somebody who "*performs specialized activities together with the performance of educational activities ...*" and who is responsible for the implementation of novice teachers' induction and its continuous monitoring. The position of mentor-teacher can then be performed by an independent educator (teacher) or professional employee with the first attestation. The Act partially defines specific activities and responsibilities of mentors, but it says nothing about the necessary preparation or training for this position. The first attestation and several years of teaching experience are considered to be adequate preparation for this position (the method and conditions under which to carry out attestations was set in Decree No. 445/2009 *on the continuous education, credits, and attestation of teaching and technical staff*, issued by the Ministry of Education of the Slovak Republic).

Besides the official legislative standing, there is also a network of Methodology and Educational Centres (so-called MPC: Metodicko-pedagogické centrum) in all regional cities in Slovakia. These centres play quite an important role in raising teachers' awareness in many areas of education, including mentoring (Výbohová, 2012). They organize various in-service courses and events for teachers and also publish supporting educational materials.

Many experts, who articulate their position towards specifics related to modification of a socio-professional teaching career while performing the job (among others Kolláriková, 1993; Kasáčová, 2002; Straková, 2015; Stranovská, Munková, Hvozdíková, 2014; Šírová a Krejčová, 2011), as well as those who analyse and classify professional competences of teachers and who describe acquisition and development of teaching skills (among others Orlová, 2014; Spilková, 1994; Vašutová, 2001; Belz and Siegrist, 2001; Švec and Trna, 1999; Švec a kol., 2002; Švec, 2005; Blaško, 2009; Brožová, 2011), fully agree that up to now evaluation of teachers' needs (including those of mentors) has not been investigated enough and it is even less reflected in the design of content and in the process of continuous professional development of teachers.

Materials and Methods

The incentive for organizing mentor training pilots was the training materials developed as a crucial output from the research project VEGA 1/0677/12 *Key Competences of*

Mentors Necessary for Successful Mentoring of Novice Teachers carried out by a team of researchers from the Faculty of Arts and the Faculty of Education, Constantine the Philosopher University in Nitra (SK). After their piloting, the designed and tested materials became a core part of the published university textbook (Gadušová a kol.,2014).
The research team organized four seminars, which took place in four schools in the region of western Slovakia in the period February to March 2014. One of the schools is situated in a city (Nitra), two of them in district towns (Hurbanovo and Topoľčany) and one in a village (Cabaj). Two of the schools are upper secondary (Nitra and Hurbanovo) and two are lower secondary (Topoľčany and Cabaj). The types of schools and their locations were selected intentionally so that the research could address teachers with different professional backgrounds and collect diverse opinions on the piloted materials.
The total number of seminar participants was 43 (41 females and just 2 males). The four schools were merely the venues where the seminars were held, as the participants were also mentors (86%) and teachers (14%) from other schools in the locality who had indicated their interest in the training seminar advertised on the school website. The relatively small number of participants in each seminar was intentional on the part of the researchers, so as to run the seminar in a highly interactive manner and offer space for spontaneous discussion and comprehensive feedback.
The design of the tasks for training mentors followed previous questionnaire findings taken from research carried out during the first year of the project. The questionnaire research was aimed at identifying mentors' shortcomings in performing their roles as mentors. The analysis of the research data helped to identify five basic areas in which mentors experience a lack of skills and competences. The identified areas are the following: 1) interpersonal and communicative competences; 2) skills in monitoring and observations; 3) evaluation skills of a novice teacher; 4) management skills; 5) reflection and self-reflection skills. For each of these areas the team developed around 16-18 training tasks. Naturally, it was not possible to pilot them all. Thus the research team had to limit their number.
For the needs of experimental teaching, the research team split into 4 two-to-three member groups and each group intentionally prepared a training set with a limited number of different types of tasks (5 to 8) from at least 3 identified areas considered to be manageable at the session. Though not all of them had been expected to be used, the researchers were ready to flexibly react to the situation on the spot, where they had to take into account a couple of influential factors, such as number of the participants, length of their teaching practice, number of years in their position of mentor, their personal experiences, predispositions and traits, motivation and willingness to communicate and share, and possible suspicious or dismissive reactions to performing the chosen tasks. The length of the seminars was not strictly scheduled either (from 120 to 180 minutes).
The aim of the pilot seminars was to find out to what extent the developed tasks match the needs of mentors they have already identified and how far the tasks contribute to identifying and exploring the needs they had not been aware of before. The other aim was to find out how the tasks contribute to the development of the mentoring role during the novice teachers' induction period. Last but not least, the tasks were expected to help them to consider and evaluate various strategies and materials currently available to support mentoring. This should have resulted in an increase in their knowledge about the qualities, skills and practices involved in novice teachers' guidance.
The specific objectives of this training were to make mentors:

- more aware of their needs and responsibilities;

- more able to articulate novice teachers' needs;
- aware of the ways novice teachers develop their professional profile;
- sensitive to their pedagogical, social, emotional, managerial, organizational and communicative supporting skills and train them in those skills;
- more philosophical, with greater awareness of why they do what they do;
- more aware of their rights to specific training and support as mentors;
- familiar with the use of tools and materials developed for their training;
- generate a positive attitude to life-long learning.

The group of mentor trainers used three qualitative research methods: experimental teaching - mentor training pilot, indirect observation, and a questionnaire for the participants of the pilot training. The experimental teaching was carried out with four groups of mentors and will-be-mentors. While dealing with the tasks, the trainers observed seminar participants' work and involvement. They focused on the participants´ willingness to do the task; willingness to discuss the task and share opinions and ideas with their partners/colleagues; positive and negative reactions; understanding of the task (number of questions asked); relevance of answers. By the end of each of the seminars the questionnaire was applied.

Results and Discussion

The two case studies presented below are just a small contribution to exemplify how the piloting of the designed tasks was carried out and what was discussed.

Case study 1

The first of the two tasks was aimed at the development of self-reflection and empathy abilities of mentors and was related to the topic of observation in the second chapter of the book (Gadušová, Z. a kol., 2014). The task of the seminar participants was to recall from memory the start of their teaching career, when they were in the position of novice teachers themselves. First, they had to write down their recollections; then they had to discuss in pairs how they felt being observed by their mentors or head teachers and how they felt in the position as observer of their more experienced colleagues. They were asked to think about positive and negative feelings connected with these situations and then compare their initial feelings with their current ones, i.e. to show how they see and perceive these situations after gaining some experience in teaching.

In this workshop there were just 10 participants. At first, they were given five minutes of thinking time for individual work, followed by pair discussion to compare their individual feelings and finally to share their ideas in a whole group discussion.

While observing the work of the participants, the researchers could see that the task was designed in a clear manner, as no one asked for clarification. However, the set five minute time was not enough, as the participants spent it thinking quietly, hardly writing any notes. Though it may seem a simple task, it was not easy for them to recall their past experiences and feelings. We could see that within the following three minutes, no one wrote more than five remarks, and the majority of them were positive. It is a natural tendency to forget bad experiences and remember only pleasant ones. But as soon as they entered pair-discussions the range of the mentors' recalled experiences started to grow. They were inspired by one another, and the researchers witnessed that the participants loved discussing their memories, and the discussions were not that easy to stop. Instead of the planned 10 minutes the vivid sharing of elicited ideas lasted almost 30 minutes. Their willingness to speak and comment on their peers' feelings and experiences indicated how

important the raised question was and how deeply and widely it could be discussed.
To make the findings more systematic, it is possible to group them into several areas and exemplify each of them.
The participants' positive feelings regarding the experience of being observed were of two types. The comments were related: a) either to the teachers' desire for success and performance excellence, or b) to the verification and justification of the used teaching skills and competences.

a) *"I wanted to demonstrate my friendly interaction with learners.*
   "I wanted to be praised for my teaching and told how good I was."
b) *"I expected some advice on time management, as what often happened to me was that I could not complete my lesson plan as I had designed it. Lack of time all the time."*
   "I was constantly scared and thinking I couldn't manage my pupils… though thinking about it now, I was not so hopeless, I just needed someone to tell me that I was doing well or that things were moving towards the better."

Negative feelings related to the position of being observed referred to a great extent to personal and methodology failure:

"I was so nervous, afraid that something would go wrong, that I really was unable to follow my lesson plan and, naturally, my teaching was horrible – a messy lesson."
"There were so many things I was concerned about – timing of the activities, respect of pupils and discipline in the class… will learners follow my instructions? Will I be able to calm them down and motivate them for the activities?"
"I definitely had a lack of confidence in my language use and this influenced also the methods I was able to use. My course book was my 'master' and I followed it very closely. My fears were then connected with scary situations 'What will I do if I can't find my course book… if I am unable to find the page or the task in the book…"

In the situations during which former novices were in the role of observers, they usually took two very contradictory positions – either they became very strong critics of their colleagues, or they put themselves into the more amenable position of observers who would like to learn something from their observees and copy what they did. These feelings were expressed in such statements as:

"I know I was overcritical of my more experienced colleagues. I thought 'I know better' and I was not willing to accept anything they wanted me to do or discuss with them. I considered them old-fashioned, using fossilized and repetitive methods, not willing to learn something new or change their ways of teaching to mine."
"I knew I had many reserves and I wanted to become better and better. So I was very happy if any of my colleagues invited me to see their lessons. I was even envious that their lessons were running so smoothly and any problem had a solution at hand … I observed carefully what they did and how they did it, but sometimes I could not understand… so I was happy if they found some time to reflect my problems and help me to solve them… and it worked."

Having carefully observed the discussions, it can be said that some participants tackled this topic more holistically, pointing to their general feelings either of joy, excitement and reward from their first steps in teaching, or feelings of fear, nervousness and confusion when on their own. On the other hand, other participants remembered better their very particular and individual experiences, mostly the ones connected with lack of confidence

and uncertainty. They eagerly looked for relevant solutions – "how to do it" or "how to solve it" – or they just wanted to see and copy the ways experienced colleagues did it.
Findings from the discussion with mentors and teachers wanting to be mentors show and prove that the majority of them were positive about this role, and if any negative comments were expressed, they related mainly to mentors' administrative duties and not to their work with novices as such. The mentors were welcoming the opportunity to share their experience and acquired knowledge as the following statements show:

> *"I like having novices in my classes to share my experience with them and discuss their opinions."*
>
> *"I think I am able to observe my novices fairly and guide them in a constructive way. Not just to criticize them but to point to some of the observed issues analytically, with evidence and to offer some good advice, if I see the novice teacher is open to it."*

Case study 2

The second piloted task and which will be discussed here relates to the topic of evaluation in the third chapter of the book (Gadušová, Z. a kol., 2014) of novices' teaching. The seminar participants had to express their opinions about the range and validity of the presented aspects which a mentor can observe in a novice's lessons. They had to consider their relevance and the suggested way of assessment. They were also asked to express suggestions as to a possible change of the key idea in each of the aspects, whether they would add something, and if yes, what and why.
The participants were given a chart with four columns and seven lines. Under the first heading *Achieving Educational Aim* there were listed seven aspects a mentor can take into consideration when assessing whether the objectives of the lesson were achieved or not. The listed aspects were the following: learners are made familiar with the lesson's objectives clearly; tasks dealt with are relevant, supporting the achievement of the lesson's objectives; learners are given clear and understandable instructions; they know what to do, tasks are presented in logical order; required teaching aids are available; new subject matter is presented and practised in a variety of activities; learners are given enough time to accomplish the tasks.
Next to these statements there was a column with the assessment scale (1-5) for each. The task of the participants was to become familiar with these aspects and under the heading *Comments* state their opinions and ideas on each of the aspects and their assessment. Under the last heading: *Suggestion for a possible change/alternation,* they could express other possibilities in which to reformulate or assess the aspect in focus.
This time the participants were asked to work individually, though interactions with nearby peers were observed. Sharing ideas could not be excluded either. The individual work and discussion were planned for about 10 minutes each. However, the estimated time for the discussion was exceeded again.
The positive finding was the reaction of the participants. They were quite surprised with the presented range of aspects to consider, when assessing the achievement of a lesson's objective. They said they wouldn't have expected so many. But, as soon as they started to reflect on their notes and comments, they found the range of aspects could be even larger and they themselves suggested some more, out of which three were included in the final version of the training materials for the book. The added aspects were the following:

- chosen and used methods are relevant for the achievement of the lesson's objectives;
- scope of the subject matter is relevant for the achievement of the lesson's objectives;

- relevant forms and methods are used to verify and check achievement of the lesson's objectives.

Other suggestions for change tackled the possible division of the third aspect into two separate ones – one related to instructions, the other one to ability of learners to do the task properly. Another suggestion was to use different assessment scales for these two aspects (e.g. not a numeric form, but verbal).

They also speculated on the possibilities in which to fairly assess the second of the listed aspects. They shared the view some tasks sometimes happen to be more relevant for achieving the lesson's objectives, but some tasks match the objectives only partially. Bearing this in mind, the participants wondered if it was appropriate to apply the five-number scale to assess this aspect of lesson objective achievement, as the more tasks the learners were expected to do (e.g. seven), the fewer (e.g. two) could fully match the objective(s). Furthermore, if there are just three tasks, is it enough to get the highest score if just two of them fully match the objective(s), or should all of them match it?

At the end of the seminars the participants were handed a questionnaire sheet to assess the value of the training. The six questions (Q1 - Q6) the participants answered were mostly yes/no questions with reasoning why. Out of the piloted tasks the participants appreciated (Q1) the tasks related to the topic of Monitoring and Observation. On the other hand, surprisingly (as these are currently burning issues in many schools), they were puzzled (Q2) with such tasks as self-reflection, bullying at school, and work with special needs learners. These issues, as they claimed, have to be solely dealt with in cooperation with a special counselor, education advisor, or a drug prevention coordinator. They themselves felt lost, not having enough competence to pass on some advice to novices. As for Q3, asking about a possible shift in the perception of their mentors' role due to the training, the vast majority of the respondents expressed the idea of having gained a much more complex view of their work; they realized how responsible, important and influential it is. In the responses to Q4 (is such a training useful – why) and Q5 (what should such trainings mainly focus on) they put forward a view of their undoubted necessity, especially in these days. Though, they were highly satisfied with the presented tasks, some of them would also have welcomed visualization of tasks either on video or DVD recordings. Finally, in Q6 they unanimously supported the idea of running mentor training courses on a regular and systematic basis within professional development courses. The similar findings about the importance and high value of mentoring courses are also documented in other European (cf. Skaniakos, Penttinen and Lairio, 2014 or Black &MacKenzie, 2008) and American (Bean, Lucas & Hyers, 2014) researches.

Conclusion

The piloting seminars gave the team of researchers suitable space for evaluation of mentor training ideas from the side of university educators and researchers on the one hand and teachers performing the mentoring role in schools on the other one. The participants' comments, suggestions and views not only helped the research team edit and amend the designed training materials into their final published form but the discussions also demonstrated the fundamental necessity of mentor training. Well-trained mentors who understand their job into depth are the heart of new teachers' induction. Therefore, the envisaged tasks for the researchers in the nearest future will be designing and running a mentor training programme as a part of continuous education of teachers. The programme will enable to set up a comparative research in the area of novices' induction carried out by trained in comparison to untrained mentors in order to gain evidence in what

way such guidance differs as well as to prove legitimacy of mentor trainings for quality improvement of novices' skills.

Acknowledgements

The authors would like to express their gratitude to the pilot seminar participants and heads of the following schools: Gymnázium Párovská v Nitre; ZŠ Cabaj-Čápor, časť Cabaj; ZŠ Škultétyho v Topoľčanoch; Stredná priemyselná škola stavebná v Hurbanove. The paper is based on research findings within the project VEGA 1/0677/12 *Key Competences of Mentors Necessary for Successful Mentoring of Novice Teachers.*

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EVALUATION OF NONVERBAL ELEMENTS IN MATHEMATICS TEXTBOOKS

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Abstract

This article comments on mathematics textbooks for lower secondary schools. Authors do not focus on texts in the books but on the nonverbal elements instead. A possible system of categories which enables mapping and classifying of such elements is suggested in this article. As a result of that, it is possible to evaluate and compare the textbooks which the authors have analyzed. A pilot research of putting this evaluation system in use is also described in the article. The research ascertains whether the system of categories is useable to obtain sets of nonverbal elements suitable for further analysis.

Key words

Nonverbal element, mathematics textbook, classification, evaluation, geometry

Introduction

Recently there has been a number of publications on evaluation of textual content in textbooks (e.g. Knecht, 2008; Průcha, 1985; Molnár, 2007; Slavíčková, 2003; Ilková, 2008). There are also researches that focus on nonverbal elements, specifically in geography and civics textbooks (e.g. Wahla, 1983; Janko, 2012; Jakubcová, 2012). Other researches deal with nonverbal elements from the multicultural and gender point of view (e.g. Moraová 2013) which we are also going to focus on in one of our following papers. As a follow-up to the researches mentioned, we present an article whose aim is to deal with evaluation of mathematics textbooks from the point of view of nonverbal elements. With respect to the small scope of our pilot research we have focused on the topic of planar and spatial geometry as it is defined in the framework education program: mathematics and its application. The specific chapter we have been focusing on is a chapter on quadrilaterals. Further in this article we will present a suggestion of how nonverbal elements can be categorized and how we can compare mathematics textbooks, using this categorization. This would enable us to evaluate the quality of a textbook with respect to a criterion other than textual content.

Nonverbal elements are introduced by many definitions, which do not vary from each other too much. A number of researches belonging to a research area called research on pictures (e.g. Anglin et al., 2004; Anglin et al., 1996; Levie, 1984; Brody, 1981; etc.) studied the interaction between a nonverbal element and the reader. We can distinguish four main research areas which differ in the way they look at nonverbal elements and the process of their interpretation. Janko (Janko 2012: 15) defines subareas focused on (1) the process of interpretation of an image; (2) the factors which effect remembering of images and creating mental representations of imaging elements; (3) research on nonverbal elements from the educational point of view and (4) description of aesthetic reactions and emotions in connection with nonverbal elements.

In this article we understand nonverbal elements mostly as visual representations. These

allow us to illustrate difficult mathematical phenomena in case we want to highlight only important features, without disturbing a complicated structure. In the world of teaching, nonverbal elements play an important part in pupils' creation of a concept of the given mathematical phenomenon (Janko, 2012: 43). For that reason, choosing a suitable set of visual representations, hence also textbooks is crucial.

With respect to our previous findings (Günzel and Binterová, 2014), which show that pupils' conception and mental representation of geometrical shapes with all necessary features are very insufficient, we have intentionally chosen a wide range of textbooks for this pilot research, including a fifty-year-old one, whose frequency of nonverbal elements is very low.

In another research on nonverbal elements (Günzel and Binterová, 2014), which focused on knowledge transfer we have discovered that mental representations are laden with drawbacks like formalism. In relation to this, another question comes to mind. How should we categorize nonverbal elements in mathematics textbooks and consequently, which categories are determining for forming mental representations? An aspect taken into account was the fact that pupils read without understanding and their perception of nonverbal elements is very superficial despite the fact that today's textbooks are full of these elements. Another aim of ours when testing older teaching materials was to observe such categories which are not present in contemporary books.

Materials and Methods

System of categories

The system of categories we suggest in this article follows the system of categories designed for classification of nonverbal elements in geography textbooks, which was introduced by Janko (Janko, 2012). However, we are aware of the fact that in mathematics we classify the nonverbal elements in a rather different way. In geography it is important to show for example photos that highlight key features or interesting objects that characterize a concept. On the other hand, when we want to highlight important features of a square, photography is not a very suitable nonverbal element. Before we start with the evaluation, we need to divide all nonverbal elements in mathematics textbooks into a set of basic types, regardless how employable the element might be in a lesson.

The first two groups of nonverbal elements are dynamic and static nonverbal elements. As we have already mentioned, further on in this article we are going to focus on the static ones only. These we have divided into six basic types: geometrical shape (U), graph (G), tabular type (T), pictorial type (O), combined type (K) and other types (S). Each of these types is further subdivided into more specific categories. To each category there is a description to explain the features of corresponding nonverbal elements. In the legend there is an example to each category. This division is shown in a table, see Tab. 1.

			category	label	description	legend
type of nonverbal element	*dynamic*					
	static	geometrical shape	precise shape	U1	contains important features	right-angled triangle with highlighted right angle or dimensions
			drawing	U2	recognizable geometrical shape	rectangular shaped bar of chocolate, rectangle without labels
			photography	U3	resembles geometrical shape	photograph of a scaffold in a chapter on polygons
		graph	graph, diagram	G1	curves,graphs,diagrams,sets	bar graph of percent
			number line	G2	horizontal or vertical, scale	degree scale, number line of integers
		tabular	scheme	T1	filling triangles, squares, ...	empty squares with results of multiplication
			table	T2	classic table	chart of birth rate in Czech Republic in the period of 2000-2012
		pictorial	drawing, picture	O1	no mathematical phenomenon	picture of a car in a motion word problem
			photography	O2		photography of A. Einstein
		combined	set of pictures	K1	set of corresponding pictures	object zoomed in and out in a ratio, instructions for origami
			combination of pictures	K2	more types in one picture	axial symmetry marked in an image
		others	symbols, signs	S1	highlighted mathematical text	graphically highlighted signs +/-
			map	S2	map	map of Europe in a problem on ratio
			logo	S3	no geometrical meaning	a logo on the cover of a textbook

Tab. 1: System of categories of nonverbal elements

Geometrical shape (U)

This type of nonverbal elements is divided into three categories: precisely constructed shape, drawing and photography. It covers images where we can clearly identify geometrical shapes.

Precise shapes with highlighted features are labeled U1. It can be for example a precise shape of a right angled triangle with marked right angle, see Fig. 1a. Shapes without any important features marked (right angle, sizes of sides, etc.) are labeled as a drawing U2. This category covers also shapes which are not precise, drawn by hand, but still result in a recognizable geometrical shape (see Fig. 1b). The last category, photography U3, covers only such pictures, which contain one or more geometrical shapes (see Fig. 1c).

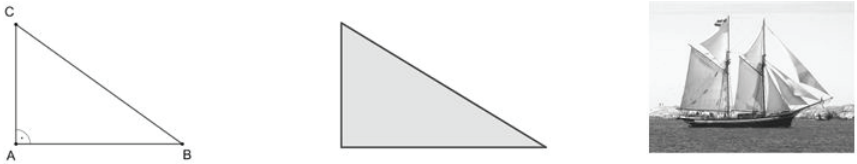

Fig. 1: Examples of precise shape (a), drawing (b) and photography (c) [1]

Graph (G)

This type of nonverbal elements covers all kinds of graphs and diagrams, categoy G1, see Fig. 2a. Number lines, vertical as well as horizontal, and various scales are labeled

[1] [online]. [cit. 2015-03-14]. Available from: http://upload.wikimedia.org/wikipedia/commons/thumb/8/82/ ATENE_im_Fjord_unter_Segeln.jpg/1280px-ATENE_im_Fjord_unter_Segeln.jpg

G2. An example of a G2 category is Fig. 2b that displays a scale on a thermometer in a chapter on integers.

Fig. 2: Examples of graph (a) and vertical number line (b)

Tabular type (T)

The tabular type of nonverbal elements includes all types of filling gaps of various shapes and styles, which follows a given rule (category T1). A prototype example could be a magic square or a chart with empty boxes to fill, see Fig. 3a. Default tables with data, which are already filled, are classified as T2, see Fig. 3b.

a	*b*	*a+b*	*a-b*	*a·b*	*a:b*
4	0,5				
	7				0,4
5,7		7,6			

x	1	2	3	4	5	6	7	8
y	8	4	$\frac{8}{3}$	2	$\frac{8}{5}$	$\frac{4}{3}$	$\frac{8}{7}$	1

Fig. 3: Examples of filling gaps (a) and default table with data (b)

Pictorial type (O)

The difference between this category of nonverbal elements and the category geometrical shape is that the pictures do not present any geometrical or mathematical element, which would accompany the text. An example is a picture of a car when students are to calculate its speed. Individual categories then classify only the technique used to create the picture (drawing or painting, photography).

Combined type (K)

A combined nonverbal element is composed of more than one image. The K1 category covers pictures that can be separated but there is a connection between them. An example is figure with instructions for origami, see Fig. 4a, or a schematic overview of quadrilaterals. The K2 category covers images that combine two or more types of nonverbal elements. For example photography of a butterfly (category O2) with marked axis of symmetry (category U1). K2 also covers dimensional sketches or photography, see Fig. 4b.

Fig. 4: Examples of separable pictures with a connection between them (a) and a combine of more types of nonverbal elements (b)

Other types

This type of nonverbal elements is divided into three categories. The O1 category includes

highlighted mathematical symbols or marks, see Fig. 5a. Category O2 covers maps, see Fig. 5b. At last, the O3 category includes any other image, which does not relate to mathematics, e.g. a logo of a publisher, see Fig. 5c.

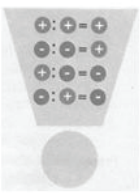

Fig. 5: Examples of highlighted mathematical symbols (a), map (b) and logo (c)

Pilot research

In our pilot research we used these categories to classify nonverbal elements in four textbooks. Each time we focused on chapters on quadrilaterals. The aim of our research was only to map the nonverbal elements in these chapters, using our system of categories. In the research we have been testing whether our system of categories includes all types of nonverbal elements and whether all these categories are defined unambiguously. For that purpose we have asked three mathematics teachers to classify nonverbal elements in the four textbooks. Another aim of our pilot research was to compare the textbooks as far as the relative frequency of the nonverbal elements is concerned. Using our system of categories we have classified these textbooks:

A) Molnár, J. (1999). *Matematika 7*.
B) Novotný J. (1963). *Matematika pro odborná učiliště a učňovské školy: tříleté učňovské obory*.
C) Reichel, H-CH.; et al. (2012). *Das ist Mathematik*.
D) Cihlář, J.; et al. (2013). *Matematika 7*.

Results and Discussion

The results of our pilot research are presented in a table; see Tab. 2, which shows the relative frequency of single categories of nonverbal elements.

textbook	U1	U2	U3	G1	G2	T1	T2	O1	O2	O3	K1	K2	S1	S2	S3
A	24	52	20	0	1	0	0	3	1	0	0	0	0	0	0
B	84	16	0	0	0	0	0	0	0	0	0	0	0	0	0
C	39	43	14	0	0	0	0	0	0	0	4	0	0	0	0
D	49	20	4	0	0	8	1	3	0	0	1	8	0	0	5

Tab. 2: Relative frequency of single categories of nonverbal elements

Since the teachers have classified almost all the elements to belong to one of the first three categories and in a similar way, we present also a graph of one of the respondents; see Figure 6, to illustrate the relative frequency of the first three categories of nonverbal elements present in textbooks A, B, C, D.

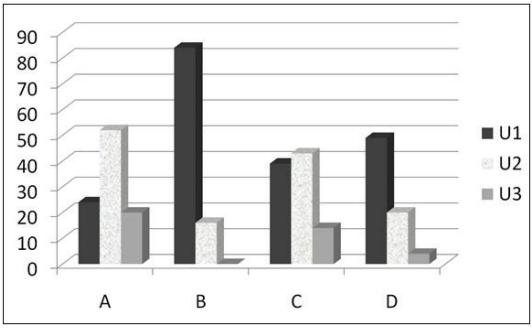

Fig. 6: Relative frequency of the first three categories of nonverbal elements

The results of our pilot research can be summed up into three conclusions. First of all, we have discovered that the textbooks presented here, whose nonverbal elements we have analyzed; differ from each other a lot, as far as the frequency of the elements U1, U2 and U3 is concerned. In the following research we are going to need to focus on more textbooks and chapters in which we could again classify the nonverbal elements and then compare the relative frequency of all categories.

Another discovery regards the quality level of our system of categories, which we have created to classify the nonverbal elements. It turned out that some categories are difficult to distinguish from one another and it was not possible to classify some of the figures according to the given descriptions and legends. That is the reason why we are to keep improving the system so that the categories are easy to distinguish from each other. We plan to use the system in our further analysis of textbooks, using not only absolute and relative frequency but also other statistical characteristics.

Lastly, we have discovered that different respondents came to different results while using the same system of categories. In this pilot research we compared classifications of nonverbal elements of three respondents (mathematics teachers). It is obvious that the system of categories needs to be studied further and used by a higher number of respondents. Then we shall analyze to what level the classifications of our respondents are coherent. According to this analysis we are to optimize the system of categories so that its use is as flexible as possible.

Conclusion

In this article we have introduced a method for classifying nonverbal elements in a textbook. Our pilot research was focused on testing our system of categories for classifying all nonverbal elements one can come in touch with in textbooks, as well as on an analysis of the results we have obtained. We have learned that the textbooks we have analyzed differ a lot in the frequency of especially G1, G2 and G3 category, which were the most frequent ones in the chapter on quadrilaterals. We have also observed that some categories of the system are not explained sufficiently which causes the classification to be ambiguous. The last problem is the differing classifications of the same set of textbooks handed in by our three respondents, all using our system of categories. The limited number of pages for this article does not allow us to describe the calculation of the relative frequency of single categories more thoroughly, as well as some other results presented in the paper.

We will try to solve all these problems. We also plan to continue with the research with more respondents, more textbooks and on a wider range of topics. We shall map all

geometry topics on a lower secondary school level. The result we will obtain will be analyzed more deeply and thoroughly.

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INTERCULTURAL COMMUNICATION OF FOREIGN AND CZECH STUDENTS AT THE CZECH UNIVERSITIES

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Abstract

At a time of massive developments in information and communication technologies the increasing importance of global communications combined with the changes in the value structures of individual and different entities studying at universities and colleges is reflected in society. Intercultural relations are mostly based on exchanging mutual values and life models that create a link between different cultures, seek ways for the coexistence of different cultures in order to gain detailed mutual understanding and thus prevent communication conflicts. Research into the behaviour of both individuals and groups of students thus represents a comparison of their value orientation with carriers of specific value preferences. This paper addresses the developmental trends in the intercultural communications of foreign students and their views on forming intercultural relations with Czech students in order to find the most suitable form of working intercultural relations between different cultures.

Keywords

College education, communication, company, preferences, students, values

Introduction

Communication constitutes the basic means of expressing one's attitudes and value structures. Currently, communication is changing in relation to developmental trends in information and communication technologies. It is possible to observe a number of changes in people's value approach in modern society. The growing role of interculturalism and intercultural communication is linked with these changes.

Despite massive use of information and communication technologies, the population is getting more and more into direct contact with members of different cultures (Prudký, 2009). These contacts and relationships, whether at the verbal, non-verbal or media level, can be characterised as intercultural relations. Intercultural relations are mostly based on exchanging mutual values and life models that create a link between different entities, they seek ways for the coexistence of different cultures in order to gain full mutual understanding and not to give cause for communication interference and the resulting conflicts. Europe can serve as an example; in its democratic approach to the infiltration of foreign cultures into its continent it had to assent to the introduction of certain migration rules, in particular on the grounds that the behaviour of Europeans is submissive, conservative, they don't invest the relevant efforts to maintain their identity and also due to traditional European values regarding immigrants.

On the other hand, however, they show a deep-rooted distrust of foreigners, and in certain parts of Europe even hatred. The opposite of Europe is North American society, which was formed by numerous immigrations and thus seems to be an intercultural society. After 1989, with the establishment of an open economy and opportunities to work and

study in a Czech environment, also the Czech Republic became involved in the process of building intercultural relations. This was primarily manifested by an influx of new foreign managers into Czech businesses and foreign students at Czech colleges and universities (Pelsmacker et al, 2007). The development of social values and factors that have had a major impact on intercultural communication is not clear-cut and simple.

Since the seventies their scale does indeed prove certain stability, but not, however, if we relate this to the influences of a global environment and the open economies of countries, including the Czech Republic. It is certain that during the current economic and social shifts in modern society, in which development in the diversification of working and living opportunities can be seen, it is possible to find other relevant factors that strongly affect Czech society (Inglehart, 1997). It is therefore necessary to identify and formulate new priorities for the value structures of selected entities, in order to demonstrate a correlation between the values of today's modern society with the elements of a diglossic culture for certain entities in the Central European economic environment and thus find a compromise environment for intercultural relations and different cultures (Morawski, 2005). Verification of this issue can be found in the intercultural concept of communication between different entities. It is not easy to define intercultural communication as a process of direct interpersonal communication between members of different cultures. Studies focus solely on communication between people in an interpersonal contact. The results are presented as dialogical forms in whole areas of verbal, non-verbal and paraverbal communication (Hofstede et al, 2006). One positive aspect is that under a dialogical form of communication it is possible to create a social relationship that can be combined with the communicants' values and value structures, which will be mutually shared and accepted or rejected. This finding is very important in the context of globalisation. Here we come upon a serious fact, in what form do the members of different entities communicationally present their value structures and in what manner are they willing to accept different ones. Crouch (1993) classifies the conditions for shaping relations between entities according to two dimensions:

- the communicants' mutual distance (from alienation to full identification),
- the level of calculation in the relations (from the absence of an agreement/contract to calculations in relations of the type friendship and love to the purely contractual in market relations).

The types of conditions for a change according to these two dimensions are then classified into six categories:

1. Hostile sporadic contact (a low level of calculation, large mutual distance between communicants).
2. Conflict within the rules (average to high level of calculation, great mutual distance between communicants).
3. Market relations (high level of calculation, average mutual distance between communicants).
4. Markets with reciprocity standards (greater rate of calculation, small distance between communicants).
5. Friendship (smaller rate of calculation, a small mutual distance between communicants).
6. Love (absence of contract and calculation, small mutual distance between players or even identification).

This structuralisation of categories can be used as a template to address positive intercultural communication in the global environment. For instance, European countries

in the European Union found a path to one another through market relations and markets with reciprocity standards, but in communication with other states the category of conflicts within the rules to hostile sporadic contact may occur (Prudký et al, 2009). A certain parallel can be found in intercommunications between foreign and Czech students. It is important to realise that foreign students bring their culture to Czech colleges and it depends on the environment as to whether their value structure will be left in peace or it will be hostile towards it. The adoption of "foreign" values and value positions in people's conduct generally has the character of a certain communication process, not just in the form of a language process, but also in the form of recognising the social models generated in the family, at the workplace and at school (Prudký et al, 2009). This idea is further elaborated by Weltzer et al (2014), stressing the fact that while the language differences can be overcome with the use of English as a lingua franca, we do not have a Culture as a culture franca, state. This means that attention should be paid to intercultural collaboration in a virtual environment. Education in cultural studies, cultural awareness and appropriate tools are all necessary (Weltzer et al, 2014). In Roubal's view, the importance of an empirical examination of the views, attitudes and needs of students at schools goes beyond the need for obtaining a certain argumentation material communicated to external target groups (they are part of the external academic environment - potential applicants, graduates, partners), and it is possible to use it in research of intercultural relations in colleges and universities (Roubal, 2013).

Another important factor is stressed by Florack et al (2014). In their view it is the initial cross-group friendship that leads to a reduction of intergroup anxiety and increase self-confidence in communication which in turn increases positive attitudes towards contact and facilitates further contact (Florack et al, 2014). Different angles of view on the communication environment between different cultures are offered by Liddicoat and by Pitts and Harwood. Liddicoat stipulates that the practices of intercultural mediation are realised in translation and argues that mediation is a process that involves aspects that are internal to the translator (mediation for the self) and aspects that are oriented to the reader of the target text (mediation for others), which are, in turn, linked through selective processes of determining what resources are needed to enable a target text reader to understand a source text meaning (Liddicoat, 2015). Pitts and Harwood on the other hand talk in relation to communication environment of foreign cultures about re-conceptualizing of Communication accommodation competence (CAT) and suggest that accommodation competence is a developmental phenomenon built on the accumulation of accommodation resources and repertoires over the lifespan. We address contexts in which communicative resources are stretched and competent accommodation becomes difficult. The competence approach provides one useful avenue for future empirical and theoretical development of CAT (Pitts, Harwood, 2015).

The subject of this paper is to examine the views of foreign students in the university environment of colleges and universities in the Czech Republic. The results are summarised using a synthesis into a modular framework expressing the attitudes and preferences of foreign students studying at Czech universities, ascertaining their relational intercultural level and pointing out deficiencies in communication between students from different cultures.

Materials and Methods

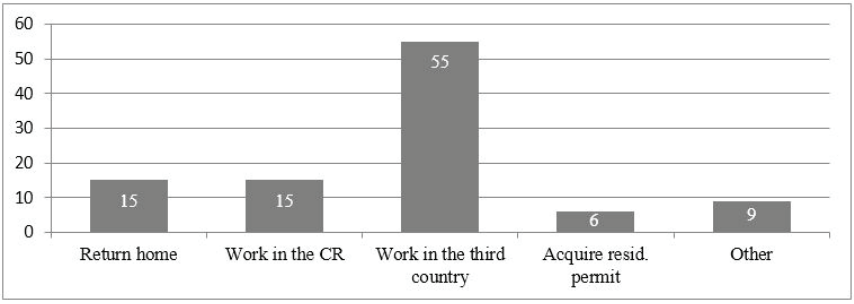
Achieving the main objective is to identify the value structures of a foreign student studying in a Czech academic environment. To obtain the primary data a questionnaire survey was

distributed among 200 students of the University of Finance and Administration in Prague with parity representation of foreign and Czech students. Within this group over 60% of students had experience also from other universities in the Czech Republic. First-grade bachelor level students formed 44% of all respondents, followed by sophomores with 33% and master studies first-grade students with 20%. The university study branches were represented as follows: Marketing communication - 46% of respondents, Business management – 32%, other branches (finance, sociology, and legal) – below 1%. The sample consists of 65% of female students and the remainder are males aged between 18 and 25 years. All respondents come from Eastern Europe, Asia and China (such as Russia, Kazakhstan, Uzbekistan, etc.) The questionnaires contained closed-ended questions with multiple-choice responses. Two trained students from the university concerned were used during the random selection of respondents. The return on the two hundred questionnaires was 100%.

The answers were processed by a quantitative scale into tables and graphs using simple comparative statistical methods. The main methods that were used when processing the topic were a structured analysis and simple contingency of the results in the framework of the questionnaire survey, as well as synthesis and logical methods and deductive methods aiming to identify and formulate the intercultural communication and relations between foreign and Czech students in the academic setting of the Czech Republic.

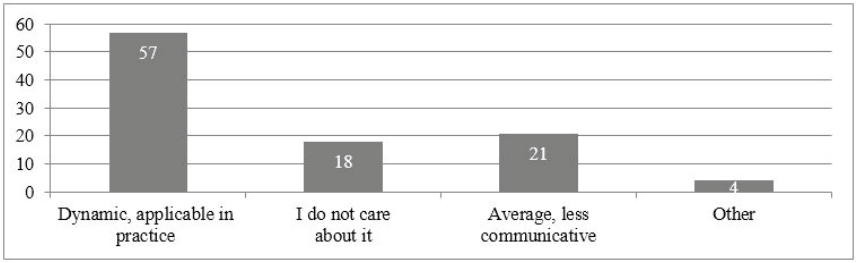
Results and Discussion

The students, who come to Czech colleges and universities to study, are first and foremost imbued with the idea that education in the Czech Republic will increase their chances of gaining a foothold in the European or world labour market.



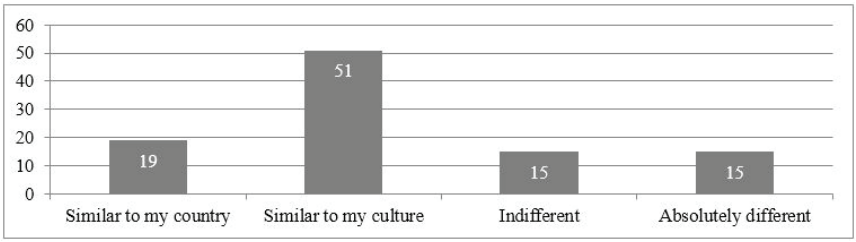
Graph 1: The purpose of gaining an education (%)

Foreign students (Graph 1) clearly come to study in the Czech Republic to make it easier to find work in third countries (55%) and in the Czech Republic (15%). Only 6% want to obtain permanent residence in the Czech Republic and 15% of the respondents want to go back to their country. The results significantly prove that after graduating from their studies foreign students want to work in one of the EU countries or overseas.



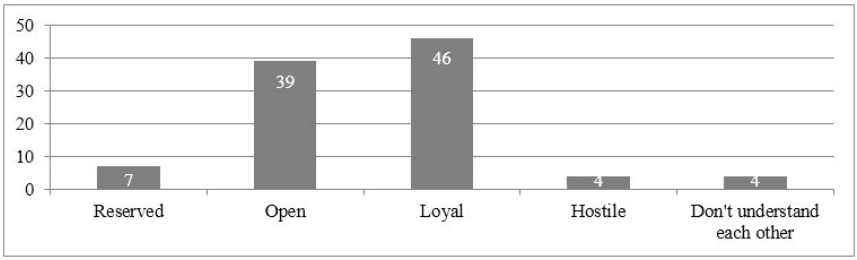
Graph 2: Assessment of the Czech university environment (%)

Foreign students (Graph 2) positively assess the university environment in the Czech Republic. They appreciate its dynamism and applicability in practice (57%), only 18% stated that the environment did not interest them and 21% assessed it as average, less communicative. In view of the fact that the predominant culture among the foreign students is that of the Eastern Bloc of the former Soviet Union, their assessment of the university environment in the Czech Republic expresses a high level of adaptation. Here it can be deduced that the environment of Czech colleges and universities is not strange for them and they can adapt to it.



Graph 3: Assessment of cultural and communications environment (%)

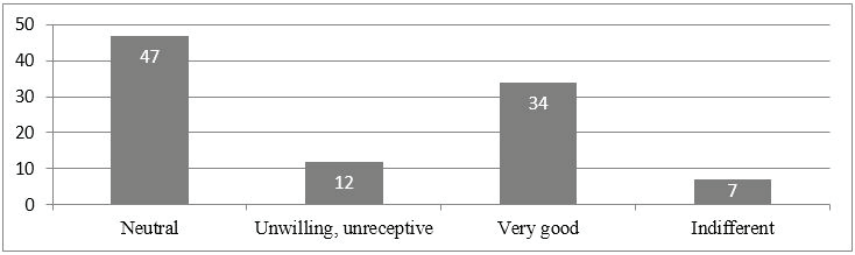
The results presented in graph 3 show that foreign students are not frustrated by Czech cultural practices as over 50% assessed Czech culture as being close to their culture, 19% identified the cultural and communication environment of Czech colleges and universities as similar, and nonetheless 30% (15 and 15) feel indifferent and different here. This last result represents a challenge for the Czech academic environment to improve the communication relations with foreign students and not to close itself off from this problem. This result is not insignificant, it constitutes nearly one-third of respondents. And the view about Czech students is specified in Graph 4.



Graph 4: Assessment of Czech students, classmates (%)

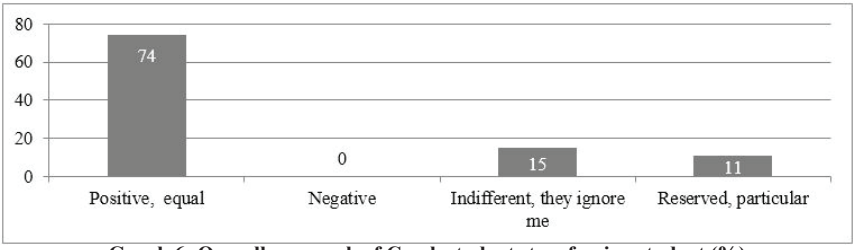
As presented on the Graph 5, foreign students consider the Czech students indifferent,

though they are open and they don't express hostility to them. It can thus be stated that communication between Czech and foreign students is neutral, without interest in other culture. Yet Czech students demonstrate openness and thus it is possible to rectify this from the position of the teaching staff, e.g. by creating mixed working groups when resolving seminary tasks and projects. Co-operation with Czech students is again assessed as indifferent and neutral. (Graph 5)



Graph 5: Assessment of the cooperation with Czech students, classmates (%)

When assessing the overall approach of Czech students to a foreign student, it can be stated that most respondents take it as positive and equal (74%). They do not suffer from negative interest; rather, they are often faced with an indifferent and closed approach.



Graph 6: Overall approach of Czech students to a foreign student (%)

It is worth supplementing the views of foreign students on intercultural relations in the academic environment of Czech colleges and universities with some views of Czech students. The response of Czech students to the perception of foreign students is given in table 1.

Closed, uncommunicative, indifferent	23
Open, communicative, interested in our culture, they are friendly	29
Loyal, they neither help nor harm	32
Unfriendly, they don't like us, we are a problem for them in their studies	2

Tab. 1: Czech students' perception of foreign students (%)

The results of Czech students significantly correspond with the views of foreign students. Intercultural relations between them are loyal, rather open and communicative (61%). Despite this 23% of students think that the relations are closed, uncommunicative and indifferent.

Similarly, as if I was a student in any other country, I don't see big differences	28
It is free to exercise my full potential and our culture	43
In view of the language barrier it is quite indifferent, no one helps foreign students	6
It is totally different, indifferent to foreign culture	9

Tab. 2: Assessment of the cultural and communications environment in the Czech Republic (%)

Czech students again agreed with the results of the foreign students' assessment of the cultural and communications environment in the Czech Republic. Most evaluated it as free and they didn't see large differences between the individual states. Here it is possible to infer from these results that the academic environment in the Czech Republic is very similar to that in other countries, and it may be the reason foreign students want to study here.

Conclusion

Based on the research carried out, the published views of the sociologists and psychologists quoted above can be confirmed. Czech society appears to be rather closed and indifferent to members of other cultures. It is not able to apply more empathy to foreign cultures and customs. Maybe it is a tax from historical experiences, where Czech society was and is ruled by more powerful entities, originating in Germany and Russia. Plus foreign students here are often faced with an indifferent approach in the academic sphere of colleges and universities. They separate, they don't let others get close other than is necessary and needed. On the other hand, even Czech students don't seek the company of foreign students, they are more wary and wait for a specific impulse for any cooperation. Nevertheless, it is necessary to appreciate that, on the whole, foreign students positively evaluate the Czech academic environment. Within the frames of identification and concretisation of intercultural relations, the following module can be proposed:

1. Communicate more with foreign students through extracurricular activities.
2. Improve the language skills (Czech and English) of foreign students.
3. Introduce joint group work during seminars - creating mixed working groups of Czech and foreign students for seminary projects.
4. Create room for more activities connecting all students - school excursions, introductory "mixer" courses where they can become acquainted, understand and make friends with one other.
5. Promote greater tolerance towards Czech students - generally it is not a problem in Czech students' communication, rather in the foreign student's communication - they are closed, elusive and ignore Czech students.
6. Change the teaching language to English.
7. Make a thorough correction of the benefits for foreign students, their greater integration among Czech students. Czech students feel less important.

Among the main preferences in the value structure of foreign students whilst studying at Czech colleges and universities is the acquisition of employment opportunities in third countries, in particular in the EU or the US. Only a small number of them (15%) want to return home. Another preference for foreign students is maintaining their own identity and culture; they do not intend to accept a foreign culture at all costs. Czech students show higher level of willingness to compromise and loyalty when in contact with foreign culture and its representatives. On the whole it can be said that the Czech academic environment appears to be equivalent to other developed countries and that it is sought-

after, especially by applicants from eastern parts of Europe and Asia, which is reflected in the rising interest in studying at Czech colleges and universities from these destinations.

Acknowledgements

This paper resulted from the project „Cognitive attitude forming within the frames of intercultural communication within the Czech universities“ covered by the specific research No. 7427 implemented in 2014 at University of Finance and Administration in Prague.

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DISTINGUISHING THE EDUCATIONAL TEXT STYLES BY NEUROTECHNOLOGIES: RESEARCH DESIGN

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Abstract

Neurotechnologies represent relatively new and progressive class of approaches contributing to objective measurements in education. In this paper we focus on two main neurotechnologies: Electroencephalography (EEG) and functional Magnetic Resonance Imaging (fMRI) frequently used for comparing the brain activity within working with educational texts. The objective of the paper is to suggest a research design for identification of differences in the brain activity, when readers work with common educational texts and the texts created based on the knowledge representation adopted from Knowledge Engineering, i.e. knowledge units. Furthermore, the above-mentioned techniques are compared subject to selected criteria to provide benefits to all, who is going to design his/her own research and has to make a decision on which of the techniques to employ.

Keywords

Brain activity, brain scanning techniques, EEG, fMRI, knowledge texts

Introduction

Within the time the neurotechnologies or brain scanning techniques are more and more accessible for the purposes of pedagogical research. The price for an equipment of sufficient quality as well as its size decrease; it allows to carry out the experiments independently on specialized places such as hospitals or clinics.

In our paper, we aim at the utilization of brain scanning techniques for measuring the brain activity of students within working with the educational texts of different styles. In particular, we are dealing with the most used ones: electroencephalography (EEG) and functional Magnetic Resonance Imaging (fMRI). As results from literary survey, both neurotechnologies are being used in the field for specific purposes.

Even if Jindráček, Škoda and Doulík (2013) deal with an overview on neurotechnologies in education, a good-practice cases on using the EEG for distinguishing the text styles are also included in their work. They provide the list of the most –frequently used parameters worth measuring in pedagogical experiments and, in particular, within working the educational texts of various styles.

In their fMRI study, Anderson, Murphy and Poesio (2014) deal with concepts with a variety of concreteness levels. For this purpose they use a state of the art lexical resource (WordNet 3.1) as the source for a relatively large number of category distinctions and compare a taxonomic style of organization with a domain-based model. They use multivariate pattern analysis to proof that all taxonomic categories and domains can be distinguished from fMRI data.

Schultz (2012) provides in-dept analysis and comparison of both technologies from practical points of view.

The objective of the paper is to suggest a research design on how brain activity reflects working with different type of educational texts. Furthermore, we also concentrate on criteria for selecting an appropriate brain scanning technique for monitoring the brain activity within the learning. For this purpose we first describe the most popular brain monitoring techniques used in pedagogic research and then summarize strengths and weaknesses of the techniques. Second, we set up the research procedure able to measure the differences of the brain activity, when a student works with different kinds of the texts. Finally, we discuss our approach with other researchers, who have carried out similar research successfully. This is the necessary step for our further research, however it can also provide benefits to all, who is going to make a decision on which technique to use in his/her own research. For instance, the neurotechniques could extend methodologies in pedagogical research and experiments (e.g. Novotná, Esenmann and Přibyl (2015) could use them) or provide new insights and dimensions in measurements in human resources management (e.g. Urbancová (2014) could enhance her approach).

Materials and Methods

Knowledge unit

As we presented in Dömeová, Houška and Houšková Beránková (2008), we establish an advanced form of knowledge representation, so called knowledge unit (*KU*), as
$KU = \{X, Y, Z, Q\}$,
where
X stands for a problem situation,
Y stands for the problem being solved in the problem situation *X*,
Z stands for the objective of solving the elementary problem,
Q stands for a successful solution of the elementary problem (result).
Simultaneously, we described the representation of a knowledge unit in a natural language as
"*If we want to solve an elementary problem Y in the problem situation X in order to reach the objective Z, then we should apply the solution Q*."

Normal text and knowledge text

Based on representing knowledge with knowledge units, we are able to write sentences, paragraphs or even longer texts in knowledge form. For instance and comparison, we provide the texts of several sentences in a) normal and b) knowledge form. We demonstrate these texts on a topic of agriculture waste processing (translated from Enviregion, 2014) used for analysing the technical differences among normal and knowledge texts in our previous work (Horáková and Houška, 2014).

a) "The waste arisen from industry production differs in comparison with the one arisen from households in more properties. It differs in the composition influenced with the kind of the production. It can often contain elements, which are of the hazardous character for people as well as for the nature (toxic, explosive, flammable, etc.). That is the reason for special manipulation for such waste."

b) "If we consider the waste arisen from industry production and describe its properties, then it differs from the households one in more characteristics influenced with the source of the waste. If it contains elements denoted as hazardous for people or nature (toxic, explosive, flammable, etc.), then we should manipulate with the waste carefully. When we consider the industrial waste and describe its processing, we should bear in mind that each production generates a different kind of the waste, and thus there is no unique way of processing the waste."

Results and Discussion

The research design is subordinated to our aim to measure the brain activity of students by neurotechnologies during reading different styles of texts. In particular, the validity of the following main hypotheses will be investigated:

1. The average brain activity in the alpha level is equal for reading text fragments in the knowledge and the normal version.
2. The average brain activity in the beta level is equal for reading text fragments in the knowledge and the normal version.
3. The same brain regions are activated during reading the text fragments in the knowledge and the normal version.
4. The average brain activity in the alpha level is equal for solving tasks from text fragments in the knowledge and the normal version.
5. The average brain activity in the beta level is equal for solving tasks from text fragments in the knowledge and the normal version.
6. If the respondents solve tasks within the hierarchy of data-information-knowledge, the average electrical characteristics are not in the same frequency band.

To follow the successful experiments by other authors (as presented in the next paragraph), we concentrate to a number of participants and their roles in a research and the nature of the educational texts used in the experiment to identify the aspects (parameters) measured by neurotechnologies or other ways within the experiment.

The participants of the experiment and their roles

First we determine a number of the participants. Based on experiences from literature, an appropriate number of participants is about lower or middle tens of persons. According to Martín-Loeches et al (2008) the half of participants will be women and half will be men (i.e. 20 women and 20 men). Each participant will be a right-hander (Robertson et al, 2000). The participants will be selected between age 19 and 40 years old which is very often used age category for this type of experiment (Speer et al, 2000; Martín-Loeches et al, 2008). Each participant will fill a form about his/her health situation, i.e. it will be taken into account e.g. previous illnesses, diseases, operations, genetic loads etc. (Smart and Burrell, 2015). Testing will involve (except tested people) an administrator (neurologist, neuropsychologist or biomedical engineer), who will oversee the conditions of entire process of testing. He/she will acquaint the testing people with the whole course of the testing and moreover, he/she will do provide serious interpretation of observed results. The irrelevant and incorrect interpretation of such results is very often criticized e.g. by Vul et al (2009). Therefore, we prepare our experiment for 40 volunteers.

Text fragments presented in the experiment

The idea of the experiment stems from the assumption that we have two types of didactic texts. One is made using the concept of knowledge units and the second is made as a typical classical study text (Houška and Rauchová, 2013). Both types of texts will contain the same topic (i.e. will be selected from the same problem domain). These texts will be both divided into 26 text fragments. Similar to Mason and Just (2011) each text fragment will have from 100 to 150 words. That means that 26 text fragments in total (13 knowledge and 13 normal) should be introduced to the participants of the experiment.

Observed aspects

Aspects that would be useful to monitor are the following:
a) Monitoring the electrical activity of the brain while reading different text styles - aspect is measured in Hz, using imaging neurotechnology (Kondylis, 2014).

b) Monitoring of activated brain regions – aspect is measured by neurotechnology in Talairach coordinates (x, y, z) and the side of activated hemisphere (left/right) is observed as well (Siebörger, Ferstl and Cramon, 2007).
c) Monitoring the electrical activity of the brain when solving tasks - aspect is measured in Hz, using imaging neurotechnology (Kondylis, 2014) except an electrical activity we observe accuracy of responses (yes/no).
d) The ability of recalling data-information- knowledge – aspect is measured by test and we observe accuracy of responses (yes/no).
e) Monitoring of prior knowledge - subjective aspect is observed by a survey when participants subjectively evaluate their prior knowledge of selected problem domain presented in text fragments. The participants express their opinions whether they are familiar with the knowledge included in the text fragments on the topic. The Likert scale of 5 descriptors: Strongly agree - Agree - Neither agree nor disagree - Disagree - Strongly disagree is used for this purpose (Norman, 2010).

Statistical analysis

Observed aspects (a, b, c, d) mentioned above will be measured for normal text fragments and knowledge text fragments as well. Therefore we can identify two groups (i.e. for knowledge text and normal text) for each observed variable. The possibilities of statistical analysis (e.g. Lindsey, 2000) are shown on Fig. 1.

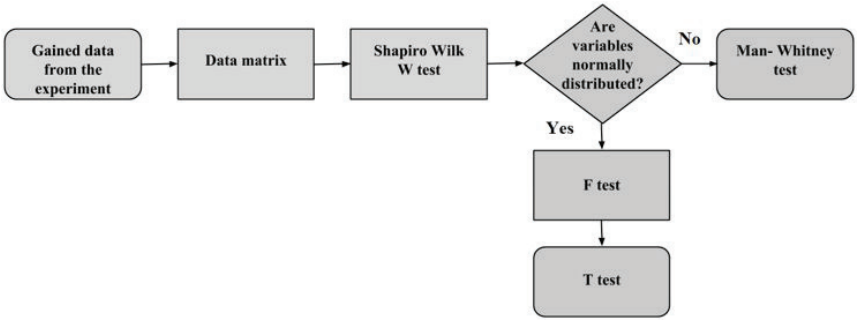

Fig. 1: Scheme of statistical analysis, (e.g. Lindsey, 2000)

In addition to the above-mentioned analysis we could use ANOVA (if variables are normally distributed) or Kruskall-Wallis test (if variables are not normally distributed) for variable (d) to distinguish the differences between data, information and knowledge correct recalling. Moreover, ANOVA (or Kruskall-Wallis test) could be used for testing influence the prior knowledge on accurate results for observed aspect (e and c).

Ethical and moral context

The ethical and moral rules for this experiment must be obeyed. It means that the participants of the experiment are anonymous. The gained data from the experiment especially about their brain activity or their health situation will be used just for this experiment. According to Hruby (2012) the findings will be seriously interpreted in collaboration with experts at fields of neuroscience, neuropsychology and education.
Selecting the appropriate neurotechnology
To design the experiment and especially the evaluation system correctly, we stem from the rules for determining the evaluation criteria (Bazerman and Moore, 2013). The criteria determined for the particular decision-making problem have to be in line with the goal of

the problem solving. Moreover, the set of the criteria has to fulfil the following conditions (Bazerman and Moore, 2013):

- completeness – there is no important aspect of evaluation omitted;
- operability – each criterion is well defined, i.e. the decision maker describes its content clearly and the way of measuring including units as well;
- uniqueness – each aspect of evaluation is mentioned exactly once;
- minimum range of the set – the criteria of really marginal (weak) relationship to the goal of the problem solving are omitted.

We consider two imaging neurotechnologies, i.e. EEG and fMRI which are used for similar experiments described in the review study by Jindráček, Škoda and Doulík (2013). Based on selected criteria and their rules we find out the neurotechnology appropriate for our experiment.

The set of criteria

To be in line with the recommendations by Bazerman and Moore (2013), we use the following five criteria to compare the above-mentioned neurotechnologies.

- Costs
  This is a cost criterion measured objectively in a currency unit (CZK is used in our case). It covers two sub-criteria: fixed costs and variable costs. Fixed costs are connected with purchasing the technology, variable costs are calculated as costs per technology used for 1 participant of the experiment.
- Availability
  This is a benefit criterion measured subjectively using the Saaty's scale and recalculated to the percentage share of 100% (see e.g. Saaty and Liem, 2010). The criterion evaluates availability of the technology in region, if consumed as a service provided by a third party, or in space, if the technology is bought.
- Time consumption of the experiment
  This is a cost criterion measured objectively in time units required for carrying out the experiment with one participant.
- Technical hardness of the experiment
  This is a cost criterion measured subjectively using the Saaty's scale and recalculated to the percentage share of 100%. It describes the hardness of the carrying out the experiment, e.g. on preparation, other equipment needed (notebooks, data projector, mirrors, etc.).
- Relevance in according observed aspects
  This is a benefit criterion measured subjectively in number of points (scale from 0 to 5). This criterion expresses how many observed aspects (a-d, as mentioned above) correspond to the selected neurotechnology.

The comparison of the EEG and fMRI subject to the criteria is presented in Tab. 1.

Criterion	EEG	fMRI
Costs – if bought [1 000 CZK]	38	40 000
Costs – per 1 participant [CZK]	1 500	8 000
Availability [%]	0.67	0.33
Time consumption [minutes]	20	60
Technical hardness [%]	0.17	0.83
Relevance in accordance with observed aspects [points]	3	2

Tab. 1: The comparison of EEG and fMRI

Remarks: the prices for the criteria "Costs" (both if bought and per 1 use) were taken from common sources; they are commercial prices for private purposes, not paid from public health insurance. Even if we carried out only a quick web survey on how many institutions provide the measurement as a service, we found enough providers of such services in really short time. However, we can say that a number of the ones providing the EEG measurement is slightly higher than the ones providing the fMRI services. The values for the criterion "Time consumption" are taken from literature, e.g. (Smart and Burrell, 2015); based on the literary survey we can say that they are the usual values for the experiments similar to ours. In "Technical hardness" we evaluate the EEG as strongly preferred against the fMRI. The main reason is that we need to the participant provide active performance within the measurement. Even if it is technically feasible to use the fMRI (using a data projector and mirrors to the participant see the text with no necessity to make any moves), it is much easier to operate the experiment with the EEG, because limited moves of the participants within the measurement do not influence the results. The EEG also allows us to measure more aspects defined in page 3, i.e. a), c) and d) in comparison with the fMRI suitable for the aspects b) and d).

As results from Tab. 1 and the remarks to individual criteria, the EEG dominates the fMRI for the purpose of our experiment on distinguishing the text styles. Therefore, the decision is to select the EEG and the experiment will be carried out using this neurotechnology.

Conclusion

In this paper we suggest a research procedure for an experiment on how to distinguish the individual kinds of educational texts using the neurotechnologies and relevant methods of statistical analysis. Also we provide a comparison between the EEG and fMRI subject to the most relevant criteria for the neurotechnology selection problem in various kinds of pedagogical research. Based on the analysis we start our research on distinguishing the educational texts styles with using EEG as a compromise alternative of neurotechnology equipment available for this kind of the research.

Acknowledgements

The paper is supported by the grant project of the Internal Grant Agency of the FEM CULS Prague "Determining the neuropsychological characteristics of learning for different kinds of educational texts using neurotechnologies", No. 20151047.

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USING TEXT MINING FOR THE IMPROVEMENT OF DIDACTIC TOOLS IN LANGUAGE ACQUISITION

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Abstract

The article focuses on modification of didactic tools for foreign language teaching, specifically English language using Teaching proficiency through reading and storytelling method, which is based on comprehensible input and storytelling. The core is to repeat new words and structures in meaningful context sufficient times and make sure that the new items were successfully acquired.

Six books containing graded stories were analyzed. These books are used in non-profit organisation ICEO o.s. focusing on language learning. The frequency of words is determined by using text mining. Moreover, recommendations are given to repeat and recycle the low frequency words by augmenting the existing texts through different point of views and mini-stories.

Keywords

Didactic tools, educational texts, text mining, term - document matrix, TRPS method

Introduction

Slavík (2012) states, that didactic tools used by teachers in education process can be divided into two basic groups: *material* and *immaterial*. Material tools include classrooms, equipment, technologies and teaching aids. On the other hand, immaterial tools include teaching methods and techniques. Merrinam, Stayt and Ricketts (2014) observe the efficiency of specific didactic tools, both material and immaterial. Further, Drigas, Kokkalia and Lytras (2015) analyse combinations of material and immaterial tools to determine their influence on knowledge transfer and retaining and recalling it by students. Teaching proficiency through reading and storytelling (TPRS) is one of the methods that belong to immaterial didactic tools.

Teaching proficiency through reading and storytelling is a teaching method of foreign languages that uses a combination of techniques helping learners to acquire foreign language. TPRS focuses on comprehensible input (ideally 100%) using graded stories (stories which use grammar and vocabulary appropriate for a learner and grow in complexity) and tries to achieve the ideal comprehensible input by establishing the meaning of new words or structures through pictures, gestures, translations and personalized questions, adjusting vocabulary to the particular level of learners and pace of speech and constant asking of easy questions. Grammar is explained very shortly (so called pop up grammar) but repeatedly (Ray and Contee, 2004, Asher, 2000).

Graded interesting stories enable to create the stress free environment where the entire class is conducted in a foreign language, where learners comprehend everything (stories are graded, pace of speech is adjusted) and learners are able to engage in conversation through constant asking of questions that are connected with the story. Stress free, relaxed but engaging and interesting environment enhances learning experience, shortens time

needed for language acquisition and fights anxiety and boredom, which usually lead to failure (Ray and Contee, 2004).

The key concept to successful language immersion and acquisition is to provide sufficient repetitions of new items - vocabulary, structures, grammar (Ray and Contee, 2004). The new items are repeated 50 and more times (depending on the different types of learners) and are revisited again in the following stories. Communicative approaches like TPRS could be deemed successful only if the teacher understands the student (Hattum, 2006).

We can also improve the acquisition of new items by improving the text structure. We can use text mining for this purpose. Text mining refers to a process of deriving information from texts and is mostly used in business, marketing, health care and recently also in education. For example, Leong, Lee and Mak (2012) describe the experiment in which students using SMS evaluated various didactic tools which they encountered. Text mining was used to determine the sentiment of individual SMS messages, which lead to a feedback for teachers. He (2013) uses data and text mining techniques to examine a large number of students through online questions and online chat messages. Horáková, Luhanová and Houška (2014) use text mining to find out the student´s preferred combinations of material and immaterial didactic tools. Based on results of text mining teaching concepts were designed and their success rate on knowledge transfer was observed.

The main aim of this paper is to analyze the books used in classroom settings and to verify whether these books are appropriate for TPRS. In case of low frequency words we would like to recommend other didactic tools to achieve and balance the frequency of these words throughout the books. The basic TPRS principles and techniques are applied in teaching from them.

Materials and Methods

TPRS methodology

The centre of each lesson is a story. The story itself is at a level corresponding with learners´ knowledge. It always contains new words and/or structures, but never too many. New vocabulary and structures are explained before the story is told (because we aim at 100% comprehension) and then the story is told in an engaging and interesting way (the voice of the teacher adapts to different characters, parts of the stories can be retold, gestures are used and pictures accompanying the story are shown). After telling the story teachers use circling techniques (set of questions used to repeat new items in the context) to help students to acquire new structures and vocabulary. Usually, during the next lesson the story, which was told during the previous lesson, is listened and read again. Moreover, the story is reviewed from a different point of views. The student becomes a character from the story and teacher asks him/her the story from the character´s point of view. This character story telling enables to recycle everything important not only from the story itself but it also allows the teacher to use the ideas from the previous stories and recycle the vocabulary and structures from the previous stories.

According to Asher's studies (Asher, 2000) the sufficient frequency of items repetition through the education process is 50 to 100 times. This number includes both the occurrence of the item in texts and its recycling through circling method. Therefore the frequency of items 10 and higher in the graded books is deemed sufficient.

Non-profit organisation ICEO o.s.

Non-profit organisation ICEO o.s. focuses on language learning and uses TPRS in its lessons. The lessons last 50 minutes each and take place once or twice per week. There

are usually 3 to 6 students in each class. The comprehensible input in the form of stories is enhanced mainly through gestures and pictures accompanying the stories. From this reason, projectors are used so students can not only hear the story but also see the story. Therefore, many concepts can be demonstrated using the pictures without the need of translation. To optimize and improve the output of lessons it is necessary to find out how many times key words and structures are repeated in the books used in lessons. As a result, it is necessary to find out which key words and structures belong to low frequency items. During the English lessons at ICEO o.s. every item in a particular story is repeated approximately 10 times using circling technique. The new items are recycled through new points of view and in the following stories. If the item appears in the texts 10 times using the circling technique the item is repeated 100 times. Therefore we need to identify the frequency of all items throughout the texts and items that appear throughout the book less than 5 times (with circling method 50 times) are seen as low frequency items as their frequency does not meet the threshold needed for acquiring the new items successfully.
In case that the new items are not repeated in recommended way it is necessary to modify the questions and make sure that the less frequent items are recycled more often.
The graded books used in the lessons are:

- Elementary Steps to Understanding (Hill, 1981a) used as Text no. 1.
- Intermediate Steps to Understanding (Hill, 1981b) used as Text no. 2.
- Elementary Anecdotes in American English (Hill, 1979) used as Text no. 3.
- Intermediate Anecdotes in American English (Hill, 1981c) used as Text no. 4.
- Stories for Reproduction: Elementary: Book (Series 2) (Hill, 1987a) used as Text no. 5.
- Stories for Reproduction: Intermediate: Book (Series 2) (Hill, 1987b) used as Text no. 6.

Text mining

Text mining is a process of deriving information from a text. It usually involves document categorization, information extraction, linked data mining, key words and patterns recognition, data pre-processing for text mining, web mining and hypertext mining. The basic mathematical tool is term-document matrix, which is used to analyze English language textbooks (Srivatsva and Sahami, 2009).
The term-document matrix represents a relationship between document and terms, i.e. documents are represented as rows and terms are represented as columns. The number of times a given term appears in a given document is used as entries in the matrix (Samatova et al, 2013).
Srivatsava and Sahami (2009) consider a word as a sequence of letters from a defined alphabet. In our paper we use word and term as synonyms. We consider a corpus as a set of ℓ documents, and a dictionary as the set of N terms that appear into the corpus. We can view a document as a bag of words. This bag can be seen as a vector, where each component is associated with one term from the dictionary.

$$\theta : d \to \theta(d) = \left(tf\left(t_1,d\right), tf\left(t_2,d\right), \mathbf{K}, tf\left(t_N,d\right)\right) \in R^N, i = 1,2,...,N, \quad (1)$$

where d stands for document,

t_i stands for term,

$tf\left(ti,d\right)$ stands for frequency of the term t_i in document d.

If the dictionary is consists of N term, a document d is mapped into N dimensional space. A corpus of ℓ documents can be represented as a term-document matrix D, whose rows are indexed by the documents and whose columns are indexed by the terms. Each entry in position (i, j) is the term frequency of the term $t_j, j = 1,2,...,N$ in document $i, i = 1,2,...,\ell$.

$$D = \begin{pmatrix} tf(t_1,d_1) & L & tf(t_N,d_1) \\ M & O & M \\ f(t_1,d_l) & L & f(t_N,d_l) \end{pmatrix} \quad (2)$$

Petrushin and Khan (2007) say that the term-document matrix is used for first pre-processing of the documents to filter out the stop words and convert the remaining words to their root from trough stemming. After that the term weights for each document are calculated to obtain a vector representation for each document.

Results and Discussion

We analyse six texts mentioned in the section Non-profit organisation ICEO o.s by using the text mining. Each row of the following term-document matrix represents one of the analyzed texts. The matrix has 6 rows and the columns represent the terms (key words). Term-document matrix contains 1722 terms excluding prepositions, conjunctions etc., which are listed in "English stop words list" (available at: http://ulozto.cz/xkCuP5Ft/term-document-matrix-xlsx**,** sheet: English stop words list). The module Text mining is include in software Statistica 12, Statsoft and automatically excludes items mentioned above (i.e. prepositions…). These items are not used in the subsequent indexation and analysis. The small part of the term-document matrix is shown in Table 1.

Terms	gone	good	goodbye	got	place	plan	plane	plant	plate	play
Text no. 1	0	13	0	8	4	0	3	1	0	11
Text no. 2	1	6	0	12	2	2	2	0	0	7
Text no. 3	0	9	0	14	1	0	8	0	1	9
Text no. 4	2	14	0	9	4	0	0	0	0	6
Text no. 5	1	9	1	15	1	0	0	0	1	4
Text no. 6	1	1	0	11	2	0	0	3	0	3

Tab. 1: A part of term document matrix

For example, the term "plane" can be found 3 times in the Text no.1, twice in the Text no. 2, and 8 times in the Text no. 3. This term is not presented in the rest of texts. Complete term-document matrix for above mentioned six texts can be found on link: http://ulozto.cz/xkCuP5Ft/term-document-matrix-xlsx.

Based on the analysis of texts using text mining the comparison of the suitability of individual texts for their application in TPRS methods can be used. Table 2 shows that each text has a high percentage of items with repetition frequency 4 and a very low percentage of items with a repetition frequency of 10 or higher. Therefore, it is necessary to adapt the teaching techniques for the use of the aforementioned texts in the TPRS method.

Frequency	Text no. 1	Text no. 2	Text no. 3	Text no. 4	Text no. 5	Text no. 6
Items with frequency 4 and lower	81.26%	84.44%	75.21%	82.12%	76.56%	76.56%
Items with frequency within 5 to 9	11.38%	10.14%	16.92%	12.06%	16.07%	16.07%
Items with frequency 10 and higher	7.36%	5.42%	7.87%	5.81%	7.38%	7.38%

Tab. 2: Repetition frequency of items in texts

By dividing the texts in terms of their requirements for each level of difficulty (Elementary level consists of Text no. 1, Text no. 3, Text no. 5 and Intermediate level consists of Text no. 2, Text no. 4, Text no. 6) we can state that, even as a group of texts in a particular level of difficulty, they do not fully meet the requirements for the use of TPRS method. As shown in Table 3, texts belonging to the group at Elementary level have 80.37% items with frequency 4 and lower and texts belonging to the group at Intermediate level have 78.75% items. In total, 65.33% items do not meet the frequency or distribution requirements for the use of texts with TPRS and the modification of teaching tools is required.

Frequency	All texts summary	Summary text no. 1, 3, 5	Summary text no. 2, 4, 6
Items with frequency 4 and lower	65.33%	80.37%	78.75%
Items with frequency within 5 to 9	16.32%	10.28%	11.90%
Items with frequency 10 and higher	18.35%	9.35%	9.35%

Tab. 3: Repetition frequency of items in group of texts

As many as 65.33% items do not meet the frequency or distribution requirements. The teachers will be given the list of these items and advised to do the following:

1. recycle and distribute these items more often through different points of view i.e. by reintroducing the low frequency items where they are not used originally but where they fit when a different point of view is used,
2. recycle and redistribute these items by adding short and interesting mini-stories to selected stories i.e. by reintroducing the low frequency items through newly written mini-stories that add new perspectives to the original stories.

After adjusting the teaching tools in the language courses in ICEO o. s., mentioned above, increased efficiency in language acquisition can be expected. Because as Asher (2000) pointed out, that the TPRS is much more efficient than traditional methods. Asher proved higher efficiency in his research comparing a class of 30 students taught with TPRS with a class of 30 students taught with the audio-lingual method (ALM). During the lessons when they listened to a story they had never heard before, but that had familiar vocabulary, the TPRS students with the 50 times repetition of items had significantly higher comprehension than the ALM students.

Garczynski (2003) also reached similar result. She followed two groups of students over a six-week period. The students who learned with TPRS scored slightly higher than the students who learned with the audio-lingual method.

In contrast to the traditional teaching approaches widely used in public education

(Kučírková et al, 2012), which rely on memorization of vocabulary and grammar translation in the target language, there are other methods for language teaching. Besides TPRS, there are methods such as Communicative language learning (CLL) that uses structured materials (these materials concentrate on the various different social meanings a given item of grammar can have) in such a way that learners can choose how to progress through the course themselves (Harmer, 2003). This communicative approach is deemed successful if a teacher understands the students (Hattum, 2006). Learning-by-doing (LD) is a concept, which achieve high efficiency of acquire foreign language through practice, self-perfection and minor innovations (Young, 1991).

One of this concept method is Project method (PM), which, unlike to traditional education, allows a student to solve problems with as little teacher direction as possible. Nowadays, this method is used by teachers worldwide (Gutek, 2009), modifies the role of the teacher who is seen more as a facilitator than a deliverer of knowledge and information. Students in a project method environment should be allowed to explore and experience their environment through their senses and, in a sense, direct their own learning by their individual interests. Very little is taught from textbooks and the emphasis is on experiential learning, rather than memorization. A project method classroom focuses on democracy and collaboration to solve purposeful problems. These methods based not only on the frequency of items repetition also increase efficiency of language acquisition (Young, 1991, Gutek, 2009).

Conclusion

The paper responds to needs of ICEO o.s. and provides feedback to teachers of English from this non-profit organization. Using text mining tools (i.e. term-document matrix) determines the frequency of keywords in chosen six textbooks. These six textbooks are used in ICEO o.s. in the course of teaching foreign language (English) by TPRS method. The frequency of word is analyzed in the section Results. The words that do not meet the threshold for memorizing foreign words are observed. Further, the way, how to target terms to reach threshold values and respect standards of TPRS method as well, is recommended.

As part of future research, the authors will focus on monitoring synonyms, morphology of verbs and other grammatical features that will respect more terms as one term. Furthermore ICEO o.s. is planning to publish their own textbooks suitable for the method TPRS. Therefore text-mining methods will play an important role as an analytical tool in of the creation process of texts. Moreover, text mining and data mining techniques could be used for search and classification of already made English texts suitable for teaching by TPRS method.

Acknowledgements

The paper is supported by the grant project of the Internal Grant Agency of the FEM CULS Prague "Determination of Neuropsychological Characteristics of Learning for Different Types of Educational Texts through Neurotechnology", No. 20151047 and a special thank to Erik Škorník from the non-profit organisation ICEO o.s.

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CHANGES OF ACADEMIC EFFICACY IN THE COURSE OF EDUCATION LEVELS TRANSITION

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Abstract

The paper briefly introduces the concept of self-efficacy first described by A. Bandura. It further elaborates particular topics of the concept, i.e. academic efficacy and self-regulation. Four main sources of self-efficacy are also introduced and described.
The research project focused on transitions between levels of education and changes in the academic efficacy of students due to the transfer into higher educations – in this case transition from elementary school to junior secondary school. The goal of the study is to compare the development of academic efficacy with the experience of transition. In contrast to other studies, the results did not reveal any significant changes in the academic efficacy level. However, further analysis and interpretation of the results are required, which may lead to practical implications of the results.

Keywords

Academic efficacy, education levels, elementary school, junior high school, self efficacy, transitions

Introduction

The concept of self-efficacy was first introduced by Bandura (1997) as a belief and trust in one's ability to complete various tasks and challenges. It is based on socio-cognitive theory and the individual belief is highly dependent on cognitive analysis of a particular situation, which is affected by several sources of information (see later) (Bandura, 1997; Doll, Zucker, Brehm, 2004; Pajares, Johnson, 1995). It is school that ultimately turns children's attention to the fact of effort. It occurs to such a degree that 6- to 9-year old children consider any goal achievable, provided they try hard enough. The downside of such an approach is that a child might feel inferior due to failing to achieve a goal which is beyond his/her capacity.
Over time a child develops a differentiated approach to various tasks and to his/her ability to fulfil them. These ideas become clear between the third and sixth grade. This process incorporates realism as to the idea of oneself, which can, however, negatively impact one's development, e.g. when a pupil achieves the lowest result in comparison with his/her schoolmates, in spite of the fact that his/her individual performance keeps improving. With regard to school reality, there is sufficient scientific evidence to conclude that academic self-efficacy can significantly affect school success and therefore has to be encouraged (Bandura et al. 1996, Doll, Zucker, Brehm, 2004, Souza, Brito, 2008). Academic efficacy is tightly linked to educational process and school achievements (Yilmaz, 2014). However, the principles of its development and implementation are the same as in case of self-efficacy.
Current research shows that academic efficacy tends to decrease in the course of school attendance (Doll, Zucker, Brehm, 2004; Jacobs et al., 2002; Frydenberg, 2007). When

adolescents reach senior high school their academic efficacy is often very low. Jacobs et al. (2002) carried out a study which observed children and adolescents throughout their school career. The results confirmed continuous decrease of students' trust in their abilities, which also led to devaluation of school work and the value of education. The transfer to secondary school can be a particular trigger for school disengagement. The difficulty experienced by pupils on transfer to secondary school has been a longstanding problem (Gorwood, 1991). Self-efficacy is further studied at university level and even at this stage of education results show its clear link to school achievements, level of stress as well as use of coping strategies and well-being (Chylova, Natovova, Michalek, 2013; Natovova et al, 2013).

Both self-efficacy and academic efficacy are developed and supported by information from four sources (Bandura et al., 2003; Pajares, 2006; Schunk, Meece, 2006; Schunk, Zimmermann, 1997). First and apparently the key source of information is mastery experience. When a student reflects a situation as mastered, he/she realizes his/her abilities and skills to cope with a task and solve a problem, and then the academic efficacy is given a strong boost.

The other two sources come from social environment. The second source involves social persuasion, i.e. information from significant others who appreciate one's work and achievements and give an adequate feedback. The third source is brought via observation of others, especially peers while they cope with a certain problem. When a person identifies oneself with the observed individual, he/she trusts in their ability to master the problem on the same level. Last, but not least source is connected with emotional and physical reactions to a particular situation. The impact lies in the way how a student interprets his/her feelings.

Adults, i.e. parents and teachers, as well as peers often play a crucial role in academic efficacy development (Bandura, 2007; Pajares, 2006; Schunk, Meece, 2006). As Pajares (2006) emphasizes the adults are to mediate an experience of competence and also adaptive interpretation of students' school work. This leads to authentic experience of students. They understand what they are capable to do, how they have to process their work and how to solve possible errors.

As students continue their academic career their academic efficacy decreases as mentioned above. Transitions between school levels thus deserve even more special attention as they put students in new situation and bring specific demands and requirements. Studies considering this process have mostly focused on the transition from home and/or kindergarten to first grade of elementary school (Dunlop, 2014; Harrison, 2014; Murray, 2014). However further transitions into higher levels of education also play an important role in the development of academic efficacy as well as school achievements and school engagement (Brooman, Darwent, 2014; Salmela-Aro, Uadyaya, 2014). Apart from school, parents and community are considered important in this process (Dunlop, 2014; MacDonald et al, 2014).

As Dunlop (2014) states, the transition requires support to students, adaptation of educational processes, creation of social network (teachers, parents, peers) who help to create new educational environment, and finally clear recognition that systems of schooling at different levels really differ and all participants are agents of the change (Bailey, Baines).

The aim of our current study is to describe changes in academic efficacy among students who transferred from elementary school to junior high school (i.e. the second level of elementary school in the Czech school system). Apart from academic efficacy we will also

focus on their experience of the change, on their feeling and emotions connected with the change. The respondents were observed longitudinally - at the end of their fifth grade and then repeatedly during the following school year, after the transition. The paper presents partial results of a larger study which surveys changes of academic efficacy and other related variables at all levels of school transitions.

Materials and Methods

We were interested whether academic self-efficacy and self-esteem change during the transition from the 5th to the 6th grade, or if these characteristics are stable. As the main research method self-report questionnaires compiled into an assessment battery were used. They focused on academic efficacy, self-control of homework and experience of the transition from the 5th grade to the higher educational level. The questionnaires were administered three times per the data collection to each child - once in May 2014 before the transition and then after the transition in September 2014 and November 2014. The children answered our questionnaires on-line or in paper-pencil form in their school. They received also an e-mail with the link to the questionnaire after their transition.

The first part of the questionnaire battery included MALS (Myself-As-a-Learner Scale) focusing directly on students' perceptions of their learning abilities and skills (Burden, 1998). The scale is simple to administer and to score, whilst containing sufficient items to ensure that different aspects of the learning self-concept were taken into account. For this reason, a twenty-item scale providing five optional responses, leading to a maximum possible score of 100 and a minimum score of 20, was constructed. The scale is comprehensible to pupils and students across a fairly wide age range, and standardized so that comparisons could be made between those with average, high and low self-concepts. MALS is applicable to students between the ages of 8 and 16, provided that suitable precautions are taken with younger and less able children to ensure they fully understand each item and how to respond appropriately (Burden, 2012).

Children's self-efficacy was measured with a modification of the Children's Perceived Self-efficacy scales (CPSE; Pastorelli et al. 2001). The full CPSE has 37 items representing seven domains of functioning that formed the three fundamental factors: Perceived Academic Efficacy includes 19 items; Perceived Social Efficacy includes 13 items; Self-Regulatory Efficacy includes 5 items. For each item, children rated their belief in their level of capability to execute the designed activities using a 5-point response format. After pilot stage of the project we had to reduce the questionnaire with respect to the capacity of children to be able to complete them. We selected 17 items which cover all three factors – Perceived Academic Efficacy - 9 items, Perceived Social Efficacy - 4 items and Self-Regulatory Efficacy - 4 items (the abbreviation used for the shortened version is ChSE).

Sample

In May 2014 participants of the study were children aged 10 to 13 years. The sample contained 740 children (346 female and 394 male) from different schools throughout the Czech Republic. The follow-up data collection in September 2014 involved data from 335 (171 female, 164 male) children, in November 2014 we gained data from 329 (174 female, 155 male). The collected data were paired by using a code (first three letters of a family name and first three numbers of the date of birth). It seems that the construction of the code was a source of problems for children. We were only able to pair data from 174 (90 female, 85 male) children, who participated in all three data collections, 244 (127 female, 117 male) children only participated in September and November 2014. The

obtained data show longitudinal as well as transversal results. The following text will present both depending of a variable we observe.

Results and Discussion

The outcomes of MALS and the Children's Perceived Self-efficacy scales (ChSE) appeared quite stable during the transition. We can say that the academic self-efficacy and self-esteem do not change significantly over the time of the transition. The results are presented in Table 1. For MALS the maximum is 100, the minimum 20, where a lower score means a higher academic self-esteem. For ChSE the maximum is 85 and the minimum 17, the higher score means a higher self-efficacy.

	MALS		ChSE	
	Mean	SD	Mean	SD
May	68.75	(.934)	63.51	(.857)
September	67.50	(.788)	63.25	(.910)
November	67.83	(.789)	63.94	(.878)

Tab. 1: Means and standard deviations for MALS and ChSE

Furthermore, we were interested in the covariance and correlation between outcomes of the questionnaires. In table 2 we can see significant correlations of MALS and in table 3 results for ChSE from May, September and November. The outcomes support the result, that the self-efficacy and academic self-esteem remain rather stable. For ChSE we see a significant, but lower correlation for May and November.

MALS (n=174)	May	September	November
May	150.970	[.531**]	[.526**]
September	67.634	107.507	[.770**]
November	67.078	82.809	107.621

Tab. 2: Correlations MALS; ** correlation significant on the level p=.01 (two tailed test); along the diagonal, we see the variance of scores

ChSE (n=174)	May	September	November
May	126.972	[.406**]	[.237**]
September	54.759	143.167	[.553**]
November	30.878	76.381	133.392

Tab. 3: Correlations ChSE, ** correlation significant on the level p=.01 (two tailed test); along the diagonal, we see the variance of scores

Results for different groups of children

We used two-sample t-test to see whether children differ in their MALS and ChSE outcomes. We hypothesized that the results would differ due to the gender and the size of their home town.

Variable	Value	n	Value	n
Gender	Female	127	Male	117
Size of home town	Less than 30000 citizen	152	More than 30000 citizen	192

Tab. 4: Sample differentiated according to gender and the size of a home town

There is no significant difference (t (242) = -0.466, p=0.642) between the MALS score in September in the group of males (M=66.7, SD=9.94) and females (M=67.3, SD=10.4). Likewise, we found no significant difference (t (242)= -0.586, p=0.558) between the MALS score in November (males: M=66.6, SD=10.4; and females: M=67.4, SD=10.4). There were no statistically significant differences in the ChSE in gender either. We also did not find any differences dependent on the size of a home town.

To find out how the results are affected by (a) a number of adults who live in the same household with a child, and (b) a number of siblings, we performed a one way ANOVA (using SPSS) in both cases. In the case of variables showing a lack of homogeneity of variance between groups, we computed the F value with the Welch-test. The descriptive results are presented in tables 5 and 6, but again there was no significant difference between the children. Only when comparing the mean values we can identify a trend in the decrease of ChSE in single-parent families.

	Average grade			MALS Sep		MALS Nov		ChSE Sep		ChSE Nov	
Nr. of siblings	N	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
0	27	1.61	.52	68.56	9.80	66.19	13.43	63.93	12.02	60.56	13.37
1	136	1.65	.62	66.96	9.70	67.61	10.17	63.05	12.87	64.18	11.76
2-3	68	1.66	.62	66.56	11.26	66.00	9.29	63.26	11.35	62.32	11.99
4+	13	1.72	.40	67.23	12.06	68.46	12.29	63.77	6.94	61.15	9.91
Total	244	1.65	.60	67.04	10.24	67.05	10.43	63.25	12.06	63.10	11.92

Tab. 5: The mean and standard deviation linked to the number of siblings

	Average grade			MALS Sep		MALS Nov		ChSE Sep		ChSE Nov	
Nr. of adults	N	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	28	1.59	0.50	67.29	10.32	67.86	10.57	64.36	11.34	61.89	11.55
2	154	1.60	0.56	67.53	10.51	67.41	10.86	63.23	12.15	63.77	11.90
2-3	48	1.80	0.73	65.42	9.88	65.69	10.03	63.42	12.30	62.02	10.94
4+	14	1.87	0.52	66.64	8.61	66.14	6.00	60.57	12.46	61.86	16.27
Total	244	1.65	0.60	67.04	10.24	67.05	10.43	63.25	12.06	63.10	11.92

Tab. 6: The mean and standard deviation linked to the number of adults living in the same household with the child (children with more than 4 adults are children from foster homes)

Conclusion

Our main outcome is that the academic self-efficacy and self-efficacy appear quite stable in the time of transition of our sample. It seems that between the 5th and 6th grade, i.e. the age of 10 to 13, the perception of one's own qualities does not undergo massive changes. We have to think about the reason, why our outcomes differ from other authors (Gorwood, 1991; Doll, Zucker, Brehm, 2004; Jacobs et al., 2002; Frydenberg, 2007), who report a decrease of self-efficacy in time. The decrease of self-efficacy during the course of school attendance is mainly monitored by comparing different cohorts of children (from different grades). From the perspective of our research results it seems that individual changes are not as extensive as the mean changes of children in one grade. The outcomes open a question to evaluate whether children with different levels of self-efficacy react differently to the fact of the transition. This will be a next step in our study.

If we applied our outcomes to practical recommendations, we would interpret the academic

self-efficacy and self-esteem as a quite stable personality characteristic. By diagnosing the level of students' self-efficacy and self-esteem we can decide about strategies to support coping demands of school education. Our current results present more reliable outcomes for the MALS (Burden, 2012) than for the modified Children's Perceived Self-efficacy scales (CPSE; Pastorelli et al. 2001). On the basis of further research we can recommend, that if a child has a high academic self-esteem and self-efficacy, this characteristics will be a good base for mastering the transition. Bailey and Baines (2012) even consider these factors as resilience factors in the transition process. Considering the triadic reciprocal causation model - i.e. personal, behavioural and environmental factors affect each other as well as one's development (Bandura, 1997), we can presume that the healthy personality component positively influences the behaviour and environmental factors. Complementary to it we should focus on children with low academic self-esteem and self-efficacy and develop interventions to improve their self-efficacy. The four sources of self-efficacy can be our inspiration in that process.

Acknowledgements

The paper is supported by the Czech science foundation GACR grant no. 13-28254S „Transient moments in the life path of the child and adolescent".

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THE FORMATION OF A PERFORMANCE EVALUATION MODEL

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Abstract

Managerial competencies are ranked among the necessary demands of employers while hiring. The characteristics of basic notionsis inherent in the first part of this study. The next part contains defined aim, which is to evaluate managerial competencies through a sample of 140 second-year students studying at the Faculty of Business Economics in Košice and subsequently to form a student performance evaluation model. In the Methodology part of the research, there are defined the selection and modification of the metrics concerning the competency valuation which are proposed by experts from the OECD. The last part deals with the output of a linear regression using a formula that predicts student performance.

Keywords

Decision making, managerial competency, student performance model, troubleshooting

Introduction

In their definitions of competencies, some authors do not distinguish between the meanings of the words 'skills' and 'abilities', which can be confusing to readers. Gallardo (2009) dealt with the problem of disparities in his publication in which he refers to different approaches. The definition of key competencies should be brief, clear, and accurate; it is a matter of a set of knowledge, skills, abilities, values, and attitudes. To widen this definition in order to specify it in greater detail, knowledge means absorbed information, whereas skill means the appropriate use of knowledge at the proper time and in the proper place. Various kinds of thinking are related to abilities. Values are phenomena and things that are meaningful for an individual. Attitude means the reaction of an individual to a situation. There are many individuals who do not have a proper proportion of these elements. Some people have a lack of logical and creative thinking; others do not have the theoretical knowledge which they should acquire during their studies. These problems can flow into difficulties with finding employment. The domestic and foreign literature often states how important it is to create an educated society and develop competencies during study. Several recent research projects, such as, Assessment of Higher Education Learning Outcomes, the Programme for International Student Assessment, the Maryland Performance Assessment Program, and the Criterion-Referenced Evaluation System, aimed to measure managerial skills and searching for answer to the question why managers do not have the qualifications needed for proper effectiveness in business activities (Khattri, Reeve and Kane, 2012; Minedu, 2012; Smetánková, 2011; OECD, 2003).

Managerial competencies are ranked among the necessary demands of employers during hiring. Each section of the labour market requires from the workers such knowledge as it is necessary to gain and support by education (Navrátilová and Romanová, 2014). According to Urbancová (2013), in today's highly competitive environment the goal of each organisation is to defeat the competition and win new customers. Individuals

who are holders of knowledge represent a tool for the generation of innovations. Thanks to their personal creativity and their knowledge, skills, and abilities, it is possible to generate new and innovative ideas that will help organisations to achieve a competitive advantage. Potgieter and Coetzee (2010) focus on the fact that despite the changing roles of managerial workers, only scant emphasis was placed on the improvement of their managerial competencies in the past. The relationship of managerial competencies means that the effective leadership should be universal in terms of the transferability of its meaning (Govender and Parumasur, 2010). The developmental quality of managerial job assignments is multidimensional and includes the features of managerial assignments that provide opportunities for learning new skills, behaviour, and perspectives (Dragoni et al., 2009). According to Čambal, Baňasová, and Cagáňová (2010) a managerial competency is the ability of managers to apply their knowledge, skills, attitudes, and personal characteristics into practice to achieve a desired performance. To develop competencies, it is needed to change the traditional forms of education into modern forms. They could be implemented into an educational process (Pčolinská, 2012b). Using experimental teaching methods, especially simulation games, can help students to develop communicative and interpersonal skills (Pudło and Gavurová, 2013). Gauging the effectiveness of specific teaching strategies remains a major topic of interest in science education (Jiang and McComas, 2015).

The development of problem solving as one of the managerial competencies is an educational aim in the framework of all school curricula in many countries. Teachers place an emphasis on students' development of competencies related to the solution of problems in a real life, which means to understand the information, identify critical features and their relations, solve, evaluate, justify, and communicate a problem. The process of problem solving is inherent in mathematics, science, arts, the social sciences, and in many other fields. Problem solving is the basis not only for future learning, but also for effective participation in society while performing personal activities. Even though this activity appears in an everyday life, the framework for the development of a detailed evaluation of students' abilities is not clear. The development of different initiatives for a more general evaluation of competency has begun. For instance, in mathematics, there is a long tradition of problematic thinking and learning studies. In psychology, the study of inductive knowledge and analogical thinking has been developed.

The Organisation for Economic Co-operation and Development (next OECD) organised the Programme for International Student Assessment (next PISA) research study in which they tried to discover whether the future graduates are able to offer the competencies demanded by the labour market (OECD, 2006). The disadvantage that the employers have is that they do not have the knowledge of students´ competencies acquired during their studies. Neither is the employer well informed on the student's average performance. And we know that there are employers that are interested in the academic performance of graduates too. According to a survey of more than 200 employers by the National Association of Colleges and Employers, 67% of companies said they screened candidates by their grade point average (Adams, 2013). This is because this information can help to make a basic prediction about the future workers. This information would be helpful in ranking the students according to their accomplishment in groups before the other parts of an interview. *Because of these facts, we set the goal of proposing a model of student performance evaluation by means of an evaluation of managerial competencies.*

Materials and Methods

We will begin by with the general term 'competencies', from which the specific terms are derived. While defining the general term, we were inspired by the opinions of the experts from the European Union (European Parliament, 2006), by the definition review of individual countries (Deseco, 2002), (OECD, 2006), and by Blaško (2010), who introduced the term 'rational skill' in his publication.

Our own definition and the structure of competencies and their division needed for the research are shown in the scheme below (Figure 1). The managerial competencies are designated by a dashed line in order to indicate that they are a subset of general competencies. For the purpose of this research, it is necessary to understand managerial competency as a competency for future managers.

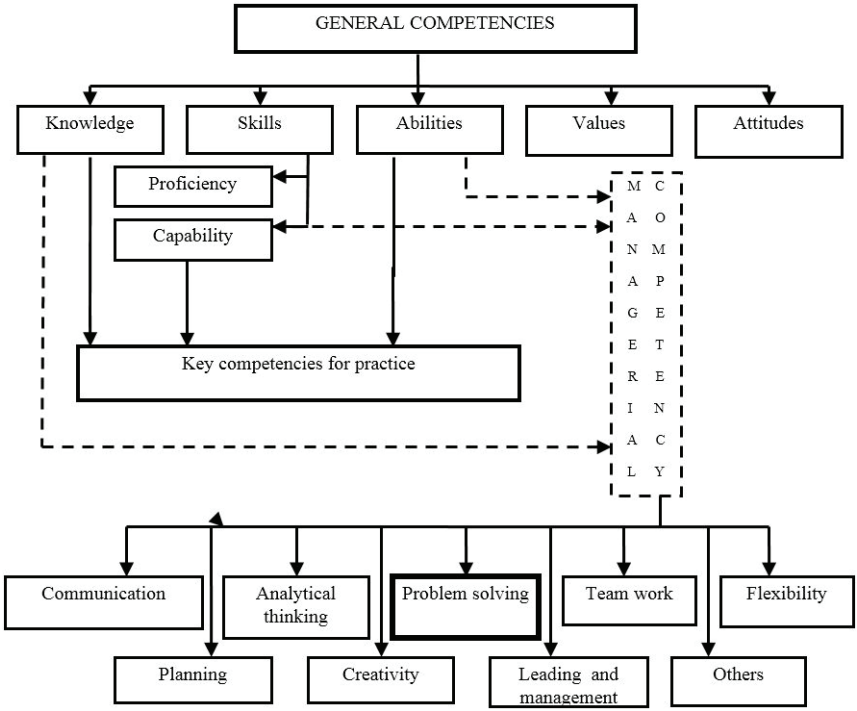

Fig. 1: Our own schematic illustration of the division of competencies

The scheme is completed by the division of managerial competencies; to be more specific, these are the properties that each manager should have. The problem-solving competency that is surveyed is highlighted in grey in the scheme. Creativity, communication, analytical thinking, teamwork, the basic managerial properties, planning, organising, leading, checking, and flexibility are also depicted in the scheme. Each division depends on viewing the perspectives of the authors involved in this problem.

The research methodology

To fulfil the aim and arrive at the creation of the model, the three steps explained below were needed:

1. Defining the managerial competencies and problem solving which is necessary to test in order to treat the results by the linear regression method.
2. In order to test the problem-solving competency, it is essential to create metrics, such as a set of tests inspired by an exploratory study of the OECD.
3. To create a model of student performance evaluation using a linear regression method.

Research sample

The sample was composed of the second-year students studying at a degree called "Engineer" at the Faculty of Business Economics in Kosice. Tested group had 175 students, and 140 of them took part in testing. It means that the research sample involved 80% of the second-year students. Regarding gender, 72% of the women and 38% of the men were tested.

For the purposes of this research, instead of the term marks, we have used the phrase *academic performance*, because from our point of view, the term mark reflects the performance achieved by student only during educational proces. The student performance has been provided by a student officer. The data was obtained continuously during the summer semester in 2012.

The creation of the metrics used for measuring managerial problem-solving competency

The information given above described in detail the reasons which influenced us in the selection of a specific managerial competency. To fulfil the aim, we started to search for the tests that would be appropriate for the solution of given problem. We were inspired by OECD research (2006, 2003) realized for a similar purpose. The students were given a set of tests. Each test was focused on a different type of problem-solving competency. There are three types existing, namely, decision making, system analysis and design, and troubleshooting.

1. System analysis and design competency

System analysis and design problems require a student to analyse a complex situation in order to understand its logic and/or to design a system that works and achieves certain goals, given information about the relationships among features of the problem context. For example, in Problem-solving Unit 2: Managing CD Sales, the student is asked to analyse a record-keeping system for managing CD sales in a music store (OECD, 2003).

We used the previous paragraph while creating a case study. In the text of the study, the interactions among employees were defined. The task for the students was to depict graphically the relationship of systematic and communication flows that was implicit in the text. The maximum number of points possible to reach after completing the task is 22 points, i.e. 22 correctly drawn arrows. The students were given 20 minutes to complete the task. The task was given to the students during the lesson entitled Business Information System.

2. Decision making competency

According to the OECD (2003), decision making problems require students to understand a situation involving a number of alternatives and constraints, and to make a decision that satisfies the constraints. For example, in Problem-solving Unit 1: Say No To Pain, students are asked to decide which of a selection of painkillers is the most suitable one, considering the patient's age, symptoms, and other medical conditions.

The students were required to write a final work on their own. The title of the course in

which the research was conducted was Sales and Vending Strategy of the Company. It was very interesting to see how the students were able to apply the knowledge they had acquired to the chosen business, because the knowledge is one of the main factors of a success. The main aim of the students was to determine the internal and external background of the business. The demands of the syllabus of given subject for working out the assignment were as follows: the essay must solve some of the problems (theses) of the course; the students must present their own introduction to solve the problem, to generalize of the current situation, and to give their own solution with a clear conclusion and the sources in the literature from which knowledge or information was taken. The students complete the essays with a summary in which findings and results are clearly formulated and in which the opportunities for future work are described as well. (Curriculum of the course "Sales and Vending Strategy of the Company", 2011.) The final work includes the "decision making" competency. It was up to each student how much depth they went into to work out the analytical part and whether they were able to perceive and determine the problem correctly in the chosen business (Romanová and Pčolinská, 2012). A very important part of the final work was specific proposals. Regarding the classification in terms of points, we needed two scores for each student. The first score – creativity – was set as follows: the total score that the students could gain was 11 from which, four points were given for fluency, two points for understandability, two points for elaboration, and three points for originality. These specified factors are the general factors of creativity.

3. Troubleshooting competency

OECD (2003, 2004) in its research study also defined a next type of problem-solving: troubleshooting. Its basic character can be expressed as follows: solving a problem situation requires students to understand the main features of the system and diagnose its errors. Resolving the situation requires understanding the logic of the mechanism, such as the operation of a physical system or procedure.

Upon investigation of these features, we decided to use the assignment being prepared by the OECD (2003) itself, in order to have one task representing the organisation that had created it for worldwide testing. The original task was centred on the solution of the issue of troubleshooting and how to examine individual valves through which water flows. The maximum number of points is nine. The students were given nine minutes to complete the task.

Results and Discussion

This chapter comprises two parts. The first part contains a brief presentation of the results achieved by students for the problem-solving competency. The second part includes a model proposal of a linear regression.

The results of the tests

In total, the students could gain 41 points. The maximum points a student achieved was 28.2, and the minimum number was 5.2 points. Between 20% and 25% of them got 12 to 18 points. The final conclusion of the finding is that the problem-solving competency is not as highly developed as we had expected.

For this reason we suggest use more modern practices in education, such as case studies and discussions to foster communication among students, to encourage them to engage in critical discussion, to express opinions, and finally to increase their competencies by suggesting solutions to problems working in pairs or groups. We also suggest motivating students learn more, study theoretical backgrounds, because without them they will not

have a holistic view of the topics being discussed. According to Pčolinská (2012a) and Romanová (2014), the most modern methods are simulation games.

The creation of a student performance evaluation model

While creating a model of student performance evaluation, we used student performance as a characterising variable which would represent a fixed value of the target output should aim for. Its construction can be helpful in predicting the students' performance, for example, at interviews, so that employers obtain further information about the students.
The model will be consisted of regression coefficients of the primary metrics, preferred in our work because it was adopted from the OECD research. Table 1 (below) shows the regression coefficients used to create the model. The last column contains p-values. These are used to verify the statistical significance of the regression coefficients; in this case, because of the type of the sample, they only serve as a "certain indicator" that these regression coefficients are sufficiently significant.

Parameter Estimates					
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	2.76762	0.12	22.32	<.0001
Troubleshooting	1	-0.01174	0.02	-0.64	0.5213
System analysis and design	1	-0.02468	0.01	-2.42	0.0166
Decision making	1	-0.05646	0.02	-2.94	0.0039

Tab. 1: Regressive indexes of mathematical regressive models

On the basis of the above, we can define a mathematical model for predicting the grade average. The following equation can be used to calculate the grade average from the individual results used as input.

$$GA = 2.76762 - 0.01174 \times TS - 0.02468 \times AD - 0.05646 \times MD \quad (1)$$

where: GA – Grade average
TS – Troubleshooting (in points)
AD – Analysis design (in points)
MD – Decision making (in points)

This is the definition of a mathematical model that can be used to predict a student's grade average. It can be used as follows.
The equation must be populated with the values of all the variables for each individual. This means that firstly, it is necessary to test students with our proposed metrics and then enter the results into this equation obtained by linear regression.
According to the long-term research by Schoonover Associates (taking 15 years), the orientation on competence has achieved four basic results in more than 60 organisations in the USA: increasing the success rate of hiring new high quality employees by 5–10%, increasing the length of employment of people the organisation has interest in by 15–20%, increasing staff morale by 15–20% and improving the achievement of targets by individuals and work teams by about 20% (Turek, 2002). The inspiration of our research has come from a multi-annual study of the literature about the students´ competences development. In Slovakia, we are inspired by the research of Bašistová and Ferencová (2011), who indicate that the problem-solving competency is mostly requested by employers.
The outcome of this research was to create a mathematical model of students´performance evaluation. According to studied literature, this model has not been developed abroad.

In Slovakia, it was developed by the author in the year when the research was realized. The author proposes it on the basis of the extensive study of the issues of competences, and he came to this idea also by more personal experience by graduating in the field of management and countless number of selective processes. On the basis of modification of mathematical model, the author´s idea of the future is to predict the performance of potentional employee´s in comparison with other workers, who are already working in the company.

At our tertiary schools, evaluation has the form of grading. Slovakia uses a new system with the grades A, B, C, D and E (where A is the best). The schools in the Czech republic use the traditional model with grades 1, 2, 3 and 4. On the labour market, there are still employers who consider this method correct, and in fact, candidates with a "red diploma" (which is given for an excellent grade average) have preference over others. Because of that, we have decided to expand the knowledge that the employers have about their candidates by telling them two characteristics at once. By testing the listed managerial competencies, the employer can learn what the competencies of the candidate are and can also determine from the results (using the equation) what their grade average at school was. The proposed model should be integrated into the evaluation frames of assessment centres when hiring the future managers too. The results of the research should be very helpful for employers to acquire two more pieces of data about a potential candidate. The second purpose is to create an image of the student's performance as an individual.

At the present, this contribution is limited, because it is valid only for the students who were tested. It is not possible to generalise the model because the selection of the students was goal-directed. Firstly, it will be necessary to verify it through a sample of next year's students in the second year of their master's degree studies. If it proves inaccurate, it will be necessary to modify the model.

Conclusion

The main aim of this study is useful for three groups – for teachers, the students who are tested, and employers. The model can help teachers to improve their teaching process and for students to know in which competencies they are excellent or weaker. This information can help them to be successful on the labour market. Our own suggested model can be helpful for employers to improve their recruitment of applicants.

The first step of this study was to test the managerial competencies of the final-year students and to propose a model for the evaluation of student performance. This research target was set because our developing society places higher claims on applicants every year. We wanted to know if the future workers have the requisite qualifications for the jobs they apply for. This is why we have created a managerial profile, and each applicant had a chance to get to know about their competencies. Inter alia, this information can be very helpful for teachers to know how many points their students gained from the suggested metrics. In the case of a below-average score, they can make an attempt to improve the learning process, to develop competencies, because nowadays, each educational institution is required to implement the foundations for the competency-based learning process.

If we review our results, we can suggest that the university participates in the development of competencies. On the other hand, the fact that the students did not gain higher numbers of points in each category may be the result of there not being sufficient time to develop the competencies to the highest quality. Therefore, we recommend that educators take a positive approach to incorporating modern methods into the educational process and participate in the balanced development of the three types of competencies – troubleshooting, system analysis and design, and decision making.

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TESTING KNOWLEDGE AND COMMUNICATION DURING THE COMPETENCY-BASED LEARNING PROCESS

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Abstract

This article points out the need for the development of the communication competency of a student involved in the learning process by means of several methods, namely by discussion, presentation and activity, while also emphasising the need to reconsider the importance of students' knowledge in the preparation process of future managers. The main aim of this article was to evaluate the relationship between the communication competencies of students in the last year their studies at the Faculty of Business Economy at the University of Economics in Košice, Slovakia and the score of their knowledge as shown in tests. We found a negative correlation between these variables. More communicative students gained fewer points in the area of theory.

Keywords

Communication competency, education, student, theoretical knowledge

Introduction

It is necessary to create conditions in educational and pedagogical development to secure optimal opportunities for self-realisation for the country's residents (Ministry of Education SR, 2012). It is important for every country because their economic development depends on individuals with competencies. Thanks to their personal skills and abilities it is possible to generate new innovative ideas that will help organisations gain a competitive advantage (Urbancová, 2013). The main goal of the education process is the adoption of the key competencies to such an extent that students can apply all the competencies they have gained in their future careers (Tomeček, 2009). Modern educational trends involve the teacher and school developing key competencies concurrently (Hučínová et al, 2007). Competency Based Education, which emerged in the United States in the 1970s, focuses on the outcomes of learning. It addresses what learners are expected to do rather than what they are expected to learn (Richards and Rodgers, 2001). Learning processes should develop in close cooperation with the requirements of the market. (Modéer, 2012). The data implications of competency-based educational programmes are important both for evaluating programmes and for conveying meaningful information about students' performances (Voorhees, 2001). Various research studies points out the fact that students are not able to think well in the working environment. Although the curriculum must present the necessity to develop competencies in the courses, some students learn texts by memorisation or there are teachers who transmit new theory to students through dictation. According to Andrawes (2011), students should acquire the ability to perform specific behaviour connected with the pedagogic activity in the learning process.

All the above mentioned components can be summarised under the heading of a common concept – key competencies. The definition of key competencies should be brief, clear, and accurate. It is a matter of a set of knowledge, skills, abilities, values and attitudes. To

elaborate this definition, knowledge means absorbed information, whereas skill means the appropriate usage of knowledge at the proper time and in the proper place. Various kinds of thinking belong under the heading of abilities. Values are a phenomena and things that create meaning for an individual. Attitude means the reaction of an individual to a situation. There are many individuals who do not have the proper ratio of these elements. Some people lack logical and creative thinking; others use inappropriate knowledge, which can result in difficulties finding employment. Communication is a key competency. The ability to communicate is a vital ladder component to of all career and personal development. Without sufficient communication skills it is possible that there will be little upward movement (or, increasingly these days, sideways) (Ellis, 2009). Communication is the foundation of all management and employee development (Schwartz, 2001). Communication is a vital part of our daily routines. Experts tell us that 70-80% of our working time is spent in some form of communication (Worth, 2009). The focus on communication competencies is clearly due, in part, to the fact that much communication is a pragmatic enterprise directed at accomplishing an array of practical tasks (Greene and Burleson, 2003). The importance of upward communication has traditionally been viewed from the perspective of management and the organisation. Most employees have trouble at one time or another with upward communication. For many employees, this causes numerous problems (Green and Knippen, 1999). 'Communication competency is defined as social behaviour that is perceived as relatively appropriate and effective for a given context' (Samovar, Porter and McDaniel, 2011: 424). Communication can take on different forms and occur in different contexts. A basic distinction in all human communication is between verbal (language-based) and non-verbal communication. In terms of verbal communication, we can communicate by ourselves or with others (Berry, 2007). When we communicate our thoughts without using words, we communicate non-verbally (Sen, 2006). Many authors, for example (Balaji and Somashekar, 2009), structure communication competency into the following components: oral communication skills**,** presentation skills and listening skills. In schools, some subjects foster the planning of the development of communication competencies more easily, while others do not. According to Strohner and Rickheit (2009), representation methods have been defined as procedures that incorporate a particular communication reality and the relevant problems. The main problem students have with speaking is not planning what to say, but managing to say what they have planned once they are standing in front of an audience. Most master's degree students realise that spoken presentation skills are worth developing, but very few look forward to the opportunity (Davies, 2001). Other methods for the development of communication competencies in the education process include discussion, interviews, etc. (Thomas and Adair, 2003). For our study we chose a course in which new methods of education that support the development of competencies are utilised. One of them is communication competency which we will deal with in this article. The aim of this study is finding the relationship between total communication competencies and the results of traditional education (within theoretical tests) and whether this relationship is positive, which means that communicative students gain more points from the tests.

Materials and Methods

It was stated in the theoretical part of this article that there are courses that can develop key competencies. One of them is a course called "Sales and Vending Strategy of the Company". This course was planned to be taught by using several forms because of the development of more communication skills together, e.g. learning to listen to other people

during a presentation, to review situations objectively, to put oneself in the place of the speaker, to acquire the confidence to present in front of an audience and to learn to be critical and assertive. We try to test knowledge and communication competency during discussions, presentations and the activities of the students. We wish to determine whether the communication skills of tested students are somehow connected with their knowledge and efforts to study as shown in the score they achieved during the theoretical tests.

Sample

The research sample consisted of final-year students studying at the University of Economics in Košice, Slovakia, via a chosen sample of thirty-four students in one class. The students were anonymised for the purposes of the research. The data was obtained continuously in the 2011 winter semester. The research was carried out in 2012.

Methods

The students took two tests of a theoretical character during the course. From the first test they could gain a maximum of eight points and from the second test they could gain a maximum of seven points. For our purposes, we worked with the sum of both test scores – fifteen points. In addition to these points, the students could gain points in communication competencies divided into three groups. In the first and second groups, we measured the presentation of the term work and discussion during the presentation. The term work was oriented towards the application to business activities of the theoretical knowledge they had gained. We were interested in presentation and communication competencies, which were evaluated during the presentation and discussion by awarding of up to three points, so all together the students could gain six points from communication.

For the evaluation of the following competencies we used information gained from pedagogical minimum (attended by the evaluative). The information about how to evaluate has been provided during the studies by a psychologist and teacher of the field of didactics through various kinds of games, trainings and exercises, where the student was informed how to proceed during this kind of evaluation and upon what the student should focus. The presentation was measured by a teacher and we focused mainly on the students´ ability to present the main aim of their term work and to explain the problem they solved, and also their ability to captivate the audience (to attract the attention of the students) and their presenting behaviour (body language, expression tools, terminology). As they could receive three points for the presentation, we divided the evaluation of the presentation into 3 parts – 1. presentation and explanation of the aim and solved problem, 2. captivation of the audience, 3. presenting behaviour. Each part of the evaluation of presentation as communication competence was monitored and evaluated by one point – together they could receive three points. If the student passes all communication competences, it is possible to gain together three points. The discussion was evaluated also by three points and we evaluated mainly the following levels: the ability to give a clear respond with not changing the matter, to give arguments on the questions and the ability to explain the matter. Again, if the student passes all communication competences, it is possible to gain together three points. The third variable to be measured was an activity in which the students could express themselves and their opinions, be critical, argue, and ask relevant and logical questions. The students' group work was also part of the activity during the lessons, where they had to solve a given problem. The activity during the term was optional. The students could gain the points for their active behaviour during the whole term lasting twelve weeks. Assuring to have a chance to gain points during the term, the teacher had prepared the task for students and they could join. But during the presentation

of their schoolmates, there were also possibilities for the students to be active by: asking questions, expressing ideas, being critical. Also working within the group could bring the chance to receive some points. The teacher had to monitor the students and their activity or passivity during the lessons. Together for the activities, they could gain ten points. At the end we considered all three groups into the one named "total communication".
We used the Pearson´s correlation coeficient (level of significance, alfa=0.05) for the statistical processing, which shows us the power of the relationship of two numeric variables, that are continuous. It is a statistical measure of the strength of a linear relationship between paired data. In this research, we use Cohen's (1988) interpretation of effect size. A correlation coefficient of .10 represents 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. We used simple statistics too.

Purpose of the Research

The research, as we have mentioned, was realized among students during the "Sales and Vending Strategy of the Company" course. The aim was to identify the relationship between total communication competency – a sum of three types of competencies (the presentation of the term work, discussion, and activity), and points from theoretical tests from the "Sales and Vending Strategy of the Company" course. We transformed this aim into the hypothesis:
We assume that a relationship exists between total communication competency (the sum of presentation, discussion, and activity of tested students and their theoretical knowledge.

Results and Discussion

In this part we show the outputs obtained by using the SAS statistical program and the Microsoft Office Excel spreadsheet application.

Distribution analysis

First, we had to test the students so that we could correlate the variable. Below, Figure 1 (a histogram) shows us the percentage of points gained for theoretical knowledge during the "Sales and Vending Strategy of the Company" course. The x-axis shows the points awarded for theoretical knowledge and the y-axis the percentage of the students who gained these scores. From Figure 1 we can see that the highest percentage of students (30) gained points at the level of 12 and 13.2 points. It is evident that a lower percentage of students gained the lowest number of points – approximately 2.5% gained only approximately 7.8 points. All the students being tested were studying for their master's degrees at the faculty, which is why we expected considerably better results. At the same time, we had expected the learning process as a whole to be set for evolving the competencies which are mostly required by the market these days. It is insufficient that the students are focused mostly on theoretical knowledge when they study several subjects related to management and its branches (Romanová, 2014). At present, most examinations are designed in a way that requires students to learn a large amount of information, which will eventually be forgotten. This is not a problem specific to the university at which the research was conducted, but a problem of the education system.

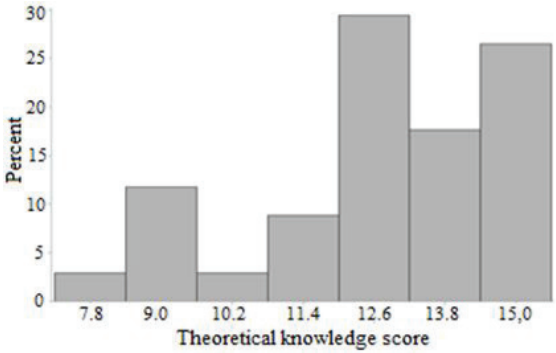

Fig. 1: Distribution analysis of the theoretical knowledge score

Correlation analysis

We present the second part of the research. The outputs from the SAS statistical program are shown in the tables and graphs. The results are very interesting considering the assumed contradictory correlation. Table 1 contains descriptive statistical data about the total communication competency and the theoretical scores of the students. We chose data such as mean and standard deviation, minimum and maximum values.

Simple Statistics						
Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
Theoretical score	34	12.51471	2.06792	425.50000	8.00000	15.00000
Total communication	34	10.80882	3.24741	367.50000	3.00000	15.00000

Tab. 1: Simple Statistics

When we were deciding which function to use, in the SAS program the data was loaded, and from this, the outputs were made. The largest R2 resulted from the linear function, therefore, this output is shown in this article.

The next table (Table 2) presents data obtained by calculating the Pearson Correlation Coefficient that describes the situation of full population because we analyse of dataset of all members of population. The p value stated in the table (0.0908) is used only for the descriptive purpose, to quantify the importance of the correlation coefficient, (we assume, that when we use the random sample, the coefficient will be significant). In this case we can see that the coefficient is not equal the zero, a moderate negative correlation exists (-0.29457). Therefore we can reject our hypothesis. It is not true that tested students who acquired more points from theoretical knowledge also acquired more points from the total communication competency. On the contrary, more communicatively competent students gained fewer points in the area of theory.

Pearson Correlation Coefficients, N = 34, Prob > |r| under H0: Rho=0	
	Total communication
Theoretical score	-0.29457
P value	<.0.0908

Tab. 2: Pearson Correlation Coefficients

The last graph (Figure 2) demonstrates the negative correlation, with a visible decreasing trend. The graph was created in the Excel spreadsheet application.

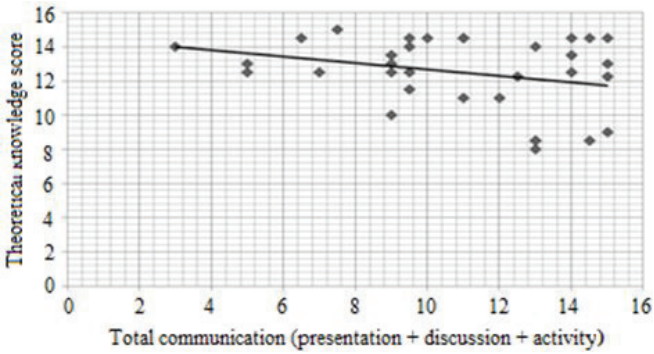

Fig. 2: Correlation between score and total communication

From studied literature is resulting the fact that the authors dealt with the communicative competences a long time ago. The oldest research, from which other reseraches were developed, was from the year 1982. It says that communication competence is not the same as the communication performance (McCroskey, 1982). According to him, many studies of children show, that children know more, than they can say. In comparison to our results it is also obvious, that the students, who have better results in writing part of communication research, don´t show the equal level of oral communication and vice versa. More institutions started to deal with the evaluation of communication competences. For example, the institution NEFR-NELSON in England, which focused on verbal competences (namely verbal understanding and critical thinking skills). The research, which was realized by Romanová (2013) in Slovakia on 140 students finishing their studies, evaluated verbal competences in relation to their gained academic average during the whole studies. The research brought the results that according to Pearson´s correlation coefficient (0.14759), there is no a strong relation between the two variables. For verbal competences, the students gained not too much points, which means that the students are not prepared for working interviews of the type of assessment centers, which are widely spread in the companies called "Big Four".

The negative influence for the theoretical results has also an increasing number of the students working during their studies, and that is why they do not pay enough attention for the preparation for the theoretical subjects – this is our own experience. It is also interesting to point out the fact that the schools accept a huge number of new students even if they do not attend any interview. From this reason, some students attending the educational process have not sufficient conditions for the type of study. The effort to acquire the theoretical knowledge supposes the interest of a student in the study and desire to have the knowledge. It influences the effort and time that is spent for gaining knowledge, and the theoretical knowledge score depends also on the remembered knowledge. Of course, not all the students have the same memorizing skills. The points for theoretical knowledge were influenced by the time of their preparation for writing tests and memorizing.

Conclusion

Each section of the labour market requires its workers to have gained knowledge and support from their education (Navrátilová and Romanová, 2014). Unemployment in the country continues to increase, and most students are forced to travel abroad, where it is difficult to find a job, in part because the students of other types of schools in different

countries (with a focus on a competency-based learning process) are better prepared for practice and are more creative and communicative in interviews at assessment centres, which currently focus on monitoring various competencies (Romanová, 2014). The aim of this study was to find out how students' knowledge and communication competencies are developed. The study was conducted in the "Sales and Vending Strategy of the Company" course, which reflects the new concept of education. The second idea discussed in the paper is finding the relationship between total communication competency and the results of traditional education. We obtained this by means of testing students. We tested their theoretical knowledge and total communication competency, which we relate as the sum of three competencies - activity, discussion and presentation. By calculating the Pearson Correlation Coefficients, we learned that a moderate negative correlation exists (-0.29457) between the variables. The study produced very interesting results. On the basis of the results we can deduce that the group of students who participated in the negative correlation were not interested in writing theoretical tests, as we assumed. On the contrary, they are probably interested in the newer forms of education such as discussion, activity, presentation, etc., which means that we can reject hypothesis. For group of tested students we can conclude that to be good in communication does not presume to also be good in theory, and vice versa.

The very mention of competency-based learning leads to a range of responses. Reasonable people may argue that a total alignment with external demands for competencies may subvert the purposes of higher education. Still others may not agree on what parts of a student's total educational experience should be competency based. There are no uniform answers to these concerns, as institutions across higher education operate in many different environments and circumstances (Voorhees, 2001). Because teachers are one of the main inputs in the educational process, their efforts should elevate the quality of instruction and the performance of students with high professional standards because their role is to prepare and develop human resources in scientific, intellectual, cultural, economic, and social aspects (Andrawes, 2011). Many students rely on their ability to discuss, to say something during their courses, and to show how promptly they can think. This approach is correct, but some of them often remain in this position and do not have sufficient interest in working hard on memorising knowledge, preparation from lesson to lesson, and looking for new information to learn. That is the result of our measurement of the students we selected. For this reason we suggest using more modern practices in education, such as simulations, case studies, and discussions to encourage students to communicate more among themselves, to foster critical discussion and expressing opinions, and, finally, to increase their creativity by asking them to suggest solutions to problems when working in pairs or groups. We also suggest motivating students to learn more and to study the theoretical background, because without this they will not have a holistic view of the topics being discussed.

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PERSPECTIVES OF COMMUNITY EDUCATION WITHIN THE CZECH RURAL AREAS

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Abstract

The paper is based on the concepts of the learning society and community-led local development. It is particularly focused on community education in rural areas of the Czech Republic. The research question is connected with the creation of objective and subjective conditions for the functioning of Rural Community Schools. The aim is fulfilled through secondary analysis of publicly available data produced by these schools about the activities of Rural Community Schools, and evaluation of information about the state of rural community education, received from involved organisations in the public sector. In addition, primary research was carried out by interviewing techniques using the answer sheet for semi-standardised interviews. The results of the study show that Rural Community Schools are of a pioneering nature in the Czech Republic, with only a minor part of their activities focused on the issues of local development. These perspectives stem from their incorporation into local developmental strategies.

Keywords

Community education, community-led local development, learning society, rural community school, rural municipality

Introduction

The interest of the authors in the issue of rural community education is based on the concept of the learning society (Maskell and Malmberg, 1999; Lam, 2002; Morgan, 2007) and also on concepts dealing with the activation of endogenous potential in rural development (Atterton, 2007; Lee et al, 2005; Shucksmith, 2000). Intersecting the basic ideas of these concepts are the theories which accentuate local sociocultural potential and the ability to learn through cooperation as important development sources (Amin and Thrift, 1995; Hudson, 2007; Lundvall and Nielsen, 2007). From the practical perspective, this interest of the authors is supported by realisation of the Community-led Local Development (CLLD) concept, which is implemented in the practice of rural development within the 2014– 2020 programming period (EC, 2014).

Because the school is a traditional social and cultural institution in rural municipalities, we assume that the position of rural schools could be strengthened by using the community education approach. This approach assumes innovation of content, form and methods of the educational process and an extension of adult education (not only for inclusion in the labour market and personal growth, but also for adults‘ participation in local development). However, the latest strategic documents of the Czech Educational Policy[1] state that the tendencies of „open schools towards the world outside the schools“ are managed by educational institutions in a way which is inferior to that of other institutions

[1] Guidelines Strategy of Educational Policy to 2020 (MEYS, 2013a) and Information Material to Guidelines Strategy of Educational Policy to 2020 (MEYS, 2013b)

dealing with education in the support of active citizenship (both private and public sector institutions).

From the study of results in the professional literature (Coleman, 1987; Heers et al, 2011; Sanders, 2003), community education is considered as a modernisation trend in education. Innovation is mainly focused on the wider social environment — education of juveniles and adults on the basis of social networks, with the aim of social inclusion and strengthening of social capital (as an individual and also as a collective entity). Although the concepts of community schools are inconsistent and their application differs in various countries, their common feature is a recognition that the educational process realised within the locality results in a significant advantage in the increase of the development potential of the locality.

The paper, based on secondary research and the first stage of primary research, deals with the ensuing research question — how are the objective and subjective conditions created to ensure that Rural Community Schools are able to fulfil their mission in rural areas? The main aim of the paper is to bring first structured results about newly established institutions – Rural Community Schools (RCSs) in the Czech Republic (they have been established since 2005 and the most of them since 2010). The attention is also paid on reasons and ways in which are these institutions involved in CLLD.

Materials and Methods

The aim is fulfilled through secondary analysis of two types of data:

a) publicly available data about the activities of RCSs, produced by these schools;

b) evaluating information about the state of rural community education, produced by involved organisations in the public sector.

In addition, primary research at the pilot stage is used for the fulfilment of the objective.

ad a) There is not any common methodology for the compulsory content of information produced and published by RCSs about themselves in the Czech Republic. Due to this fact 16 additional telephonic surveys were conducted to obtain basic information about activities of RCSs, whose public websites are outdated and contain no relevant information. Because one of the RCSs does not meet the condition of leading mainly educational activities, this RCS was excluded from the basic set for ensuing research.

ad b) Materials containing information to evaluate the state of RCSs were chosen with regard to their content (timeliness and perspective range) and their producer (direct connection to RCSs in advisory, methodical and contact activities). Materials were studied from the Ministry of Education Youth and Sports of the Czech Republic (MEYS), as a superior part in the hierarchical structure of the educational sphere, and from the National Network of Rural Community Schools (NNRCS), as coordinating organisation in the network structure. The secondary analysis of these materials forms contextual background for the evaluation of the results obtained by primary research.

The pilot stage of primary research was carried out by interviewing techniques using the answer sheet for semi-standardised interviews. The interviews consisted of the issues of the activities and promotion of RCSs within the locality (from the supply and demand point of view); partnership and participation of RCSs in municipal development strategy; conditions for functioning of the RCS within the municipality (structured according to two dimensions: subjective – objective, endogenous – exogenous) and recommendations with regard to perspectives of RCS within the municipality. For the pilot study, 5 very active and 5 little active RCSs were deliberately chosen.

The aim of this part of the study is not only the collection of „soft data“, but also the

evaluation of whether the created interviewing tool is also possible to be used in a research survey without the presence of an interviewer. If this is possible, the authors would aspire to a complete research survey, since the basic set consists of 25 units (this paper is focused on some important results obtained by the pilot stage of the primary research).
The data produced by primary research (using semi-standardised interviews – each of them takes about 90 minutes) have qualitative character and could not be processed by statistical procedure. The content analysis of these data will be used to create hypothesis for ensuing quantitative research.

Results and Discussion

Thirty-seven Rural Community Schools are registered[2] in the Czech Republic. They operate within municipalities with a population of between 64 and 5 490 inhabitants (the average is 1 390 inhabitants). Publicly available information is provided by these RCSs on their own websites (48.6 %), on municipality websites (27 %), or on websites of the local school (16 %). The provided information is not relevant and up-to-date (or is completely missing) in one-tenth of cases. These institutions have been established in the Czech Republic since 2005.[3]
According to the indicator of the number of courses provided within the 2014/2015 year (see Tab. 1), it is possible to identify 6 very active RCSs (i.e. 16.2 % which provide 8 and more courses); 13 moderately active (i.e. 35.1 % which provide 3–7 courses); 6 less active (i.e. 16.2 % which provide 1–2 courses) and 12 inactive RCSs (i.e. 32.5 %). The subset of inactive RCSs consists of a majority of RCSs (8, i.e. 66.7 %) with discontinued operations and a minority of RCSs (4, i.e. 33.3 %) with interrupted operations.
One of the most common reasons for inactivity is the end of the project within which the RCS was established, which is connected to the lack of resources for subsequent funding. The absence of a Community Coordinator (responsible person for RCS) and the lack of interest in the existence of the RCS within the municipality are rarely mentioned as further reasons for inactivity. These results point out low sustainability of the projects focused on RCSs establishment. Thereafter it is possible to deduce the low efficiency of funds invested in these projects.
From the total number of municipalities where RCSs have been established since 2000, this institution is functional in 0.64 % of cases considering all the registered RCSs, and in 0.45 % of cases considering the RCSs which realised the activities for which they were established during the 2014/2015 period. The size of the municipality is not considered as an important factor for the inactivity of RCSs (see Tab. 1) — one half of the very active RCSs is located in municipalities with up to 1 000 inhabitants; RCSs with discontinued operations are approximately equally divided between the municipalities above and below the average scale of the municipalities in which this institution was established (i.e. 1 516 inhabitants). The question, if and in which way is municipality size related to activity of RCSs, could be connected with diversity of actors involved and their ability to cooperate within CLLD – the municipality size could be potential of actors diversity. These facts will be subject of ensuing research.

[2] According to valid rules (NNRCS, 2011), these schools are located in municipalities of up to 5 000 inhabitants (the specified size exceeds RCS in Telč – about 9.8 %). The research within one of the localities confirms that only one Community Centre operates there. It is a private initiative without any relation to the municipality or local school. This case was excluded from the researched set.

[3] Half of the 10 RCSs examined by primary research in detail were established in 2010.

Region (NUTS 3)	Number of RCSs	Average No. of Courses 2014/2015	Average RCSs Municipality Size
Vysočina	11	5.45	1417.55
South Bohemian	5	2.80	2144.40
Moravian-Silesian	3	4.00	1828.33
Pardubice	3	5.33	2196.33
Pilsen	7	0.71	1666.57
South Moravian	2	0.00	274.00
Olomouc	3	7.67	794.33
Hradec Králové	1	1.00	703.00
Zlín	1	4.00	623.00
Central Bohemian	1	0.00	1803.00
Total	37	3.65	1516.62

Tab. 1: Number of realised courses and average RCSs municipal size

Focusing attention on the content of the courses and other realised activities of RCSs, it is possible to identify three basic types of course (see Tab. 2). These are the courses focused on the personal growth of participants (A); courses to increase opportunities on the labour market (B), and courses with the mission of promoting active citizenship (C).

Region (NUTS 3)	Relative Frequencies from the No. of Courses within the Region (%)			Relative Frequencies from the Total No. of Particular Type of Courses (%)			Total
	A	B	C	A	B	C	
Vysočina	42.20	33.95	23.85	35.39	45.68	50.98	41.60
South Bohemian	56.52	43.48	0.00	10.00	12.35	0.00	8.78
Moravian-Silesian	100.00	0.00	0.00	1.54	0.00	0.00	0.76
Pardubice	63.89	16.67	19.44	17.69	7.41	13.73	13.74
Pilsen	37.93	20.69	41.38	8.46	7.41	23.53	11.07
South Moravian	0.00	100.00	0.00	0.00	1.23	0.00	0.38
Olomouc	59.38	28.12	12.50	14.62	11.11	7.84	12.21
Hradec Králové	58.82	41.18	0.00	7.69	8.64	0.00	6.49
Zlín	44.45	33.33	22.22	3.07	3.70	3.92	3.44
Central Bohemian	50.00	50.00	0.00	1.54	2.47	0.00	1.53
Total	49.61	30.92	19.47	100.00	100.00	100.00	100.00

Tab. 2: Types of realised courses – relative frequencies

Courses focused on personal growth predominate, with a proportion of 49.6% of all the courses organised by RCSs — with Art, Ceramics and other handicraft activities prevailing. The second most represented type of course are courses to increase opportunities on the labour market, with a proportion of 30.9% — with Language and PC courses the most popular. Courses promoting active citizenship have the lowest proportion of 19.5%. The structure of the latter type of course is the most varied. These mainly include various meetings of inhabitants and their mutual activities to support the local identity of residents, in liaison with the municipality. Common courses are also those supporting the perception of the significance of local products in rural development and courses focused on the activation of different groups of inhabitants — mainly seniors, and young mothers with children. In addition, activities focused on community negotiations on local problems are represented to a lesser extent.

There are significant regional differences with regard to the types of courses organised. No course was organised to support active citizenship in the South Bohemian, South Moravian, Hradec Králové, Moravian-Silesian or Central Bohemian Regions (NUTS 3). On the other hand, the proportion of this type of course is 41.4 % in the Pilsen Region, 23.9 % in the Vysočina Region and 22.2 % in the Zlín Region. These significant differences stem mainly from different methods of the establishment of RCSs within specific regions, their collaboration and networking within the regions and, in individual cases, differences also stem from the personal characteristics of the Community Coordinator.

The last part of the results (mentioned in this paper) consists of chosen findings resulting from our pilot study on the differences between very active and less active RCSs. The results chosen for this paper are related to relations between actors of RCSs (Community Coordinators), activity of RCSs and incorporation of these institutions into CLLD. It seems that the level of activity of RCSs is not influenced by the fact whether the Community Coordinator is an individual or a collective body (group of 3–5 persons). Within both types of RCSs (according to the level of activity) courses are organised focused on local development, which is a stable quantity. The level of activity is also not dependent on the fact whether the courses organised are intended for mixed groups of juveniles and adults.[4]

Other important findings refer to differences. Community Coordinators of very active RCSs more often have a university education with pedagogical specialisation. In their opinion, the role of the RCS in the municipality is increasing. This could be documented by further facts — incorporation of RCS into local development strategy; not decreasing the number of participants in the courses, and increasing the interest of the local population in the RCS. This is accompanied by a statement of good cooperation with the municipality and the awareness of inadequate cooperation with local entrepreneurs. It is valid for the group of very active RCSs that they do not place emphasis on a close connection to the local school, but they require the professionalisation of the RCS (professional employees with positive motivation; the requirement of a parent organisation to provide information, advisory and methodical support). In general, these RCSs place more emphasis on subjective conditions for the development of RCSs, both on local and supralocal levels.

On the other hand, it is a more typical requirement of less active RCSs to resolve objective factors — mainly financial resources and the institutional connection with the local school. If the Community Coordinators of this group of RCSs suppose that the RCS could become a local centre of education, it is possible only through a close connection with the local school and increasing the attractiveness of the courses from the perspective of their contents and fees.

Conclusion

The paper is focused on the issue of the renaissance of rural education through the concept of community education within the framework of CLLD. The issue is topical due to the consideration of the closure of schools within small rural municipalities and also due to the criticism addressed towards these schools. The criticism is based on the fact that schools are dealing in a way that is inferior to that of other (new) educational institutions regarding new tendencies in education — which are mainly focused on new contents, forms and methods of adult education.

The basic chosen results of the pilot study in one-quarter of the cases imply that these institutions are still of a pioneering nature in the Czech Republic. A minor part of their

[4] While Lauermann (2008) states that (compared to urban community schools) a typical problem, specifically of RCSs, is that the courses are intended either only for juveniles or only for adults.

activities is focused on issues of local development. Community Coordinators see perspectives of these institutions. This assessment is based on the fact that RCSs are incorporated into local developmental strategies. Weaknesses are seen more as subjective than objective conditions for development. There are mainly problems in cooperation and promotion on the local level. An even more sensitive issue is supralocal cooperation — the lack of representation of the interests and cooperation with MEYS.

The tool which has been verified by this pilot study could be used for a complete research survey of RCSs. The authors plan this for the 2015 year. The most sensitive issues will be researched by an in-depth survey using interview techniques.

Acknowledgements

The paper was supported by the project of the Internal Grant Agency of FEM CULS in Prague, No. 20141027, entitled „Appreciation of Natural and Sociocultural Potential of Rural Areas through Activities Contributing to Social Inclusion“.

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ON THE STATISTICAL LITERACY OF PROSPECTIVE NATURAL SCIENCE TEACHERS: A PRACTICAL MODEL

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Abstract

In any academic discipline, students should acquire a variety of skills during their studies, including problem-solving skills. When a problem comprises statistical content, one's ability to solve that problem appears to require a certain statistical literacy as well as familiarity with particular statistical principles or methods. Succinctly put, statistical literacy is about the ability to understand and communicate statistical information. This contribution reviews the evolution of the concept of statistical literacy and discusses its meaning and purpose in a context of natural science curricula. Subsequently, through the lens of cognitive load theory, we conclude with a practical model aimed at helping prospective natural science teachers to develop statistical literacy.

Key words

Statistical literacy, natural science teachers, cognitive load theory

Introduction

One of the core characteristics of the information society we are living in is an ongoing exposure to numbers and charts. We attempt to make sense of the multitude of quantitative information reaching us through a variety of media and we communicate some of that to others. Doing this appropriately requires some *statistical literacy*. Put briefly, statistical literacy is about the ability to understand and communicate statistical information. Using these skills requires basic knowledge of key statistical principles and methods.

This contribution reviews the evolution of the concept of statistical literacy and discusses its meaning and purpose in a context of natural science curricula. Subsequently, through the lens of cognitive load theory (Sweller, Ayres and Kalyuga, 2011), we conclude with a practical model aimed at helping prospective natural science teachers to develop statistical literacy.

The first goal of the paper is to show level of knowledge of statistical concepts of university students. The second goal is to describe how to teach statistics having regard to cognitive load theory. By merging both goals some questions arise: Why are basic statistical concepts unknown for students? Do we teach statistics correctly? How to improve knowledge of students?

How the concept of statistical literacy evolved

The concept of statistical literacy has been widely discussed and various researchers have sought to establish a working definition of it (for an overview, see for instance Hovermill, Beaudrie, and Boschmans, 2014).

In the early 1990s, Wallman (1993, p. 1) defined statistical literacy as "the ability to understand and critically evaluate statistical results that permeate daily life, coupled with the ability to appreciate the contributions that statistical thinking can make in public and private, professional and personal decisions."

Watson (1997) then observed that definitions like the just mentioned involve both a literacy component and a statistical component, and that statisticians tend to place more emphasis on the statistical rather than on the literacy component. In that line, Watson (1997) proposed to focus rather on the ability to understand text and the meaning of statistical information in that text.

Later definitions, however, appear to move back towards a more prominent role of the statistical component, through a focus on: 1) critical thinking about statistics as evidence in arguments (Gal, 2000; Shield, 1999); 2) understanding the statistical language: words, symbols and concepts (Garfield, 1999); and 3) an understanding of statistical concepts and reasoning at the most fundamental level (Snell, 1999).

Analyzing some of the views just mentioned (Gal, 2000; Garfield, 1999; Snell, 1999; Watson, 1997) and yet other broad views on statistical literacy, Rumney (2002) concluded that the concept or, as she points it, phrase of statistical literacy is not defined consistently. She argues that the phrase statistical literacy is too broad and instead proposes two distinct phrases that refer to two distinct learning outcomes: statistical competence and statistical citizenship. The former refers to basic knowledge underlying statistical reasoning and thinking, whereas the latter revolves around "developing the ability to function as an educated person in today's age of information" and "may very well require high order statistical reasoning and thinking."

Rumney's proposal points at a potential conceptual difficulty to distinguish between statistical literacy, statistical reasoning, and statistical thinking; these concepts appear to have considerable overlap. Garfield, DelMas and Chance (2003) attempted to provide working definitions of the three concepts, that were adopted by Ben-Zvi and Garfield (2004, p. 7) and are still used today.

1. *Statistical literacy*: includes basic and important skills that may be used in understanding statistical information or research results.
2. *Statistical reasoning*: may be defined as the way people reason with statistical ideas and make sense of statistical information.
3. *Statistical thinking*: involves an understanding of why and how statistical investigations are conducted and the "big ideas" that underlie statistical investigations.

This set of definitions and aforementioned definitions taken together, one can conclude that statistical literacy, reasoning, and thinking are overlapping concepts that operate at two levels, namely the ability to *understand* and the ability to *communicate* statistical results. For simplicity, we speak of statistical literacy at these two levels in the remainder of this contribution.

Methods and Results

For answer the question what concepts students of biology and mathematics education from Charles University in Prague know were arrange survey. The sample of 364 students of biology and mathematics education from Charles University in Prague was asked to rate their knowledge on a three-point scale (0: I have never heard of this concept; 1: I have heard of this concept, but I don´t know what it means exactly; 2: I know the concept and can use it) the following concepts:

- mean
- arithmetic mean
- probability
- median
- random variable
- hypothesis testing
- coefficient of correlation
- mode
- standard deviation
- dispersion
- relative frequency
- quantile
- quartile
- interquartile range

Students were asked for fill in short questionnaire during the lecture so the response rate is 100%.

Study grade	Relative frequencies
1.	37%
2.	26%
3.	15%
4.	12%
5.	10%

Tab. 1: Relative frequencies of study grades of respondents

Sample covers all grades of university (see Tab. 1). Almost 64% of respondents are from 1st and 2nd grade of study. Rest of respondents is approximately uniformly distributed among others grades.

Relative frequencies of answers for each of the concepts are presented by Fig. 1.

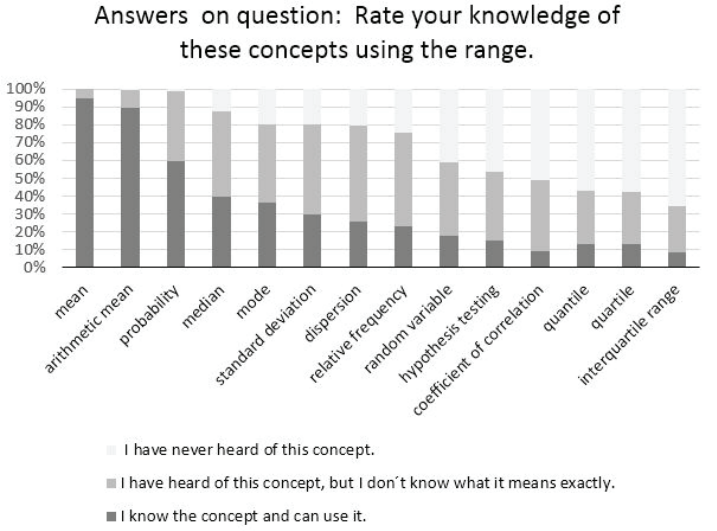

Fig. 1: Students answers on rating their knowledge of concepts

There is relative frequencies of answers on rating knowledge of several concept in Fig.1. The most known term is mean (95%). Interesting is that only (89%) know and can use arithmetic mean. Only 60% knows and can use term probability. Although median and mode are very used terms in media less than 50% knows and can use median (39%) and mode (36%).

The most known term appears to be the mean (95%), followed by the arithmetic mean (89%). Further, only 60% of respondents indicated they know and can use the concept of probability. Finally, frequently used concepts like median and mode are apparently not fully grasped by the majority of the students.

Discussion

The survey shows that there is poor knowledge of basic statistical concepts among students of teaching mathematics and biology. Concepts as median and mode should know all of the university students, because it is very commonly used in media. For example it is used in election polls. Also this statistics politicians use like arguments. Not only in politics but also in verification of researches are usually use this concepts. The increase of numbers in these days is huge and society should understand to numbers and statistics to better orientation in the world. But us it is evident from little survey made by authors of this paper asked students are not sure about some basic concepts which are commonly used. How to improve that? One of the possible way is to consider changing current methods of teaching. There are some improvement:

First, cognitive load theory should be consider in preparing curricula. In cognitive load theory, learning is the integration of new information elements into cognitive schemas stored in long-term memory (Sweller et al, 2011). Novices have very premature schemas, if any, and therefore need instructional support to avoid that students engage in ineffective learning strategies. Simultaneously, support that benefits novices tends to become redundant as students develop better schemas and may at that point even undermine learning.

Second, today statistics is teach thematically and dogmatically for non-mathematical study fields. First topic is descriptive statistics which take no longer than few weeks in semester. For understand to this topic well student needs to repeat it and have a complexity. After that they can communicate their findings to others. But usually after this few weeks of descriptive statistics teacher goes to another topic. The effect of that thematic and dogmatic process is that after the exam student forget quickly because he or she didn't fix the knowledge. There is consensus among teachers of statistics that introductory courses in statistics should raise students' awareness about types of data they encounter in their daily lives and prepare them for a career (Rumney, 2002). What the latter means, appears to depend on the aims of a curriculum. If the aim of a curriculum is to prepare students for a scientific career or another type career that involves understanding and communicating statistical results, statistics education should help students to become familiar with tools used by professionals pursuing such a career. For this improvement authors of this paper prepared a practical model:

Towards more statistically literate natural science teachers: A practical model

Learning is optimal if students need to invest as little effort as possible into *how* information is presented to them and use their available cognitive resources to deal with the *intrinsic content* of information (Leppink, 2014). The latter can be expected if the complexity of the content is properly tailored to students' prior knowledge (i.e., existing schemas). To achieve this, three steps are needed.

1. *Start with worked examples of problems that involve basic concepts and gradually fade that support towards autonomous problem solving*.
   Have students start with basic concepts like arithmetic mean and standard deviation in worked examples or completion tasks and gradually fade the support towards autonomous practice with these concepts.

2. *Repeat step 1 for higher-complexity concepts.*
   Repeat the approach taken in the first step for concepts like Pearson's correlation coefficient and, at higher levels, semi-partial and partial correlation and other concepts.
3. *From understanding to communication.*
   Once the first two steps have resulted in a sufficient understanding of a coherent set of concepts, one can challenge students to communicate findings from a simple study, later on a somewhat more complex study, and at some point a thesis. Again, it is important to start at each level with sufficient support and relatively low complexity to then gradually decrease support and gradually increase complexity.

With this approach, students can receive the amount of instructional support they need at any given time, and they gradually develop more enhanced cognitive schemas that are needed first to understand statistical information and subsequently communicate that information.

Both the ability to *understand* and the ability to *communicate* statistical results require students to go beyond common sense and common misconceptions about concepts like probability or graphical concepts, and an ability to communicate can be expected only once a certain understanding has been reached. In fact, one may distinguish three levels in statistical literacy in this context: 1) nonprofessional common sense; 2) conceptual understanding; and 3) professional communication of statistical information and, whenever necessary, explanation of concepts. Teachers and researchers in the natural sciences have to arrive at the third level. In both understanding and communication, one can distinguish between rather easy concepts and relatively complex concepts, with the latter typically building forth on the former. For instance, to come to a proper understanding of Pearson's correlation coefficient, one needs some understanding of the concepts of arithmetic mean, standard deviation, covariance, and standardization.

Finally, various studies have demonstrated that an understanding of statistical concepts does not come naturally and at first requires teachers to provide a sufficient instructional support – through for instance worked examples or completion tasks – that is then gradually faded as students advance (Leppink, Broers, Imbos et al, 2012a, 2012b; Leppink, Paas, Van Gog et al, 2014). This finding runs counter to popular belief that students learn best by finding their way autonomously yet is easy to explain in the light of cognitive load theory. Teaching with regard to cognitive load theory can improve the process, extend and deep knowledge of statistical concepts. If the aim of teachers of statistics is improve statistical literacy they should make some changes toward this aim.

Conclusion

Responses of the 364 students indicate that knowledge of basic statistical concepts is somewhat on the poorer side. Only mean and probability are concepts that more than 50% can use. Other concepts for example mode and median which are very used in media are less known.

Authors of this paper are persuade that statistics is teach thematically and dogmatically. Every week is discussed new topic and students of non-mathematical study fields cannot understand well to the topic. Cognitive load theory can provide a way how to improve that negative trend through three level concept designed by authors of this paper.

This paper introduces a practical three-step model of improving knowledge of students: 1) to start with worked examples that involve basic concepts and gradually fade that support from examples towards autonomous problem solving; 2) to repeat the former

for higher-complexity concepts; and 3) to make the transition from understanding to communication. This model emphasize that education on the use of statistical concepts should be properly spaced throughout the curriculum rather than comprised within a limited period of time, as frequently happens in contemporary education.
The survey showed interesting results. Authors want to repeat the same survey in next year to compare knowledge of students in time.

Acknowledgements

The study was supported by the Charles University in Prague, project GA UK No. 341115.

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ADHERENCE OF LOGISTICS EDUCATION PROCESS TO CURRENT BUSINESS REQUIREMENTS

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Abstract

This paper is focused on analyzing an education process in the area of Logistics which is provided within the minor specialization Logistics - International Transport and Freight Forwarding of the master program at the Faculty of Business Administration at the University of Economics, Prague. The main aim is to provide analyses of this process from perspectives of graduates and job market and also to identify its strengths and weaknesses. Proposed findings are based on the questionnaire survey conducted among graduates of the minor specialization. Having knowledge about process and its output quality belongs to the key competitive advantages and which could be based on customer satisfaction. This type of education process is not an exception. Hence, focal group of graduates is those that graduated from the university more than a year ago so that they can adequately appraise impact of their studies on their success on the job market.

Keywords

Alumni, logistics, job market penetration, competences

Introduction

Continuously growing competitiveness among companies leads to increasing pressure on recruiting and retaining highly qualified and skilled employees. Such necessity has initiated never-ending search for great source of qualified and flexible employees. Great potential has been uncovered among undergraduates and young graduates. In addition to that, gradual demographic changes cause decline of number of students entering bachelor and master programs. Hence, fierce competition among educational institutions and reduced funding (Lutz, Birou, 2013) have contributed to higher concerns about the quality of their educational process shaping directly the quality of their graduates.

Thus, universities have started establishing closer cooperation with local and global corporations. It involves varied form e.g. establishment of alumni clubs, invitation of successful alumni and alumnae to lessons as a guest speakers, organization of field trips, monitoring of impact of educational process on alumni and alumnae professional success etc.

Therefore, quality of educational process is a topical issue of today. Thus, "quality" and "effectivity" in university education and its impact on success of graduates on job market has become critical. It has been of interest in several researches e.g. IPN Kvalita or Reflex 2006, 2010, 2013. This issue is analysed from different perspectives e.g. Průcha (2014), Starý (2012), Šimonová (2005), Mužík (2013), Kalnický, Uhlařová and Haplová (2012). Education process quality could be evaluated from different perspectives. Drule et al. (2014) suggest that it is crucial to emphasize the importance of an education quality assessment from the students´ perspective and also to consider pedagogical staff and study program quality appraisal. Ionică et al. (2009) use EFQM model having been

established by the European Foundation for Quality Management and representing Total Quality Management in assessment of training and education process quality. However, the first quite complex framework of service quality appraisal was formulated by means of conceptual model of a service quality called SERVQUAL defined by Parasuraman, Zeithaml and Berry (1985). Effectivity of SERVQUAL in measuring university education quality was proved by Calvo-Porral, Lévy-Manging and Novo-Corti (2013). SERVQUAL is a method used for measuring service quality based on identification of gaps between customer service expectations and its provision by means of five gap categories: tangibles, reliability, responsiveness, assurance and empathy (Parasuraman, Berry and Zeithaml, 1991).

The area of education in Logistics is not exception, thus it is researched by e.g. Lancioni, Howard and Smith (200l) or Fawcett and Rutner (2014). Rapid changes in practice and continuous developments in research of logistics and supply chain management are challenging educators to upgrade their courses due to gap between education and practice in the area of market relevance, professional skills and research capabilities of students (Hoek, 2001).

Empirical study of logistics programs and courses based on analyses of publically available syllabi is provided with the outcomes about degrees, course and program specialization of logistics and supply chain education (Wu, 2007).

Mayers *et al.* (2004) conducted a research among mid-level logistics professionals in order to identify predictors of future job success. Thus, it was analysed from the perspective of business and the outputs confirmed necessity to orient on job-related skills.

Lutz, H., Birou, L. (2013) used content analyses of logistics course syllabi to identify gaps between education and industry needs.

Concerning the variety of above mentioned researches it is obvious that unified system of logistics education process has not yet been established. The reason for that could lay in ambiguous definition of education process customer of which satisfaction should be monitored and evaluated within quality control. Either students, their parents or employers are considered to be customers of education process. Hence their expectations are different. Students want to have a competitive advantage over peers when they enter a job market after graduation or closely before that, parents want success of their sons or daughters to gain appropriate value for invested money into education of their descendants and finally employers require fresh and qualified labour which would not needed to be long-termly and costly trained to provide adequate performances (Ferrin et al., 2001).

The proposed paper is dedicated to analysing educational process quality by combining interest of all three aforementioned customer categories. The focal educational process is of minor specialisation Logistics-international transport and freight forwarding organized by the Department of logistics at the University of Economic, Prague. Representation of the education process customer requirements are formulated here by three pivotal areas: working in the focal area, job market penetration and salary. Thus, mutual satisfaction of the all three customer categories are expressed. Based on these three pillars hereinafter described conceptual model is built in order to assess quality of the education logistics process. The conceptual model encompasses six hypotheses which are here listed and the detail explanation is provided in the following parts of this paper:

H1: graduates of minor specialization Logistics-international transport and freight forwarding find their job in the area of Logistics or Transport.

H2: the minor specialization enables specialization of students across logistics and transport areas

H3: graduates can easily and quickly find a job
H4: graduates with longer work experience can more easily find a job
H5: minor specialization graduation has direct impact on great job market penetration in logistics and transport
H6: graduates of the minor specialization and who works in the logistics and transport is sufficiently financially honoured.
Hence, the model helps to identify gaps between what educational process provides and what is required by business on job market in the area of logistics and transport.
Before explanation of conceptual models essentials of the minor specialization of Logistics – international transport and freight forwarding is provided here. The minor specialization is organized and materialized by the Department of logistics and is a part of the master program at the Faculty of Business Administration. However, students of all faculties can sign up to this specialization which enables to produce great mix of knowledge, mostly IT and logistics, business administration and logistics or international trade and logistics.

Materials and methods

Research

The outcomes that are presented in this paper are based on a questionnaire survey conducted in July and August 2014 among graduates of the minor specialization Logistics – International Transport and Freight Forwarding. The targeted group were graduates that studied the minor specialization between spring term 2009/2010 to autumn term 2012/2013 so it comprises of 201 graduates throughout 4 years. Finally, 44 filled questionnaires were received and due to incompleteness and error 4 had to be removed. The questionnaire consists of multiple choice questions and open questions focused on the following areas: area and function of occupation, conditions of market penetration, impact of the minor specialization on success or failure on the job market and salary.
Proposed conceptual model is shown on Fig. 1 and outlines methodological flow by which the education process quality is assessed. The process quality is appraised by the rate customer satisfaction with the process outputs. Hence, three pivotal characteristics enabling process quality evaluation are defined: how and where the graduates succeed, how difficult their initial job market penetration is, what their initial month salary is and how it has changed throughout the years. These educational process KPIs are gained by verification of six scientific hypothesis which are more deeply explained hereinafter.
Concerning the fact that the aim of the presented research is to assess the educational process of the particular minor specialization without skewing the results by mixing graduates across the universities with specialization on Logistics and international transport in the Czech Republic, the authors have conducted the questionnaire research among graduates rather than among their logistics employers. When employers were interviewed their outcomes might reflect not only positive and negative features of graduates of the minor specialization but impression from all graduates that have applied there for job. This might occur as employers can rarely distinguish among graduates from different educational institutions (universities, faculties, specializations etc.) unless they studied there as well or such institution belongs to the best in the focal area.

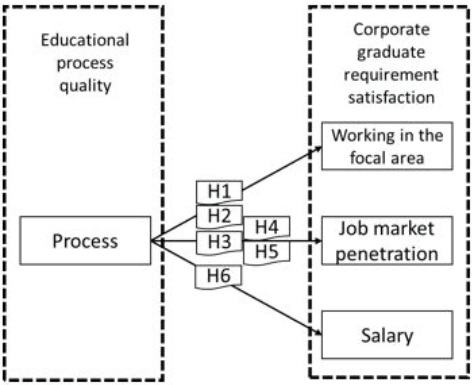

Fig. 1: Conceptual model

Working in the focal area

Fundamental aspect of educational quality is whether graduates can and want to find a job in a field which corresponds with the graduate profile of an educational profile defined by the particular program or specialization. When most of the graduates finally work in completely different business areas without any possibility to apply knowledge and skills gained during the previous educational process it indicates low quality of educational process they previously went through. Such process obviously failed to provide the students adequate orientation and understanding of corporate practice unlike to different competitive educational institution. The educational process quality could be defined here as: graduates work in the focal area, graduates work in different area but can make use of their knowledge and skill, graduates work in completely different area and can hardly use knowledge and skills gained throughout educational process. Two hypotheses are formulated to support this feature:

H1: graduates of minor specialization Logistics-international transport and freight forwarding find their job in the area of Logistics or Transport.

This hypothesis enables verification that students of the specialization can finally apply their knowledge in Logistics or Transport or identify if they rather go to work in to different field where they can just marginally apply their knowledge of logistics and transport. H1 is verified by means of respondents´ answers to the question in the questionnaire if a graduate works in the area of logistics or transport today. 2-sample t Test is applied to identify if the authors can prove with statistical significance that there are more graduates that work in logistics and transport than those graduates that work in different areas. When statistical significance wouldn´t be proved in that authors would apply 1-sample t Test to verify if more than 40% of graduates work in logistics or transport.

Such level is set because students of the minor specialization come from the different faculties and of the various major specialization. Thus, students of some major specialization cannot elaborate their master thesis and participate on internships organized by the Department of logistics which highly weaken their ability to find adequate job in logistics and transport. Hence, 40% could be considered as a significant share.

H2: the minor specialization enables specialization of students across logistics and transport areas

The second hypothesis assumes that graduates of the minor specialization are distributed

evenly on the job market across all main areas of logistics and transport: freight forwarding, transport operators, logistic providers (3PL, 4PL), logistic department of a manufacturing company, logistic department of a wholesale or retail company. H2 is verified based on responses of graduates that work in the logistics and transport field.

Authors formulate this hypothesis in order to test if the minor specialization is not narrow scope oriented. If so it would weaken competitiveness of the graduates and would influence number of graduates that can succeed in logistics and transport job market. One-Way ANOVA test is used to test the differences in number of graduates that work in particular logistics and transport areas: freight forwarding, transport operators, logistic providers (3pl, 4pl), logistic department of a manufacturing company, logistic department of a wholesale or retail company.

Job market penetration

Ease of job market penetration expresses not only education process quality but also it is dependent on length of practical work experience that a graduate has gained throughout the studies or also on personal characteristics such as communicativeness etc. Concerning the above mentioned, the H3 is firstly formulated to verify how easy graduates can penetrate job market. Then, H4 and H5 are defined and verified to uncover how graduation of the minor specialization logistics – international transport and freight forwarding contributes to successful job market penetration and uncover the impact of work experience length on that.

H3: graduates can easily and quickly find a job

The hypothesis assumes that the minor specialization graduates gain significant competitive advantage due to high quality of education process. Hence they can soon after graduation if not earlier find a job in the area of logistics and transport. During the verification process authors analyse the time graduates need to find a job in the area of logistics and transport by means of 1-sample t Test. In addition to that, 2-sample t Test is used to analyse how difficult graduate perceived their job market penetration based on their personal experience.

H4: graduates with longer work experience can more easily find a job

Hypothesis four is used to statistically prove the impact of work experience on job market penetration and separate it from the effect of the minor specialization graduation. Hypothesis four is verified by correlation analysis between length of work experience and the time to find a job in logistics and transport and between work experience in logistics and time to find a job in logistics and transport.

H5: minor specialization graduation has direct impact on great job market penetration in logistics and transport

The fifth hypothesis is used to reveal the rate of the minor specialization graduation impact on great job market penetration. Verification of the hypothesis is done by means of 1-sample t Test by which authors want to find if more than half of the graduates perceive the graduation of minor specialization as a significant factor that helped them get a job. Authors want to identify the reflection of business HR specialist, logistics specialist and managers to a record about the minor specialization in graduates´ CV. Furthermore, how knowledge and skills are helpful within human resource selection procedures.

Salary

The height of salary is commonly considered as a significant attribute of success not only at work but also in a society as a whole. Moreover, it influences attractiveness of business areas and indirectly the demand on studying programs and specialization. However,

to some extend it could also be used as an indicator of graduate quality and so of the education process quality itself which enables gaining a graduate particular competences. The sixth hypothesis is formulated to encompass this aspect of education process quality.
H6: graduate of the minor specialization who works in the logistics and transport is sufficiently financially honoured.
Authors want to uncover how the graduates are paid when they penetrate the job market and then later on and how they are satisfied with that. 1–sample t Test is applied to identify if graduates get higher month salary than the average gross salary in the Czech Republic. In addition to that, 2-sample t Test is used to verify graduates´ satisfaction with initial salary and the one they had at the time of the questionnaire survey.

Results and Discussion

Processing and evaluation of data collected during questionnaire survey lead to the following results. They are provided regarding education process quality characteristics (working in the focal area, job market penetration and salary)

Working in the focal area

H1: Statistical results related to H1 are expressed in Tab. 1 and indicate that it hasn´t been proved by 2-sample t Test on a significant level (either 95% or 90%) that the group of graduates working in the area of logistics and transport dominates over those being employed in different business areas outside the focal one.

Hypotheses	Question	N	Mean	Median	Test	P-value	Result
H1	more graduates work in logistics and transport than in other business areas	40	55%	yes	2-sample t Test	p=0,189	partially con-firmed
					1-sample t Test share of graduates > 40%	p=0,034	

Tab. 1 Results of H1

Results of the sample shows that majority of the graduates (55%) work in logistics and transport area, nonetheless, it cannot be generalised on the population of graduates of the minor specialization because of insufficient significance level. However, the result of 1-sample t Test proved that more than 40% of graduates work in logistics and transport. It could be concluded that the H1 hasn´t been verified but the result of 1-sample t test shows that significant number of our graduates bind their professional career with logistics and transport.
H2: Statistical results related to H2 are expressed in Tab. 2 and expresses that based on One-Way ANOVA test there is no significant difference among logistics and transport areas in which graduates works.

Hypotheses	Question	N	Mean	Test	P-value	Result
H2	graduates can be employed across all sectors of logistics and transport	22	freight forwarder (15%) transport operator (5%) 3LP, 4LP (15%) logistics of a manufacturer (15%) logistics of a whole. or retail (10%) other areas (12,5%)	One-Way ANOVA test	p-0,499	con-firmed

Tab. 2 Results of H2

Hence, our graduates find their job equally across all main logistics and transport sectors. Thus, it has been proved that the minor specialization enables students gaining knowledge and skills in wide range of logistics issues so the graduates have unified knowledge to be employed in all logistics and transport sectors.

Results achieved by verification of H1 and H2 imply that the minor specialization is well parametrized concerning the scope and the depth of knowledge and skills provided during the educational process. As graduates succeed in placing jobs in wide range of logistics and transport areas of logistics providers and manufacturing and trading companies. Moreover, more than 40% of graduates end up in logistics and transport. Besides continuous comparison of subjects´ content being part of the minor specialization, close cooperation with large number of companies of high diversity (manufactures of different sectors e.g. electronic industry, brewery, automotive etc., retail and wholesale companies e.g. food and beverage etc., transport operators, logistic providers (3PL, 4PL)), graduate especially appreciate high number of field trips that are organized throughout the term. Such excursions help students get better insight into logistics and transport operation and also enable networking with professionals. In addition to that, students can take part in internships and elaborate their master thesis during it on practical problem. All above mentioned help students to adopt theoretical models and concept to real life environment.

Job market penetration

This part is dedicated to results of analysing how easy our graduates can penetrate the job market.

H3: Statistical results related to H3 are expressed in Tab. 3.

Hypotheses	Question	N	Mean	Median	Test	P-value	Result
H3	graduates quickly penetrate job market	22	2,68 month	during studies	1-sample t Test < 5 months	0,007	confirmed
	% of graduate get a job in 3 months		77%		1-sample t Test get a job > 60%	0,036	
	graduates can easily penetrate the job market		very easily or easily (82%), difficult or very difficult (18%)	easily	2-sample t Test	p=0,001	

Tab. 3 Results of H3

The results of statistical analysis shows that graduates can quite quickly find a job as more than 60% of graduates can find a job in less than three months. Moreover, quite commonly students start working in logistics and transport even during their studies either simultaneously or shortly after graduating the minor specialization. Statistically, the mean of all graduate is between 18-54% with 90% of reliability, the range will be narrowed by further research which enables involvement of graduates from year 2013. It has been confirmed on 95% reliability that graduates perceive their penetration on job market as easy and without any obstacles.

H4: Statistical results related to H4 are expressed in Tab. 4.

Hypotheses	Questions	N	Test	p-value	Result
H4	graduates with longer work experience find a job earlier	22	correlation analyses	p=0,091	unconfirmed
	graduates with longer work experience penetrate job market easily			p=0,416	unconfirmed

Tab. 4 Results of H4

Unlike to common believe, statistical analysis hasn´t proved significant correlation neither between time and work experience nor between easiness and work experience on 95% reliability. However, correlation between time and work experience has been proved on 90% reliability but the one between easiness and work experience remained unchanged. Explanation of this could be found in the fact that companies widely accept a fresh unexperienced graduate for position of a specialist when they have good long term experience with graduates from a particular education institution. Moreover, when they are aware of the fact that the education process is highly practically oriented and guest speaker from many companies participate on the educational process. Nonetheless, the result will be further monitored in the second round questionnaire survey.

H5: Statistical results related to H5 are expressed in Tab. 5.

Hypotheses	Questions	N	Mean	Median	Test	P-value	Result
H5	graduation of the minor specialization has direct impact on success on the job market	22	0,727	yes	1-sample t Test >50%	0,015	confirmed

Tab. 5 Results of H5

Confirmation of hypothesis five leads to conclusion that graduates identify significant value in graduating the minor specialization as more than 72% of the respondents and more than 50% of the whole graduate population support this idea. The value is recognized not only in gaining knowledge and skills adhering to logistic business requirements but also the minor specialization mentioned in CV brings competitive advantage regarding the questionnaire survey.

Salary

The last component of educational process quality evaluation of the proposed conceptual model covers financial reward of the graduates when they enter the job market and after several years in business.

H6: Statistical results related to H6 are expressed in Tab. 6.

Hypotheses	Questions	N	Mean	Median	Test	P-value	Result
H6	starting monthly salary of graduates	22	29 770	28 000	1-Sample t Test > 26 637 CZK	p=0,022	confirmed
	graduates are satisfied with their starting salaries		90,90%	yes	2-sample t Test	p< 0,001	confirmed
	graduates are satisfied with the current salaries		72,70%	yes		p< 0,002	confirmed

Tab. 6 Results of H6

Survey conducted among the graduates of the minor specialization showes that the most frequent starting salary is between 26 000 – 30 000 CZK, for the purpose of the statistical processing this interval was simplified to 28 000 CZK in average, which is provided in Tab. 6. 1-sample t Test proved on 95% reliability that the graduates starting salary exceeds average monthly salary in the Czech Republic. Moreover, graduates are satisfied not only with their starting salary but also with the growth of it throughout the time. However, the satisfaction with the starting salary is higher than later on with the growth.

Conclusion

The proposed paper brings insight into monitoring of quality of educational process in the minor specialization of Logistics – International Transport and Freight Forwarding organized by the Department of logistics at the University of Economics, Prague. The aim of the paper isn´t to analyse the standard monitoring process of educational process quality consisting of checking compliance of actual education process with accreditation materials, by means of students´ opinion surveys regularly organized, supervision of bosses, content analysis of syllabi etc. The goals is to outline how supervisors of specializations, courses etc. could use their graduates to establish continuous collection of real feedbacks from their outputs who the graduates undoubtedly are. The outlined conceptual model enables measuring the quality of educational process from the business perspectives.

Moreover, the research outputs have outlined that the structure and the content of the minor specialization curriculum shouldn´t be changed rapidly as it provides great variety enabling placing students quite soon and in different companies on the job market. Furthermore, graduation of the specialization has an positive impact on success on logistics and transport job market. Besides the outputs of the presented research this could also be also supported by the fact that more and more companies in which some of the graduates are places want to cooperate with the department of Logistics.

However, the higher share of the graduates succeeding on the logistics and transport job market could be gain by further work on closer and closer cooperation between the department and companies. Hence, the education process should establish a platform in which high number of students could have an internship in logistics and transport and can find and elaborate their master theses on relevant topics.

It hasn´t been proved that longer work experience would lead to earlier job finding as when companies want to employ fresh graduates they definitely appreciate some work experience in logistics and transport area but they also are aware of the advantages of young graduates in term of different view on company processes, lack of professional blindness, contribution with new approaches etc.

Additionally, it has been uncovered, that the perceived advantage of entering students of different major specialization into the minor specialization Logistics – International Transport and Freight Forwarding brings also some negatives, e.g. graduates of the major specialization IT are commonly lured by much higher wages in IT than in logistics and transport sector. Nonetheless, even in IT the graduates can contribute to Logistics and Transport wealth being by participation on it logistics projects.

Thus, such research has proved to provide invaluable information to education process management as it helps identify gaps between what is required by business and what the educational process produces and so to establish continuous improvement process.

Acknowledgements

This paper and associated research was carried out as a part of the project financed by Internal Grant Agency of University of Economics, Prague, IG305025.

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INTERNATIONAL STUDENTS' FRIENDSHIP NETWORKS AND SOCIO-CULTURAL ADAPTATION

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Abstract

This present research is concerned with adaptation of international students to a different cultural context by creating various friendship networks. A questionnaire survey was conducted on 118 international students in Australia. The aim was to examine the three types of friendship networks; co-national, multi-national and host-national, and search for their role in the adaptation process. As expected, although international students create fewer and weaker friendship ties with host-nationals (Australians), these friendships show to be the most beneficial. International students with more host-national friends had fewer difficulties with various socio-cultural situations and a greater English language progress. Since participants from international colleges had limited direct access to host-country nationals, those working in a job and participating in a social club were found to show signs of stronger host-national ties.

Keywords

Friendship networks, intercultural contact, international students, socio-cultural adaptation

Introduction

Anglophonic countries are extremely popular destinations for a study abroad. Apart from enabling international students to learn the local language, they are home to the most prestigious universities (in particular in the disciplines of management, commerce and economics). Australia is one of the few national economies that can benefit from international students mobility, because international education has developed in a growing export industry (Brooks and Waters, 2011). Therefore, research conducted in Australia in the field of student mobilities might bring cutting edge findings and implications for institutions around the globe.

Multicultural classrooms are a reality in Australia today. They can pose difficulties in social interactions as well as provide opportunities for building social confidence and friendships with people from different ethnic backgrounds. Oppose to university students, students of International Colleges might not have direct contact with host-country Australian students, which makes their quest for finding local friends even more difficult. The rationale behind this study is to explore the friendship networks that international students create and to disentangle the role of friendships in adjusting to a different cultural environment.

Researchers usually build on well-established and profound frameworks for studying intercultural contact such as Ward, Bochner, & Furnham´s (2001) Psychology of Culture Shock or Berry and Poortinga's (2011) Cross-Cultural Psychology. Ward (2001) studied the acculturation process that migrant students go through while studying in a different cultural context. When it comes to adaptation outcomes, Ward distinguishes between psychological and sociocultural adaptation. Recent studies (Rienties and Nolan, 2014,

Hendrickson et al, 2011, Sakurai et al, 2010) dealt with the effect of having different social networks on adaptation. Studies concerning friendship network analysis usually focus on the relationship with psychological adaptation, which primarily involves well-being and satisfaction with life. There is a lack of studies focusing on the relationship between friendship networks and sociocultural adaptation. Sociocultural adaptation primarily concerns behavioural responses and refers to the ability to acquire culturally appropriate skills that help to "fit in" the host environment (Ward et al, 2001).

Bochner et al. (1977) classified international students' friendships into three networks according to their functions: a) a co-national network (to affirm and express the culture of origin), b) a multi-national network (to enable recreation), and c) a host-national network (to facilitate academic and professional aspirations). Researchers usually ask for the number of friends, however, it has been found that the notion of friendship varies among individuals and groups. According to Granovetter (1983), who deals with social networks analysis, weak ties give access into other groups and function as bridges between different networks. The current study incorporates the issue of friendship strength in order to measure the three friendship networks more accurately and objectively. It is generally believed in social network theory that the web of relationships in which people are embedded can predict their behaviour (Hendrickson, 2011).

The study aims to explore the three types of friendship networks that international students form while studying abroad. It is expected that students will form many friendships with their co-nationals but not as many with host-nationals. Besides the number of friends, the study will look into an overall strength of the network and an average strength of a friendship. Based on a review of previous research (Zhang, 2011), mainly friendships with host-nationals are expected to aid adaptation. Which conditions tend to facilitate the formation of friendships with host-nationals will be subject to analysis. The role of these networks in knowledge creation will be discussed.

Materials and Methods

Directors of seven English language focused International Colleges were asked to participate in the study by allowing the administration of a questionnaire survey to their students. Three of them approved during-class administration and even involved their staff to facilitate the process. One offered online participation and three Colleges refused participation entirely.

The questionnaire survey was administered to 178 international students of more than 30 different nationalities. Most of them came from Asia, but many of them were also from Latin America, Europe, Africa, or Middle East. They all studied English at least at an intermediate level (some in combination with Management studies).

23 students chose not to fill out the voluntary survey (or didn't fill it out entirely). 6 of them stated English as their mother tongue (from Britain, Scotland, Ireland, Botswana), and 31 participants reported being in Australia for a shorter period than four months. To meet the aims of this research (the target group are international students in the position of sojourners as defined by Berry, 2011), the responses of these participants were excluded from the analysis, which was therefore conducted on 118 participants.

The questionnaire was composed of five parts; demographic variables, context variables, friendship network variables (FN), variables of socio-cultural adaptation (SCA), and English language variables.

Instructions for the part on friendship networks were adapted from Hendricksen et al (2011), but adjusted to include separate sections on co-nationals, multi-nationals and host-

nationals. Participants were asked to fill in a blank grid for each friendship network. They listed a maximum of five of their friends for each of the three networks and indicated the strength of each relationship on a scale from 1 to 10 (1=acquaintance, 10=close friend). Since different nationalities vary in their interpretation of the notions of acquaintance and close friend, descriptions were added as reference points to allow the data to be comparable. Two variables were computed from the grid for each friendship network:

1. Network Strength - ranging from 0 to 1 and expressed in percentages (the ratio of the sum of filled in strengths and the highest possible total strength). This variable combines the number of listed friends and their strength.
2. Friendship Strength - ranging from 1 to 10 (the ratio of the sum of strengths and the amount of listed friends). This variable gives an average friendship strength.

Besides filling out the grid, participants indicated the overall number of friends on a scale from 1 to 5 (1=none, 2=only one, 3=a few, 4=some, 5=many). This ranking also functioned as a control mechanism on properly filling out the friendship network grid.

Socio-cultural adaptation measures the amount of difficulties a person experiences in various situations while living in a different cultural context. 25 questions (e.g. coping with schoolwork, following rules and regulations, coping with different ethnic groups, etc.) were adapted from Ward's (2001) Socio-Cultural Adaptation Scale and used in the questionnaire. Participants ranked the difficulty of each situation on a scale from 1 to 5 (from 1="no difficulty" to 5="extreme difficulty").

Since the four international colleges, which allowed this research to be conducted, are primarily focused on teaching the English language, a self-evaluation with 10 questions focused on the progress in English language was added to the questionnaire, and its average was used in the analysis. Acquiring English language skills and abilities in order to function effectively in a culturally diverse environment is taken as another indicator of successful adaptation.

By incorporating context variables (e.g. being in a relationship, having relatives in Australia, etc.), the study aimed to go beyond direct associations in order to investigate indirect mediating situations that could have an effect on the variables that were expected to predict successful adaptation (strong host-national ties).

Whether significant differences in variables for friendship networks (Network Strength and Friendship Strength) exist was computed using the repeated measures one-way ANOVA. Relationships between the variables of friendship networks and variables of the socio-cultural adaptation scale were analysed by Pearson's correlation coefficients. Spearman's correlation coefficients were used when the variables were in the form of rankings (non-parametric variables) as in the case of the indicated ranking for the number of friends. Independent samples *t*-tests were used to test whether significant differences in the mean averages of the variables on friendship networks exist between students in different contexts.

Results and Discussion

The overall composition of friendship networks of international students was explored. All three forms of measuring the three friendship networks showed fairly corresponding results (Table 1). On average, international students indicate having the strongest friendship network with co-nationals and they tend to rank co-national friends as their closest friends. Conversely, the host-national network is the weakest and host-nationals tend to be regarded rather as acquaintances. Multi-national friendships are in between. Follow-up tests compared the two sets of variables to see whether the difference between the Network and Friendship Strengths are statistically significant.

CO-NATIONAL FN			MULTI-NATIONAL FN			HOST-NATIONAL FN		
Network Strength	Friend-ship Strength	Number of Fr.	Network Strength	Friend-ship Strength	Number of Fr.	Network Strength	Friend-ship Strength	Number of Fr.
(0-1)	(0-10)	(1-5)	(0-1)	(0-10)	(1-5)	(0-1)	(0-10)	(1-5)
63%	7.334	4 - some (median)	56%	6.407	4 - some (median)	37%	4.869	3 - a few (median)

Table 1. Friendship Networks with Co-nationals, Multi-nationals and Host-nationals.

1. Variables for the Network Strength were tested by one-way repeated-measures ANOVA to evaluate the null hypothesis that there is no difference in participants' network strength when measured for home-country, foreign-country and host-country (N=118). The results indicated a significant "country" effect, Wilks' Lambda = .63, $F(2, 116) = 33.99$, $p < .01$, $\eta^2 = .37$. Thus, there is significant evidence to reject the null hypothesis. Follow up pairwise comparisons indicated that each difference was significant, $p < .05$.
2. Similarly, variables for the Friendship Strength were tested by one-way repeated measures ANOVA. Again, the results revealed a significant "country" effect, Wilks' Lambda = .67, $F(2, 116) = 28.68$, $p < .01$, $\eta^2 = .33$, which enables to reject the null hypothesis that there is no difference in participants' friendship strength when measured for the three different networks. Follow up pairwise comparisons also indicated that each difference was significant, $p < .01$.

International students indicated the amount of difficulties experienced with various socio-cultural situations. Based on the average results of the Socio-Cultural Adaptation Scale (SCAS), only "10) Dealing with someone who is unpleasant / cross / aggressive" appeared in the upper half of the spectrum (3.09), indicating more difficulties in dealing with this situation. However, many individual scores of other situations appeared in the upper, more difficult, half of the spectrum.

A correlation analysis of the FN variables and the average of the SCAS didn't reveal any relationships with co-national friendships, suggesting that having home-country friends doesn't have an effect on socio-cultural adaptation. However, negative relationships were found between multi-national friendships and the average scores of the SCAS. And even stronger negative relationships were found between host-national friendships and the average scores of the SCAS. Therefore, relationships with specific situations within the SCAS were explored. Pearson' s correlation coefficients (and Spearman's c.c. for Rankings) of the most significant relationships can be found in Table 2. The correlation analysis suggests that a FN with co-nationals isn't associated with socio-cultural adaptation, but that strong friendship ties with multi-nationals and specifically with host-nationals can be associated with fewer difficulties in socio-cultural adaptation. The results stress the importance of host-national ties in coping easier with cultural differences (e.g. dealing with different ethnic groups or understanding cultural differences) and thus gaining some degree of intercultural competences.

	CO-NATIONAL FN			MULTI-NATIONAL FN			HOST-NATIONAL FN		
Friendship Network V.	Net-work Str.	Friend-ship Str.	Number of Fr.	Net-work Str.	Friend-ship S.	Number of Fr.	Net-work Str.	Friend-ship S.	Number of Fr.
SCAS (aver-age)	-.033	-.052	-.082	-.223*	-.247**	-.200**	-.352**	-.290**	-.257**
1) ...making friends	-.006	.038	-.191*	-.424**	-.377**	-.473**	-.408**	-.266**	-.390**
4) …the pace of life	-.150	-.009	-.267**	-.244**	-.159	-.190*	-.295**	-.190*	-.236*
6) …social events	.055	-.003	-.041	-.187*	-.192*	-.209*	-.339**	-.224*	-.237**
10) ...some-one cross	-.050	.008	-.017	-.069	-.096	-.021	-.234*	-.162	-.138
11) ...local food	-.079	-.008	-.151	-.100	-.144	-.072	-.258**	-.286**	-.208*
12) ...rules and regul.	-.083	-.160	-.006	-.117	-.187*	.007	-.217*	-.257**	-.176
15) ...differ-ent ethnic	.023	-.048	-.014	-.098	-.077	-.118	-.249**	-.194*	-.217*
17) ...local accent	-.025	-.006	-.029	-.158	-.181	-.032	-.328**	-.356**	-.238**
20) ...school-work	.095	.051	.033	-.308**	-.232*	-.294**	-.327**	-.255**	-.240**
23) ...politi-cal system	.045	-.050	.093	-.264**	-.287**	-.250**	-.290**	-.221*	-.249**
25) ...cultur-al differ.	-.107	-.150	.035	-.105	-.193*	-.010	-.168	-.249**	-.115

**. Correlation is significant at the 0.01 level (2-tailed)., *. Correlation is significant at the 0.05 level (2-tailed).

Table 2. Relationships between Friendship Networks and Socio-Cultural Adaptation.

Additionally, side values 1, 2 ("none" and "only one") and the side values 4, 5 ("some" and "many") ranking the number of host-national friends were combined, making one grouping variable. By excluding the middle value, we separated the participants into two groups; those reporting a low number of host-national friends (N=35) and those reporting a high number of host-national friends (N=53). A Mann-Whitney U-test (for non-parametric variables) of the mean rankings for the average SCAS between these two groups was conducted. At a p= .03 the null hypothesis that there isn't a difference between these two groups was rejected. Participants reporting a higher number of Australian friends tend to have fewer difficulties with sociocultural adaptation (Mean=2.1488 and Mean Rank=39.69) than those reporting less Australian friends (Mean=2.5088 and Mean Rank=51.79).

A correlation analysis of the FN variables and the variables for English Language Progress revealed only one significant relationship. The correlation analysis suggests that a friendship network with co-nationals isn't associated with the English language (mind the negative direction of the insignificant correlation coefficients), but that a strong friendship network with host-nationals can be associated with an on average greater progress in English language. Pearson's correlation coefficients (and Spearman's c.c. for Rankings) can be found in Table 3.

	CO-NATIONAL FN			MULTI-NATIONAL FN			HOST-NATIONAL FN		
Friendship Network V.	Net-work Str.	Friend-ship Str.	Num. of Fr.	Net-work Str.	Friend-ship Str.	Num. of Fr.	Net-work Str.	Friend-ship Str.	w
Level of English	-.019	-.041	.001	.071	.033	-.023	.080	.057	.050
Average Progress in Eng.	-.048	.047	-.124	.118	.021	-.045	.267**	.135	.165

**. Correlation is significant at the 0.01 level (2-tailed)., *. Correlation is significant at the 0.05 level (2-tailed).

Table 3. Relationships between Friendship Networks and English Language

Context variables were found to be randomly distributed among the participants. This suggests that international students have various previous and current experiences while studying in Australia. Table 4 represents the occurrence of each variable among the 118 participants. A correlation analysis revealed that none of these variables could be associated with host-national friendships.

N=118	Previous stay in Australia	Previous stay Abroad	Currently in a relation-ship	Having relatives in Australia	Accommo-dated with an Aust.	Previous cross-cultur-al training
No	58	85	82	83	88	103
Yes	60	33	36	35	30	15

Table 4. Context Variables among international students

However, correlations and independent samples *t*-tests with two other context variables revealed that international students who; a) have worked in a job where one has to speak with local Australians, and who b) have been members of a social club where one has to speak with local Australians, tend to have a stronger network and stronger friendships with host-nationals (results for $p < .05$ in Table 5).

Conclusion

The findings of this study confirmed that international students create fewer and weaker friendship ties with host-nationals (Australians) compare to ties with other multi-nationals and co-nationals. Mostly friendships with host-nationals were found to play a key role in aiding socio-cultural adaptation. International students with more host-national friends showed signs of adapting better to various social situations and making a greater progress in learning the English language. Some of the social situations, such as coping with schoolwork, are directly related to the academic context and correspond to the expected function of host-national friendships; being facilitators of academic objectives. However, the study discovered relationships with social situations that relate to gaining intercultural competences. This suggests that social ties with locals transcend the rather straightforward and expected effect of learning the local language and highlight the more underlying effects of intercultural learning.

Host-national friendship network	Working in Australia		Social Club Participation	
Distribution of context variable	92 (yes)	26 (no)	19 (yes)	99 (no)
Mean Network Strength	42 %	19 %	58 %	33 %
Independent samples t-test results	$t(116) = 3.56$, $p = .001$		$t(116) = 3.27$, $p = .001$	
Mean Friendship Strength	5.317	3.285	6.558	4.545
Independent samples t-test results	$t(116) = 2.96$, $p = .004$		$t(116) = 2.58$, $p = .011$	

Table 5. Independent Samples *t*-tests Results for Host-national friendships

Additionally, the current study aimed to disentangle which conditions can contribute to overcome the difficulty of creating host-country friendships. The study revealed that being involved with Australians in the working process or in a social club tends to support the creation of these important local ties. Therefore, institutions, such as the ones involved in the study, should encourage contact with host-nationals through social club participation and actively look for ways of facilitating international students' access to the host-country labour market. Since having more host-national friends appears to be a valuable benefit in the adaptation process, additional ways of supporting these forms of friendships should be explored.

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SOCIAL REFLECTION OF THE COMMUNITY EDUCATION IN THE CZECH REPUBLIC

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Abstract

This paper deals with social reflection of the community education in the Czech Republic. In this regard, it explores the meaning of community education from the point of view of its implementers. For this purpose, it uses the method of semantic differential which helps us to identify the main functions of the community education. The paper presents the methodology and findings of an empirical survey on the level of descriptive (D-matrix analysis) and inductive (chi-square test) statistics. The results show that community education has a predominantly integrative function for its implementers. On the basis of our results, we suppose that the concept of community education is best framed by a consensual approach to social and educational reality.

Keywords

Community education, lifelong learning, public opinion, semantic differential, social function

Introduction

Social aspects in economic environment, such as so called corporate social responsibility which "is one of the useful tools to positively affect society and develop relationships with stakeholders" (Kvasničková Stanislavská, Kvasnička, Kuralová, Margarisová, 2014: 95), are as important as social aspects in educational environment, for example community education. Community education is a "social activity (social training) realized within the given area (a geographical aspect of the community) which connects the inhabitants by a common issue, interest or need (a social aspect of the community) and which is based on organizing the community life by means of social-cultural animation intervention strategy" (Smékalová, 2014: 86).

Community education is a given historical phenomenon in various social contexts and currently, it is not only proclaimed but also more and more significant on the practical level. It is being included into chosen strategy documents (for exemple: Delors, 1996: 19, 27; World Declaration on Education for All, 1990: 21; World Trends in Adult Education Research, 1999: 90, 174), into regional and international projects as well as programmes of social organisations. Individual initiators promoting the idea of community education often derive from the practical, alternatively field grounds (for example educational, sociological, philosophical dimension) to advance it, which is understandable. These grounds are in harmony with their cognitive or emotional conviction. Given the situation, there are specific forms of community education in the social reality and therefore its use in different context. Thus, what does the social reflection of community education phenomenon look like in the action field of adragogy practice?

The given facts imply two current failings of defining the issue of community education in the Czech Republic. The first of them is the absence of social reflection of the community

education that would enable to design and characterize the concept of community education in national context and compare it with its concept abroad. We assume that it is especially important to ask how the community education is perceived by its implementers themselves, since these are the dominant social group connected with the existence and running of this educational activity.

The second failing lies in the absence of complex and unambiguous understanding of the community education concept from the theoretical point of view, particularly in the andragogy discourse. In the Czech Republic, an appropriate interpretation frame for community education has been missing so far which would define it on the level of social science theory. In other words, one may argue that although community education has been substantially realized since 2000, the conceptualisation of the phenomenon has not been made yet. At the same time, we believe that all foreign interpretations of community education may present an inspiration for homeland authors only, not a social-culturally adequate and empirically based framework. That is why we pursue an empirical reflection of community education in the Czech Republic which will enable us to create preconditions for the construction of a theoretical concept of community education appropriate for the local conditions.

How has the community education been defined in the literature so far? Firstly, it must be stated that community education is frequently understood as one of the possibilities of life-long learning. It is understood in this way for example by Jarvis (1985: 161–164) who terms it an alternative strategy of adult education. Community education understood as direct participation on life-long learning as an educational opportunity can be found i.e. in Darkenwald (1986: 28), Decker and Boo (1995: 7). Other relation between community education and adult education are apparent on the basis of expressing its principles (Abreu and Abreu, 2015; Buhren, 1997: 82; Husin and Zawawi, 2012; Murphy and Novák, 2005: 10), the context of its realization (Lorenzová, 2001: 129–135), curricula characteristics (Armstrong, 1977: 75–84; Fletcher, 2013: 340; Groombirdge, 1983), the way of organizing and building the civic society (AONTAS, 2004: 18–19; Beneš, 1997: 103; Erikson and Anderson, 2005: 161; Segal, Gerdes and Steiner, 2013: 169;), and possibly on improving the quality of relationships and life (Hickey and Von Voorhees, 1969: 36; Martin, 1987: 14;).

Although community education and adult education are closely related, community education does not definitely have a unified terminology at its disposal, unlike for example further education. Brookfield (1983: 67) emphasizes that the community education definitions are frequently of tautological nature. Moreover, general characteristics of community education (see i.e. Buhren, 1997: 82; Jarvis, 1999: 33;) point out at the large sphere of its activity, which often falls outside the area of direct adragogic activity. That is for example typical of the characteristics of community education which mention it as a developmental concept (Association of Municipal Authorities, 1991: 8), a philosophical approach (Tierney, 1980: 30) or as an educational programme (Maqbool, 2008: 94). Even the Scottish Council for Community Education was well aware of its wide scope of orientation and it concluded that community education includes all areas of human experience (Tight, 2012: 74).

It can be stated that defining the issue of community education is characterized by vast eclecticism, which is also the reason for our empiric research aiming at finding out how community education is perceived by those who implement it, outside the expert scientific discourse, and at presenting empiric data for a better conceptualisation of a given phenomenon.

Another reason for our research lies in varied theoretical approaches that are explicitly or implicitly hidden in the individual definitions of community education. This happens for example when community education is defined as a reform movement (Fletcher, 2013: 325), or when it is related to the issue of social change (Thorpe, 1985), possibly also when some researchers point out that there are three possible contract types in the form of curricula - directive, partnership or populist (Groombirdge, 1983). Some authors (Munoz and Garcia, 1989: 5) even warn that there can be several communities within the same geographic environment that are mutually opposing. Thus, they pressupose the possible occurence of a conflict in the framework of community education.

Suffice it to say that these theoretical approaches differ from each other by the extent in which they emphasize one of the general theoretical approaches to social reality (Brookfield, 1984; Mezirow, 1981; Popkewitz 1978, 1980; Suppes 1974): 1. consensus approach (community education is a source of solidarity and integration), 2.conflict approach (community education is a source of conflicts, competition and power emancipation), and 3. interpretation approach (community education is based on communication and the interpretation of the interests of those who are being educated. These three general approaches form an alternative interpretation frameworks of community education.

With respect to this starting point, our paper aims at studying the given conceptual framework empirically which should help us find out what dominant significance the community education has for the respondents from the Czech Republic. In other words, we want to find out *how community education is perceived (a social reflection) by the respondents (its own implementers) with respect to the presented theoretical approaches?* On the basis ot that, we will be able to determine which significance prevails in the Czech Republic and which of the presented approaches represents the most appropriate theoretical approach.

The empirical data were gained by means of semantic differential method and its findings were subsequently processed by means of a linear distance D and written into a D-matrix. Subsequently, the findings were statistically verified on the basis of chi-square test.

The distribution of the form took place from June 2013 to January 2014 by means of two coordinators. The way of distributing the research form was based on a purposeful choice of the institutions that realize community education and dispose of experts (potential respondents) who pursue community education. We interviewed representatives of 45 institutions which specialized in community education. The choice of the respondents had to meet necessary criteria and was realized by means of the snowball method. The snowball method is based on "the choice of individuals in which the original informer leads us to other members of our target group" (Disman, 2002: 114). The particular description of the research is presented in the following chapter.

Materials and Methods

The research sample consisted of 15 respondents only. The reason for this was (1) the data sorting (discarding forms when sorting) and (2) the choice criteria: (a) the respondent had to implement community education on the position of a lecturer, facilitator, coordinator, supervisor, manager, and (b) had to have at least 3 years of work experience. Thus, data validity was ensured.

The respondents expressed their attitudes by means of a semantical differential which measures the connotative meaning of concepts in the sematical environment of the respondents. Based on a certain number of evaluation scales formed by couples of opposite adjectives, the respondents determine their attitudes to the defined objects with respect to

three factors (evaluation, capacity and activity factor). Subsequently, a quantification of the results is made by means of so called linear distance D and by its writing down into D-matrix it is found out how close or distant the evaluated concepts are in terms of their meaning (Osgood, Suci and Tannenbaum, 1975: 25, 75, 94–100).

Ten objects were chosen: (1) community education, (2) solidarity, (3) stability, (4) consensus (objects No. 2–4 represented the consensus approach), (5) conflict, (6) radical change, (7) emancipation (objects No. 5–7 represented the conflict approach), (8) interpretation, (9) interaction, (10) context (objects No. 8–10 represented the interpretation approach). Also, a 7-point classical scale was chosen to transform the frequencies to a point score. It included the adjectives that represented all the mentioned factors: valuable–worthless, active–passive, strong–weak, nice–awful, large–small, fast–slow, relaxed–tense, heavy–light, sharp–dull.

The chi-square test was chosen to find out the statistical significance of the point score averages of the researched objects. It verifies if the frequencies gained by measuring differ from the theoretical frequencies given by a null hypothesis (Chráska, 2007: 71). The counted test criterion of chi-square for the significance level of 0.05 and a certain level of latitude is compared with a critical figure and if the test criterion of chi-square is smaller than the critical figure, we accept the null hypothesis (Chráska, 2007: 74). All counting was done by hand, without using statistical programmes.

Results and Discussion

The respondents´ answers are expressed by a point score. Therefore, each researched object reaches an average numebr of points for all respondents (see Tab. 1). The highest average number of points in descending order was reached by the objects: community education (5.42), solidarity (5.37), consensus (5.25), stability (5.20) and interaction (5.24).

	Community education	Solidarity	Stability	Consensus	Conflict	Radical change	Emancipation	Interpretation	Interaction	Context
Average number of points	5.42	5.37	5.19	5.25	4.23	5.06	4.97	5.00	5.24	4.69

Tab. 1: Average number of points for each object

It is evident that these objects are somehow related. The average point score, however, does not testify to their relationship. In this case, a question is asked: *Are the researched objects close or distant to each other in their meaning ?* The response is provided by a calculation of a linear distance D in D-matrix (see Tab. 2).

D-matrix shows the distance between community education from the other objects. If each of the chosen theoretical approaches (consensus, conflict and interpretation) is represented by three objects, we look for the first three objects with the lowest figure. The low levels represent the proximity of objects. Therefore, it can be argued that the following objects are the closest to community education: consensus (1.21), stability (1.37) and solidarity (1.57). These three objects represent the consensus approach. It is interesting to see that the objects of emancipation (1.72) and interaction (1.80) are also quite close. It can be explained in the way that the respondents understand community education as something that makes it possible to liberate themselves from some unfavourable conditions (see emancipation) and that community education is not possible without interaction. Other factors should of course be taken into account as well.

	Community education	Solidarity	Stability	Consensus	Conflict	Radical change	Emancipation	Interpretation	Interaction	Context
Community education	X	1.57	1.37	1.21	5.97	4.54	1.72	2.04	1.80	2.94
Solidarity		X	1.52	0.81	5.14	3.25	1.56	1.53	0.96	2.40
Stability			X	0.95	5.27	3.98	1.32	1.62	1.33	1.78
Consensus				X	4.93	3.53	1.03	1.44	1.13	2.12
Conflict					X	3.18	4.54	4.30	4.66	3.93
Radical change						X	3.80	3.41	3.28	3.67
Emancipation							X	1.18	1.27	1.63
Interpretation								X	1.10	1.13
Interaction									X	2.02
Context										X

Tab. 2: D-matrix

For the research purposes, there is an informative value in the fact that all three objects that saturate consensus approach have appeared close to community education. It is possible to visually demonstrate the objects in the semantic space that depicts the capacity and evaluation factor (see Fig. 1).

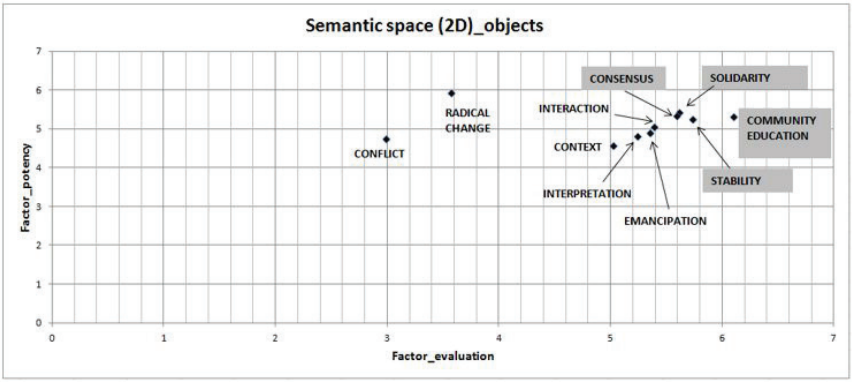

Fig. 1: Semantic space (2D)

Descriptive statistics has proved the relationship of community education to the consensus approach. Semantic space shows that the objects of conflict and radical change representing conflict approach are very distant to community education. The question is *whether the stated results are statistically significant.* We go on to the aim of the research and to the answer to the formulated research question: *How is community education perceived (a social reflection) by the respondents (its own implementers), namely in relation to the given theoretical approaches?*

Objects	P	O	P - O	$(P - O)^2$	$\frac{(P - O)^2}{O}$
Community education	5.4	5.2	0.2	0.04	0.007
Solidarity	5.3	5.2	0.1	0.01	0.001
Stability	5.1	5.2	-0.1	0.01	0.001
Consensus	5.2	5.2	0	0	0
∑	21	-	-	-	0.009

Tab. 3: Chi-square test

The previous analysis of the data proved the relationship of community education to the consensus paradigm. Therefore, the research question can be operationalized and respective hypotheses can be statistically verified. The research question is: *Is there a statistically significant relationship between community education and the consensus approach?* The factual hypothesis presupposes that yes. Statistical hypotheses are formulated in the following way: (a) *null hypothesis*: There are no statistically significant differences between the objects´ averages representing the consensus approach (that means that the objects are close to each other, the researched relationship exists); (b) *alternative hypothesis:* There are statistically significant differences between the objects´ averages representing the consensus approach (that means that the objects are distant to each other, the researched relationship does not exist). The objects´ averages and the calculation are presented in Table No.3).

The calculated test criterion reaches the figure of 0.009. There is a table critical figure of 7.815 for the significance level 0.05 and for 3 levels of scope (Chráska, 2007: 248). Due to the fact that the test criterion is smaller than the critical figure, *we accept the null hypothesis.* In this case, accepting the null hypothesis does not mean rejecting the factual hypothesis because proving the non-existence of a difference between the objects actually means that the objects are close to each other (there is a relationship between them because they belong to the same group).

Conclusion

The empiric research of the sample analyzed the relationship of community education to a particular theoretical approach and defined itself against the eclectic approach. Therefore, we can unambiguously interpret that the research results statistically confirm that there is a relationship between community education and the consensus approach. Therefore, in the framework of andragogy discourse, the consensus approach seems to be an appropriate interpretation framework for community education in the Czech Republic. The empirical research has therefore fulfilled its purpose and prepared a theoretical framework of community education at the level of social-scientific theory that specifies the conceptualization of the given phenomenon. However, it is necessary to continue researching the social reflection of community education from the point of view of other social groups for its complex conceptualization. That means not only from the implementers´ perspective, but also from the users´ perspective etc.

Acknowledgements

We would like to thank two coordinators of the research form distribution who participated on the empirical research. Thus, up to 45 institutions could be addressed where experts on community education work. The coordinators are: (1) *Mgr. Olga Bauerová,* the headmistress of Elementary school and kindergarten Jihomoravská, Brno.

She is the initiator and co-founder of The Network of Brno Open Schools that pursue community education; (2) *Mgr. František Eliáš,* the headmaster of Elementary school of Hana Benešová and Kindergarten Bory. He is also the head of the National Network of Rural Community Schools.

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MAPPING THE SELF-REGULATED LEARNING OF ADULTS

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Abstract

The paper deals with adults self-regulated learning from the perspective of qualitative research. The self-regulated learning is explored via method of situational analysis which is based on the work of the second generation of Grounded Theory. It shows what are the key elements of self-regulated learning on the basis of data from the focus groups with students of combine study program (N = 34). The paper argues that important role in self-regulated learning plays: temporal elements (as time management, time investing and planning), discursive construction of adult learners, educators, and school organization, nonhuman elements (as electronic communication environment), as well as self-management issues connected with learning strategies, and motivation. The main results are presented using two kind of situational map – messy and ordered, and relational analysis with focus on motivation to learning. The paper demonstrates why is situational analysis an useful tool for exploration of learning activities.

Keywords

Situational analysis, lifelong learning, self-regulated learning, qualitative inquiry, adults learning

Introduction

The presented study demonstrates the results of a qualitative research on self-regulated learning in case of adult students of a combined study program. Self-regulated learning is, in this matter, understood as the basic ability of individuals to manage their own learning with respect to the demands of the educational and social environment and their individual goals, while it also enables the participants to overcome the mismatch between expectations and reality (see eg. Brown, Miller, Lawendowski, 1999; Carver, Scheier, 2011; Hoyle, 2010; Zimmerman, 2000).

Effective self-regulated learning is, in this regard, considered to be a precondition for successful coping with studies (see eg. Boekaerts, 2002, 2005; Pintrich, 1999, 2000), and it also includes multiple components in the form of internal thoughts or speech, emotions and behaviors that are planned, monitored and cyclically adapted both according to the feedback from the environment and on the basis of reaching the goal.

The foreign research in this area is very extensive and focuses both on various problems related to the management of learning (Zimmerman, 2000, 2002; Zimmerman, Schunk, 2011) and diverse groups of learners (see eg. Boekaerts, Corno, 2005; Hadwin et al., 2001; Karaberick et al., 2007). Despite this considerable diversity, most of the research on self-regulated learning derives from the social cognitive theory proposed by A. Bandura (1986, 1991) which is developed and complemented by the individual researches.

In comparison with other countries, the research in the Czech Republic is considerably less extensive and focuses mainly on the study of self-regulated learning of full-time university students (see eg. Hladík, Vávrová, 2011; Gavora, Jakešová, Kalenda, 2015;

Jakešová 2014; Jakešová, Hrbáčková, 2014; Vávrová, Hladík, Hrbáčková, 2012). Very little space is devoted to the research on the management of learning of adults, whether of those situated in non-formal education, or those returning to the formal education system after several (decades) years since their last systematic study.

For this reason, we aim to explore what makes the situation of self-regulated learning of adults in the formal education system specific. In this respect, we also respond to the current methodological critique of the research on self-regulated learning (see eg. Boekaerts, Corno, 2005; Hadwin et al., 2001; Jakešová, Kalenda, 2015; Karaberick et al., 2007; Nesbit, Winne, 2006; Winne, Jamieson-Noel ,Muis, 2002; Winne, 2010) which emphasizes that the exploration of the phenomenon is overly burdened by positivistic study methods, especially by the standard psychometric techniques.

On the ground of this reason, we choose for our research a methodological design, which, in the case of the phenomenon, has not been used yet and which substitutes the shortcomings of the positivistic methodology. This is a situational theory suggested by Adele Clarke (2003, 2005) which represents a specific variant of a qualitatively oriented methodology based on the work of the second generation of the grounded theory (see eg. Bryant, 2002; Clarke, 2003, 2005; Charmaz, 2007; Charmaz, Belgrave, 2012).

The situational theory is characteristic that it aspires to capture all key elements (eg. human, nonhuman, mental or discursive) which are found in a certain social situation and which constitute meaning and progress. The situational theory is, from the methodological standpoint, further characterized by its emphasis on a creation of situational maps which, on the one hand, enable to grasp the diversity of components found in certain situations, and, on the other hand, it is distinguished by the refusal of the implicit causality of the so-called paradigmatic model with which the first generation of the grounded theory operates (see eg. Corbin, Strauss, 2008; Strauss, Corbin, 1999).

We suppose that due to the chosen methodological design we will be able not only to better understand what factors (components) intervene in the process of self-regulated learning of adults, but we will be also capable of outlining how it is possible to make greater use of the qualitatively oriented methodologies for the study of adult education.

Methods

As mentioned above, *the aim* of the research was *to capture and describe the key elements of self-regulated learning of adults in formal education*. We formed the research problem into the research question: *How do adults in formal education regulate their learning?* At the same time, however, we wonder how individual identified key elements affect self-regulated learning. For the present study we chose only one of them – motivation to learn. Following both the research problem and our methodological grounding, we chose the *qualitative research strategy* using *the technique of group interviews* in the form of focus group. For our research, we used a variation oriented on content, rather than on interaction in a group (Beitin, 2008; Morgan, 2010, 2012).

The selection of the research group was deliberate within an institution – the University. The survey involved a total of 34 informants (30 women and 4 men). All the respondents were 3rd year students of the combined form of a bachelor degree. Informants were in the age cohort from 27 to 56 years.

All the group interviews were realized in the fall of 2014 within 4 focus groups consisting of 7-9 informants. Duration of the interviews lasted from 60 to 80 minutes, and the progress of each interview was recorded on video. Questioning and moderating of each discussion was carried out according to a predetermined scenario with two moderators,

each of whom conducted two focus groups according to the parallel scenario. This ensured the triangulation of researchers and supported the validity of the results obtained. The triangulation was subsequently applied also in the processing, analysis and interpretation of the acquired data.

The scenario of each interview included interactional and organizational research questions. The interactional questions focused on the effects of the motivational factors in the analysed process, student self-efficacy and causal attribution. The organizational questions referred to cognitive and metacognitive strategies exercised by students in the learning process.

Within the research, all the rules of ethics were observed by researchers, and all the participants were guaranteed anonymity.

When analyzing the data, we proceeded on the basis of the situational theory (see eg. Clarke, 2003, 2005), which means that we first identified all the key components in the transcribed material that are found in a situation of management of adult learning. From these components we managed to compiled the so-called Messy map (see Fig. 1.). Subsequently, we organized the components of the map into key categories offered by Adele Clarke (2005), whereby we created the so-called Ordered map (see Fig. 1.). In the last step, we then performed the so-called relational analysis which consists in the conceptualization of action of all individual components always only on one of them. Generally, we arrived at *five significant relational analyses,* out of which we present one, particularly the relational analysis focused on motivation for learning (see Fig. 2).

Results

Regarding the management of education of adult students of distant education, it is characteristic for such situation that a wide range of elements that create its course and outcome are presented in it (for details see Fig. 1).

Fig. 1. Messy map

These are labelled as elements and can be sorted into a few broad categories, which then represent the key structures present in a given situation (the list of all of the 51 elements and 10 categories can be found in Table 1). These are the bases for our analysis.

Situational Analysis

In this regard, it is mainly the individual human element which is represented not only by students and their teachers, but also by another three important participants: student's partners, their children and co-workers, who intervene in various parts of the learning process. Other important factors are the non-human elements, so called actants which, according to Bruno Latour (2005), play an important role in the structuring of space and social processes. These are, in the case of adult learners, represented mainly by the faculty where the learning takes place, organization that employs the research participants and electronic computer environment, which becomes the main instrument of communication between the participants in the learning process as well as a space for storing and sharing of the learning materials.

The discursive representation of an individual also plays an important role in the management of learning. Mainly the image of an adult who is presented in the contrast with a secondary school student and the image of a full-time student of higher education in contrast with a student of a distant education. The role of a full-time student of higher education and of an adult is perceived as more demanding by the participants. Further, the participants design an image of a teacher (demanding/undemanding, communicative/uncommunicative) to whose requirements and teaching styles they must adjust their learning.

Besides the discursive representation of participants, the discursive construction of non-human elements can be identified, mainly the: study program, labor market, academia or occupation of the students. All these elements help the participants to better depict their social role (of a student), study motivation and obstacles. With regards to this, two relative discourses also play an important role. By referring to them the individuals legitimize their behaviour and clarify their basic motivation for the study. These are the employment discourse, drawing the attention to the need of having a higher education in order to ensure a perspective position on the labor market, and the tertiary education discourse, describing the diminishing value of a higher education degree and the increase of students of higher education.

Another important two categories present in the management of learning of students of distant education are the time and space elements. The management of these two elements is very important because an effective time and space management is, according to the participants, the first step to creation of an effective management of learning.

According to the research participants, the self-regulated learning is then represented by five main elements (see Table 1): (1) the motivation to study/learn, which is perceived as a prerequisite for achieving of optimal study results. This is connected to the participant's definition of their own concept of (2) study success, i.e. the expected results of their study. This, according to the participants, depends on (3) their prerequisites for learning and on (4) their learning strategies used to achieve their goals. Current (5) learning result is then the last element of a given category. The participants compare it with their own concept of study success (see no. 2) and with their motivation to study (see no. 1).

In addition to these categories we can also find emotions in a given situation (category 10, see Table 1) which are present not only in the learning and study process, but also in the examination process which thereby creates a demand on the students to self-regulate

their emotional experience. It is no coincidence that the word emotions (from lat. *emovere* = put in motion) has a very similar etymological basis as the word motivation (from lat. *movere*). Emotions and motivation are, even according to psychologists (Cakirpaloglu, 2013), an interconnected system, because the emotions start and direct our behaviour. Motive, on the other hand, starts a power that activates an individual. In this regard, the motivation is understood as a process of starting an activity of humans focusing on their goals as well as on their regulation of such activity.

Categories		
1 Individual human elements	2 Discursive construction of individuals and collective human actors	3 Temporal elements
Participants of the research Teachers Husband / wife Children Coworkers	Adult Secondary-school student Student of combined study program Full-time student Unsuccessful student Successful student Challenging teacher Unpretentious teacher Communicating teacher Incommunicative teacher Bosses Coworkers	Education as an investment Time management Academic year schedule Planning Daily schedule Weekly schedule Student age
4 Nonhuman elements	5 Discursive construction of nonhuman elements	6 Spatial elements
Faculty Employing organization Electronic communication environment (email, facebook) Electronic data storage Seminar tasks	Study program Labor market Academic culture Student profession Socioeconomic status Work place Family	Inner space perception of learning Space management
7 Collective actors	8 Process of learning	9 Main referential discourses
Class Groups of students helping each other Collective of coworkers	Motivation to study / learning (1) Success in study (2) Preconditions of learning (3) Learning strategies (4) Learning outcome (5)	Discourse of employment Discourse of tertiary education
10 Emotions		
Emotions related to learning Emotions related to testing Emotions related to faculty		

Tab. 1. Ordered map

Relational Analysis

If we move our focus from the partial elements that make up the structure of a self-regulated learning situation to their relations, we get into the field of relational analysis. For relational analysis we have chosen the issue of *learning motivation* which is considered as a pivotal factor influencing the self-regulation and its results by many authors (see e.g. Boekaerts, 2002, 2005; Pintrich, 1999; Zimmerman, 2000, 2002).

In the field of adult education we understand the self-regulation as a regulation of one's own learning. Then, the self-regulation can develop only if a favorable conditions are created for a student because, according to Mareš ((in Čáp, Mareš, 2007), the ability to observe oneself, evaluate how one is learning and motivate oneself to change is stored in every one of us in the form of potentialities whose development depends on a situation. With regards to the self-regulated learning, the author also mentions four skills indicating the extend of its development in students: management of one's motivation, management of one's attention, management of emotions and management of failures in learning.

Our research showed that a wide range of elements (see Fig. 2) influences the motivation to learn which the informants see as a synonym for the motivation to study. We believe that the individual factors can be divided into five groups: (1) The influence of a socio-economic environment, (2) The influence of an occupation, (3) The influence of an educational institution, (4) The influence of family and relatives and (5) The age of students.

(1) The influence of a socio-economic environment

The socio-economic environment influences the motivation of students through the employment and higher education discourse. Because the participants emphasize that there is a presumption that: "only people with higher education are being employed" (2/A) and "people with a higher education are being preferred when choosing a candidate for a position" (1/A). The necessity to earn a higher education degree is then determined by the fact that "the labor market is an uncertain (...) and risky environment" (4/D) and by the fact that the number of people with a higher education degree in the population increases. This puts the people without a higher education degree in even more unfavorable situation. It is mainly the transformation of labor market and its risks that are considered a very strong motivation for further education. In this regard, the informants see their learning as an investment which will pay off by getting a better position on the labor market in the future. In accordance with this statement, the participants of one focus group say: "I have a job and the girls also can find jobs on the labor market, but I think ahead. I mean my work is not permanent, nothing is. It is the future that frightens me a little. The future is really uncertain (...). We certainly take it as insurance" (4/D).

(2) The influence of an occupation

Another essential element influencing the motivation of students is their occupation. Here, the organization employing the student plays an important role because it can "force" the student to participate in education, which is perceived in a negative way by the participants, as opposed to a situation when the students participate in education of their own free will. Furthermore, the organizations might not create favorable conditions for study which is regarded as demotivating. The participants say that if they admit that they participate in education, they might be accused of an unsatisfactory working effort: "The fact that one studies means that he is suspected of an inferior working performance" (2/F). In this regard, an important role is played by the group of co-workers as well as by the individual co-workers who, if they support the student, motivate the student: "It really helps me when others support me instead of doubting me" (4/B). But if the co-workers attitude towards education is negative, the students have a tendency to conceal their education and they state that they experience a fear from a possible failure. The negative emotions, on the other hand, also serve as an alternative motivational factor, because the students do not admit the possibility of failure: "I don't even think about failing" (2/D).

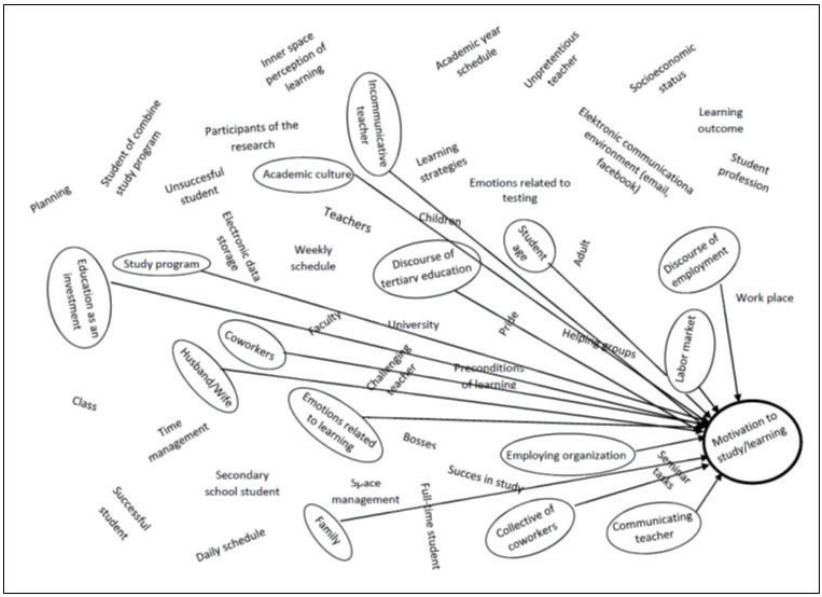

Fig. 2. Relational Analysis with focus on motivation to study/learning

(3) The influence of an educational institution

The educational institution also influences the motivation of participants. Mainly through the teachers, who are sorted by the informants into two categories: communicative and uncommunicative. The students say that the communicative type presents them with enough information and gives them a feedback on their study results. This keeps them motivated. On the other hand, the uncommunicative type does not communicate enough. Here, the students draw the attention to the fact that in such case the "study is more difficult" (4/C) and they "get lazy" over time (4/B).

But it is not only the teacher who influences the motivation of students. Another feature of the educational institution is the overall culture of academia. Participants in distant education perceive their study as a need to adjust to the rules of academia which demotivates them: "(The academia) is a bit different world. Maybe it's different for us because we are used to something else (...). It really bothers me because this is not how the world works and it even couldn't work in this way. Mainly if you talk about the market where a completely different rules apply. And we have to combine these two worlds together. The stress might come from this difference, when someone just says: it's not worth it, I will not adapt, it is an obstacle, I don't need this" (1/D).

(4) The influence of family and relatives

The influence of family and relatives is the fourth group of motivational factors appearing in the situation of participants of our research. If the family members are in favour of the participant's study, the participants are positively motivated. But if the participants are not supported, they feel demotivated and frustrated, mainly if they feel that by their study they neglect their family, e.g. their children: "I feel horrible because I can't devote as much time as I would like to my child. It is as though as I drive him away all the time. Wait just a little longer, Vašku. I'll just finish writing this and then we can play" (4/F).

(5) The age of students.

Last group of factors influencing the motivation is the age of students. The older the individual is, the more he or she realizes that there is less time to finish the studies in order to profit from the gained education: "The older a human is, the less time he has. And if I want to enjoy the degree then I have to really try. I can't take one or two years to decide that I'll give it another try therefore I really try to finish my studies" (4/B).

Discussion

The motivation with regards to learning or study, which becomes the topic of the presented relational analysis, can be understood as a state which activates human behaviour and gives it a certain direction (Atkinson, 2003). Subjectively, it can also be understood as a certain wish or desire. In the presented study we can consider the goal, towards which the behaviour of an adult student of distant education is directed, to be a study success, i.e. obtaining a higher education decree. For the purpose of our study we distinguish two types of motivation – intrinsic and extrinsic. We are aware of the fact that the psychologists use far more complex theories of motivation (incentive and instinct theories) where the differences in these concepts are: where does the motivation come from, what is the reason for the motivation and how it affects the behaviour.

Fig. 3. Hierarchical model of motivation to study

The respondents understand the motivation to learn in a wider context as a motivation to study, as we can see from the obtained answers. From the research results we found that it is necessary to have an extrinsic motivation first to support the development of student's intrinsic motivation to study. The intrinsic motivation is then, in the process of adult education, only the "top of the iceberg" (see Fig. 3).

The elements discovered due to our relational analysis that can be classified as extrinsic motivators and that are the bases for the development of intrinsic motivation are: (1) the influence of a socio-economic environment, (2) the influence of an occupation, (3) the influence of an educational institution and (4) the influence of family and relatives. (5) The age of students is a specific element that is significant on its own.

From the performed analysis it can be seen, what is the specific fact of adult students of distant education. It is the emphasis they put on the external study conditions which regulate their motivation.

Conclusion

While we can say that the motivation and emotions are important factors which initiate the self-regulated learning of adult students of distant education, they alone are not enough for a successful self-regulation. They are part of only one of the five groups which we

discovered during the relational analysis.

On the other hand, the cyclic (e.g. Zimmerman) as well as the tire (e.g. Boekaerts) models of self-regulated learning support the presence of motivation in all phases of this process. A number of researchers (e.g. Pintrich, 1999, Linnenbrink, Pintrich, 2003, Bandura et al., 2008) then, during a further research on motivation, present three of its components: self-efficacy, attributive belief and perceived (subjective) value of a task. All three components are, according to researchers, closely related to self-regulation. As we can see, the motivation becomes an essential element of the process of self-regulation, which is supported even by our relational analysis. The procedures performed during our analysis were used for the first time in the research of self-regulated learning of adult students.

We believe that the procedures of situational theory, which emphasizes the importance of identification of all elements presented in a given situation (by means of the situational mapping) and their mutual relation (by means of relational analysis), significantly contributed to a deeper understanding of the investigated reality and to identification of factors connected with the process of self-regulation of learning of adults. The benefit of our chosen approach is the fact that the theory is not constructed deductively but inductively and is anchored directly in the answers of participants. Due to the abovementioned characteristics, the situational theory becomes a suitable and stimulating tool not only for a further research into the self-regulation of learning, but also for a research of other phenomena presented in the world of education.

Even though the theories on self-regulated learning usually state that during the learning process the intrinsic and extrinsic factors are equally important and together can influence the will of an individual for a certain task and induce possible changes in the strategies exercised during the study, our research on adult students of distant education clearly showed the importance of conditions and extrinsic factors, including extrinsic motivation. We think that this is a very important finding and that it would be suitable to apply this finding further in the field of adult education and to use it during the process of creation of study plans. The realization of the study and learning itself should take into account the intervention of extrinsic motivational factors.

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ANALYSIS OF ENTRANCE EXAMINATIONS

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Abstract

The paper reports on an analysis of the entrance examinations at the Faculty of Informatics and Statistics at University of Economics in Prague. Applicants can be accepted to this faculty by three ways. The aim of this paper is to compare these ways of acceptance students at the Faculty of Informatics and Statistics and to study dependence of the results of entrance examinations in mathematics on test variants. Results of this analysis can be used for improvement of the entrance examinations at the Faculty of Informatics and Statistics at University of Economics in coming years.

Keywords

Entrance examinations, course Mathematics for informatics and statistics, statistical methods

Introduction

Applicants can be accepted to study Faculty of Informatics and Statistics at University of Economics in Prague by three ways:

- on the base of tests in mathematics and English, which is used at University of Economics in Prague (VSE tests)
- on the base of the national comparative exams - t**he tests of general academic prerequisites (**SCIO tests)
- without entrance examinations (on the base of results in mathematics and English at grammar school etc.).

The relations between the ways of acceptance applicants to study Faculty of Informatics and Statistics and study results in mathematics are studied in this paper. Similar problem (the dependence of study results and results of the learning potential tests) is solved in Kubanová and Linda (2012), Linda and Kubanová (2013). On the other hand, analysis of the study results in basic courses in mathematics at University of Economics is in Kaspříková (2012), Otavová and Sýkorová (2014).

In the second place we shall study dependence of the results of entrance examinations in mathematics on test variants. The math tests are prepared by the Department of Mathematics of the Faculty of Informatics and Statistics. These tests are the multiple choice question tests. The tests in mathematics have 10 questions for 5 points and 5 questions for 10 points (100 points total). Questions are independent. Each question has 5 answers (one answer is correct), wrong answer is not penalized. The number of points in the test in mathematics can be

$$0, 5, 10, 15, 20, 25, 30, 35, 40, 45, \ldots, 90, 95, 100.$$

These tests are used to the three faculties of the Prague University of Economics (Faculty of Informatics and Statistics, Faculty of Finance and Accounting, Faculty of Business Administration). The multiple choice question tests for entrance examinations at University of Economics in Prague from probability point of view are analysed in Klůfa (2013), Klůfa and Kaspříková (2012), Klůfa (2012).

The second aim of this paper is to analyse the entrance examinations in mathematics (similar problems are solved in Brozova and Rydval (2013), Hruby (2013), Mosna (2013)) at the Faculty of Informatics and Statistics at University of Economics in Prague from point of view test variants. We shall study dependence of number of points in the test in mathematics on test variants. These results will be used to further improve of the preparation of test variants in coming years.

Material and Methods

The analysed data are the results of the entrance examinations of 849 applicants in mathematics. Four test variants (denoted A6, A7, B2, B3) were parallely used for the entrance examinations in mathematics at the Faculty of Informatics and Statistics in 2013 (variants are randomly selected immediately before the test). The analysed data are sorted according to test variants (contingency table).

On the other hand the results in mathematics of 104 students in summer semester of the 2013/2014 academic year in the course Mathematics for informatics and statistics (ident 4MM103) are analysed. The number of points in the test in the course Mathematics for informatics and statistics can be in interval [0,40], the multiple choice question tests are not used. The analysed data are sorted according to ways of acceptance students to study Faculty of Informatics and Statistics at University of Economics in Prague – see Table 2.

Some statistical methods are used for an analysis of the entrance examinations at the Faculty of Informatics and Statistics – see e.g. Anděl (1978), Rao (1973).

For study dependence of number of points in the test in mathematics on test variants we shall use χ^2 test of independence in contingency table. Statistic χ^2 is

$$\chi^2 = \sum_{i=1}^{r}\sum_{j=1}^{s}\frac{(n_{ij} - n_{ij}^o)^2}{n_{ij}^o}, \tag{1}$$

where r is number of rows, s is the number of columns in contingency table and n_{ij}^o is the expected frequency in case of independence. When

$$\chi^2 > \chi_\alpha^2((r-1)(s-1)), \tag{2}$$

where $\chi_\alpha^2((r-1)(s-1))$ is critical value of χ^2 distribution, hypothesis of independence is rejected at significance level, which is asymptotically equal to α.

For comparison of the ways of acceptance applicants to study we shall use nonparametric Kruskal-Wallis test. When (statistic Q see e.g. Anděl (1978))

$$Q > \chi_\alpha^2(k-1), \tag{3}$$

where $\chi_\alpha^2(k-1)$ is critical value of χ^2 distribution for $k-1$ degrees of freedom (k is number of the ways of acceptance applicants), hypothesis "distribution of number of points in mathematics is the same for all three ways of acceptance students" is rejected at significance level, which is asymptotically equal to α.

Results and Discussion

Dependence on test variants

Results of the entrance examinations in mathematics in 2013 are in Table 1 (for example 6 students with variant A6 obtained 10 points in test in mathematics, i.e. 6 is frequency n_{31} in 3rd row and 1st column of the contingency table) and Figure 1.

Points in test	Variants				
	A6	A7	B2	B3	Sum
0	2	1	0	1	4
5	2	0	0	2	4
10	6	3	1	6	16
15	4	4	2	8	18
20	9	7	7	7	30
25	12	10	8	6	36
30	18	10	8	11	47
35	15	9	16	16	56
40	22	17	21	10	70
45	19	18	21	15	73
50	17	13	22	19	71
55	15	14	17	15	61
60	17	14	12	15	58
65	26	12	19	9	66
70	9	9	11	13	42
75	11	10	17	11	49
80	7	12	13	10	42
85	3	13	11	7	34
90	5	7	10	5	27
95	0	5	4	7	16
100	5	11	7	6	29
Sum	**224**	**199**	**227**	**199**	**849**

Tab. 1: Distribution of number of points in test in mathematics (contingency table)

Now we shall study dependence of number of points in the test in mathematics on test variants. Null hypothesis is

H_o: number of points in the test is not dependent on the test variant.

χ^2 test of independence in contingency table is used for the decision on the validity of the hypothesis H_o. In the first step we calculate according to (1) statistic χ^2 (for example $n_{11} = 2$ (see Tab.1) and expected frequency $n_{11}^o = 4 \quad x \quad 224 / 849 = 1.055$). Because of the small expected frequencies, we combine first 3 rows of the contingency table. We have

$$\chi^2 = 63.89 \qquad (4)$$

Critical value of χ^2 distribution for 54 degrees of freedom and significance level $\alpha = 0.05$ is $\chi^2_{0.05}(54) = 72.15$. Since

$$\chi^2 = 63.89 < 72.15, \tag{5}$$

null hypothesis H_o is not rejected at approximately 5% significance level. Moreover p value is 0.168 (null hypothesis H_o is not rejected also at 16% significance level). For calculation we used MS Excel version 10 – see Marek (2013). We can say that the number of points in the test does not depend on the test variant.

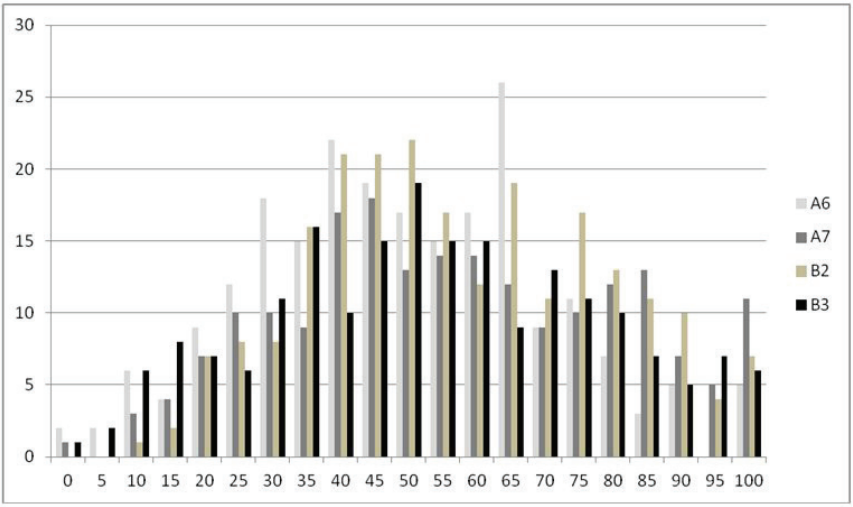

Fig. 1: Distribution of number of points in test in mathematics in 2013 – test variants A6, A7, B2, B3 (histogram)

Differences between the ways of acceptance applicants

Now we shall compare the ways of acceptance applicants to study Faculty of Informatics and Statistics. Results in mathematics in the course Mathematics for informatics and statistics sorted according to the ways of acceptance applicants are in Table 2.

We shall test null hypothesis

H_o: distribution of number of points in mathematics is the same
for all three ways of acceptance students (VSE tests, SCIO tests, other)

Some parameters of distribution of number of points in mathematics are in Table 3. To verify the validity of the hypothesis we use Kruskal-Wallis nonparametric test.

VSE tests: 9,10,11,11,12,16,20,21,22,23,23,23,23,24,24,26,26,26,27,28,28,28,28,28,29,30,30,30,30,32,32,33,34,35,35,38,38,38,39,39,40,40
SCIO tests: 2,6,18,19,19,23,27,29,30,34,37
Other: 14,18,21,22,22,23,24,24,25,25,26,26,27,27,27,28,28,29,30,30,31,31,31,31,32,32,32,32,32,32,33,33, 33,34,35,35,35,35,36,36,37,38,38,38,39,39,39,39,39,40,40

Tab. 2: Number of points in test in the course 4MM103

	VSE Tests	SCIO Tests	Other
Average	27.119	22.182	31.039
Median	28.000	23.000	32.000
Modus	28.000	19.000	32.000
Std. Deviation	8.500	10.944	6.135
Kurtosis	-0.248	-0.215	-0.095
Skewness	-0.496	-0.633	-0.550

Tab. 3: Descriptive statistics for number of points in the course 4MM103

Value of stastistic Q is (Q is calculated on the base of rank of values in Table 2 - see Anděl (1978))

$$Q = 9.95 \tag{6}$$

This statistic has asymptotically χ^2 distribution for 2 degrees of freedom. Critical value of χ^2 distribution for two degrees of freedom and significance level $\alpha = 0.01$ is $\chi^2_{0.01}(2) = 9.21$. Since

$$Q = 9.95 > 9.21, \tag{7}$$

null hypothesis is rejected at significance level, which is approximately equal to $\alpha = 0.01$. There are significant differences between ways of acceptance students to study Faculty of Informatics and Statistics (VSE tests, SCIO tests, other).

Discussion

Similar problem as in this paper is solved in Kubanová and Linda (2012). There is studied the dependence of study results and results of the learning potential tests (SCIO tests). The insignificant correlation was detected between results in learning potential test and study results. In this paper was solved other problem - dependence between study results in mathematics and SCIO tests (ways of acceptance students) has been proven.

On the other hand, analysis of the study results in basic courses in mathematics at University of Economics is in Otavová and Sýkorová (2014). There is studied whether the score from final test depends on the score from mid-term test. Similar methods as in this paper show that dependence between the score from final test and the score from mid-term test exists.

The multiple choice question tests for entrance examinations at University of Economics in Prague from probability point of view are analysed in Klůfa and Kaspříková (2012). Disadvantages of such type of test is that a student can obtain certain number of points in the test purely by guessing the correct answers. Results of the paper show that risk of success of students with lower performance levels is negligible. The analysis of entrance examinations in this paper (the dependence on the test variants) also shows that these tests are suitable for entrance examinations at University of Economics.
Relation between results of the entrance examination test in mathematics and examination in mathematics at University of Pardubice is studied in Linda and Kubanová (2013). This paper had demonstrated the dependence of the test results in math on the results of entrance tests in mathematics (in contrast to SCIO tests). This finding should lead to the conclusion that the schools should focus on admission process, students should be accepted on the basis of own admission. Similar results we obtain also in this paper.

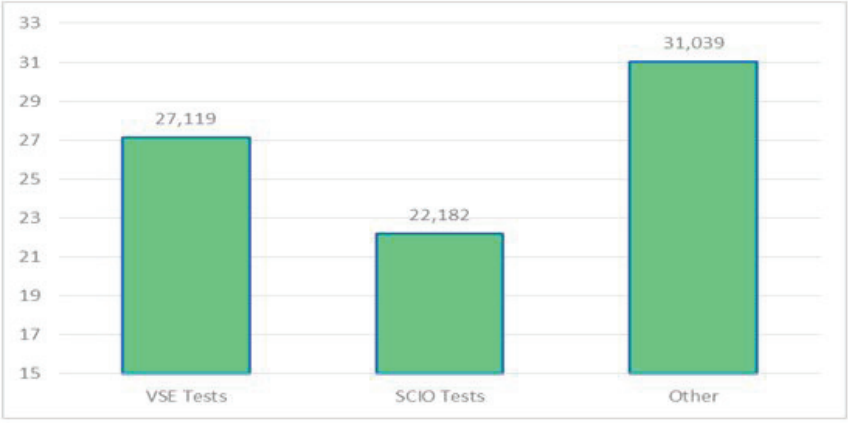

Fig. 2: Average number of points in test in mathematics in the course 4MM103

Conclusion

From χ^2 test of independence in contingency table it follows that the number of points in the test in mathematics does not depend on the test variant. From the results of this paper we can say that significant changes in test variants in mathematics in the coming years are not needed.
There are significant differences between students which were accepted to study Faculty of Informatics and Statistics on the base VSE tests, SCIO test and without entrance examinations from the point of view test score in mathematics (see also Figure 2). The best results from the point of view number of points in test in mathematics in the course 4MM103 achieved by students which were accepted on the base of good results in mathematics and English at grammar school (without entrance examinations). For the eventual changes in the admission process, it would be useful to test the differences between ways of acceptance students to study Faculty of Informatics and Statistics in other courses. This problem will be addressed in the following paper (the paper will be offered to the Journal on Efficiency and Responsibility in Education and Science).

Acknowledgements

This paper was processed with contribution of long term institutional support of research activities by Faculty of Informatics and Statistics, University of Economics, Prague.

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USING MOBILE TECHNOLOGIES FOR FLIPPED CLASSROOM TEACHING

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Abstract

Teaching based on flipped classroom principles requires specific teacher´s skills. This paper deals with the possibility of using a tablet to prepare video lessons, and it is based on the summary of experience gained from teacher training sessions. This work also includes an analysis of the most common fears of teachers who think about applying the flipped classroom method. Objective of this paper is prove that using proper tools these fears can be minimalized. The data was collected using unstructured interviews. This article also describes options of iMovie tool for creating video lessons.

Keywords

Flipped classroom, video lesson, recordings, tablet

Introduction

The teaching form called flipped classroom has been intensely discussed since the year 2011. Even though it cannot be considered a completely new form of teaching, it received a huge support thanks to the phenomenon called Khan School. Salman Khan began to create educational videos for private purposes at first and uploaded them on the YouTube portal. They were mostly math lessons for his relatives. The published videos gradually gained popularity, however the key point came in the statement of Bill Gates, who claimed that he watched the videos with his children. (Bergmann and Sams, 2012a; Kadlecová, 2012)

The classwork based on the flipped classroom principles is based on a very simple idea (Flumerfelt and Green, 2013). The time a student spends at school and the time he or she spends at home self-studying are switched. The traditional classwork, of course, shows a teacher presenting facts and data to students. According to the Czech School Inspection statistics, frontal instruction remains the most common method of Czech education. At home, students' job is to solve tasks based on their school lesson, however their possibilities to consult their teacher or classmates are rather limited. (Berrett, 2013; Hamdan et al, 2013a).

The flipped classroom is based on the opposite model. A teacher prepares his or her lecture in the form of a video recording which is made available to students (Smith and McDonald, 2013). At home, in time they would otherwise spend doing their homework, the students watch a regular lesson (Herreid and Schiller, 2013). The next day, they come in the classroom with specific questions regarding the matter they have already studied. The teacher is available to them and his or her efforts can be focused mostly on the problematic part of subject matter. This model also encourages teachers to introduce rather cooperative kind of activities instead of frontal teaching.

The form itself is not strictly defined. A teacher can use already existing internet sources and share only a list of links. The already mentioned Khan Academy is a good example

of this. This being the case, the teacher must necessarily know all the sources really well to be able to discuss their content with the students. However, there is another alternative. The teacher can create the video recordings him/herself. Some schools also experiment with the model of older students creating the video lesson for their younger classmates.
Flipped Learning Network with the www.flippedlearning.org is one of the respected social communities dealing with this way of teaching. (Brdička, 2013; Hamdan et al, 2013b).
The commission of this community is to share experience with the flipped classroom implementation. Great number of teaching materials proving successful application of this method can be found on the above mentioned website. (Bergmann and Sams, 2012b)
However, the published papers do not only focus on monitoring the impact on students knowledge and skills but they also describe possible problems with the flipped classroom implementation (Herreid and Schiller, 2013; Brdička, 2013).
The objective of this paper is to define the most common fears of teachers who think about applying the flipped classroom method. The data was collected using unstructured interviews.

Materials and Methods

The following text is based on unstructured interviews with teachers who were involved in the project called The Integration of Mobile Technologies in Teaching. It was one of the EU projects realized in the context of so called Call 51 activity. Its main purpose was to equip the teachers with mobile devices like tablets and at the same time provide them with a series of training sessions showing them how to implement the device in everyday lessons. The project has been in progress since October 2014 and it is planned to finish in June 2015.
586 teachers from 39 primary and 3 secondary schools participated on the above mentioned project. All schools are located in the Moravian Silesian Region. The sample included teachers of random subjects. Every teacher was equipped with an iPad tablet and underwent a series of training sessions aimed at their utilization in classroom. During the first stage, general operating skills were taught. The first stage included namely the following courses:

- Cloud Services – aimed at the possibilities of file sharing and web applications for file management;
- Students in a Computer Lab – introduction of multiplatform applications for cooperative work, e.g. Socrative, Paddlet;
- Electronic Texts – ways of work with different kinds of e-texts and their specifics – PDF, ePub, iBooks;
- Creating Teaching Materials with Regards to Copyrights legislative – using online sources while not violating the copyrights, Creative Commons licence;
- Presenting with an iPad – using an iPad to present information, project, and work in a more interactive way;
- iPad in a Classroom – possibilities of using an iPad in everyday lessons.

During the following stages of the training, teachers could choose sessions according to their interest or qualification. Individual courses were introduced with a brief description. Principles of work in a flipped classroom environment could be studied in one of the courses. 68 teachers, that is 11.5% teachers chose this course.
Teachers who chose the flipped classroom course were informally interviewed, the goal being to identify the greatest obstacles they saw with implementing the flipped classroom in teaching. The interviews did not have any defined structure nor did the teachers have

to fill in any form. The interview rather had the form of a discussion before and after each training session. Thanks to the fact that there were groups of approximately 10 teachers, it was rather easy to record their opinions and analyse the most common ones.

The iMovie Tool

Sweet (2014) mentioned using of iMovie tool as the tool for creation the microlectures.
The iMovie tool is an application for the iOS operation system designed to be used on Apple iPad tablets. It is available for free, however, it is necessary to install it after the iPad is activated. The app comes with full localization and it is ready to use any media present in the iPad.
The iPad tablet version available now is equipped with a HD camera and it comes with basic video tools such zoom in/out, autofocus on/off, and brightness adjust option. The camera is ready to be used for time-lapse recording. Using the iPad it is also possible to take pictures and record sound.
Every video clip can be used repeatedly, cut it in more smaller clips of any length, and see the final length immediately. As an alternative, it is possible to use the video tool for measuring the time period of certain phenomenon, such us speed. Thus the iPad might become a tool to be used in physics, physical education, etc.
The basic iMovie tools include:

- ability to merge various recordings (video, photos, sound) in one timeline;
- cutting individual video clips;
- slowing down, fast forwarding, or pausing any part of a clip;
- adding subtitles to any clip;
- making additional commentary track and merging it with the original video;
- removing od muting the original sound track;
- combining individual clips – the PIP (picture in picture) function, simultaneous projection of two clips.

Video can be processed real-time, thus it is not necessary to compress of reformat the final file. The iMovie application allows to export and share the edited video via YouTube in all three settings (private, unlisted, and public).

Other Than Video Materials

The above mentioned results are supported by data collected from another course from the same project, this one being focused on creating an electronic book using the Book Creator application. The group of 235 teachers applied for the course to learn how to create simple electronic texts which would include pictures, descriptions, and basic graphics. These teachers similarly underwent an interview prior and after the course. 90% of them claimed they used MS Word on PC to create teaching materials they need to share with students, however, only one third of the group stated they do it on a regular basis. Majority of teachers use regular textbooks with the addition of printed materials downloaded from the internet or photocopied textbook and magazine pages. They all expressed similar fears from the given task:

- the time spent on creating the materials will not be worth the effect brought;
- their technical skills will not be enough to create such materials.

The Book Creator app enables teachers to create simple electronic texts and publish them in the form of an iBook or in pdf format. Some of its features include:

- adding any pictures and text saved in the iPad device;
- adding photographs taken directly using the iPad;
- drawing (highlighting parts of text, pictures, drawing simple schemes, graphs, etc);
- adding sound and video (not available if the outcome is in pdf format).

All the teachers were able to create an e-book and share it with others. In the interview after the course they all without exception agreed on the following:

- compared to the standard way they prepare teaching materials (MS Word), using the Book Creator app is faster;
- using Book Creator is not faster compared to photocopying or printing, however they see the difference in quality;
- until now they never thought about adding sound and video (not available if the outcome is in pdf format).

Using the iMovie app significantly reduces the time a teacher needs to prepare an educational video lesson. Using the Book Creator significantly reduces the time a teacher needs to prepare other materials that include text and pictures, however, it does not save time compared to photocopying and printing materials. Concerning the fact that teachers originally expressed the fears from time and technical difficulties of preparing such lessons as the strongest arguments against using this method, the iMovie app might be one of the solutions as well as the Book Creator. They are really easy to use, and especially the teachers with worse technical skills were likely to change their attitude towards using the recording devices and tools. After taking the basic course, every teacher was able to create a simple educational video from their own materials which included their own commentary and text in the form of added subtitles, and every teacher was able to create an e-book using their own pictures, text, and drawings.

Results and Discussion

The first sample included 68 teachers who deliberately picked the course and thus they were briefly informed about its idea and goal. These teachers expressed the following fears:

- creating the video recordings will be technically demanding;
- they will not be willing to present their lessons to others;
- preparing such lessons will be time consuming.

All teachers claimed that they had never been able to implement such method in their teaching due to the lack of their technical skills. Many of them had negative experience using the standard camera-PC editing software model. Large number of teachers was unwilling to present their work publicly, however it was not possible to clearly identify their reasons. Small minority of teachers showed no interest in sharing their work. Some teachers were afraid of possible negative criticism. Only about 10% of teachers knew about the possibility to share videos on YouTube without making them public.

iPad as an Experimental Tool for Teaching Science was the name of another course offered. The course annotation also included using iPad as a tool to work with video recordings and creating videos using iPad formed a major part of the course. At the end of the course, teachers were introduced to a couple of basic examples of the flipped classroom method. Consequently, they were asked whether they could imagine such a lesson in reality, and what problems they would expect. They expressed the following fears:

- unwillingness to change the verified teaching model;
- necessity to change their approach and subsequently create new teaching materials;
- preparing lessons would be time consuming.

The above stated findings show that after being trained to work with iPads, teachers lost their fears from technical difficulties, especially compared to the traditional camera-PC model. However, the fears from the change of traditional teaching models remained.

Teachers who took the Flipped Classroom course, which included work with video,

appreciated mainly how easy it was to create and edit video using iPads, and also the possibility to share and publish the video immediately. These teachers had been thinking about changes to their way of teaching, which they demonstrated by picking this specific course. After completing the course, the absolute majority of them claimed they were surprised by the simplicity of using iMovie app and that they would try to use it in their future work.

Conclusion

The idea behind the flipped classroom method is really simple, however, teachers' technical skills often present a high obstacle. According to our research, teachers mostly fear that preparing a flipped classroom lesson will be technically demanding and time consuming. This paper proved that using proper tools these fears can be minimalized.

The iMovie app especially proved to be a suitable tool for recording, editing and even publishing a video clip. After going through a short iMovie training, majority of teachers claimed that the iMovie is easier to use and more efficient to for video lessons making compared to regular Windows PC software.

Thanks to the fact that the project is still running, it will be possible to monitor the impact of the above mentioned courses on real utilization of the flipped classroom method in teaching.

In the following course of our research we are going to focus on the application of the flipped classroom method, monitoring the quality of video lessons created and their utilisation in real teaching process.

However, it will be necessary to get a feedback from participating teachers after several months (best in the beginning of the following school year) to see, whether they keep using the iMovie app to prepare video lessons. This data will be collected from a simple questionnaire.

Acknowledgements

The research was carried out as part of the project "I Share, You Share, We Share – or Using the ICT to Increase Teaching Effeciency" – CZ.1.07/1.3.00/51.0039. The project was realised by iSmart premium s. r. o. and there were 42 schools (38 primary and 4 secondary) participating.

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HOW TO ENHANCE MOTIVATION IN STUDENTS OF A FOREIGN LANGUAGE

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Abstract

The main objective of this paper was to encourage students' motivational attitude when learning a foreign language. Whether learners are able to accomplish their academic goals strongly depends on their motivational elements, intrinsic and extrinsic, which remarkably influence students' learning performance. The aim of this paper is to describe certain techniques with special attention given to their impact on enhancing learners' motivation in a foreign language class. Specific techniques were developed due to which students manage to relieve their anxiety, discomfort and in positive atmosphere initiate their will to perform. This paper also aims to emphasize compelling effect of a teacher's selection of specific activities thus influencing students' motivational approach. Findings of this paper demonstrate how indispensable motivation is and how specific activities can influence students' self-esteem and learning performance.

Keywords

Anxiety, extrinsic, intrinsic motivation, positive approach

Introduction

Motivation plays a vital role in any kind of discipline and it is one of the key predictors of mastering a foreign language. Psychological comfort of learners participates on capability of being motivated. As Dornyei (1998) emphasizes, motivation provides the primary impetus to initiate learning the L2 and later the driving force to sustain the long and often tedious learning process. Dornyei (1998) further stresses out that motivation is responsible for determining human behaviour by energizing it and giving it direction. According to Hussin, and D'Cruz (2001, as cited in Ebata, 2008) positive self-concept high self-esteem, positive attitude, clear understanding of the goals for language learning, continuous active participation in the language learning process, the relevance of conductive environment that could contribute to the success of language learning. They state (as cited in Ebata, 2008) that six factors influence motivation in language learning: attitudes, beliefs about self, goals, involvement, environmental support, and personal attributes.

The objectives of this paper are to enhance students' self-esteem. Following the author's teaching experience, it is almost impossible for students to perform academically if they are not motivated, if they do not feel respected, if they are not given a chance to find out that learning is part of their own responsibility. Verifying the viability of using certain techniques in order to encourage learners' motivation and providing sufficient reasons for applying those (techniques) into a language class has become the main goal of this paper's research. By offering a teaching framework and collected data survey, this paper focuses on one of the fundamental issues faced by the university teacher in language classes.

The methodology used in this paper comprises description of several techniques that introduce the subject of self-esteem and motivation to the learners of English language

classes at Czech University of Life Sciences in Prague. They (techniques) were drawn upon the questionnaire's results obtained from the students at the beginning of the surveyed semester (winter). Another questionnaire was given to the learners at the end of the surveyed period (summer semester). These answers were also valuated by points (0-9), which gave the students' comments mathematical value. The concluding assessment was supported by the author's observation of the students' changes in motivational behaviour and their progress in accomplishing the academic goals based on the survey's results. All of the described procedures are classroom tested, as evidenced by the number of students, age, genders, origin and students' responses quoted in six tables that have become the base of this paper's findings. Subsequently, this paper provides methodological discussion emphasizing concernment of self-esteem's presence in students of foreign languages that can be obtained through the framework of specific techniques developed for this purpose.

Materials and Methods

The most significant challenge for teachers lies in motivating their students. Without motivation hardly any accomplishment can be reached. Each student is an individual with different needs, interests and approach towards life. Horwitz (2007) points out that the necessity of focusing on the emotional states of learners falls into the most important demands. Understanding the emotional vulnerability of language learners becomes a crucial influential factor in teaching process (Horwitz, 2007). As Kotekova (2012) emphasises the teachers' task is thus not only to provide knowledge and information but also to immerse themselves into the student's mind and discover the best way to awake the learner's will to communicate. Although gaining self-confidence is a difficult task, it just needs certain factors to be recognised and specific strategies developed. Russel (2013) points out that it appears to be very important that students should be led to feel 'in control' of their own lives and education. Assor (2002, as cited in Russel 2013) modifies the 'educator' role to be of use to students as they explore their own interests, goals and learning. This implies that in order for language learners to experience success and become satisfied, it is essential for instructors to create a relaxing learning so that students can perform successfully (Ebata, 2008).

The basic principle of this study was to find out character of the elements that deprive students from feeling motivated and confident, and accordingly define techniques that help develop and enhance self-esteem and motivation in students. Two specific questionnaires were applied to the students of intermediate (B1) level of English in 4 classes (95 students in total, 45 males, 50 females) and in 6 classes of the students of upper-intermediate (B2) level of English (146 students in total, 64 males, 82 females) studying at the University of Life Sciences in Prague. The questionnaire was given to 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 in the learners' behavioural approach towards learning and motivation was executed by the author during the surveyed period of two semesters of the academic year 2013-14 (24 lessons, once per week, 90 minutes). The survey was conducted in the form of two anonymous questionnaires consisting of 3 questions given to the learners at the very beginning and also at the end of the surveyed period. The first questionnaire at the beginning of winter semester has revealed character of the motivation restraining elements that the students defined themselves within their answers.

- How do you feel about learning English?
- How motivated do you usually feel before each English lesson?
- What things might affect your motivation?

Although only few questions were provided, they (questions) offered variety of possible approaches as could be seen in the answers (Table 1). After the main components from the learners' responses had been identified, they were used to develop certain techniques. The second questionnaire, with the same questions but added points to assess their (learners') level of improvement, was given at the end of the surveyed period to find out how the students felt after specific techniques were applied. The learners associated their answers with points in a scale from 0-9 where zero point was no improvement, ongoing anxiety, no interest and motivation; while valuation in 9 points meant high enjoyment, strong positive perception of the motivational atmosphere in the class, and self-esteem improvement. Findings were then summarized in percentage by counting up the amount of particular points for each answer in the second questionnaire. The outcomes from these responses provided the author not only with changes in the learners' behaviour but also with concrete factors that have had a fundamental impact on modifying the learners' feelings and approach. They (techniques) have formed the lesson into specific framework which supported the tasks necessary for awakening the learners' self-esteem and motivation thus maintaining the final academic goal. This research is rather qualitative providing an overall breakdown of the learners' assessments (answers, comments and points) describing their (students') personal feelings and improvement (Tables 1-6).

Technique 1: Introducing the lesson with a positive quote.

The aim of this technique is to evoke positive and relaxed atmosphere in the class. A teacher introduces the quote and writes it on the board. Students are kindly asked to bring in their opinion on it. The quote should not be of any serious or dramatic character. It should create fun and at the same time bring some motivational thoughts and ideas in which students should also be able to find its (quote's) relatedness with their personal situation. Making English lesson fun can help teachers to break down barriers and establish a feeling of trust in the classroom (Rosenberg, 2013). A teacher should always have some amusing quotes ready for the lesson since students' mood and attitude are not always in harmony with the lesson's goal expectations. Following quotes have been used in this survey:

- *Expect problems and eat them for breakfast.* Alfred A. Montapert
- *In order to succeed we must first believe that we can.* Nikos Kazantzakis.
- *Our greatest weakness lies in giving up. The most certain way to succeed is always to try just one more time.* Thomas. A. Edison
- *If we did not make mistakes, we would never learn anything.* (unknown author)

Technique 2: Discussing the plan with students.

Teachers very often fall into a daily routine of just announcing the plan to students; this technique offers motivational delivering of the class's programme. A teacher not only names the topic of the lesson but he also explains why he is going to teach it, why certain exercise is important and what kind of goal they want to accomplish by doing this exercise. The next step of this technique is that a teacher asks students if they agree or like his/her plan.

Technique 3: Presentation/a small talk on students' favourite/chosen topic.

Students are introduced to ten new words. They are written on the board. This technique transforms a casual, not appealing memorising task into challenge and amusement because they (students) are asked to apply new vocabulary into a context they consider as being their favourite. Choice is implemented through learners' option to pick their own

personal topic which is a very strong motivating factor in such typical language exercise as learning new vocabulary is. Students are offered possibilities how to embrace this task. They can apply new words into a short presentation (no more than 3minutes) or give a small talk on their favourite topic, tell a story what has happened to them; anything that they feel comfortable and content about. The only criterion which they need to follow is to use as many new words as possible. Another part of this technique compliments speaking skill of learners, and at the same time it contributes to remembering new vocabulary. Students are asked to make questions on the topic they have just heard. The point is that these questions must also include at least one new word mentioned in the presentation or a small talk.

Technique 4: Guess the word' exercise.

This technique complements the previous one by mastering new vocabulary in a different way than just memorising it. The same new words are still seen on the board. Instead of having to passively memorise them, one student is asked to explain the meaning of one of the words from the list. He/she must explain it in a foreign language (English in this survey) without saying which one she/he is busy with. The class must guess which word was explained. Each well-guessed word is awarded by 'an active point' (as explained in the following technique).

Technique 5: Motivational points.

The purpose of this technique is to increase students' willingness to perform and participate in their own education through extrinsic motivation factor – rewards in the form of active points. Students are involved in all kinds of activities. The fundamental task for a teacher is to make sure that they (students) have the opportunity to earn 'active points'. It could be for a well-mastered presentation, nicely explained quote, the fastest and correctly completing exercise or just showing an attempt to participate. There is one more significant point in this technique and that is to connect these rewards (active points) to further activities which would help students sustain in their motivated approach. The author of this paper has used semester's final test, as a means where all active points gained during the semester by each student had been added towards the learner's final score. Students are thus given an opportunity to successfully accomplish their final goal on account of their whole semester's activity.

Technique 6: Keeping progress visible.

In order to enhance self-esteem thus encourage motivation, a teacher should not only give 'active points' but also ask students to keep a visible record of their progress. If students can see their improvement, they immediately gain stimulus which is the key-element to get motivated. This technique suggests that students make a table of their personal success after each lesson. The table would not only provide constant feedback but also show a student's improvement and activity during a particular lesson and also at the end of semester. It includes the date, specific activity, points he/she received for the activity and his/her comments.

Results and Discussion

Based on observation and questionnaires' analysis the above-described techniques applied to the lesson confirm that specifically developed activities help encourage students' motivation that plays an essential role in learning a foreign language. Moreover it was proved that a teacher's selection of particular activities markedly encourages motivational

attitude in students. The aim of this paper was to enrich pedagogical methods by introducing specific techniques that help teachers awaken students' willingness to participate in learning a foreign language (Tab.1). These techniques were developed on the basis of the university students' comments revealed in the questionnaire at the beginning of the surveyed period. Findings have proved a very strong relationship between motivation and a learner's success. Ebata (2008) emphasises that in order for language students to become satisfied with a lesson, it is required to produce a stress-free classroom and develop integrated-tasks lesson.

QUESTIONNAIRE	
How do you feel about learning English?	
BEFORE	AFTER
I am not very confident to study English because I do not always find the words that I need to express what I think.	The exercise about guessing the new word was wonderful. It helped me to remember it and I could also hear the others how they express themselves. (9points)
I feel frustrated because I have never been good at foreign languages and I am worried to start speaking.	Our teacher has done a marvellous job to tell us positive quotes at the beginning of each lesson. I got immediately amused and thought of the meaning. It was inspiring. (9 points)
I don't like when I just have to do what the book says. I would like to discuss something that I know and do in my free time.	When the teacher asked us if we agreed with the plan for the lesson, I was nicely surprised. We could even suggest some different ideas. So great. (9 points)
How motivated do you usually feel before each English lesson?	
BEFORE	AFTER
It depends on how much homework we had and if the grammar is difficult. I do not like working on exercise that are not interesting and only about grammar.	I must say that presentation we did and discussion afterwards with the whole class was truly amusing. It helped that the topic was my favourite one. (8 points)
If I start the day with English, I need some kind of nudge to be excited because it is hard for me to just speak the foreign language.	Discussing positive quote at the beginning was a great idea, and so different from the usual lessons. I had a chance to take a breath and even laugh about that funny quote. (7 points)
I love English lessons but I would like to try something new that is different from ordinary lesson, some challenge or competition.	We did few exercise where was important to be fast and correct in completing it. I managed to finish one and got an active point for it. Great. (8 points)
What things might affect your motivation?	
BEFORE	AFTER
If I know what I have to reach by the end of the lesson, and I understand the plan, it is easier for me to follow it.	I have never experienced that a student could change the plan of the lesson. It is so motivating to see that a teacher appreciates my opinion. (9 points)
We usually do exercises but I cannot feel any progress, if I improved myself or not.	Wonderful idea that we got active points for new words we managed to remember and then we made a note of it and after the lesson we could check how many small goals we accomplished. (8 points)

Tab. 1: Breakdown of the results: Questionnaire

Nothing is more important than drive. The students' answers at the beginning of semester (before the techniques were applied) have revealed a wide variety of reasons why they sometimes walk into the class not being comfortable and not willing to perform. If they (students) demonstrate such lack of willingness, it is important to find out what causes this particular anxiety. Drawing on the students' responses, it is very often caused by fear from making mistakes or just not practising communicative skill in their previous language education. These are the main factors why they (students) hold themselves back in the class. There comes a teacher's supportive role. As Fontecha (2007) emphasizes, particular attention must be given to understanding and enhancing the role of a teacher as a facilitator, a teacher who includes learners' inner processes into the instruction. Starting the lesson with a positive quote (Tab. 2) has brought a novelty into the language class by the teacher's gentle attempt to firstly awaken the learners' interest instead of a casual plan following structure. Findings experienced through observation and complemented by the questionnaire at the end of semester have shown that 98% of observed participants felt very much relieved when they were given a chance to relax and reset their mind-set by discussing interesting and appealing to them quotes. They also expressed their appreciation in finding relatedness of the quotes with their own life. They (students) said that even a short time at the beginning of the lesson devoted to positive talking helped them get rid of discomfort and start the lesson with an interest and motivation.

INTRODUCING THE LESSON WITH A POSITIVE QUOTE		
Technique 1	**Before**	
	•	I feel embarrassed; I can make a mistake in front of the class.
	•	I do not like starting the lesson with homework exercise. I need to set my mind first.
	After	
	•	Since we first discussed a funny quote at the beginning of the lesson, I always look forward to it.
	•	It was very pleasant to talk about our life at school and hear some positive hints before we started new grammar.

Tab. 2: Breakdown of the results: Positive opening of the lesson

It was also observed that there was a significant improvement in terms of enhancing self-esteem when the students could have a say in what they were going to do during the lesson. At the start, the learners' revealed their will to know more about the plan for the lesson in order to understand and remember more. They were not shy to come out with their feelings of being motivated due to information what their goal is and also its reasons. On the other hand, some learners revealed their poor interest in learning because they were uncertain about some reasons of the tasks which they were supposed to work on (Tab. 3). 98% of the students have expressed strong appreciation of the teacher's will to discuss the plan for the lesson. They said it was usually only delivered to them. Arousing discussion generated a strong motivational effect on the students because their opinion was wanted and possibility of discussion or eventual change of a plan was offered. Kohn (1993, as cited in Russel, 2013) points out that students will participate more in learning if they have a say in what they are doing, rather than following orders or feeling outwardly compelled. The idea is further complemented by Russel (2013) who says that in the interest of maximising understanding, participation and motivation, teachers should spend some time discussing plans and details with the class, while making sure they do so in such a way as to promote and value the students' opinions. Active involvement of

the students in their own learning was one of the major keys to motivation in this survey (Technique 2). 97% of the answers in the final questionnaire revealed that students like to be needed (Tab 3). Also findings experienced through observation have proved that 98% of the students were actively participating in modifying the lesson's plan. Explaining the students what kind of skill they are going to practise by doing which exercise, has come out as one of the fundamental parts when discussing the lesson's plan. Only 3% of the learners have shown inessential needs to be part of the lesson's plan discussion. Nevertheless, as Russel (2013) points out that having choices makes students feel that they have some control and the ability to act for themselves, which can have powerful effects on their feelings of autonomy and motivation. This technique demonstrating the students' interaction with the teacher's important decisions has showed a strong impact on enhancing their (students') motivation.

DISCUSSING THE PLAN WITH STUDENTS		
Technique 2	**Before**	
	•	We usually only do exercises but I would like to know what skill we practise so I can use it next time again.
	•	School does not usually give us a chance to change some ways in learning. I think that we should be allowed to suggest some kind of a game with new words or crosswords which would be fun.
	After	
	•	I felt so important and motivated when the teacher asked us what we think about the plan for the lesson. We could even change it and compete in our ability to express our opinion including new vocabulary.
	•	One classmate suggested singing an English song and analyse its meaning. Teacher agreed which was so great that we did it next lesson again.

Tab. 3: Breakdown of the results: Introducing the plan of the lesson

Learning new vocabulary is one of the main challenges in learning language. Regular repeating of new words, whether in presentation or in questions, has appeared as very effective in 96% of asked participants (Tab. 4). Their answers show that applying inventive tasks where they (learners) could sense competition and remember words in a different way than just memorising them passively encourages their will to perform. Rosenberg (2013) points out that providing students with tasks which require them to use their communicative skills, as well as problem-solving strategies or negotiation skills, is crucial, as these skills are just what they have come to class to learn. The final questionnaire's responses have shown that 97% of the participants appreciated possibility to choose their favourite topic. Their motivation was naturally teased out. Katz and Assor (1993, as cited in Russel, 2013) say that in their study when choice was offered in a way that met the needs of the students, it was found to enhance motivation, learning and well-being. 98% of the learners expressed amusement and inspiring challenge in creating questions that must include new words.

PRESENTATION ON STUDENTS' FAVOURITE TOPIC & GUESS THE WORD EXERCISE		
Technique 3,4	**Before**	
	•	Learning new words has never been my strong side, it is so difficult to remember them, I wish there was some hint how to keep them in head.
	•	I do not always like the article in the book. The topics are not related to my experience at school which would be easier for me to discuss.
	After	
	•	I really enjoyed the game with new words in it. I had to explain the words and also answer the questions including new words. It was fun.
	•	Presentations are so much fun, it is a big challenge but fun for me to talk about my favourite subject.

Tab. 4: Breakdown of the results: Students' choice in specific activities

The efficiency of Technique 5, 6 was revealed through the outcomes that show their (techniques') strong impact on the learners' motivation (Tab 5). What is even more appealing is that extrinsic motivation (active points) has contributed to rising positive intrinsic attitude in the learners. 96% of the learners have appreciated recognition of their accomplishment during learning process. When the students had the possibility to see their results in the table, they could identify their progress in a concrete way (Tab 6). Experience of success provides students with more power to pursue a new goal (Ebata, 2008). Ebata (2008) then continues that the feeling of success time again emerges specifically when he (a student) realises the degree of his improvement and achievement. Connecting points with the final test's score at the end of the summer semester gave 98% of the participants a very strong intrinsic encouragement. They were consciously motivated to take every opportunity to succeed in the task during the lesson in order to earn another active point. They have expressed their strong motivation due to the fact that their final accomplishment is influenced by their whole semester's work. They found out that the more active points they had earned, the more confident they felt about the final success.

MOTIVATIONAL POINTS & KEEPING PROGRESS VISIBLE.		
Technique 5,6	**Before**	
	•	I like English but it is hard for me to see if I am getting better at it.
	•	I try to do all my homework every time but I don't see any progress in improving my skills.
	After	
	•	It was a great idea to start writing all my active points down. I could see what I was successful at during each lesson.
	•	Wonderful table of my progress. I am impressed. I am getting feedback from all my good work and it will also help me to pass the final test.

Tab. 5: Breakdown of the results: Evaluation transparency

Date	Exercise	Points	Comments
6th Oct 2014	Presentation	3	I was worried, but classmates asked interesting questions which was super.
	Vocabulary	2	Only 2 words I remembered today.
	Past tense grammar	1	I completed it first and correct, great.
Results of the day		6	Well done today ;)
12th Oct 2014	Quote analysing	1	It was a bit difficult but I tried...
Results of the day		1	I felt a bit tired today
18th Oct 2014	Homework	1	Teacher liked my home-study. Next time I have to do it again.
24th Oct 2014	Vocabulary	4	We discussed an interesting topic, could remember more.
31st Oct 2014	Small talk on my hobby	2	I did well; I used new words, I'm very happy.
	Present perfect	1	I did well, I studied it at home.
Results of October		**15**	Wow, so many points, I want to work like that every lesson, it will definitely help me pass the final test!

Tab. 6: Breakdown of the results: Technique 6

Conclusion

The university classroom-based research for this paper aimed to enhance students' motivation through implementing specific techniques that would bridge the gap between self-esteem, motivation and learning a foreign language. They (techniques) were aimed at awakening and strengthening motivational attitude in learners of a foreign language. Implementing choice into the lesson's plan was an interesting challenge for the students to apply their personal context into learning through which they not only became responsible for their own education but also encouraged their self-esteem. 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, 2012). This paper shows that even though the level of self-esteem is different in each student, it can be enhanced. Some students are naturally enthusiastic about learning, others are not. Developed techniques help learners move from their unproductive, yet negative ways to healthier patterns of their approach. Moreover, this survey's outcomes proved that a teacher's role in students' motivation is vital, especially by introducing specific motivational activities. As soon as the lesson was opened by positive quote and its discussing, the learners immediately felt inspired, being ready to perform and participate in the learning process. Teachers should smoothly transmit enthusiasm to their students who will more likely become interested in learning. At the same time, not only giving active points (reward) but also making them visible, strongly participates in building learners' motivation. If students are able to watch their progress in language skills, their willingness to participate is subconsciously enhanced. This drive that is so fundamental in motivational attitude can be reached through variety of activities, as having been approved in this survey. As Mozgalina (2015) demonstrates, small decisions in task design can have a subtle but important influence on students'

motivation and thus encourages future research on task motivation and task engagement. Nevertheless, learners need to feel motivated not only to learn but also to use what they have learnt in the class. If only they remembered using positive quote when feeling discomfort, it would be a strong initial step to activate their will to perform because 'life is 10% what happens and 90% how people react to it'.

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WHAT HAPPENED TO THE STUDENTS OF APPLIED MATHEMATICS?

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Abstract

For last several years there is a disturbing trend discussed by university lecturers of mathematics. In academic field, the lecturers are less and less satisfied with math knowledge of new students, i.e. the graduates of secondary schools who are eager to continue their studies at the university. After several years of work with first-year university students, we observe sharply decreasing proportion of students who are able to pass the exam of basic university course of mathematics.

In the paper we will focus on first-year students of bachelor programme Applied Mathematics offered at Palacký University in Olomouc. At first, we will analyse their knowledge of basic mathematics with respect to the type of secondary school they graduated at. Later, we will discuss their study behaviour and study results based on the data from 2009 to 2013.

Keywords

LMS Moodle test, mathematics, statistical analysis, students' structure, students' successfulness, study results analysis

Introduction

During last several years an annoying trend has occurred. The level of basic mathematical knowledge of secondary school students is decreasing (Gallimore and Stewart, 2014). In the Czech Republic, the successfulness of the students in the state part of school-leaving math examination dropped from 80 % in 2013 to 76 % in 2014 (CERMAT, 2015). Moreover, in 2014 this exam was taken by 2.8 % less students than in the previous year (CERMAT, 2015). These findings correspond with the conclusions presented in OECD (2013). According to this source the index of mathematical anxiety in the Czech Republic increased by more than 6 % between 2003 and 2012. It means, that the number of secondary school students who feel uncomfortable or anxious when taking math class or solving mathematical tasks increased.

Poor level of mathematical knowledge among the university applicants was observed also by Hošková-Mayerová and Račková (2010). They analysed the results of entrance exams at the University of Defence and identified the most problematic areas of secondary school mathematics.

Usually, the university students with insufficient mathematical background face severe study problems even in basic mathematical courses. One of the studies devoted to this kind of problem was presented by Brožová and Rydval (2014). Moreover, Pikálková, Vojtěch and Kleňha (2014) pointed out that in the Czech Republic the number of students who left their university studies unfinished is rising. As a possible solution to these problems many universities are forced to provide math support systems for new-coming students to increase their retention (Gallimore and Stewart, 2014). One possible and very popular way is the e-learning support system. Most of the students appreciate

the e-learning materials or tests as supplementary source of information (Jindrová, Vostrá Vydrová and Dömeová, 2013).

There are three goals of the paper. Our first goal is to find out who our new-coming students are and what kind of secondary schools they graduated at. We compare the structure of our students with the structure of all graduates of secondary schools in the Czech Republic, who want to continue their study at universities (Kuchař, Vojtěch and Kleňha, 2014). Moreover, we study if the students' structure changes in time.

The second goal is to explore the new-coming students' knowledge of basic mathematical notions and principles, i.e. the students' ability to solve linear and quadratic equations and inequations or to simplify a mathematical expression.

Our third goal is to analyse study results and study behaviour of the university students. We discuss not only the change of their successfulness in time, but also the relation of students' results and the type of their secondary education.

Materials and Methods

In the paper we analyse the data concerning the university students of mathematics, especially the students of Palacký University in Olomouc, who enrolled in the bachelor programme Applied Mathematics (AM) between 2009 and 2013. This programme is designed for students who want to study mathematics together with its applications to economy, banking, insurance systems or some more advanced statistical methods. It is a popular study programme with over one hundred new students per year. Large portion of new students usually disappears during first several weeks of their study. There are also students who have never been to any lecture and enrolled in the study only because of the status of "student". These students (approximately 30 %) would bias the statistical calculations, therefore they are excluded out of the data set and further analysis.

During their studies students are put through several tests to evaluate their knowledge and understanding of discussed topics. The first of these tests is focused on basic secondary school mathematics. It is an on-line test designed and run through LMS Moodle. Each student is allowed to do the test repeatedly. Each time student answers a new set of twenty test questions. These questions are randomly chosen out of over one hundred questions created for this purpose. Students need to reach eighty or more percent of points to pass the test. To achieve the second goal of our paper we analyse the test data provided by LMS Moodle in 2012 and 2013.

The successfulness and behaviour of first-year students is explored via students' results in Mathematics 1. It is the basic course of mathematics obligatory to all the first-year students of AM bachelor programme. Its completion is necessary for completion of other obligatory courses and many of the students lack the strength and knowledge to finish it properly.

The data is analysed with help of Pearson's Chi-squared contingency table test (Anděl, 2005). The results are calculated via statistical software R.

Results and Discussion

The first goal of the analysis is to find out what kind of secondary schools the AM students graduated at. Based on the records from 2009 to 2013 the AM students are divided into three groups. Group A denotes the graduates of general secondary schools. Group B students are the graduates of lyceums. The rest of the students, i.e. the graduates of business academies and secondary technical schools, form Group C. This partition allows us to compare the structure of AM students with the structure of graduates of all secondary

schools in the Czech Republic who intend to continue in their tertiary studies (Kuchař, Vojtěch and Kleňha, 2014). Let H0_*i*, where *i* =10, 11, 12, 13, be null hypothesis: *The structure of students enrolled in AM in the year 20i corresponds to the structure of all CZ graduates of the year 20i*. Analogically, let HA_*i*, where *i* =10, 11, 12, 13, be corresponding alternative hypothesis: *The AM structure and CZ structure differ in the year* 20*i*. Based on Pearson's Chi-square contingency table test we fail to reject all the null hypotheses at the 5 % level. At the same level we also fail to reject the null hypothesis H0_10_13: *The structure of AM students changes in time.* (The alternative hypothesis HA_10_13: *The structure of AM students does not change in time*.) The results of the tests are presented in Table 1. Both structures are displayed in Figure 1.

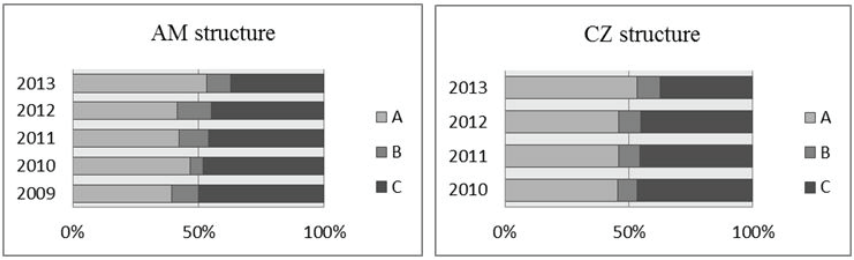

Fig. 1: left – The structure of AM students and its development between 2009 and 2013; right – The structure of CZ students and its development between 2010 and 2013.

In 2012 and 2013 the first-year AM students were tested with help of on-line test run through LMS Moodle. There is a set of one hundred and fourteen questions designed to test understanding of basic mathematical notions and principles which the students are supposed to know from their previous studies of mathematics. Each time a student starts the test, twenty of these questions are randomly generated. Students can run the test repeatedly. To pass the test students need to achieve 80 % of maximal number of points. Studying the data, we have asked several questions: How many attempts did the students need to pass the test? Is there any connection between the test results and the type of secondary school they graduated at? What test questions are the most difficult for them? Is there any visible change in their results?

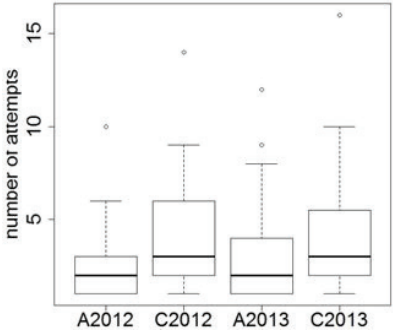

Fig. 2: The number of attempts Group A and Group C students needed to pass the test in two consecutive years 2012 and 2013. Bold lines denote medians.

At first, we focus on the number of attempts. According to the data an average number of attempts students needed to achieve the goal of 80 % were 3.1 in 2012 and 3.3 in 2013.

Nevertheless, due to high variability of the data and several outliers, the average is quite misleading. Therefore, in the next step, we combine the number of test attempts together with the partition of the students into two groups A and C (partition described in previous paragraphs). Group B is omitted from this analysis because of quite small number of observations. The results for groups A and C for two consecutive years 2012 and 2013 are demonstrated in Figure 2.

Here are some interesting outputs. While one half of graduates from general secondary schools (Group A) needed no more than two attempts to beat the limit, the same portion of Group C students needed at least three attempts. The same number, i.e. three, is the number of attempts sufficient to 75 % of Group A students to pass the test. The same pattern can be observed in both years we analysed. Group A students are more successful in this on-line test which did not changed for last two years, i.e. since the on-line test has been running.

The easiness of each test question is measured by Facility index. Usually it is denoted by *F* and represents the average question score reached by all students who answered the question. It is expressed in percent and calculated with help of formula (1):

$$F = 100\frac{\bar{x} - x_{min}}{x_{max} - x_{min}}\% \qquad (1)$$

Here $\bar{x}$ denotes the average score granted to a student for answering the question, x_{min} denotes minimal possible score and analogically, x_{max} stands for maximal possible score for this particular question. The higher the Facility index is the easier the question is. In our test, minimal score for each question was set to zero, i.e. $x_{min} = 0$.

We analyse the test questions set to look for the Facility index of these questions. According to the data, the Facility index highly varies (from 16 % to nearly 97 % in 2012 and from 16 % to 92 % in 2013). Nevertheless, the median is approximately 65 % for both discussed years.

When looking for the most difficult questions, we search for those with the lowest Facility index. The most difficult question of 2013 turns out to be a question with Facility index of only 16 % (Figure 3-left) followed by the question visualized in Figure 3-right with Facility index 21 %. Moreover, the same analysis of 2012 data set points at the same two questions. Both of the questions test the same piece of knowledge, i.e. the ability to understand and work with simple inequations.

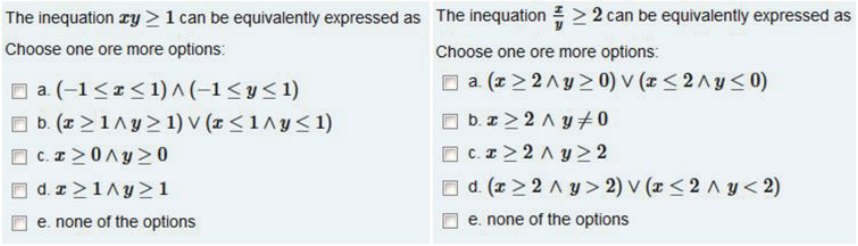

Fig. 3: left – The most difficult question of 2013 (*F*=16); right – The second most difficult question of 2013 (*F*=21).

This result corresponds with our own observations of students solving this type of inequations. Mostly, they proceed quite automatically, acting like following some kind of a handbook without thinking about the problem and looking for some logical solution.

For more details on the problematics of different types of reasoning, see Bergqvist (2007). The test questions were designed to test the students' knowledge covering basic areas of secondary school mathematics: equations and inequations, work with powers, the ability to simplify a mathematical expression and students' acquaintance with basic elementary functions. According to data, the students are troubled generally with any question concerning goniometric functions. All these test questions are assigned Facility index lower than the median of Facility index of all analysed questions (65 %). It supports the results of Hošková-Mayerová and Račková (2010) who also identified the tasks concerning goniometric functions as the most unsuccessful tasks in the entrance exams.
Browsing through the data set, we come to an interesting discovery. There are two questions testing the same piece of knowledge, offering the same five options but using slightly different mathematical symbols (see Figure 4).

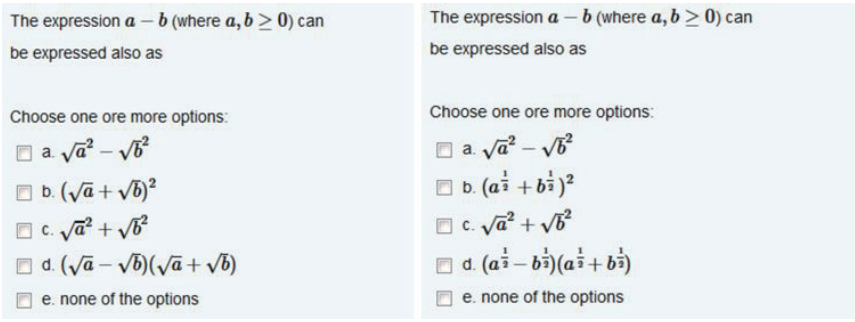

Fig. 4: The twin test questions.

The interesting thing about these two questions is their Facility index. While, in 2013, test question visualized in Figure 4 – left was assigned a Facility index 74 %, its twin question presented in Figure 4 – right was labelled with Facility index 59 % (in 2012 it was 75 % and 64 %). We investigate the data from 2013 for students' responses to these two questions and analyse them more deeply. The question on the left was asked of 79 students, 48 of them answered correctly. The question on the right was answered correctly 29 times out of 76 attempts. Let p_L and p_R be probabilities of answering correctly the questions on the left and right, respectively. We test null hypothesis H0_twins: $p_L = p_R$ against the alternative hypothesis HA_twins: $p_L \neq p_R$. The null hypothesis is rejected at the 5 % level, i.e. there is sufficient evidence to conclude that the difficultness of the two questions differs.

Hypothesis	X-squared	df	p-value
H0_10	1.05	2	0.4294
H0_11	1.80	2	0.5097
H0_12	3.0264	2	0.2202

Hypothesis	X-squared	df	p-value
H0_13	2.08	2	0.3165
H0_10_13	9.0454	6	0.1498
H0_twins	7.037	1	0.007984

Tab. 1: Results of Pearson's Chi-squared test (df denotes degrees of freedom).

This example demonstrates that new-coming students are not very acquainted with rational powers and work with them. This conclusion is supported by the results of several other questions concerning rational powers. For example, only one third of the students were able to rewrite correctly the expressions $a^{1/2} + a^{1/3}$ or $x^{1/2} \cdot y^{1/4}$.
Unfortunately, these basic shortcomings influence the students' successfulness in their further university studies. Only small portion of students without the proper mathematical background are able to keep pace with more prepared ones.

Last, we discuss the students' results and behaviour during their first year of university studies. We focus on the data concerning the course of basic mathematics, called Mathematics 1. The course is finished via the written test and oral exam. A student receives the course credit in exchange for the successfully written test. The exam consists of two parts: written part, where the student's ability to calculate is tested, and oral part. During the oral part of the exam, the student's understanding of basic notions and principles is evaluated.

Figure 5 describes the successfulness of the students in Mathematics 1 course. Here, the differences between particular groups A, B and C can be observed. Every year, the most successful students are the graduates of general secondary schools (Group A). More than three quarters of these students receive a course credit and approximately 60 % of them finish the course properly. The last year in the graph, i.e. year 2013, is exceptional with only 40 % of Group A students passing the exam. The results of Group B students are quite fluctuating. This fluctuation is caused mainly by small number of these students (usually 10-15 students). Nevertheless, they can boldly compete with Group A students (except of the year 2012). Group C students are the least successful ones. Until 2011 the proportion of the successful students is growing. Since then the proportion of the students who receive a course credit and subsequently pass the exam is decreasing.

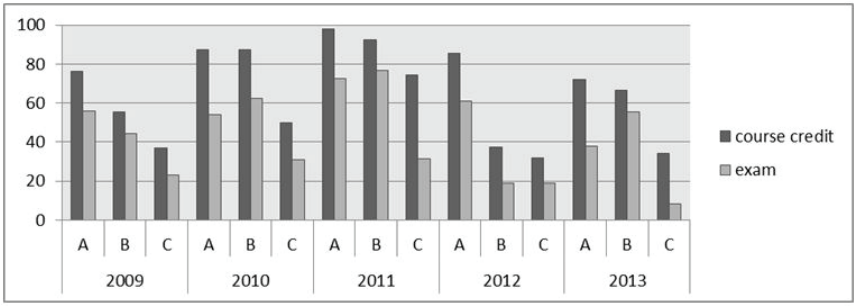

Fig. 5: The successfulness of the students in Mathematics 1 course.

Generally, since 2011 the proportion of all students who finish the course successfully during their first year of study declines. While in 2011 approximately one half (54 %) of all students passed the exam, in 2012 it was 36 % and a year later, in 2013, only 29 % students finished the course successfully.

Furthermore, we observe a disturbing trend in students' behaviour. More and more students, who receive the course credit, postpone their exam. The proportion of the students who eventually accept the challenge and try to pass the exam is decreasing (from 100 % in 2009 to 87 % in 2013).

Conclusion

In the paper, we focus on three main goals. At first, we analyse the structure of new-coming students enrolled in bachelor programme of Applied Mathematics at Palacký University. We find out that the structure corresponds to the structure of all secondary schools graduates continuing their studies at universities. Moreover, the structure did not change during past five years significantly. In the second step, we explore the first-year students' knowledge of basic principles and notions of secondary school mathematics. We analyse the data received from online testing. According to the data, most of the students lack the understanding of basic mathematical principles and work with mathematical

symbols quite automatically. On the example of two twin questions, we prove that even small change in question may influence the students' answer dramatically. Nevertheless, we cannot spot any change in students' knowledge for past two years. The last part of the paper is devoted to the behaviour of the students during their first year at university. We analyse the results of the course of basic mathematics, called Mathematics 1. In conclusion, the most successful students are the graduates of general secondary schools, although their results tend to decline during past three years together with the results of all remaining students. Unexpectedly, we observe quite strange trend in students' behaviour. Less and less students are willing to try to pass the exam even if they get the course credit.

Acknowledgements

The presented research is supported by the grant FRUP_2015_046 - Inovace předmětu KMA/M1N Matematika 1 obtained from Palacký University in Olomouc.

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DISCUSSION ON POSSIBLE USE OF SOCIAL NETWORKS AS LEARNING TOOL IN COURSE "GIO"

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Abstract

Modern information and communication technologies have impact on whole society. They became parts of our private as well as professional lives. Czech universities have had to reflect this trend for a long time and have offered study courses based on the use of ICT as learning tools. E-learning and blended learning courses were launched in order to make the university education more available and in order to increase effectiveness of traditional face-to-face learning. These types of courses often use support of Learning Management Systems, e. g. LMS Moodle. This system offers various learning tools, but perhaps fails as communication channel among participants of the course. Is there a space for social networks and their use as communication and learning tools? We would like to discuss main aspects connected with the use of social networks as a part of electronic support of the university courses in our paper and we would like to promote public discussion about it.

KEYWORDS

Blended learning, communication learning tool, Facebook, LMS Moodle, millennial generation, social networks

Introduction

The Czech society of the year 2015 is much more different than the society of the year 2000, the formal beginning of the 21st century. A lot of things and thinks have been changed since that year. Universities, their study programmes, every learning course and its teachers/educators/tutors have had to reflect these changes in order to offer new, interesting and attractive educational possibilities to young population. Pressure to innovation of universities' educational processes is stronger also due to declining size of young population and increasing competition among universities as a result of this demographic trend. Švaříček and Zounek (2008) write that nowadays universities have to think about fundamental questions such as: *what* to learn and *how* to teach students that should be successful in our information and knowledge society. Study programmes of Czech universities have reflected developments and shifts of the society for a long time. Modern information and communication technologies (ICT) play very important role in learning processes, they are used as flexible and students' friendly learning tools.

Our paper is focused on evaluation of effectiveness of two online communication possibilities - LMS Moodle and social networks - in the blended learning of the course *Globalization and international organizations* taught at the Faculty of Economics, VŠB-Technical university of Ostrava. *The aim of our paper is to introduce selected learning approaches using modern ICT support, especially e-learning and blended learning, to discuss pros and cons of two online communication channels – LMS Moodle and Facebook. Results of our paper are based on analysis of Czech and foreign literature and*

on own questionnaire survey realized among participants of our course. We would like to promote public discussion about the use of social networks as a tool in formal learning.

Theoretical discussion

Learning methods using ICT started to occur in 1960s. Nowadays we can distinguish many concepts of learning approaches supported by ICT. The earliest concept is known as computer assisted instructions, later computer-managed learning was popular, well-known and widespread was computer assisted learning. In 1990s web-based learning or resource-based learning started to prevail (for detail explanation of concepts see Zounek, 2009). All concepts have direct relation to *e-learning* and *blended learning*; nowadays widely used learning approaches in the management of study courses in postsecondary educational processes. Launching of these two innovative learning approaches has connection not only to new technological possibilities offered by Web 2.0, but also to changes in students' behaviour. Current university students are different, therefore learning approaches and educators' attempts should be also different.

Changes in students' behaviour: background for new learning approaches

Young people attending universities differ from previous generations of university students because they were born to the society highly influenced by modern ICT. They take computers, Internet, cell phones etc. as ordinary part of their lives. This, so called *millennial generation*[1] growing up with technologies has an information-age mind set (Jonas-Dwyer and Pospisil, 2004). Therefore teaching and learning activities have to be changed in order to satisfy learning styles and expectations of current students.

Every author offers different characteristics of millennial generation. Jonas-Dwyer and Pospisil (2004) say that this generation love teamwork, group projects, service learning and community service. Rennie and Morrison (2013) point out on this generation's ability to multitask, its preference to learn from pictures, sound and video rather than from text and its preference for interactive and networked activities (instead of independent and individual study). Millennial generation has, due to modern ICT, access to information base which is unprecedented possibility in human history. But at the same time, it is more than obvious that this generation fails in basic skills. Rennie and Morrison (2013) highlight on shorter span of attention, lack of reflection, relatively poor text literacy and lax attitude to quality of sources. Monaco and Martin (2007) present seven characteristics of millennial students that have their background in students families and parents' attitudes. Inter alia they say that students are team oriented, confident and highly optimistic but also yearning for feedbacks and achievements. Dzuiban et al. (2005, p. 3) describes behaviour of millennial generation during learning process: *Millennials take class notes on personal digital assistants, get their information from blogs and wikis, and are asked by their professors to turn off their cell phones in their face-to-face courses... They can complete task, listen to portable CD player, and talk on the cell phone simultaneously, but employers report that their basic skill levels, critical thinking ability and initiative are developmentally lacking.*

Learning supported by ICT: e-learning and blended learning

E-learning as a term is not easy to explain, every author tries to cover some of its various aspects. Vlčková (2012) explains e-learning as multimedia form of education through

[1] As millennial generation (possibly net generation, Internet generation or generation Y) is labelled generation of people born within the period of years 1982-1994, so majority of present university students belong to this generation.

Internet, Intranet, computer, TV, radio, CD, DVD etc., i.e. education using modern information technologies. Švaříček and Zounek (2008) quote similar thoughts but they add that data have electronic feather. Bell and Federman (2013, p. 167) stress that term e-learning is frequently used to *refer to instruction in which most (often 80 percent or more) of the content is delivered through networked technologies (such as Internet)*. Defining of the term *e-learning* is critical for definition of *blended learning* because as Harding, Kaczynski and Wood (2005, p. 56) state *blended learning mixes e-learning and other more traditional types of learning.* They also write that blended learning can be richer than either a traditional face-to-face or a fully online learning environment. Zounek (2009) defines blended learning as integration of electric data resources and tools with the aim to use the potential of ICT in synergy with methods and tools used in traditional learning.

E-learning courses can be organized or supported by either learning management system (LMS) or by content management system (CMS). LMS can be described as collection of e-learning tools available through a shared administrative interface. Typical representative of LMS is system Moodle. This system usually serves as storage of digital materials, their distribution and presentation channel, also as synchronous and asynchronous communication channel. LMS and CMS are widely used because they offer, as Veletsianos and Navarrete (2012, p. 145) write, opportunities for *organization, efficiency and security*. But they admit that LMS and CMS are often used only as *static repositories of content, failing to provide the robust social experience found on platforms that have garnered societal interest and appeal, such as Facebook*. Veletsianos and Navarrete (2012) also argue that LMS and CMS support motivation and enthusiasm but they fail in support for personalization. Their arguments open space for discussion whether social networks (such as mentioned Facebook) can be used as specific learning and communication tools that can serve as supplement for LMS or CMS and that can increase effectiveness of blending learning courses.

New communication channel: social networks

Social networks are very important part of social life of current young population. Face-to-face communication has been gradually replaced in interpersonal relationships with communication through new technological devices. Tiryakioglu and Erzurum (2011, p. 135) write: *social networks are almost at the heart of virtual communication forms*. Why? It is no doubt that social networks facilitate interaction, communication and cooperation of participating users. At the first sight it is obvious that social networks can partly remove shortages of LMS or better said they can add new communication possibility to blended learning courses with LMS support. Can social networks be effective learning and communication tools? Veletsianos and Navarrete (2012) say that educators have begun exploring social networks as alternative platforms providing them social communication tools that allow ease of use, pedagogical freedom, fluid online discussions and identity management since the birth of Facebook.

Tiryakioglu and Erzurum (2011) state that social networks can be successful in many areas of educational process:

- Social networks can interface educators. Educators may obtain such benefits as program exchanges, job announcements, creating relief funds and searching such funds, arranging conferences, publishing studies etc. Educational activities will be more efficient if educators can communicate together and share one database. The effectiveness will be higher with higher number of participating educators.

- Social networks can increase effectiveness of teamwork of the study group, encourage students in professional discussions about certain topics and make interesting information and study instructions more available. Students could communicate and share their study problems with other members of study group and with educator very quickly. Cheung, Chiu and Lee (2011) capture the essence when they say that online social space created by social networks can build and maintain social capital with others.

What pros and cons should be taken into account if we seriously consider possibility of social networks use? Social network is the communication tool that can create a sense of presence; build the community; form social connections; strengthen cooperation and teamwork; start and promote interactive discussions. It enables to share ideas and receive timely feedbacks. But it is balanced by a lot of negative aspects, potential issues and risks. First, some students do not have modern ICT suitable for work with social networks at home. Then it is quite large group of people sceptic about social networks because of the fear of privacy loss. More problematic are the ownership issues with regards to public and collaborative spaces and difficulties in protecting the anonymity of students, as highlight Veletsianos and Navarrete (2012). It can be also taken into account the potential risk that communication via social networks could replace all face-to-face communication between educator and students outside the lectures. This communication is very important for good mutual interpersonal relations, trust and cooperation between educator and his students.

Discussion on practical use of social networks in the course *Globalization and international organizations*

We have taught course *Globalization and international organization* (*GIO*) at VŠB-Technical university of Ostrava, Faculty of Economics, since the year 2009. Course is attended by students of bachelors study programs of various branches of study. We found this course very important because it offers possibility to study about our present global world, global economy, global issues and their solution through the activities of international organizations. Since the January 2015 we have realized project focusing on innovation of our course. We would like to teach a lot of topics from different perspective; create more attractive lectures and improve pedagogical methods we have used in order to increase the effectiveness of the course.

Description of the present state of the course

When we started to teach *GIO*, we took over the existing course schedule and we have followed it so far. Our course consists of two parts based on face-to-face learning: lectures and seminars. Both parts are supported by electronic version of the course in LMS Moodle. In some sense our course is based on blending learning approach. Nowadays electronic version of the course serves as storage and release of study materials for lectures or seminars and additional materials for self-study; space for loading of students' essays and space, where we announce important news. We do not use LMS Moodle for testing of students' knowledge. The nature of the topics of our course does not allow us, in our opinion, this form of testing.

We found out at the end of the winter term of the academic year 2014/2015 that our students had been using LMS Moodle support of our course during the term less and less. They did not work with additional materials delivered them in LMS Moodle. They also did not use communication possibilities offered there. We think that these facts had impact on the learning goals represented by competencies that students should have obtained during

our course. Some students were not able to work properly with information, analyse it and make their own opinions on it.

In order to increase the effectiveness of the course we are thinking about new channel that would enable us better communication and cooperation with students; that would attract students to our topics. We are thinking about creating of a Facebook site or a Facebook group for our course. Why Facebook? In our opinion Facebook offers a lot of possibilities for formal and informal communication among its users. The participants of certain learning course could create closed Facebook group, could communicate and discuss together, could create and share documents, photos, videos etc.

Brief survey among course *GIO* participants

As a part of our ideas of the use of social networks as communication and information channel we decided to make brief survey among participants of our course. We wanted to know their opinions and to find out their attitudes to our LMS Moodle course. We weighted up several survey techniques of data collection and we chose technique of questionnaire survey. This technique is connected with a lot of advantages. Apart from the others, it enables to obtain easily and quickly information about certain population. As the population we considered all participants of our course in the winter term of the academic year 2014/2015. We did not choose sample, questionnaires were filled by all participants - we made census. The population of our survey counted 23 students. All students were members of millennial generation as it was defined above. Questionnaire contained five closed ended questions of multiple choice and one scaled question. We analysed collected data in order to obtain results that could confirm or refuse our hypothesis: *Students have positive preferences to the use of Facebook as information and communication channel for the electronic support of the course GIO*. We used methods of descriptive statistics for the evaluation of the collected data.

Brief presentation of some results of our questionnaire survey:

- Question 1: *Are you regular user of the Internet. If yes, do you work with Internet - on your own computer/notebook, only on school's computer or on your mobile phone? More than one possible answer can be chosen.*
  - All 23 students used regularly Internet on their own notebook/computer, 12 students also worked with Internet in their mobile phones.
- Question 2: *Did you use electronic version of the course GIO in LMS Moodle during the term? If yes, how often did you work with it – every day, once or twice time per week, twice time per month, once time per month, once or twice time per term (term had three months)?*
  - All 23 students used electronic version of the course *GIO* in LMS Moodle: 61 % once or twice time per week, 13 % twice time per month, 13 % once time per month, 4 % once or twice time per term. Only 9 percent of students visited our course in LMS Moodle every day.
- Question 5: *Do you use social networks for communication with your friends and relatives? If yes, which social networks do you use – Facebook, Twitter, Google+, Instagram or any other (please write which)? More than one possible answer can be chosen.*
  - All 23 students were users of social networks. All of them had their personal profile on Facebook. Eight of them used simultaneously services offered by another social network – Instagram. On student used also network Google+.

Detail analysis of some questionnaire results:

Students were asked to choose which of learning tools available in LMS Moodle they were using during the term in the third question. The question was: *Which of learning tools available in LMS Moodle did you use during the course? More than one possible answer can be chosen.* Students could choose from these possibilities:

1. downloading of learning materials,
2. loading of an essay,
3. following news presented by tutor,
4. discussing with tutor or other students of the course and
5. sending messages with tutor and other students of the course.

All 23 students answered this closed ended question and results, as you can see in Figure 1, confirm our assumption. Students used electronic version of the course only as a static storage of learning materials and a place, where they could easily hand in their essays. Nobody discussed with other participants of the course in LMS Moodle, nobody sent any message there.

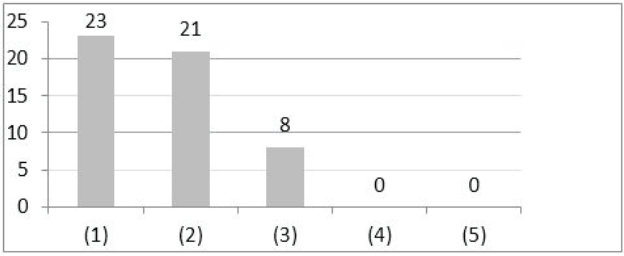

Fig. 1: Number of students choosing the defined possibility of answer regarding LMS Moodle

Next, forth, question was focused on evaluation of some characteristics of the electronic version of our course in LMS Moodle. The question was: *Please, evaluate the learning environment of the course in LMS Moodle with respect to the given set of its characteristics*. Students should have had to evaluate set of characteristics with the use of five-point scale. Scale 5 meant *I am very satisfied* and 1 meant *I am very dissatisfied*. We used arithmetic mean diameter to show clearly students' preferences (see results in Table 1).

Characteristics	Students average evaluation
Overall design of the course/its clarity	3,57
Ease of use	3,91
Offering tools/ Communication and discussion tools	3,61
Flexibility of use	3,52

Tab. 1: Students' evaluation of selected characteristics of the course in LMS Moodle

As it can be seen in Table 1, students' evaluation of the set of characteristics did not enable us to formulate specific conclusions about their satisfaction with the electronic support of our course in LMS Moodle. All characteristics were on average evaluated near the middle of the scale. However these results also showed that students did not have distinctly positive or negative attitude to our electronic course.

We asked students in sixth question whether they would have used social network Facebook as information and communication channel if our course had had its Facebook site with closed membership. They should have chosen from possibilities *yes* or *no*. 19 students chose possibility *yes*, 4 students *no*. As a part of this question they were also

asked why *yes* or *no* was marked. Students answering *yes* could choose from these given set of reasons:

1. better physical and time availability (e.g. in mobile phone),
2. higher flexibility and speed of communication with other participants of the course (also with tutor),
3. better possibility to discuss with other participants of the course (also with tutor) and the possibility to obtain feedbacks,
4. clearer and more friendly visual environment of social network and
5. possibility to follow and share photos, videos, music, scientific papers and studies etc.

Students appreciated especially flexibility and speed of communication that are offered by Facebook and also its better availability. The possibility of following and sharing learning content was the least important for them. This fact was quite surprising for us because we had thought that Facebook could make learning content more attractive, because of the use of photos, videos and other interactive forms. Detail results can be seen in the Figure 2.

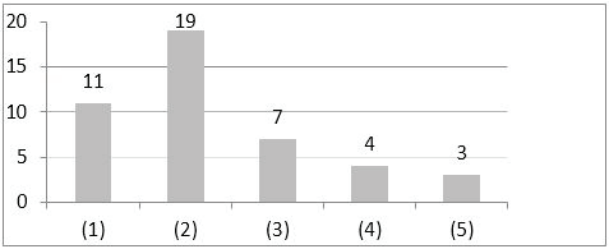

Fig. 2: Number of students choosing the given possibility of answer regarding social networks

Four students, it meant 17 % of students, did not prefer use of Facebook as communication and information channel for our course. These students had again the possibility to choose from five reasons, why they marked answer *no*. They were defined:

1. I am not user of Facebook and I do not want to become its user because of one study course,
2. I do not consider Facebook as appropriate learning tool for university study course,
3. I am afraid of the loss of privacy,
4. there is a risk of inaccurate discussions, negative attitudes to my opinions in discussions, personal grudge and
5. there is a risk of sharing of inaccurate content.

All four students chose second possible answer; one student chose also answers number 3 and 5. We thought about possible risks connected with the use of Facebook quoted as answers 4 and 5. In our opinion these risks can be solved if we assume that tutor will have the right to check sharing content and remove inaccurate one. Also ethics of discussion through Facebook should be set at the beginning of the course in order to avoid inaccurate discussions.

Now we can confirm our hypothesis. We revealed positive preferences of our students towards the use of Facebook as a part of the electronic support of our course. However, we consider our survey and this paper as the first step of our effort in implementing social network Facebook into our course *GIO*.

As the second step we would like to create Facebook group for our course for the academic

year 2015/2016 and offer students possibility to use it as a supplement for electronic version of the course in LMS Moodle. Nowadays we are testing seriously various tools that are offered by two Facebook's platforms – Facebook site (based on the Community) and Facebook group. We weigh up pros and cons of them. However we consider Facebook group as more suitable for the electronic support of our course. Therefore we are going to create Facebook group for the course *GIO* with these settings: it will be designed as a closed group with the tutor in the position of administrator. The group will be accessible for all students of the course, the tutor and for other educators from our university that will want to be the members of this group. We are also thinking about the possibility to invite various experts to participate on our platform. All members of the group will be able to post to the group, but the administrator will approve all posts of other group's members. Thanks to the tools available in Facebook, tutor will have the possibility: to post open and closed quiz questions to other participants of the course (with the aim to prove briefly their knowledge); to present multimedia with content corresponding to the topics of the lectures (with the aim to open discussions and to receive students' feedbacks); to present links to information resources on and outside Facebook (with the aim to promote students' self-study); and to pay students' attention to important events suitable for them (conferences, external lectures and seminars, workshops etc.). At first we are planning to use Facebook especially as a communication and a discussion tool; and for presentation of additional learning materials. LMS Moodle will be still used as a distribution channel for the official learning materials and as a formal communication channel among participants of our course. As the third step of our effort in implementing Facebook into our course, we will measure the efficiency of the use of both information and communication channels by appropriately chosen variables and will evaluate found data by more exact methods. We will also pay attention to competencies that students will obtain during our course *Globalization and international organizations*.

Conclusion

We tried to introduce several learning approaches based on the use of modern ICT, especially e-learning and blended learning in our paper. We showed that nowadays widely used LMS Moodle sometimes served only as static storage of study materials. We discussed pros and cons of social networks in the sense of their use as learning tools. Similar discussions have been quite often led in foreign handbooks and scientific papers (that are focused on effectiveness of e-learning and blended learning) since that time when Facebook started to be mass available.

We introduced our thoughts about the use of social networks in our course *Globalization and international organizations*. We tried to solve problems with the declining attractiveness of the electronic version of our course in LMS Moodle. Students did not use it as communication and discussion channel. As a part of our ideas we decided to reveal students' preferences towards the use of Facebook as a learning tool in our course. Therefore we made questionnaire survey among all participants of our course in the winter term of the academic year 2014/2015. We found out that students had positive preferences to this possibility. More, students told us, that they had been using closed Facebook group for communication among members of their study group. Therefore they would invite possibility to communicate with us through Facebook too. *What is your opinion on the use of Facebook as a learning tool? Do you have any experiences with it in your school/university? Do you think that Facebook has its place in informal learning but not in formal learning process? We would like to know your opinions or experiences.*

Acknowledgements

The innovation of the study course Globalization and international organizations and presentation of this paper are supported by so called Institutional development projects FRVŠ 2015 (Institucionální rozvojové projekty FRVŠ 2015), number of the project is FRVŠ/2015/40 and the project is implemented at VŠB-Technical university of Ostrava, Faculty of Economics.

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AGE OF EQUIPMENT IN EDUCATION – A POSSIBLE INDICATOR OF THE MODERNISATION PROCESS

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Abstract

The paper focuses on the estimation of an average age of machinery and equipment in education as indicator of modernisation process. For this purpose we use adjusted model of the Czech version of Perpetual Inventory Method. Average age and age structure are estimated on the basis of gross fixed capital. We estimate the age of small tools separately. Small tools are considered as investment from implementation of new standard ESA 2010. For these purposes we applied the average service life of software instead of official service life used for assets above the original price threshold.

The average age of machinery and equipment in industry of education has been increasing since the year 2009. Moreover, the average age also depicts different situation and investment decision making in private and public educational institutions.

Keywords

Average age of assets, gross fixed capital stock, Markov chain, perpetual inventory method

Introduction

Despite the modernisation of education is mainly focused on the intellectual capital of teachers, educational processes and innovation of curricula, it is impossible to separate the modernisation of material background. National Programme for the Development of Education in the Czech Republic, White Paper (Ministry of Education, Youth and Sport, 2001) speaks about an investment into new information and communication technologies. Similarly, Strategy for Educational Policy in the Czech Republic until 2020 (Ministry of Education, Youth and Sport, 2014a) mentions educational infrastructure, where the Information and Communication Technologies (ICT) have the main role.

We can identify a lot of effort on improvements of education, which would be impossible without modern educational infrastructure. Houška and Beránková Houšková (2011) show positive impact of video lectures on students' knowledge. Šírová and Krejčová (2011) use the video interaction guidance of the Czech teachers to improve their pedagogical performance. Pavlíček, Švec and Tichá (2014) apply the artificial intelligence in course of Strategy management to improve the output of pedagogical process.

Nevertheless, the indicators of Strategy for Educational Policy in the Czech Republic until 2020 (Ministry of Education, Youth and Sport, 2014b) prove that modernisation of fixed assets is secondary or implicit goal – no indicators on the topic of fixed assets are presented. On the other hand, when the goal is stated, then it should be measurable (Lawler and Bilson, 2013). When the goal is defined in the S.M.A.R.T. form (Doran, 1981), at least the measurable indicator of progress must be defined; manager cannot declare without defined indicator whether a process is successful or not.

The problem lies in the non-existing official data for such indicator. We can understand education as an industry (Czech Statistical Office, 2015b) with labour and capital inputs,

production etc. (Vltavská and Fischer, 2013). Since the estimation of age of assets is beyond traditional measures (Harper, 2008), only a few statistical offices publish the average age of capital (see e.g. U.S. Bureau of Economic Analysis (2013) or Australian Bureau of Statistics (2014)). Despite the fact, the Czech Statistical Office has different goals and thus produces indicators, which represents mainly value of assets (Czech Statistical Office, 2015a) and thus are not satisfactory for that problem. However, we can use the same data inputs as the CZSO uses to build balances of fixed assets for our estimation of average age and age structure of fixed capital.

Krejčí (2013) showed the development of average age in Education industry. This analysis was aimed mainly on age estimation and comparison with other industries on the basis of 'average age/average service life' ratio. Krejčí states that it will be necessary to actualise the estimation after the official data on investments are changed due to the change of rules from European System of Account 1995 to 2010 (European commission, 1996 and 2013). Among others, after this change the threshold of 500 European Currency Unit ECU (EUR nowadays) has been cancelled. Therefore investment flow now includes the small tools under with price under this threshold.

The aim of this paper is to estimate the average age of machinery and equipment. For these purposes we separate the small tools and show the development in private and public schools. Average age is estimated by an adjusted model of the Czech version of Perpetual Inventory Method (Krejčí, 2010; Krejčí and Sixta, 2012).

Materials and Methods

Perpetual Inventory Method (PIM) is used to transform inputs as investment, price indices and other changes into output in a form of net and gross stocks of fixed capital and consumption of fixed capital (Dievert, 2005, OECD, 2009). For such calculation, the average service life and the retirement function are essential parameters. In our calculation we focus on gross stock of other machinery and equipment. We recommend using gross stock because application of net stock would be the same like weighting the people by their productivity for demographical purposes. Similarly to Krejčí (2013), we estimate the age only for machinery and equipment without transportation equipment. According to data from Czech Statistical Office (2015a), transformation equipment represents negligible amount of fixed capital in industry of education (less than 1% in 2013) and we do not consider it to be directly connected with the process of education in most cases.

For estimation of the age structure, we have implemented the software that records the remaining part of the past investments in disaggregated form. For this purpose the software is based on transformation of the Czech variant of PIM (Sixta, 2007) into Markov chains. The aging/retirement process in PIM depends only on present state and transition probabilities, i.e. the process has Markov property (see e.g. Tjims (2009)):

$$P\left(X_n = i_n \middle| X_0 = i_0, \ldots, X_{n-1} = i_{n-1}\right) = P\left(X_n = i_n \middle| X_{n-1} = i_{n-1}\right). \quad (1)$$

The retirement function used in standard PIM is transformed into transition matrix $\boldsymbol{P}$ with m+1 rows and columns, where m is maximum age and m+1*th* state represents the retirement. Thereafter, the conditional probability that asset will age to period n+1 is $p_{n,n+1}$, conditional probability of retirement in an n^{th} period is $p_{n,m+1}$. The source probability of asset retirement in *nth* period from official retirement function is a_n, survival probability is r_n. The elements of $\boldsymbol{P}$ are from equations (2)-(4):

$$r_{i-1} - r_i = a_i, i = 0, \ldots, m-1, r_0 = 1 \ , \tag{2}$$

$$p_{n,m+1} = \frac{a_n}{r_{n-1}} \ , \tag{3}$$

$$p_{n,n+1} = \frac{r_n}{r_{n-1}} \ . \tag{4}$$

Then we calculate gross fixed capital stock in age structure in the year *t* by (5):

$$\mathbf{g}_t^T = \mathbf{g}_{t-1}^T \mathbf{P} \ . \tag{5}$$

Elements of that vector $\boldsymbol{g}_t$ contain surviving investments from previous years. For more detail and Markov chain transformation of net stock and consumption of fixed capital see Krejčí and Sixta (2012)

We use the gross fixed capital formation, price indices, other changes and retirement function from annual accounts (Czech Statistical office, 2015a). Average service life of other machinery and equipment in industry of education is 14.2 years with lognormal distribution for retirement function (Czech Statistical Office, 2002: 229). Contrary the Czech Statistical Office we assume different average service life for small tools. We do not integrate the equipment under the price threshold but we assume the service life of small tools should be lower. Due to this fact there are no surveyed data on this topic yet, we use assumption that significant part of small tools (in terms of its value) is connected with software Therefore, we use normal distribution for retirement function with service life equal to 4.5 years, which is officially applied on software (Czech Statistical Office, 2002: 230)

Knowledge of distribution of fixed capital by its age allows description of changes in time and differences among groups in more detailed way. For this purposes we use the basic 4-quantiles as lower quartile (25% quantile), median (50% quantile) and upper quartile (75% quantile).

Results and Discussion

Figure 1 shows average age of machinery and equipment in section of education as disaggregated into four divisions and also on private and public educational institutions.

The average age of equipment in private education is lower in the whole period. Despite the age of private and public assets are closer in the current years, it is not based on decreasing age of public assets but by faster growth of private assets' age. The average difference of service lives is 2.1 years. Moreover, after the revision of data inputs, especially the gross capital formation, (Czech Statistical Office, 2015c) the findings are different in comparison with Krejčí (2013). Before the revision, the estimation showed the decreasing average age, which could be considered as modernisation process stated in White Paper (Ministry of Education, Youth and Sport, 2001). After the revision, the age is mainly stable, and increasing after years of crisis (2008-2009). Only in the case of post-secondary education the age has been continuously increasing since the year 2002 (from 4.5 years in 2002 to 6.9 years in 2013).

Average age of small tools is shown in figure 2. Among others, the significant increase of

the age at private institutions could be interpreted as cutting down the costs after the crisis. Small tools are also employees' benefits and tax-deductibles (e.g. company cell phone or laptop), which are the area where to cut the costs.

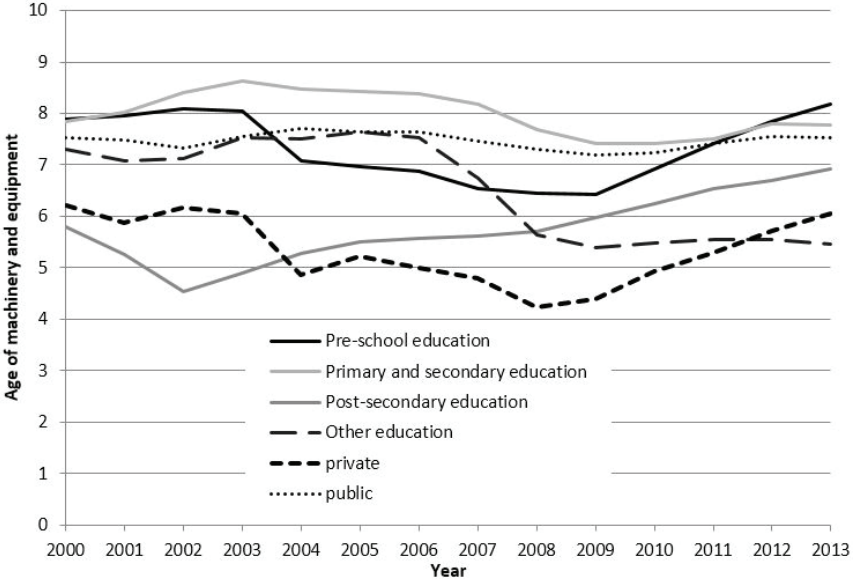

Fig. 1: Average age of machinery and equipment in period 2000-2013

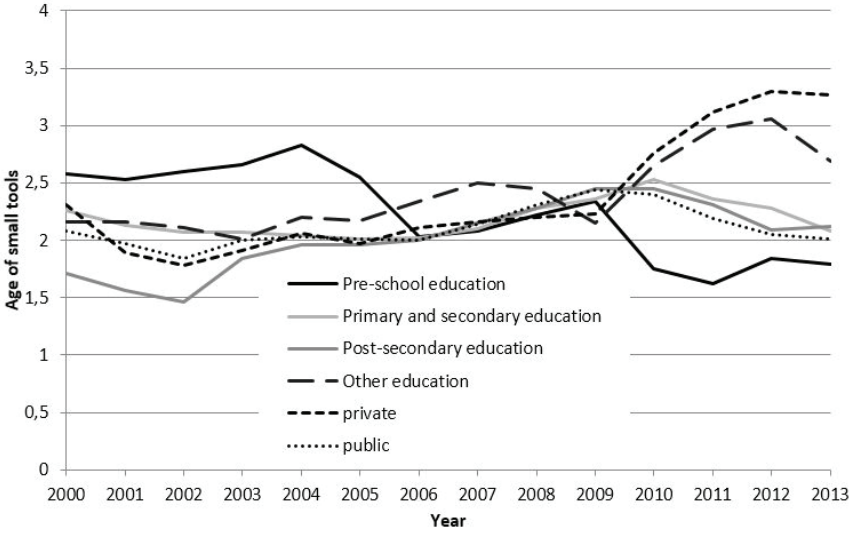

Fig. 2: Average age of small tools in period 2000-2013

As the investments in small tools in private institutions decreased, the age has been increasing significantly because the surviving investments from the past. The age structure shows that assets acquired before the year 2010 still represent nearly 50% of the gross stock of small tools in 2013. On the other hand, Strategy for Educational Policy in the Czech Republic until 2020 (Ministry of Education, Youth and Sport, 2014a: 25) states the 'continuous modernisation', which results in stable age of tools without aging peaks represented by huge one-year investments with non-proportional share on the whole value of gross stock.

Continuous modernisation is applied in only some divisions of industry of education. The impact of such behaviour is visible from table. 1. Divisions where this policy is applied have stable or slightly decreasing values in time. To compare private and public institutions we can see that quantiles for private institutions vary much more than for public schools (for both Machinery and equipment, and Small tools).

For Machinery and equipment year 2006 seems to be significantly lower for all levels and it seems to be connected with investments in private schools mostly. For Primary and secondary and Other education category age structure slightly respect the "continuous modernisation" when all quantiles has lower average age in 2013 than in 2000. Post-secondary education category is opposite – all quartiles are increasing in time.

Variability of the age of Machinery and equipment is possible to describe by interquartile range (upper quartile minus lower quartile). The lowest value is 4.2 years for Post-secondary education in 2006. The highest is 9.3 for Primary and secondary education also in 2006. Very strict change could be seen for Other education where interquartile range declines from 8 years in 2000 to 4.8 years in 2013.

In correspondence with figure 2, the age of assets in Private schools rapidly increased in all quantiles. Small tools in Post-secondary education aged (for all quantiles). On the other hand, small tools in Pre-school education become younger. The biggest variability (measured by interquartile range) is in Other education in 2013 (3.6 years).

Table 2 shows the ratio of over-aged tools (older than average service life). For public institutions, the ratio varies around 10% and for private institutions is lower and decreasing in time. There are also differences among divisions where Post-secondary education has significantly lower ratio (only about 5%) than other types of institutions (there are ratios about 10% and more). This situation is highly interconnected due to the fact most private educational institutions are in Post-secondary education division.

The situation is different for small tools. In accordance with previous findings, we can see that the ratio in private institutions in the last year (2013) increased rapidly and almost one third of small tools is older than its average service life. High ratio has also Other education institutions and, on the other hand, Pre-school education dropped in 2013 to only 3% (from 11% in 2006).

The average age of equipment could serve as S.M.A.R.T. (Doran, 1981) indicator of modernisation of material background in the whole industry with strong role of national authorities. Despite the fact that no such indicator is used (Ministry of Education, Youth and Sport, 2014b), the findings show that the goal of 'continuous modernisation' (Ministry of Education, Youth and Sport, 2014a: 25) is fulfilled in public schools and the age of equipment is not growing. We must stress that the decrease of the age of equipment is not the only indicator of modernisation in the industry, the stable age expresses that new investment compensates the aging of past investments. In comparison with public schools, the income of private schools is more dependent on the current market situation, therefore the reaction on worsening situation results in increase of age of equipment.

	Quantile	25%			50%			75%		
	Year	2000	2006	2013	2000	2006	2013	2000	2006	2013
Machinery and equipment	Pre-school education	4.6	2.3	5.1	7.5	5.3	7.4	11.1	11.3	9.9
	Primary and secondary education	4.3	3.2	4.0	7.4	7.5	6.3	11.0	12.5	10.3
	Post-secondary education	1.2	2.6	3.3	4.8	4.8	6.3	8.9	6.8	10.5
	Other education	2.8	3.4	2.0	6.8	6.4	4.8	10.8	10.8	6.8
	Public	3.8	3.5	3.6	7.1	6.4	6.4	10.8	11.5	11.0
	Private	1.8	2.1	3.5	4.9	3.2	5.6	9.5	6.9	7.9
Small tools	Pre-school education	1.1	0.6	0.6	2.7	1.5	1.6	3.7	3.2	2.8
	Primary and secondary education	0.8	0.8	0.8	1.8	1.8	1.8	3.5	2.9	3.0
	Post-secondary education	0.8	0.8	1.0	1.1	1.7	1.8	2.6	2.9	3.0
	Other education	0.7	1.2	0.9	1.7	2.1	2.3	3.5	3.4	4.5
	Public	0.7	0.8	0.8	1.5	1.7	1.8	3.3	2.9	2.9
	Private	0.9	1.0	1.6	1.9	1.7	3.6	3.6	3.0	4.7

Tab. 1: Quantiles of age distribution of machinery and other equipment and small tools in years 2000, 2006, 2013

	Year	2000	2006	2013
Machinery and equipment	Pre-school education	10%	13%	10%
	Primary and secondary education	10%	16%	13%
	Post-secondary education	6%	5%	5%
	Other education	10%	12%	5%
	Public	9%	13%	10%
	Private	8%	5%	3%
Small tools	Pre-school education	10%	11%	3%
	Primary and secondary education	13%	7%	9%
	Post-secondary education	9%	7%	8%
	Other education	13%	8%	24%
	Public	12%	7%	7%
	Private	11%	8%	32%

Tab. 2: Ratio of machinery and other equipment and small tools older than average service life in years 2000, 2006, 2013

Conclusion

This paper deals with estimation of average age of machinery and equipment in the Education industry. For this purpose we use transformed Perpetual Inventory Method. We propose the estimation as indicator of modernisation of educational infrastructure.

Results show that after the revision of national accounts, the situation is not as optimistic as it was estimated in Krejčí (2013). Especially in the post-secondary education the average age of machinery and equipment has increased by more than 50%.

For differentiation of small tools and other machinery and equipment we apply the average service life of software on the tools under the threshold. Despite the average age of machinery is smaller in private educational institutions, the age of small tools shifted after 2009. In the next step of this research we will focus on application of official service life of small tools, once it is published.

In case the consequences of the demographic structure is decreasing number of students, it is possible to argue that the investment into equipment could decrease also. As a result the investment would not compensate aging of surviving assets from previous years and average age in industry must be growing. Such argument stresses the importance of lower quartile, which contains the short-term investments. Although the development in the lower quartile supports the previous analysis at first sight, we must remember the cohorts it the quartiles are changing due to the shifts in investment. The deep lower quartile analysis in current years will be the topic for the next research.

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SELF-REFLECTION OF STUDENTS OF ECONOMIC TEACHING

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Abstract

The pilot study focused on the self-awareness of students at Department of Economic Teaching Methodology at University of Economics, Prague. We applied the content analysis on written statements of students who were asked to write an essay called "Why am I supposed to be a good teacher?" as a part of their assessment in a course of Educational Psychology.
Strength and weaknesses described by students brought important feedback information about skills that should be trained during the education of prospective teachers. Moreover, the study proved that a self-reflective essay can significantly enrich the preparation of future teachers, helping them to realize their strengths and weaknesses and to develop their self-reflective skills as an important part of professional expertise.

Keywords

Personality of prospective teacher, self-reflection, social skills, teachers' education

Introduction

In a context of escalating requirements on a teacher's personality, many attempts to classify professional competences of a teacher appeared (Sternberg, Horvath, 1995; Kyriacou, 1998; Gillernová, 2008 etc.). Kyriacou (1998) created a categorization of teacher's essential skills consisting of seven areas: planning and preparation, lesson presentation, lesson management, establishing a positive classroom climate, discipline, assessing pupils' progress, reflection and evaluation). Sternberg and Horvath (1995) described an 'expert-teacher'. The expert teacher–prototype consists of three characteristics: knowledge base, efficiency (involving executive control) and insight. Gillernová (2008) defined four areas of professional skills of a teacher: theoretical skills (connected with the subject he/she is teaching), didactic skills, diagnostic skills and social skills. Despite their differences, all these models of the professional skills of a teacher have some common features. One of them is the emphasis on the auto-diagnostic skills and self-reflection.
The self-reflection or auto-diagnostic competencies could be defined as the ability of teachers to understand their personalities, recognize their weaknesses as well as strengths help them to develop high level of self-awareness (Zeren, 2012). Moreover, 'teachers with a high degree of self-awareness are expected to be more understanding towards their students because understanding others requires one to understand herself first' (Zeren, 2012: 2445). Švarcová (2010) defined the self-reflection ability as a crucial part of social intelligence: 'The social intelligence might be divided into two types: interpersonal intelligence, which means the ability to act with others, to perceive the needs of others, to emphasize easily with others, and intrapersonal intelligence, which refers to the self-reflecitve capacities, understanding of the self and own behavior and the skill to take control of it' (Švarcová, 2010: 41). The ability of self-reflection is strongly connected with self-perception (Hayes, 1993) and with the level of self-efficacy (Bandura, 1977: 194):

'Efficacy expectations determine how much effort people will expend and how long they will persist in the face of obstacles and aversive experiences. The stronger the perceived self-efficacy, the more active the efforts.'

There is a growing tendency to teach teachers how should they help their students to reflect themselves (e.g. Freddano, Siri, 2012; Körpülü, 2012). 'Culture of evaluation among schools and self-evaluation within schools are gradually developing with the scholastic autonomy system' (Freddano, Siri, 2012: 1142). Apart from that, many studies focus on the enrichment of the teachers' abilities to observe and regulate their own teaching styles, communication styles and other forms of behavior. Some of the studies deal with prospective teachers, incorporating the self-reflection into their pre-gradual preparation (Mogonea, Mogonea, 2013; Majzub, 2013; Zeren, 2012).

Mogonea and Mogonea (2013) used the psycho-pedagogical experiment with prospective teachers using the self-correction or mutual correction, the controlled self-grading, the mutual grading, the objective inter-assessment method (Mogonea, Mogonea, 2013: 533). They found out that frequent use of self-evaluative method and the usage of metacognitive skills lead to the significant progress in self-assessment abilities in the experimental group. Authors confirmed their hypothesis that developing of metacognitive skills has positive effect on the process of self-reflection.

Majzub (2013) used qualitative analysis of narratives that students wrote during their teaching practicum at schools. Author concluded that the self-reflective reports during teaching practicum had positive impact on their awareness of their learning and teaching skills and ability to manage issues and problems relate to their teaching expertise.

The study of Zeren (2012) focused on the characteristics of students' personalities in term of Piaget's cognitive development theory, Freud's psycho-sexual development theory, Ericson's psycho-social development theory (Zeren, 2012: 2448-2449). Participants should write a personal story about chosen theory connected with his/her life-span.

Zeren (2012) worked on the assumption that 'in therms professional development, teachers' ability to understand themselves and to have awareness about their inner selves may affect their attitudes and behaviors towards their students' (Zeren, 2012: 2445). This assumption is crucial also for our pilot study dealing with the ability of students to realize their personal characteristic and abilities helping them to manage their future profession. The goal of the study is to identify which characteristics students used to describe their predispositions to become a teacher, to categorize them according to their positive or negative denotation and to assign these expressions to fundamental psychic processes and structures. These findings will be used as groundwork for future research with more quantitative orientation and as a feedback for the education of Educational Psychology at Department of Economic Teaching Methodology at University of Economics, Prague.

The orientation of our pilot study is idiographic and reflects a hermeneutic-narrative tradition of a research (Miovský, 2006). The significance of quantitative results will be verified by future research.

Materials and Methods

We applied the content analysis (Disman, 2011) on essays of students who were asked to write an essay called 'Why am I supposed to be a good teacher' as a part of their assessment in a course of Educational Psychology. They were told to summarize their characteristic that would help them to manage the profession of a teacher. In correspondence with theory of positive psychology (Seligman, 2004), the students should describe positive characteristic. They could mention their negative characteristics as well, but they should suggest some possibilities how to improve themselves in those areas (some kind of

intervention, time-management, relaxation etc.).
A sample size was 33 students of a master degree program (26 women and 7 men). A desiderative length of the essay were two standard pages and students had approximately three months for writing this essay. Therefore, we can assume that they were not in time stress during creating the essay.
In collected essays, all expressions describing self-reflective characteristics were identified and divided into categories according to their relation to fundamental psychic processes and structures. Each category had two dimensions, reflecting positive or negative denotation of expressions (resp. strengths or weaknesses).

Results and Discussion

During the content analysis of the essays, we identified 308 self-reflective statements that were divided into 11 categories according to their relation to fundamental psychic processes or structures (see Table 1). Moreover, we distinguished two dimensions: strengths (the expression was used in some positive context) and weaknesses (the expression was used in some negative context). Some expressions (e.g. "perfectionism") were designated as strength in one essay and as weakness in another. One student described "responsibility" as her strength and weakness simultaneously, so we counted it twice in both strength and weaknesses.

Category	Strengths	Weaknesses
Creativity	12	2
Emotions	17	12
Motivation	34	3
Organization	10	3
Personality	43	23
Presentation	6	7
Self-confidence	2	12
Social skills	37	20
Stress	7	8
Volition	29	15
Others	3	3
Total	200	108

Tab. 1: Categorization of self-reflective statements

Compared with described models of professional competencies of a teacher (Gillernová, 2008, Kyriacou, 1998), students described much more social skills than theoretic or didactic skills. This fact can be interpreted in connection with the content of course of Educational Psychology that is orientated more on social and diagnostic skills than on theoretic and didactic skills trained in other courses.
Students referred more about their strengths than about their weaknesses. The only areas where weaknesses predominated were Self-confidence, Stress and Presentation. Some expressions were used in more essays. The most frequent expressions from strengths were 'empathy' (described by 14 students, i.e. almost half of participants) and 'active listening' (described by 11 students). This fact might be also related to the course of Educational Psychology in which both these skills were trained. The most frequent expression from weaknesses was 'conflict avoidance' (described by 8 students).
To clarify the process of content analysis, more frequent expressions from some

categories will be described. All three expressions mentioned above (empathy, active listening and conflict avoidance) were assigned to the category of Social skills. In Emotions, more students mentioned 'extrovert' and 'well-balanced' as strengths and 'nervous' and 'impulsive' as weaknesses. In Motivation, most frequent strengths were 'I enjoy transferring knowledge', 'I can motivate other people'. In Characteristics of Personality, more students described themselves as 'friendly' and 'rightful' in strengths and as 'perfectionistic' and 'stubborn' in weaknesses. In Volition, the most frequent strengths were 'precise' and 'patient', the most frequent weaknesses were 'impatience" and 'tendency to procrastination'.

To verify and enrich our findings, a follow-up quantitative research using some methods of text mining would be appropriate (e.g. Manning, Schütze, 1999). Despite small sample size, results are highly relevant for the course of Educational Psychology and other education and training in the Department of Economic Teaching Methodology at University of Economics, Prague. Because majority of students wrote the essays at the end of the semester, we can presume that there was some effect of the content of course. The most frequented positive expressions were "active listening" and "empathy". Both these abilities were repeatedly mentioned and trained in the course. Conversely, less space was given to ability of successful solutions of conflict and "conflict avoidance" was the most frequent expression from weaknesses. Some training of effective solution of conflicts and assertiveness in course of Educational Psychology would be probably helpful also for students' self-confidence that was the only category in which negative expressions markedly predominated.

Although students seemed surprised by the fact that they should reflect themselves in the essay and worried if they were able to manage this type of assignment, finally they found the self-reflection very useful and enriching:

- "This essay was a great opportunity to try to reflect myself, to sum up my abilities, weaknesses and predispositions to be a teacher. It also helped me to realize my motivation to work as a teacher."
- "At first, I took this essay only as an obligation that helped me to gain points. However, I realized the acquisition for my personality. I was thinking about myself, what kind of person am I and what can I improve."
- "At first, I asked: How can I know if I am supposed to be a teacher? I have no experience with teaching. Simultaneously, I was pleasantly surprised by this task and by the fact that we (students at university) are finally forced to think, not only to memorize and to re-write textbooks."

We compared our findings with the article of Arif, Rashid, Tahira and Akhter (2012). They measured the Big five personality traits of future teachers at teacher education institutes of Punjab, Pakistan. They found that 'the ratio of four personality traits (Extraversion, Agreeableness, Conscientiousness, and Neuroticism) was nearly same, but the ratio of Openness personality trait is greater which means that the openness personality trait of prospective teachers is more dominant as compared to remaining four big personality traits' (Arif, Rashid, Tahira, Akhter, 2012: 161).

Despite the research has different methodology and terminology from our study, we can conclude some findings. In the study of Arif, Rashid, Tahira and Akhter (2012), Openess (characterized as 'curious, intellectual, creative, cultured, artistic, sensitive, flexible imaginative'(Arif, Rashid, Tahira, Akhter, 2012: 163) overwhelmed. In our study, we identified much less expressions in category Creativity (that could be close to Openess) than in Social skills. The category of Social skills (empathy, active listening etc.) could be

related to Agreebleness from the Big Five, characterized as 'Co-operative, worm caring, good-natured, Courteous trusting' (Arif, Rashid, Tahira, Akhter, 2012: 163). In study of Arif, Rashid, Tahira and Akhter (2012), the ratio of Agreebleness was not higher than ratio of Extraversion, Conscientiousness, and Neuroticism and was lower than ratio of Openess.

This difference from our study could be explained by a fact that in research of Arif, Rashid, Tahira and Akhter (2012), Agreebleness was significantly higher in women than in men. Both studies have different gender-proportion: 26 women to 7 men in our research and 60 women to 40 men in the study of Arif, Rashid, Tahira and Akhter (2012). Consequently, we could assume that difference in our results could be caused by different gender proportion. Therefore, it would be interesting to study gender differences in self-reflective essays in our future research.

As Majzub (2013), we concluded that the self-reflective reports during teaching practicum had positive impact on awareness of students' learning and teaching skills. In some future research during training teaching of the participants of our research, we could study impact of self-reflection skills on the ability to manage issues and problems related to their teaching expertise.

In research of Zeren (2012) students should write some personal stories within a framework of classical theories in developmental psychology. The participants stated that this task positively influenced their self-awareness and understanding towards children and youngsters (Zeren, 2012: 2445). In our study, we concentrated more on explicit naming and describing of strengths and weaknesses in relation to profession of a teacher. Because of a strong connection between speech and mind (Vygotskij, 1986), this type of task should help students to think more efficiently about themselves in the role of a teacher.

Conclusion

Our study proved that a self-reflective essay can significantly enrich the preparation of future teachers, helping them to realize their strengths and weaknesses and to develop their professional expertise. The students appreciated this type of task as an opportunity to think about themselves and their pedagogical competencies, personal characteristic and dispositions related to profession of a teacher. Despite small sample size, results of content analysis are highly relevant as a source of information about the self-awareness of students and as a feedback for the course of Educational Psychology that could positively influence its effectiveness.

This pilot study will be followed by quantitative research with larger samples, using methods of data mining and factor analysis to bring significant and detailed findings about personality of students. The study will compare differences in responses of men and women and differences between the essays from Educational Psychology and self-reflections that students write later (during their training teaching at secondary schools) to analyze development of students´ responses after confrontation with real practice.

Such study could importantly enrich the education and personal training of students in Department of Economic Teaching Methodology at University of Economics and could be exploitable for other institutions dealing with teachers' education and personal growth.

Acknowledgements

Research was supported by Internal Grant Agency of University of Economics, Prague (IGA) - project F1/31/2015 and it is part of a project of Faculty of Finance and Accounting realized with helpf of institucional support VŠE IP100040.

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EFFECTIVENESS OF BUSINESS ENGLISH E-LEARNING COURSE VIEWED FROM STUDENT´S PERSPECTIVE

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Abstract

The topic of this paper reflects the real needs and stipulated priorities within foreign language teaching at the Faculty of Economics and Management of the Czech University of Life Sciences Prague. One of the priorities in the field of education is the reduction of the lecturer´s direct teaching load, which is connected with the use of modern ICT technologies, e-learning courses for full-time forms of studies, for distance studies and for the centres of lifelong learning outside Prague. For the purposes of the research, the e-learning course was developed.

The objective of the research was to find out students´ opinion on e-learning depending on the frequencies of their responses and on their qualitative signs.

Statistically significant differences in the responses to questions are supposed to be caused by the personal experience of the students, who took part in the e-learning course and who could better judge the questions, and on the other hand, by the lack of experience of those who did not take part in the course. Most students who took part in the course supported the inclusion of the e-learning course in the distance studies and thought that the studies through the e-learning method could be as effective as through the face-to-face method.

Keywords

Action research, e-learning, qualitative sign, questionnaire survey

Introduction

The topic of this paper reflects the real needs and stipulated priorities within foreign language teaching at the Faculty of Economics and Management of the Czech University of Life Sciences Prague. One of the priorities in the field of education is reducing the number of contact hours, which is connected with the use of modern ICT technologies, e-learning courses for full-time forms of studies, for distance studies and for the centres of lifelong learning outside Prague.

Our research was conducted within the institution of the CULS Prague in accordance with its long-term aim, as well as in accordance with the language policy of the European Union, with the national policy of language education and with the long-term aims of the Ministry of Education, Youth and Sports of the Czech Republic. For the purposes of the research, the e-learning course was developed (Kučírková, Kučera and Vostrá Vydrová, 2013).

The research can be understood as the "action research" which refers to the classroom investigation initiated by researchers, i.e., teachers, who look critically at their own practice with the purpose of improving their teaching and the quality of education (Blázquez, 2007: 27). It connects received knowledge based upon practical professional experience with experiential knowledge by a continuous process of reflection. It engages practitioners in a critical and reflective attitude to their work. Teachers try to answer

questions related to an aspect of their professional practice. This means that they collect and analyse data, reflect, what they discover and then apply it to their practice. Bailey (2001: 490) points out that research which can be called the "action research" denotes a particular approach to collecting and interpreting data that involves a set of reiterated procedures for teachers (researchers) to conduct research in their own settings.
The objective of the research was to find out students´ opinion on e-learning depending on the frequencies of their responses and on their qualitative signs.

ESP e-learning and related linguistics theories

An English language course must be based on a solid foundation of the linguistic theory, especially that related to English for Specific Purposes (ESP), as well as the learning theory, specifically relating to online instruction or e-learning.
"Language description is the way in which the language system is broken down and described for the purpose of learning" (Hutchinson and Waters, 1987: 23). There is no single source from which the language course should take linguistic input. It is important to accept an eclectic approach. Our ESP e-learning language course derives its linguistic input particularly from the theory of language of registers and functional description of language with the input of philosophy and speech acts. They are not exclusive but complementary and each has its place in the course.
Bell (1981: 119) determines register as "a kind of sub-language or limited language described by correlating the linguistic forms in appropriate texts with situational variables". The whole language is then made up of a collection of registers. Hutchinson and Waters (1987: 30) define register as "the kind of language associated with a specific context, such as an area of knowledge (legal English; social English; medical English; business English; scientific English etc.), or an area of use (technical manuals, academic texts, business meetings, advertisements, doctor - patient communication etc.)." The aim of the register analysis is to identify the grammatical and lexical features of registers.
New ideas emerged in the study of language at the same time as the demand for ESP was growing. Traditionally, the aim of linguistics was to describe the grammar, the new studies focused on the ways in which language is actually used in real communication. Language does not exist for its own sake. Language can be looked at from the point of view of function, that is, what people do with it. Functions are concerned with social behaviour and represent the intention of a speaker or writer, for example, promising, threatening, classifying, identifying, reporting etc. (Hutchinson and Waters, 1987: 31). The functional view of language began to have its influence on language teaching in the 1970s, when there was a move from language syllabuses organised on structural grounds to those organised on functional criteria. It was connected with the Council of Europe´s efforts to establish some kind of equivalence in the syllabuses for learning various languages and with the establishing of analytical philosophy that became dominant tendency with the so called "turn to the language". John L. Austin (1911 – 1960) became a key personality among Oxford philosophers who founded school of "philosophy of ordinary language" (Peregrin, 2005). For instance linguists Sager, Dungworth and McDonald (1980: 87) define a special text unit as "the product of a special speech act characterised by a certain kind of unity of topic, reference and syntactic cohesion and by a conventional form which organises the content of the message according to the particular intentions pursued". They state that intentions with which we use the language arise from the voluntary nature of language and that these intentions are part of human behaviour and are determined by the circumstances which surround speech acts.

Materials and Methods

Questionnaires

The aim of the questionnaire survey was to find out the opinions of students on the influence of the e-learning method on the skills and vocabulary of students in comparison with the face-to-face instruction, and on the implementation of the e-learning course for distance students based on the frequencies of their responses and on the qualitative signs (year of study, field of study). We used a non-standardised questionnaire that was composed of 11 Likert scale questions with a high degree of explicitness (Gavora, 2000) and one open question that was intended for the respondents to evaluate the course, write their comments and also recommendations for future implications as the course in the Moodle LMS can be freely updated. The questions were as follows:

1. Gender.
2. Field of study.
3. Year of study.
4. Participation in the e-learning course.
5. Do you think that the inclusion of the ESP e-learning course is proper?
6. Do you think that the lessons of ESP within the e-learning course can be of the same effectiveness as the face-to-face lessons?
7. Do you think that the reading skill development within the e-learning course can be of the same effectiveness as the face-to-face lessons?
8. Do you think that the listening skill development within the e-learning course can be of the same effectiveness as the face-to-face lessons?
9. Do you think that the writing skill development within the e-learning course can be of the same effectiveness as the face-to-face lessons?
10. Do you think that the translation skill development within the e-learning course can be of the same effectiveness as the face-to-face lessons?
11. Do you think that the vocabulary skill development within the e-learning course can be of the same effectiveness as the face-to-face lessons?

Anonymous questionnaires, in accordance with ethical considerations in collecting research data ensured that confidentiality of the research data must be maintained (Seliger and Shohamy, 1990: 196). 94 questionnaires in the paper form were distributed among the students during the last lesson in the winter term 2012/2013. We did not have any problem with a low response rate, as all questionnaires were collected personally. The return was 93%. Some results of this questionnaire survey were also presented by Kučírková, Kučera and Vostrá Vydrová (2014).

Results and Discussion

Interpretation of the results in the questionnaire survey

There were 51 males (58.6%) and 36 females (41.4%) among the respondents. As far as fields of studies are concerned, the most highly-represented specified field was that of Business and Administration with 23 students (26.4%). Then it was Economics and Management field of study with 19 students (21.8%). Trade and Business with Machinery was represented by 17 students (19.6%). "Another" (not specified field of study) was represented by 28 students (32.2%) participating. 68 respondents (78.2%) were students in their first year of studies, only 7 respondents (8%) were in their second year of studies and 12 respondents (13.8%) were students in their third year of studies. 47 respondents took part in the e-learning course, while 40 did not.

71 respondents (81.6%) thought that the inclusion of e-learning into the ESP lessons for distance students was proper, while only 3 respondents thought that it was improper (3.4%), the remaining 13 respondents (15%) did not know.

Interpretation in dependence on qualitative signs

Most responses proved that there was no statistically significant difference in the dependence on single qualitative signs (gender, field of study and year of study, participation in the e-learning course). The survey of cases in which responses proved that there was a statistically significant difference in the dependence on single qualitative signs is mentioned bellow. In all of these cases, the observed dependence was of a medium strength with a contingent coefficient around 0.3.

Analysis of qualitative signs in dependence on gender

In Table 1, p-values of questionnaire items in dependence on gender are shown:

Questionnaire item	P-value
No. 5	0.65113
No. 6	0.29795
No. 7	0.51013
No. 8	0.09850
No. 9	0.12098
No. 10	0.50343
No. 11	0.03532

Tab. 1: Questionnaire item p-values in dependence on gender

Between genders a statistically significant difference was found only in item (question) 11, which asked if the development of vocabulary within the e-learning online course could be as effective as the face-to-face instruction. 34 (39.1%) males and 26 (29.9%) females answered "Yes" or "Rather Yes"; 12 (13.8%) males and 9 (10.3%) females responded "No" or "Rather no"; 5 (5.8%) males and 1 (1.2%) females responded "Do not know". More males than females believed in the effectivity of e-learning in the development of the vocabulary. It may be assumed that this was caused by the nature of males, who are more technically oriented and prefer information and communication technologies to the face-to-face method. P-value was 0.03532, i.e., lower than the significance level of 0.05. The analysis revealed that there was a statistically significant difference in responses between males and females. The contingent coefficient, which determines the dependence strength, is 0.3011162. The value of the coefficient is not high, the dependence strength between variables (response to item 11 and gender) is not high either, it is of a medium strength.

In all other items, there were not any statistically significant differences between the responses of students and their gender. P-values were higher than the significance level. It may be assumed that the variable, such as gender, did not have any influence on the students´ responses.

Analysis of qualitative signs in dependence on the field of study

In Table 2, p-values of the questionnaire items in **dependence on the field of study** are shown:

Questionnaire item	P-value
No. 5	0.34400
No. 6	0.99202
No. 7	0.88563
No. 8	0.71492
No. 9	0.93617
No. 10	0.15651
No. 11	0.05180

Tab. 2: Questionnaire item p-values in dependence on the field of study

Statistically significant differences among the responses of students within individual fields of study did not appear at all. P-values were higher than the significance level of 0.05. It may be concluded on the basis of the questionnaire analysis that the field of study did not represent any variable that could influence this research. Most students of all fields of studies had confidence in the inclusion of e-learning into distance studies (71 = 81.6%) and more than half of the students believed in the effectiveness of the development of the skills and vocabulary in all questions (from 44 to 68 in case of single questions).

Analysis of qualitative signs in dependence on the year of study

In Table 3, p-values of the questionnaire items in **dependence on the year of study** are shown:

Questionnaire item	P-value
No. 5	0.28419
No. 6	0.84221
No. 7	0.97364
No. 8	0.59257
No. 9	0.72488
No.10	0.59926
No.11	0.28449

Tab. 3: Questionnaire item p-values in dependence on the year of study

When the responses of students of different years of study were compared and statistically analysed, there was no statistically significant difference between the year of study of the students and the responses to questions 5 – 11. All the p-values were higher than the significance level of 0.05. The year of study did not influence the opinions of the students on the effectiveness of e-learning in the skills and the vocabulary in the research.

Analysis of qualitative signs in dependence on the participation in the e-learning course

In Table 4, p-values of the questionnaire items in **dependence on the participation in the e-learning course** are reported:

Questionnaire item	P-value
No. 5	0.04628
No. 6	0.03815
No. 7	0.10966
No. 8	0.33778
No. 9	0.13193
No. 10	0.31291
No. 11	0.88110

Tab. 4: Questionnaire item p-values in dependence on the participation in the e-learning course

Statistically significant differences in the responses to question 5 and 6 were found between the students who participated in the e-learning course and those who did not. Of those who completed the course, 42 (89.4%) thought that the inclusion of e-learning into the ESP for distance students was proper, 3 (6.4%) felt that it was improper and 1 (2.1%) did not know. Of those who did not take part in the e-learning course 29 (72.5%) thought that the inclusion of e-learning into the distance studies was proper, 3 (7.5%) thought that it was improper, and 13 (32.5%) students did not know. P-value was 0.04628, lower than the significance level. It indicated that there was a statistically significant difference in responses to question 5 about the inclusion of e-learning to distance studies between those who participated in the e-learning course and those who did not. It was also found out that there was a statistically significant difference in responses to question 6 and participation in the e-learning course. P-value was 0.03815. 29 (61.7%) students, who participated in the e-learning course and 15 (37.5%) students, who did not participate in the course, responded "Yes" and "Rather yes", 17 (36.2%) students, who participated, and 25 (62.5%), who did not participate in the course, responded "Rather no" and "No". To summarise, these statistically significant differences in the responses to question 5 and 6 are supposed to be caused by the personal experience of the students, who took part in the e-learning course and who could better judge this question, and on the other hand, by the lack of experience of those who did not take part in the course. Most students who took part in the course supported the inclusion of the e-learning course in the distance studies and thought that the studies through the e-learning method could be as effective as through the face-to-face method. In the other items (7 – 11) there were no statistically significant differences in responses between those students who participated in the e-learning course and those who did not as p-values were higher than the significance level.

Our research was based on the questionnaire analysis of students´ opinions on the e-learning method, its effectiveness and its inclusion into the distance studies. Similarly, Pop et al (2009) conducted their research on the computer-based course assessment questionnaire. The results indicated that even though the students´ motivation had increased and they had expressed positive views on the course, they had not been prepared to be fully autonomous and study through the pure online course. The Moodle LMS is also the main topic of the research paper by authors from the Technical University of Liberec (Pavlíková and Pekařová, 2010) in which they introduced Moodle language courses, various types of e-learning materials for students – Moodle resources and activities - and their experience with the Moodle LMS as well. They point out positive evaluation by the students. Nevertheless, this study did not conduct any questionnaire research related to this field.

Conclusion

The opinions of the students as to whether or not the effectiveness of the e-learning course and the face-to-face instruction was the same were influenced by the participation in the e-learning course. The results indicate that in most cases, negative views of the overall effectiveness of the e-learning course were expressed by those students who did not take part in the e-learning course. On the other hand, as far as the positive attitude to the e-learning effectiveness is concerned, the number of students who took part in the e-learning online course prevailed. The findings in opinions on the development of single skills show the students´ positive attitude towards e-learning.

The practical recommendations for the e-learning course itself based on questionnaire survey findings are as follows:

- Specialist vocabulary to be translated into the Czech language (not only the explanation in English).
- Provision of the list of words to be used during the gap-filling exercises.
- Extension of exercises for vocabulary.
- Extension of specialist articles for self-studies.

The findings from the students´ questionnaires were also very important as they expressed their views on the effectiveness of the e-learning course and its inclusion into distance studies. Most of the students who participated in the e-learning course assessed it positively and thought that it could be included in the distance studies programmes.

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USE OF THE LEARNING MANAGEMENT SYSTEM MOODLE IN THE COURSE OF TRADE THEORY IN BACHELOR STUDY PROGRAMMES

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Abstract

The learning management system Moodle belongs to worldwide systems supporting teaching in bachelor and master study programmes at many colleges and universities. Within the Czech University of Life Sciences in Prague, this system is used in almost all courses for eight years. This paper deals with the application of the Moodle system in the course of Trade theory included in bachelor courses of Economics and Management, and Business Administration. The aim of the paper is to analyse the impact of the utilization of this tool on testing students in comparison with study results in the previous years when this system was not applied. As well, this evaluation is carried out in a broader context taking into account other impacts which reflect in the final study results.

Keywords

Academic results, bachelor study, learning management system, testing, Trade theory

Introduction

Colleges and universities apply worldwide in teaching various e-learning technologies which are most commonly referred to as course management systems, virtual learning environments, or learning management systems (LMSs). These online systems allow coordination, distribution, and retrieval of online course materials and facilitate online communication between instructors and students and among students themselves (Teasley and Lonn, 2009). Effective use of a LMS has been shown to improve the quality of teaching and learning and enrich the educational experience of students (Black and Blankenship, 2010). The communication tools in LMSs can encourage active engagement in classes by students and promote constructivist rather than instructivist styles of learning (Teasley and Lonn, 2011). Implementing a learning management system provides a dynamic approach to traditional teaching methods (Davis et al, 2014).

Systems supporting teaching have become a favourite tool and are more and more often applied increasingly in connection with growing emphasis which is put on decreasing the volume of contact teaching on one hand and rising e-learning forms of study on the other hand. The LMSs are the narrowest part of electronic education support systems, which integrates in itself tools for controlling the teaching, i.e. offers a variable environment for creating and administrating Internet courses. Furthermore, it provides communication tools for all the participants of the course (in addition, with ability to differ single roles of users in a given course) (Kučera, Kvasnička and Vydrová, 2009). This is also in accordance with the key development priorities of the Czech University of Life Sciences in Prague (CULS) that include the development of indirect teaching forms and methods, electronic teaching aids creation, enhancing the quality and effectiveness of studies and self-studies within the LMS Moodle. It is an open source Virtual Learning

Environment which is free, developed by a worldwide community and is used for study purposes. It allows the teachers to create online courses and the students to enrol in them (Kučírková, Vogeltanzová and Jarkovská, 2011). As Dudeney and Hockly (2007) mention, teachers can combine various resources – pages and links to websites – with interactive activities such as quizzes, questionnaires, forums and chat rooms to create the course.

LMSs can also serve as a teaching evaluation tool. It can be effective and efficient in terms of the quality of students' participation and engagement in their learning, and for an integrated pedagogical approach in an online learning environment (Park, 2014).

Moodle (Modular Object Oriented Dynamic Learning Environment) is one of the most frequently used LMSs worldwide. Its utilization in teaching has a lot of advantages and brings a great number of benefits for both teachers and students. The integration of Moodle e-learning indeed help improve students' performance, as well as students with the Moodle e-learning are more confident in self-studying and better at understanding of the course contents (Chen et al. 2014). A combination of regular classroom teaching with the use of resources available on the Moodle platform has been designed to foster the development of skills for learning (Gonzales et al. 2014). Of course, the implementation of the Moodle e-learning has certain limitations, too. One of them is that the Moodle system presents barriers for screen reader users, limiting their ability to access the tool. One example of accessibility problems for visually impaired users is the frequent inability to publish learning contents without assistance (Calvo, Iglesias and Moreno, 2014).

In case of teaching in the Trade theory course, the Moodle system is used in order to provide students with basic information about the course and teaching organisation (syllabus, information about the conditions for obtaining the credit), source materials for lectures and other supplementary documents. In the same time, it is utilised for communication with students, in particular for notifications to important facts and providing with present news (forum for sharing news within teachers and students). The teachers of this course have also created a set of ten thematically focused theoretical self-tests accompanied with three self-tests oriented on computing instances which should make the student´s preparation for exam easier (checking questions for students – they guide students to the repetition of important parts of the taught problem). The tests are evaluated and students get points necessary for obtaining the credit. Both types of the tests – the home preparation and the main exam test are designed in the test interface provided by the Moodle system and consist of various types of questions: multiple-choice (with both one and more right answers), numerical and true/false.

The aim of the paper is to analyse the impact of the utilization of this tool on testing students in comparison with study results in the previous years when this system was not applied. As well, this evaluation is carried out in a broader context taking into account other impacts which reflect in the final study results.

Materials and Methods

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. In case of BA, we observed study results in years 2010, 2011, 2012, 2013 and 2014, when the numbers of students were 263, 264, 249, 269 and 263, respectively; and in case of EM in years 2011, 2012, 2013 and 2014, when there were 435, 452, 606 and 625 students, respectively.

The Moodle system was applied for testing BA students first in 2013 and for testing EM students in 2014; in both these cases on a credit test and a written part of combined exam

(i.e. consisting of a written and an oral part). Both these tests were generated using the same database of questions. The minimum limit which a student had to reach for passing the test was 70% and he/she had available one regular term and two resits. The test content was related to the content of the exercises.
In 2014 in case of BA the credit test did not take place and students had a possibility to try a voluntary self-test using the Moodle system.
In the observed period, there was another important change in teaching organization of the Trade Theory course which might have a significant impact on study results. Originally, in 2010 in case of BA and on 2011 in case of EM there were two hours of lectures and two hours of exercises a week (2/2 system) and in subsequent years this extent was reduced to two hours of lectures and a week and a two hours exercise once every two weeks (2/1 system).

Study results analysis

The following two indicators are used for the analysis of study results. The first one is the Odds Ratio (*OR*) (Glas et al, 2003). It is used for the calculation of chance to pass the exam successfully. It is calculated as follows:

$$OR = \frac{ad}{bc} \tag{1}$$

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. Using the same notation as in case of *OR*, the *AR* is computed by this formula:

$$AR = \frac{a}{a+b} - \frac{c}{c+d} \tag{2}$$

Results and Discussion

First let us concentrate on the BA study branch. Tab. 1 to 3 present study results from 2012 to 2014. We do not present years 2010 and 2011 here in view of the fact that the impact of contact teaching reduction between 2010 and 2011 on study results was much less significant in comparison with the implementation of Moodle testing in subsequent years. This is supported by *OR*s ranging mostly between 0.5 and 2 and *AR*s in absolute value mainly about at most 2% in this period as presented in Tab. 4 and 5.

	All students	Female students	Male students
Total number of students	249	189	60
Number of successful students	235	178	57
Number of students who failed	14	11	3
Successful students (%)	94.38%	94.18%	95.00%
Mean grade of successful students	2.285	2.258	2.368
Average number of trials	1.209	1.191	1.263

Tab. 1: Study results of the BA study branch in 2012

	All students	Female students	Male students
Total number of students	269	180	89
Number of successful students	264	179	85
Number of students who failed	5	1	4
Successful students (%)	98.14%	99.44%	95.51%
Mean grade of successful students	2.333	2.268	2.471
Average number of trials	1.136	1.151	1.106

Tab. 2: Study results of the BA study branch in 2013

	All students	Female students	Male students
Total number of students	263	184	79
Number of successful students	235	166	69
Number of students who failed	28	18	10
Successful students (%)	89.35%	90.22%	87.34%
Mean grade of successful students	2.651	2.596	2.783
Average number of trials	1.621	1.602	1.667

Tab. 3: Study results of the BA study branch in 2014

	All students	Female students	Male students
2011 vs. 2010	1.32	1.94	0.94
2012 vs. 2011	0.66	0.37	1.44
2013 vs. 2012	3.15	11.06	1.12
2014 vs. 2013	0.16	0.05	0.32

Tab. 4: *OR* for BA

	All students	Female students	Male students
2011 vs. 2010	1.16%	2.02%	-0.39%
2012 vs. 2011	-1.83%	-3.59%	2.06%
2013 vs. 2012	3.76%	5.26%	0.51%
2014 vs. 2013	-8.79%	-9.23%	-8.16%

Tab. 5: *AR* for BA

The implementation of Moodle testing in 2013 improved study results significantly, especially in case of female students. This observation is also supported by *OR*, which is bigger than 3 for all students and even 11 for female students, see Tab. 4; and *AR* of almost 4% for all students and more than 5% for female students as shown in Tab. 5.

However, a year later, a deterioration of study results with *AR* about 9% followed on as a consequence of the abolition of credit tests as one of the conditions for obtaining the credit. We can sum up that the change to pass the course successfully dropped twice in comparison with the period from 2010 to 2012. Although the fulfilment of credit test conditions was perceived by students as very difficult (due to the representation of a number of specialized topics as well as due to the possibility of multiple answers to one question and punitive evaluation in case of wrong answers), experience with the completion of this test was later very useful for the test exam. In 2014, the condition of passing the test as a part of the credit evaluation was repealed and replaced by other tasks during the semester. As a result, students met up the test for the first time during the examination. As an aid in preparing for the exam, ten self-tests focused on different topics were created, which students could try during the semester. It became apparent that only a small portion of students worked with this tool and some of these self-tests were used by students only to a small extent. It is possible to say that in this case the preparation for the exam has been underestimated by students in the sense of familiarity with the way and character of the examination test and it led to an overall deterioration of the test results year on year.

In case of the study branch of EM, the situation is meaningfully different. During all the observed period in Tab. 6 to 9, the study results were worse in comparison with BA. The biggest change in the study results came after the contact teaching reduction between 2011 and 2012 when the chance to pass the exam got twice lower (*OR* approximately 0.5 – see Tab. 10) which present just about 10% decrease as shown in Tab. 11 containing *AR*s. These facts are obviously caused by the fact that 2nd study year students are more sensitive to the contact teaching reduction than 3rd study year ones, cf. Vasilenko et al (2012) on one hand, and Kučera, Kvasnička and Krejčí (2012) on the other hand.

During next years no significant change in study results appeared, *OR* remains close to 1 and *AR* indicates changes up to 3 or 4% in maximum. It follows that the application of Moodle testing has no impact on study results in this case in contrast from the situation of BA.

There are two possible explanations for this difference. First, among the 2nd study year students there were week students who did not get into 3rd study year and these students achieve in general bad results of the exam, without respect to any study support. Second, the 2nd study year students, in difference from a year older and more experienced colleagues, cannot handle with knowledge acquired by sitting the credit test so efficiently. The idea of no dependence between Moodle credit tests and exam results in case of 2nd study year students is confirmed also by Popelková and Kovářová (2013) even in case of an optional course. However, in following two cases of a compulsory theoretically focused courses in 2nd study year slightly different results were found out. Dömeová and Fejfar (2014) discovered a weak dependency between Moodle credit tests and exam results. Nevertheless, Brožová, Rydval and Horáková, T. (2014) summed up their observation that the results of the self-tests are better than those of the exam-tests.

	All students	Female students	Male students
Total number of students	435	280	155
Number of successful students	386	258	128
Number of students who failed	49	22	27
Successful students (%)	88.74%	92.14%	82.58%
Mean grade of successful students	2.238	2.194	2.328
Average number of trials	1.223	1.159	1.352

Tab. 6: Study results of the EM study branch in 2011

	All students	Female students	Male students
Total number of students	452	273	179
Number of successful students	356	229	127
Number of students who failed	96	44	52
Successful students (%)	78.76%	83.88%	70.95%
Mean grade of successful students	2.312	2.245	2.433
Average number of trials	1.354	1.231	1.575

Tab. 7: Study results of the EM study branch in 2012

	All students	Female students	Male students
Total number of students	606	327	279
Number of successful students	461	274	187
Number of students who failed	145	53	92
Successful students (%)	76.07%	83.79%	67.03%
Mean grade of successful students	2.540	2.5	2.599
Average number of trials	1.341	1.310	1.385

Tab. 8: Study results of the EM study branch in 2013

	All students	Female students	Male students
Total number of students	625	348	277
Number of successful students	487	291	196
Number of students who failed	138	57	81
Successful students (%)	77.92%	83.62%	70.76%
Mean grade of successful students	2.632	2.622	2.648
Average number of trials	1.464	1.419	1.531

Tab. 9: Study results of the EM study branch in 2014

	All students	Female students	Male students
2012 vs. 2011	0.47	0.44	0.52
2013 vs. 2012	0.86	0.99	0.83
2014 vs. 2013	1.11	0.99	1.19

Tab. 10: *OR* for EM

	All students	Female students	Male students
2012 vs. 2011	-9.97%	-8.26%	-11.63%
2013 vs. 2012	-2.69%	-0.09%	-3.92%
2014 vs. 2013	1.85%	-0.17%	3.73%

Tab. 11: *AR* for EM

Conclusion

The implementation of LMS testing within the final exam of a course is, with assurance, beneficial. It saves effort and time necessary for correction by teachers. However, it puts more demands on students. The test implemented through the LMS is more complex in comparison to the previous test form and it tests the knowledge of students in a much more objective manner. It may impact the final evaluation of students, especially in case of higher study years and, possibly, also of better students; although in our case, there was no change in the method of testing using the Moodle system, only the form of the test changed to electronic one. Demanding credit tests may incredibly improve the LMS exam results. The subject of Trade Theory belongs due to its broad scope to challenging courses that require thorough preparation and the method of testing is not affected.

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UNIVERSITY STUDY RESULTS AS RELATED TO THE ADMISSION EXAM RESULTS

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Abstract

The paper is aimed at an assessment of the relationship between results of admission proceedings and the University study successfulness. The core of the research was the relationship between the Mathematics admission test results and the exam results of two of the courses taught during the first bachelor level study year: Mathematics and Mathematical Methods in Economics. The research was carried out on two statistical samples comprising the results by students from the Economics and Management and the Business Administration study programmes. Using the regression and correlation analysis and the Principal Component Analysis the mutual relations and the importance of separate factors were assessed.

Keywords

Admission exam, correlation, education, study success level

Introduction

One of the quality assessment criteria of university education is the rate of study success in the given study programme. Besides high teaching quality also a high quality of the selection of study candidates is to be assumed here. Hence, the university study admission proceedings should be managed such that candidates having the best dispositions for study in the given programme could be selected and those, at the same time, who have the best possible dispositions for employment in practice. The composition and form of the admission examination questions plays an important role here. There are Universities or Colleges, too, where problems of this kind is not dealt with and where the candidates are admitted based on the secondary school leaving examination being passed only. There it was assumed that the student himself/herself can assess his/her own dispositions for study of the programme given. However, at most Universities the admission proceedings take place.

At the Faculty of Economics and Management (FEM), Czech University of Life Sciences in Prague (CULS), the written admission examinations are applied in Mathematics and Foreign Language, both of them in the form of multiple-choice tests. For both these subjects a necessary number of points are required to be gained in order to pass the exam. Of those who pass, the candidates are admitted according to the sum of points gained in both the tests. Considering that the number of candidates applying is several times higher than the number of those who the faculty can admit, only candidates with excellent admission exam results can be admitted. (Svatošová, 2006).

However, during the first year of study at the bachelor level many students present rather mean level results or even some worse ones. Frequently this provokes the question whether the University study success level can be predicted based on the admission proceedings results.

Bettinger, Evans and Pope (2013) determined that, across various colleges in the U.S.A., English and Mathematics subtests of the American College Testing (ACT) can effectively predict study outcomes in college and the results in the remaining ACT subtests are not significant and important. Singh and Pundir (2012) found out that mathematics, numerical and logic based tests in the entrance exams are important aspect for cumulative grade point average earned during the first year of studies by computer science students, who took admission in IIIT-Delhi in between 2008 to 2010. On the other hand, Kim and Kee (2012) investigated whether students exceptionally talented in science and mathematics (i.e., those who received awards in Olympiads, the international competitions for gifted students in science or mathematics) excel in medical school and they concluded that academic merit alone is not a strong predictor of success in medical school. Nevertheless, Gómez-López et al (2012) tried to determine the correlation and the predictive level of the entrance examination to the medical studies with the academic performance at the end of the 8th semester of the career and concluded that students with the highest average mark during the medical study have the highest mark among single tests at the entrance examination just in Mathematics.

The aim of this study is to discover to what extent the University study success level can be predicted based on the admission proceedings results in case of FEM CULS. In particular, we examine how far the Mathematics admission test results correspond to the exam results from the courses taught in the first year of study where knowledge of secondary school mathematics is supposed. Namely, these were the courses of Mathematics and Mathematical Methods in Economics (MME) taught within the Economics and Management (EM) and the Business Administration (BA) study programmes. Two samples (one for each study programme) were set up containing the results of the first exam term. Based on the facts obtained it was examined how the results relate to the Mathematics admission examination results.

Materials and Methods

The analysis concerned was carried out on two samples of the first year students in the academic year 2013/14 (i.e. students who submitted an application to the study in 2013 and were accepted for study) from two different study branches. There were 405 students of the EM study branch and 368 students of the BA study branch. 38% of them were male and 62% were female students. We examined the number of points gained at the Mathematics admission test (the maximum which the students might gain was 50 points) and the exam mark at the first exam term in Mathematics and MME in the Czech university classification system. In Tab. 1, we present the numerical and verbal expression of single classification grades used in the Czech Republic (CR) and the corresponding classification in the scale of the European Credit Transfer System (ECTS).

Scale in CR	Numerical	1	-	2	-	3	-	4
	Verbal	excellent	very good		good		failed	
ECTS scale		A	B	C	D	E	F	

Tab. 1: Conversion table between classification scales in Czech and European universities

First the descriptive statistics methods were used to find out the level and especially the variation of the results (Hendl, 2004). Next the relationship of the Mathematics admission exam results to the university study success level was observed (Kába and Svatošová, 2012). In this part, first the comparison method was applied, followed by the correlation

analysis where the correlation coefficient served as the measure of the relationship tightness (Healey, 2009).

For identification of factors that affect University study success level at most, the Principal Component Analysis was employed. This method facilitates reduction of an excessive number of variables, or a condensation of information into a smaller number of unmeasurable hypothetical quantities causing the least loss of information contained in the variables studied. The principle of Principal Component Analysis is the transformation of a selection of original variables into new hypothetical variables. These are called components. The components are ordered according to the sizes of their contributions to the explanation of total variance of the original variables. In principle this means to create more general variables from the original large volume of data, at the same time securing a minimal loss of information contained in the original variables (Hebák et al, 2004).

The analysis was realised with statistical software SAS (Kába and Svatošová, 2012, Delwiche and Slaughter, 1996).

Results and Discussion

It is obvious from Tab. 2 that the results do not significantly differ in both the programmes and this was confirmed using the t-test and F-test. Apparently, the EM students have a better mean number of points from the admission exam with a higher variation, but their results from the courses analysed are slightly worse than in the sample of the BA programme students. As the exam results of single courses are concerned, MME exam results are more variable than Mathematics exam results.

Examination	EM Programme		BA Programme	
	Average	Variation coeff. (%)	Average	Variation coeff. (%)
Admission exam Mathematics	27.72	30.39	26.5	28.24
Mathematics examination	3.13	27.00	3.07	27.15
MME Examination	2.72	36.00	2.64	36.50

Tab. 2: Exam results by the study programme – basic measures

In order to find out whether the result of Mathematics admission exam predicts university study successfulness a comparison of the average exam results of both the observed courses and the average result from Mathematics admission exam was carried out and summarized in Tab. 3 and 4.

Programme	Mathematics assessment				
EM	Grade	1	2	3	4
	Average number of points from Mathematics admission exam	33.70	23.18	19.71	14.97
	Number of students	19	64	165	157
BA	Grade	1	2	3	4
	Average number of points from Mathematics admission exam	34.77	26.29	25	18
	Number of students	15	70	156	127

Tab. 3: Mathematics exam results considering the Mathematics admission exam result

Programme	MME assessment				
EM	Grade	1	2	3	4
	Average number of points from Mathematics admission exam	36.74	26.47	19.96	14.71
	Number of students	61	83	168	93
BA	Grade	1	2	3	4
	Average number of points from Mathematics admission exam	37.60	28.1	22.0	15.66
	Number of students	57	87	151	73

Tab. 4: MME exam results considering the Mathematics admission exam result

It is obvious from these results that the university ways of teaching can bring certain troubles to students during the first study year, especially in Mathematics. Most students count it sufficient to learn everything for an exam shortly before it, what just in the case of Mathematics may be a very risky decision. But it is obvious too, that the students with better results from the admission exam have better dispositions for a successful pass of the university examination. The same holds for MME too, where the exam results even have a more favourable distribution.

In the following analyses the relationship between the Mathematics admission test results and the exam results in the first study year was examined. The strength of relationship was measured using the Spearman coefficient of correlation. (Freud and Littel, 2000). In all the cases the correlation coefficients express moderate relationship. As the strongest one in both of the two study programmes, the relationship between the result (grade) from Mathematics and the result (grade) from MME was found. On the other hand, the weakest one was the relationship between Mathematics admission exam and the mark from MME. According to the weak correlation discovered between the exams results in Mathematics and MME a significance test was performed of the differences between the results of these examinations. In both the student samples the null hypothesis on concordance of the averages was rejected. The low value of the correlation coefficient is explained thereby, too.

Relationship	Correlation coefficient	
	EM	BA
Admission exam Mathematics / Mathematics	-0.307	-0.217
Admission exam Mathematics / MME	-0.231	-0.116
Mathematics / MME	0.435	0.357

Tab. 5: Coefficients of correlation between the results obtained

Next it was studied, using the multivariate method, which of the factors presents itself as the most important for the success of study (Hebák et al, 2004). In order to reach the target, the Principal Component Analysis was chosen as the most suitable. It was put to use on the data transformed (Delwiche and Slaughter, 1996). The model was explained using three components. The results are similar for both of the two study programmes. In the EM programme the first component contributed 55.2 % to the explanation of the total variance, and this component correlated at the strongest with the Mathematics and MME exam results. The second component contributed 26.4 % to the explanation of total variance and the component correlated at the strongest with the Mathematics admission exam results. The third component contributed 18.4 % to the explanation of total variance

and a strong effect of the examinations of Mathematics has shown here again. The results are arranged into Tab. 6.

Economics and Management study branch	
Component (name)	% explanation of the total variance
Results of university studies	55.2
Admission proceedings results	26.4
Mathematic knowledge	18.4

Tab. 6: Result of PCA in study programme Economics and Management

The situation in the BA programme is presented in Tab. 7. The first component contributed 49.4 % to the explanation of total variance. The effect of the Mathematics exam and MME exam presented itself at the strongest here. The second component contributed 30 % to the explanation of total variance and it again correlated at the strongest with the Mathematics admission exam results similar as in the case of the EM programme. The third component contributed 20.6 % to the explanation of total variance and here again the considerable effect of the examinations of Mathematics was proved.

Business Administration study branch	
Component (name)	% explanation of the total variance
Results of university studies	49.4
Admission proceedings results	30.0
Mathematic knowledge	20.6

Tab. 7: Result of PCA in study programme Business Administration

The results of these analyses are in concordance with the situation in most of the foreign universities and colleges mentioned in Introduction (Bettinger, Evans and Pope, 2013, Singh and Pundir 2012). Nevertheless, Gómez-López et al (2012) found out even a statistically significant dependency of study results on entrance exam based on correlation analysis in case of medical studies in Spanish, while at FEM CULS only a weak correlation was discovered.

At Czech universities, the research of admission exam results has focused usually on the decline of the results during recent years (Maryška, Douček and Mikovcová, 2013) or the dependency of the results on the test forms (Klůfa, 2013). An approach similar to ours was conducted by Kubanová and Linda (2012) at University of Pardubice where, instead of admission exam, the learning potential tests (LPT) by the private company Scio are used in the admission procedure. They conclude based both on the correlation and regression analysis that it is not possible to predict reliably the study results based on the LPT results. They used even four different types of correlation coefficients and in all cases the coefficients between LPT and a course exam were negative between –0.07 and –1.17, while the coefficients between particular course exams were positive and at least 0.55.

Student's failures or worse assessment at the university examinations (especially at the Mathematics exams) can be mostly considered to be caused by the fact that it is a course taught in the first year of the university study when the students are not yet fully adapted to the university study style. They believe that it is sufficient just to arrive to lectures and exercises during the semester and that it is possible to learn everything shortly before the exam. This way some of them necessarily meet the failure. This idea is supported

by Vasilenko et al (2012) who observed a significant study results deterioration in the course of Informatics taught in 1st bachelor study year after exercises extent reduction. The teachers in the first study year should take attention to this fact and they should adapt their teaching to it. In no case this means to reduce the level of study expected on part of the students or to change the ways of teaching; however, the checks of students´ preparedness for the classes during the semester should be more frequent, e.g. in the form of short tests at the start of single seminars or exercises (and, if necessary, extending the volume of seminars for this purpose). If the results of these tests will be somehow included into the student´s assessment, either as a condition for obtaining the credit or as a part of the exam mark, this can well motivate students into ongoing study and help them to gain better exam results.

Conclusion

From the analyses performed it follows credibly that the level of success at university study in CULS can be predicted to some extent based on admission examination results (in Mathematics, in our case). This was found out by simple comparison of the results as well as by correlation analysis (though the correlation was weak) and the Principal Component Analysis, where the result of Mathematics admission exam acted as the second principal factor. The lower correlation coefficient value can be explained when we recall that the exam results came from the first exam term (first student´s attempt) only and, above all, from two courses only, taught in the first study year. Namely, more detail analyses of the relationship of the admission proceedings results with the entire academic success level (over all the study years), which were carried out in the previous years in CULS, demonstrated that the effect of admission proceedings results is significant especially during the first two years of study (Svatošová, 2006).

Hence, we can conclude, all in all, that the admission process, provided the way how these are at the Faculty of Economics and Management, are objective and that based on the admission exam results (of Mathematics, in this case) the university study success level can be predicted.

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HOW ENTREPRENEURIAL ARE CZECH STUDENTS IN HIGHER EDUCATION?

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Abstract

The paper is aimed at better understanding of entrepreneurial attitudes and activity of Czech students in higher education. It uses representative samples of N = 1285 young people aged 19 to 29 interviewed in the frame of the Global Entrepreneurship Monitor project in 2006, 2011 and 2013. Logistic regression has been used to capture the development of students' entrepreneurial self-efficacy, fear of failure, perception of business opportunities, perceived image of entrepreneurship as well as early stage entrepreneurial activity itself. The results show that students significantly differed from non-students of the same age in perceiving more business opportunities and having lower fear of failure. Also, for young people in general, students or not, the image of entrepreneurship improved and fear of failure increased between 2006 and 2013. The results confirm that current effort of many universities to support students' self-employment is relevant and should further focus on students' entrepreneurial mindset.

Keywords

Czech Republic, entrepreneurship, Global Entrepreneurship Monitor, opportunity perception, students

Introduction

For today's society, entrepreneurship is of utmost importance. Entrepreneurs create jobs, support economic growth, innovate their products, services, processes and business models, help optimize market prices and support local communities (Lukeš et al., 2013). Therefore, entrepreneurship is an important topic of economic policy and receives increasing attention at higher education institutions worldwide. As Morris, Kuratko and Cornwall (2013) report, the number of higher education institutions offering courses in entrepreneurship grew to more than 3000 worldwide and this number keeps on growing. Universities also move from offering single entrepreneurship courses only to creating entrepreneurship centers and departments, developing entrepreneurship minors and majors, establishing business incubators and, especially in the United States and Western Europe, they try to integrate entrepreneurship into the very roots of university functioning. Such movements can be recognized in the Czech Republic as well, despite some delay.

There are also first research findings suggesting the positive role of entrepreneurship education at university with self-employment intentions of students. Walter, Parboteeah and Walter (2013) found that entrepreneurship education and industry ties of the university are related to self-employment intentions of male students. Recently, two studies were organized by Michael Frese and his colleagues in Uganda. In the first study (Gielnik et al., 2015), action-based entrepreneurship training of university students showed positive effects on entrepreneurial goal intentions, action planning, action knowledge, and entrepreneurial self-efficacy. Furthermore, these factors mediated the effect of the training

on entrepreneurial activities that in turn, together with business opportunity identification, mediated the effect of the training on business creation. In the second study (Glaube et al., 2015), positive consequences of training focused on personal initiative were confirmed as well on the sample of small business owners.

Besides university faculties and departments, there are also other actors in the entrepreneurial ecosystem that help young people conduct steps towards business launch and development. Business accelerators and co-working centers such as Hub, Node5, TechSquare or recently founded xPort help young people to make their dream real by offering networking options, providing mentoring and early financing.

Thus, it is important to inquire whether these developments in the entrepreneurship ecosystem for young startups relate to the development of entrepreneurial attitudes and activity on the part of young people. Descriptive data from the Global Entrepreneurship Monitor project (Lukeš, Jakl and Zouhar, 2014) suggested that compared to 2006, younger people and students in particular are now more focused on entrepreneurship. This paper aims at better understanding of this development and what role university education may play in it.

Materials and Methods

Data

We used individual-level data from a repeated cross-sectional survey, conducted in the Czech Republic within the international Global Entrepreneurship Monitor project in years 2006 (N = 2001, aged 18+), 2011 (N = 2005, aged 18–64) and 2013 (N = 5009, aged 18–64). The sampling procedure consisted in randomized mobile phone calls; more details are given in (Lukeš, Jakl and Zouhar, 2014).

Due to the aim of the present study, we restricted the sample to young people between 19 and 29 years of age; 19 is the age of the youngest undergraduates in the Czech Republic, on the other hand number of students older than 29 is negligible. Furthermore, we only retained data on the control and treatment groups in our analysis, defined as follows: the *control group* contains respondents who are not studying at the moment and have finished their secondary education, but not higher education; the *treatment group* contains those who reported being a student, while having finished a secondary school with a school-leaving exam. Thus, the vast majority of cases in the treatment group are currently enrolled in some sort of post-secondary education.[1] The final dataset contained a sample of 1285 respondents, with 821 in the control group and 464 in the treatment group.

Dependent and independent variables

We considered four different measures of entrepreneurial attitudes for the role of **dependent variables**. All of them were responses to a single yes/no question from the GEM questionnaire, and were coded as 1 = *yes*, 0 = *no*; the resulting variables are (i) *entrepreneurial self-efficacy*, obtained from the question "Do you have the knowledge, skill and experience required to start a new business?", (ii) *status of entrepreneurs*, from "In your country, do those successful at starting a new business have a high level of status and respect?", (iii) *business opportunities*, from "In the next six months, will there be good opportunities for starting a business in the area where you live?", and (iv) *fear of failure*, from "Would fear of failure prevent you from starting a business?" Apart from these four variables, we used an additional dependent variable, *early-stage entrepreneur*, which is an indicator of whether the respondent performs activities towards owning and

[1] The GEM dataset does not enable a closer description of the current education enrollment.

managing a business start-up or already owns and manages a business start-up younger than 3.5 years (1 = *yes*, 0 = *no*).

The **main independent variables** were (i) *studentship*, an indicator of the respondent's assignment to the treatment/control group (1 = treatment group, or *student*, 0 = control group, or *not a student*), and (ii) *year* of survey, which enables us to track the changes in dependent variables over time. In order to avoid obtaining results confounded by variation in respondents' demographic characteristics, we included a set of **control variables**, namely (i) *age* of the respondent (years), (ii) gender, represented by a *female* indicator (1 = female, 0 = male), and (iii) size of population of the respondent's home town, included as a categorical variable *population*, coded into four bands with thresholds at 5, 20 and 100 thousand inhabitants (see also Tab. 1 for clarification).

Model specification

We used a series of standard logistic regressions to estimate covariate effects on each of the dependent variables. In all regressions, we used all independent variables mentioned above; sets of dummy indicators were used for the polytomous variables *year* and *population*, no functional transform was used for *age* (the only continuous variable), and an interaction of *studentship* and *year* was included in the model in order to allow for different time trends in the treatment and control groups. Even though the issue of using robust standard errors in non-linear models in not open-and-shut (Freedman, 2006), we decided to use the robust (sandwich) variance estimator for standard errors. In our case, this leads to more conservative inference than the conventional variance estimator. The same robust variance estimator is used for the construction of the 95% CI for predicted probabilities in Fig. 1 below. All calculations were carried out in Stata 13.

Results and Discussion

The results show (see Fig. 1 for overview and Tab. 1 for exact estimates) that status of entrepreneurs as perceived by young people improved significantly both for students and non-students. This suggests possibly positive role of bigger focus that entrepreneurship receives in media and on the internet. Especially students are not so skeptical anymore concerning their view on general population attitudes towards entrepreneurs. The younger the respondents, the more optimistic they were concerning the status of entrepreneurs.

On the other hand fear of failure in general increased both for students and non-students. This may suggest more realistic perception of competences that entrepreneurship requires and can also be related to perceived higher market competition. However, students feared a failure less than non-students. Similarly to the development of fear of failure, entrepreneurial self-efficacy declined in between 2006 and 2013, albeit not significantly. The highest drop was in 2011, suggesting a connection between entrepreneurial self-efficacy and economic cycle. For entrepreneurial self-efficacy, there was not a significant difference between students and non-students, but females had substantially lower entrepreneurial self-efficacy and stronger fear of failure than males.

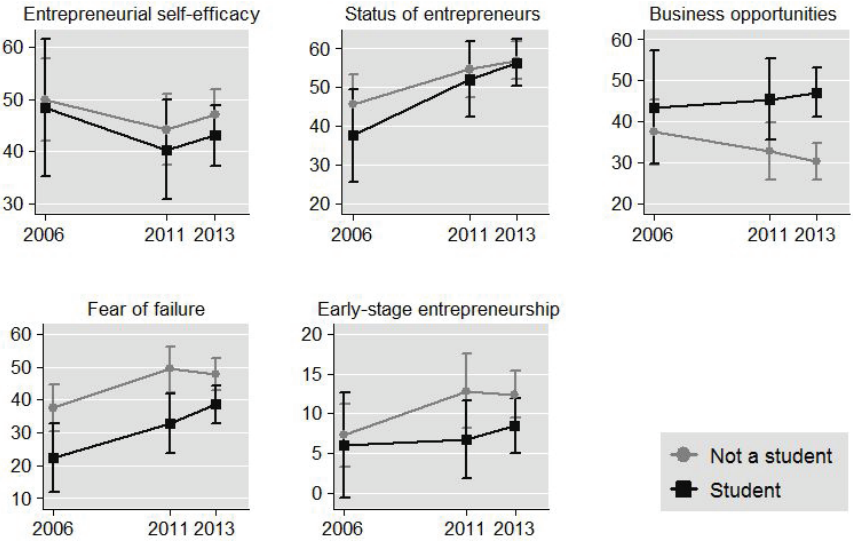

Fig. 1: Entrepreneurial attitudes of the youth, by year and studentship. Vertical axis shows the percentage of "yes" responses predicted by logistic regression (i.e. predictive margins), together with the 95% CI for the prediction. Source: own data.

In the area of the perception of business opportunities, there is a clear indication of an expanding gap between students and non-students in Fig. 1. It is probable that improvements in entrepreneurship and/or business education at universities help students to perceive substantially more opportunities when compared to other young people. Females perceived less opportunities than males.

Finally, there was not a significant difference between students and non-students in early-stage entrepreneurship. It is probable that two competing forces come into play. First, students are likely to have more knowledge and abilities that enable them to see opportunities. On the other hand, concerning labor market developments and youth unemployment issues (e.g. Eurostat, 2013) they face much higher opportunity costs compared to their less educated counterparts. Entrepreneurial activity of young people without university education is more frequently based in necessity.

	Entrepreneurial self-efficacy	Status of entrepreneurs	Business opportunities	Fear of failure	Early-stage entrepreneur
Main independent variables					
Studentship	[0.726]	[0.719]	[0.000]***	[0.001]**	[0.202]
Not a student	ref.	ref.	ref.	ref.	ref.
Student	−0.0642 (0.325)	−0.346 (0.315)	0.269 (0.357)	−0.741* (0.349)	−0.203 (0.687)
Year	[0.709]	[0.011]**	[0.587]	[0.014]**	[0.383]
2006	ref.	ref.	ref.	ref.	ref.
2011	−0.237 (0.219)	0.362 (0.219)	−0.216 (0.252)	0.492* (0.215)	0.647 (0.372)
2013	−0.120 (0.192)	0.459* (0.188)	−0.346 (0.217)	0.426* (0.186)	0.605 (0.335)
Studentship × year					
Student × 2011	−0.0951 (0.402)	0.240 (0.395)	0.299 (0.447)	0.0335 (0.426)	−0.532 (0.812)
Student × 2013	−0.102 (0.354)	0.317 (0.348)	0.501 (0.393)	0.362 (0.378)	−0.235 (0.726)
Control variables					
Female	−0.620*** (0.119)	−0.169 (0.120)	−0.398** (0.134)	0.346** (0.119)	−1.011*** (0.211)
Age	0.0522* (0.0216)	−0.0843*** (0.0218)	−0.00895 (0.0238)	0.0171 (0.0211)	0.0114 (0.0337)
Population					
less than 5,000	ref.	ref.	ref.	ref.	ref.
5,000 to 19,999	0.185 (0.177)	−0.0903 (0.181)	0.294 (0.207)	0.116 (0.178)	−0.0452 (0.288)
20,000 to 99,999	0.0242 (0.179)	−0.0980 (0.176)	0.197 (0.212)	0.295 (0.175)	−0.507 (0.328)
100,000 or more	0.191 (0.147)	−0.147 (0.149)	1.123*** (0.168)	−0.207 (0.148)	0.259 (0.231)
Constant	−1.070 (0.572)	2.011*** (0.579)	−0.643 (0.623)	−1.092 (0.563)	−2.464** (0.872)
Observations	1231	1192	1085	1250	1269

Notes: (i) Parentheses below coefficient estimates show robust standard errors. (ii) Square brackets in the *studentship* and *year* rows show *p*-values of an LR test for joint significance of all regression terms that included category indicators of *studentship* and *year*, respectively; this can be interpreted as the overall significance of the two categorical variables. (iii) "ref." indicates the base (reference) category. (iv) * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Tab. 1: Logistic regression results. Source: Own data.

Overall, the results show the improvements in the area of students' perception of business opportunities. Due to significant and growing differences between students and non-students, we can assume universities start to play a positive role in teaching students how to recognize these opportunities. In this context, entrepreneurship courses, trainings and business incubators can be further supported. On the other hand and as previous research suggests (Lukeš et al., 2013; Rauch and Frese, 2007), psychological characteristics such as self-efficacy play a very important role in the decision whether or not to start an entrepreneurial activity. In these characteristics, no better development of

students compared to non-students can be confirmed. Universities should therefore focus more intensively on supporting students in the development of entrepreneurial mindset that would encourage students to start efforts towards independent business foundation. Some recent studies and books can be recommended that will help universities to prepare effective and well-functioning programs (e.g., Hofer et al., 2010; Morris, Kuratko and Cornwall, 2013; Volkmann et al., 2009).

Conclusion

The paper helps to better understand entrepreneurial attitudes of Czech students. Students, when compared to non-students of the same age, perceived more business opportunities and had lower fear of failure. The results confirmed that universities should further focus on development of students' entrepreneurial mindset.

Acknowledgements

This paper was supported by internal grant agency of Faculty of Business Administration, University of Economics, Prague, nr. IP300040.

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MINI-DEBATE AS AN EFFICIENT LEARNING TOOL IN THE EFL/ESL UNIVERSITY CLASSROOM

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Abstract

The objectives of this paper are to demonstrate a suitable integration of simplified mini-debate into intermediate level university classes. Debate activities require students to master content and gain conceptual knowledge, while using language in meaningful ways. The debate tasks promote speaking skills, however, critical thinking, research skills, autonomous and collaborative learning skills are enhanced simultaneously. The aim of this paper is to describe classroom research with special attention given to the simplified mini-debate format and its efficient implementation within the EFL/ESL courses. The actual classroom research was performed while teaching General English through mini-debate to 19 - 20 year-old-students of at the Czech University of Life Sciences Prague in intermediate classes. By describing the methods and procedures used to engage in debates and promoting the classroom research results, this paper aims to enrich pedagogical methods for effectively teaching not only speaking skills and thus serve EFL/ESL teachers at large.

Keywords

EFL/ESL, critical thinking skills, intermediate level, mini-debate, language skills, teamwork

Introduction

The highly competitive 21st century has placed more pressing demand for university graduates who can communicate well in English and, at the same time, are equipped with other skills like critical thinking, effective independent research, autonomous and collaborative learning, and positive assessment. All of these skills that serve individuals well in school, in the workplace, and in political life are taught by a debate besides several other methods as stated by (Nesbett, 2003: 210) who considers the debate an important educational tool for analytical thinking skills and for self-conscious reflection on the validity of one's ideas. Based on his research debate is an excellent activity also for language learning because it engages students in a variety of cognitive and linguistic pathways, directing them into responsible dialogue within a diplomatic, democratic context. Even though the recent studies (Darby, 2007: 1-10), (Hall, 2011: 1-8), and (Kennedy, 2009: 225-236) have demonstrated that debate is a highly beneficial tool to develop all language skills, teamwork and critical thinking skills, debate has not been widely introduced in the university EFL/ESL (i.e. English as a Foreign Language / English as a Second Language) classrooms. "Most of the previous studies were conducted in English-speaking countries and more studies in the EFL/ESL context needs to be done," as stated by Aclan and Noor (2015: 2). Given the nature of this study, the objectives of this paper are to verify the viability of using simplified mini-debate to B1-intermediate level learners and provide sufficient reasons for larger integration of debate into university-level classrooms. It is

assumed that if a debate is introduced into intermediate level classes of General English efficiently, the students will improve their complex language skills. By offering a working framework and collected data survey, the paper focuses on a practical and yet motivated solution to multi-faceted issues faced by the university teacher of EFL/ESL using debate within their course context.

The methodology used to formulate this paper comprises a scholarly assessment of the importance of communication and other skills, including the definition of debate and a description of debate within the university context. This is followed by identifying simplified debate format and describing its implementation in practice. Having established the observation processes and explained the organization of the groups, a cohesive integration of language skills into debate are subsequently described. The concluding assessment is supported by an examination of the students' progress, attitude, satisfaction, and need-factor based on survey results. All of the described procedures are classroom tested, as evidenced by the number of students, genders, age, professional goals and students' survey results used as a source of data collection. Subsequently, this paper provides methodological discussion of the strengths and limitations of mini-debate, including those faced by both the teacher, as well as the student, before offering various solutions to specific classroom situations. Finally, the scholarly results are summarised with a reflexion on the importance of debate within the context of democracy and societal interaction.

Material and Methods

The International Debate Education Association, n.d. defines debate in the following manner: "Originally, debate is a formal contest of argumentation between two teams or individuals. More than a mere verbal or performance skill, debate embodies the ideals of reasoned argument, tolerance for divergent points of view, and rigorous self-examination." Using debate to develop advanced competency in a second language is a method that is slowly finding increased interest among instructors and students alike in the Czech Republic. For EFL/ESL, debate participation consolidates the students' second language skills via reading, writing, listening, persuasive speaking and eventual conversational fluency. Debate has been described by Lubetsky, LeBeau and Harrington (2009: 10) as a highly sophisticated form of immediate, interactive communication which assumes an elevated level of discourse skill, the mastery of which is often elusive even for native speakers. Its complexity extends far beyond the level of ordinary conversation, demanding dynamic and critical listening, as well as advanced language competency and critical thinking. It enhances public speaking skills, research skills, autonomous and collaborative learning skills as stated by Iberri-Shea (2013: 3-4). Moreover, according to Zare and Othman (2013: 1507) "those who advocate the use of debate across curriculum believe that the debate approach provide students with superior access to the content of any given subject at the same time, since they are engaged in the course content actively, broadly, deeply and personally." At the Czech University of Life Sciences Prague, few formal debate sessions are usually held by teachers who are native speakers and are focused on upper-intermediate and advanced students. Although serious debate topics are too formal and can be especially intimidating for EFL/ESL learners, simplified debate does indeed offer a powerful tool for enlivening teaching and energizing intermediate-level students. When students engage in debate, they take an active role in their education, while subjects which may once have seemed dull and abstract come vividly to life (Tumposky, 2004: 52). The following research is based on observing, monitoring and questioning the classes

of the B1 General English courses. For the purpose of the study intermediate students were defined based on the Common European Framework of Reference as B1 students. Methods and subsequent results analysed below were tested over the course of four full-length university semesters at the Czech University of Life Sciences Prague. Class sizes varied, from 20 to 25 students, included both genders (however the majority were male - 55 %) and covered an age range of 19 – 21 year olds. The total number of students was 250. Most of the students were native speakers of Czech; however 15% of them also came from multinational backgrounds (including Russian, Ukrainian, Kazakh, and Georgian, Mongolian, and Vietnamese families). The English course in which these debates were incorporated was a required course for B.A. degree majors; however the intentions of the students with regard to their professional life after completion of the degree varied (Economics and Management, Engineering, Environmental Science, Tropical Agriscience, Forestry, Wildlife and Wood Sciences, Agrobiology, Food and Natural Resources). Thus it was clear that their career choices would significantly benefit from advanced English skills, specifically in terms of speaking, discussion, opinion-gathering, etc. The choice to introduce debate into the classroom for these students was therefore a contemplated one, taking into account the best for the students based on available time and resources. Of the students participating in the course, 75% continued into the following semester and thus had the benefit of participating in debate sessions for two semesters. The courses comprises 24 contact lessons (once per week, 90 minutes) per semester held over 12 weeks. Debate sessions were taken 4 times in each class during the semester. 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.

Simplified debate formats

For efficient group discussions, small groups turned out to be ideal, because quiet students were formerly avoiding any contributions to large groups. Likewise, larger groups tended to be noisier and thus more difficult for the teacher to monitor. The group members were either assigned by the teacher or the students determined the groups by themselves. However, the groups were systematically rearranged for each separate discussion activity so that the students could cooperate with dissimilar people, learn to be open to different ideas and ultimately, test their own opinions on a variety of people. Students were placed in two teams of two or three members. The teams were then presented with a "topic" (resolution). In teams, the students subsequently prepared their arguments by following this suggested mini-debate format:

1. Affirmative team speech
2. Opposing team speech
3. Affirmative team rebuttal
4. Negative team rebuttal
5. Questions/answers from teams, field questions from audience
6. Affirmative closing argument
7. Negative closing argument
8. Audience assesses arguments' persuasiveness
9. Teacher provides constructive feedback

Mini-debates primarily focused on language use at the given level of the students. The focus was on a multitude of factors, for example: pronunciation, grammar, vocabulary, use of appropriate register, synonyms, fluency of speech and accuracy to keep the debate going smoothly. When assessing simplified debate, concentration was not on

the organisation, use of arguments, use of examples and facts, and effective counter-arguments, as would normally be done in qualifying debates. Instead, constructive feedback was provided primarily from the language use point of view, particularly in how the language was used and why. Suggestions for improvement were once again tailored, given the debate at hand. Options included, but were far from limited to: use of additional weight-carrying verbs (versus "to be," "to have," etc.), improved opinion-indication phrases, increased diplomatic approaches and referencing of external opinions to support individual opinions. This final suggestion sometimes led to number 10) being added to the above-outlined scheme in that enough time for the students' own feedback on the teacher's comments needed to be allowed. This fostered an atmosphere of excellent teacher-student communication. Students were encouraged to be creative with evidence and support for their positions. The goal was not to train world-class debaters, but instead to allow the students to consolidate their language skills, practice speaking, develop a diplomatic approach to opinion expression and enjoy the process along the way as suggested by Fedorkiw (2010).

Simplified debate – methodology in practice

When teaching mini-debate to intermediate classes, it proved to be essential, as already stipulated by Lustigova (2011: 18-30), to employ a step-by-step or scaffolding approach. Rather than overwhelming the students with the complex structure of debate speeches, it was best to start with the straightforward process of formulating and becoming aware of their own opinions, while introducing a number of language structures, grammar issues and new vocabulary along the way. Harmer (2007: 84) clarifies that "simplified debates concentrate the content of the EFL/ESL learner's speech, thus allowing the students to focus on improving their skills by using knowledge already grasped," and further explains that "skills integration is a major factor in a lesson planning." Lessons preparations for the students' debate included topic definition, class warm-up discussion, pre-reading warm-up questions, reading short news stories or texts from course textbooks on current topics, comprehension questions, reading, watching and listening to recorded debates or videos on a given topic, comprehension exercises, vocabulary review, review of useful debate phrases, discussion of where debate may be applicable to real-life situations.

This mini-debate project was split into and/or combined together with several different activities, each supporting the next. The first stage involved choosing an interesting situation to maintain student interest and keep them active. The topics were consistently targeted to the language level and background interests of the class. The students were even offered several cases to be debated and then voted for the most suitable one. Occasionally, a list of potential topics was also developed in a teacher-student brainstorming session during which relevant and thought-provoking issues were chosen. Based on extensive trial, the following topics worked well for intermediate level university classes:

- There is a good system of caring for the elderly in the Czech Republic.
- The President of the Czech Republic is doing a good job.
- Being part of the EU helps us live better on a daily basis.
- A student fee should be introduced at state-owned universities.
- Without a broad CV, it is impossible to find a good job.
- University education is vital to finding a career-based position.
- WWII still influences life here today.
- Friends are more important than family.
- Without travel, we cannot appreciate life in our own country.

Depending on the topic, students were provided with particular grammar structures (comparatives of adjectives, conditional clauses, simple past, present and future tenses). Sample grammar structures were written on the board or given to the students as a hand-out. A list of opinions on a given topic was then provided to the students in the form of cue cards. Once the students were given sample grammar structures and explained the variety of opinions for use during the debate, they pragmatically focused on correct production skills in conversation and, in time, learned to identify their own opinions. Students were also trained to form questions to challenge the other team.

With an increasing number of mini-debates, students began to form their opinions accurately, explain the reasons for such opinions and provide substantial evidence, all the while acquiring additional confidence in English. Given that mini-debates were relatively new to the students, multiple choice activities served the process of providing reasons for the opinions very well, requiring the students to select the best reason from a list of choices. Students were thus introduced to different types of reasons, such as comparisons, contrast, and cause-effect relationships which were reflected in various grammar structures to be acquired.

In the following stage, the students were asked to look for evidence to support the chosen reason as suggested by Lubetsky et al (2000: 20). This evidence could be their subjective explanation, an expert opinion based on media research or the use of some statistical data to support the reason for a certain opinion. At this stage, the students researched their debate topics using books, newspapers and the internet. This was done in the classroom or sometimes given as homework. This student research emphasized reading skills, including the skimming and scanning of texts. Moreover, students practiced writing while making their notes and developing a list of arguments. The students were asked to write their notes and list their arguments in English. It was not acceptable to write the arguments in L1 and then to translate them into English. Arguments needed to be written in clear and simple English that could be easily understood by their peers. Watching and listening to sample debates using the internet as a video database also significantly enhanced the students' listening skills.

After such preparation, the students were ready to assemble their affirmative speeches. At this point, certain simple refutation language structures were also introduced, allowing for a suitable language framework for agreement and disagreement to be established early on. Students were encouraged to provide linguistic support to the teacher at each stage of the process. Useful vocabulary for the students was sensitively chosen to serve them in the short-term debate context, as well as in the long-term life context. Several examples follows: expressing agreement and disagreement (e.g. I agree. / I don't think so. / I think that you are right), talking about point of view (e.g. From my perspective… / In my opinion... / I'd rather…), reporting what others say (e.g. From the point of view of… / So, what you're saying is…), talking about meaning (e.g. I'm not sure I understand what you mean. / Would you mind rephrasing your thought? Am I making sense?), drawing conclusions (e.g. We finally all agreed that... / After much discussion, we decided that...), giving reasons and offering explanations (e.g. To start with... / The reason why… / Many people think...), phrases of interruption (e.g. Can I come in here? / To go back to an earlier point…), language of comparison e.g. (X is bigger than Y.), language of cause and effect (e.g. If you do X, then Y will happen), (McCarthy and O'Dell, 2008, pp. 68, 72, 80-84, 96, 108).

Given that the debates were oral, the students were requested to use a louder voice than normally used during a conversation and thus be easily heard by their classmates. They were also pushed to change and modulate their tone of speech, highlighting certain words.

Results and Discussion

Based on monitoring, observations and survey data analysis the above-described scholarly work confirms that mini-debate is an active learning technique that encourages students to be interested in the teaching-learning process, while significantly benefiting the students in terms of all academic language skills (reading, writing, speaking, listening), second language fluency, verbal communication and public speaking skills which assist EFL/ESL learners be prepared for successful academic study and professional careers. Moreover, it was proved that classroom mini-debate encouraged cooperation and teamwork and promoted critical thinking, the skills definitely valued at current job markets as suggested in the findings of Lustigova (2011: 25 – 28).

A step-by-step approach proved to be the most beneficial, as students were gradually introduced to new language structures, grammar and vocabulary. By fine tuning the debate topics to the students' level of knowledge, the students themselves contributed more actively and created a relaxing and positive teaching-learning atmosphere. Taking into account the four language skills, the students manifestly improved their writing, reading and listening skills, as was evidenced within the classroom with enhanced performance in written homework, oral consultation sessions, and interim and year-end testing. Vocabulary tests, and other oral activities during the semester also demonstrated a sufficient increase of gained knowledge.

It was monitored and observed that there was a significant improvement in terms of the actual time that the EFL/ESL learners were capable of speaking. At the start, the mini-debate sessions lasted approximately 6 minutes; however by the end of the semesters, after four sessions, the students were still debating 20 minutes later. Thus, the efficiency of debate as a technique to train students to cooperate with others in a group-setting also produced the visible by-product of motivating students to express their own opinions and arguments beyond a superficial level.

By using mini-debate format which focused particularly on language use, English was able to be introduced into the EFL/ESL classroom in a way that was both challenging and interesting to the learner and teacher simultaneously. Collaborative approach proved the results of previous studies on utilising debate in and interactive learning (Oros, 2007: 293-311). Given the high adaptability of these activities, it became much easier to consolidate previous lessons, comprise reading, writing, listening, speaking, and research skills, while also providing the groundwork for future concepts and integrating these skills in such a way that they supported and enhanced one another. As the students developed communicative competence in English, the teacher directly benefited from a more interactive classroom atmosphere; this was evident from the participating students since attendance rose by 20 % on days where it was previously announced that mini-debates would take place. Students were also observed increasing the number of topics debated in conversation outside the classroom (either before or after class). As a result, society most likely also gained in the long-term since these thinking skills were eventually projected into a wide range of applications in everyday life.

In order to validate the above-recorded teacher's observations a student survey was taken at the beginning and at the end of each semester. The survey was meant as an indicator of the students' attitudes and satisfaction with implementing mini-debate into the EFL/ESL course, summarizing their needs. The survey content and results are shown in Table 1. The students expressed their opinions and suggestions at the scale from 0 to 10, where 10 marks the highest level. The Table 1 demonstrates the mean values of 250 responses. The

learners also provided their suggestions in a form of written answers. Selected student' answers are shown below.

	Question	Prior mini-debate sessions score	After 4 mini-debate sessions score
1	I enjoy speaking in front of the class	1,3	6,8
2	I speak English fluently on familiar topics	2,9	8,0
3	I feel comfortable with basic English grammar	5,0	8,3
4	I am able to skim and scan advanced expert texts	2,8	5,7
5	I am able to write down ideas and arguments on familiar topic	3,2	6,8
6	I am interested in the EFL/ESL course content	1,6	7,9
7	I value the mini-debate as a learning tool	n/a	9,1
8	I like searching and looking for evidence and resources	4,6	7,2
9	I like collaborating with my classmates	2,8	5,7
10	I would appreciate more debate sessions within the course	n/a	8,1

Table 1: Survey of student's attitudes, satisfaction and needs

Based on the student's responses mini-debates were assessed as highly beneficial tool as evidenced by a high score increase in Question 7 after 4 mini-debate sessions. Likewise, they appreciated high level of gained knowledge. Generally, mini-debates significantly improved learners' speaking and communication skills including their fluency and confidence as proved by 175 % growth with regard to the Question 2. They became more comfortable in using basic grammar structures in communication as evidenced by 66% difference prior and after mini-debate sessions score in Question 3. Students progressed significantly in reading advanced texts (by 103%), improved their writing skills (by 112.5%) and enjoyed research (by 56.5 %) considering responses to Questions 4, 5, and 8. They found themselves four times more interested in the content of the English course after the mini-debate sessions (Question 6). Being interactive within the mini-debate session, they found cooperation and teamwork with other colleague less intimidating. The numbers almost doubled with regards to Question 9. Furthermore, the overall survey results were supported by written comments. The most prevailing responses are provided below in their shortened version: 'I learned how to debate, collect data and so on.', 'I couldn't speak English well, but I became to think it is fun and I'm not afraid of making mistakes in front of other people anymore.', 'I'm sure I gained new skills that would help me in my future career.', 'I like hearing my classmates speaking. I'm learning from their usage of new words and from their mistakes as well.', I'm much more comfortable with grammar and I grasped it without much drilling and effort.', 'I feel, I'm not that anxious and stressed any more when I have to make presentation. The overall tolerant and friendly atmosphere within the class is a great help.', 'I gained knowledge and information on some subjects outside my interest and curriculum. Most of them was very beneficial.' At the start of implementing these mini-debate sessions, several students expressed anxiety at being forced to express an opinion in front of people with whom he or she did not consider himself or herself to have much in common, beyond attending the same class at the same university. All fears were allayed, however, as it was made clear that the ESL classroom was simply the chance environment where the students were at the moment. The relevance to real life was also a considerable factor in driving home the importance of debate and made the students feel more comfortable.

As demonstrated above, the teacher's thorough preparation and sensitive involvement was the tool to overcome potential challenges such as time constraints, limited knowledge and various language capabilities of the students, mixed-level groups, and the occasional nervousness of learners. Moreover, to overcome time constraints, the debate was moved forward smoothly and quickly, limiting each speaker to one minute. Small teams of two or three students were ideal. These teams were encouraged to solicit help from the rest of the class so that everyone was involved. Any lack of language capability and/or mixed-level groups was solved by the students' thorough home preparation, sensitive distribution of students within the groups and assignment of appropriate topics. Students were allowed to have their notes on hand, as well as the teacher's hand-outs or cue cards with sample grammar structures and sample opinions available for the entire debate. Any limited knowledge of grammar, pronunciation, and vocabulary needed to be sensitively addressed by the teacher, but not by interrupting the flow of communication. Instead, notes were taken while the pairs or groups were talking and then the problems were addressed to the class after the activity without embarrassing the student who had made the error. The errors were written on the board and corrected with the interaction of the entire class. If a speaking activity seemed to be stagnating, the teacher sometimes needed to assume a role-play, asking additional discussion questions, clarifying instructions or stopping an activity if it was indeed too difficult. During the preparatory stages, the teacher circulated around the classroom to ensure that students were on the right track and see if they needed help while working in groups or pairs. The teacher could also thus diagnose the problems faced by the students who had difficulty in expressing themselves in the target language and provide more opportunities adjusted to these students' needs.

It was proved based on teacher´s observation and a student survey that if a debate is introduced into intermediate level classes of General English efficiently, the students will improve their complex language skills. Moreover, the results of significantly merging mini-debate into the classroom, along with other activities, produced the tangible results of more confident students who were keen to contribute to their own language storehouse, to the improved classroom environment and ultimately, willing to tolerate others' opinions, while responding with well thought-out counter arguments. This type of diplomacy cannot be purchased. Thus, in spite of the challenges presented, debate (even in its modified and simplified version for intermediate students) proved effective for everyone involved, as well as for those who would ultimately be influenced.

Conclusion

The classroom-based research for this paper aimed to prove the feasibility and efficiency of implementing mini-debate sessions to the intermediate EFL/ESL classes. The findings indicate that both students and teacher found such teaching–learning tool very useful and highly effective. The study also indicates that used approach brings substantially more positive effects, not only significant improvement of students' language skills. As a team activity, mini-debate is cooperative and it empowers the learners to be responsible of their learning and to be autonomous in their language use. In her essay entitled "The Debate Debate," associate professor Nancy Rennau Tumposky (2004: 52) moreover links the maintenance of debate, as a method of learning, to democracy, "finally, and perhaps most significantly, debate's resilience is no doubt partly attributed to its associations with two powerful concepts: critical thinking and democracy."

In the university context, this power can be understood in terms of training individuals who are interested in the improved functioning of inter-human relationships whether that is to a larger international extent or in one-to-one interactions. EFL/ESL is not

merely transferring knowledge to students, but also helping them to develop a deeper understanding of themselves (Browden & Ference, 1998: 22), as well as the ability to think individually and responsibly within the greater context of society and to display empathy (Tumposky, 2004: 53). Besides of gaining advanced language skills, this newly-gained awareness of themselves can lead students to more effective contributions to society. For the teacher, the goal – both short and long term – should be to make a change for the better. And debating at any level can aid the teacher in reaching this goal. Debates – even in simplified formats – belong in our classrooms.

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OPEN SOURCE PROGRAMMES AS THE SUPPORT IN MATHEMATICAL EDUCATION

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Abstract

The aim of the paper is to present the results of the research in which we confirm that suitable application of some open source mathematical programmes can improve the students' attitude towards mathematics and enable them to achieve a higher level of knowledge. To assess the efficiency of use of such electronic products in teaching we test the results of two groups of students of the Faculty of Economics VŠB - Technical University of Ostrava who participated in the didactic test and completed the questionnaire. The experimental group had special extra mathematical lessons in which the teacher helped the students to use open source programmes. To evaluate the teaching experiment we use parametric methods of the statistical inference. Statistically verified results of the questionnaire and the didactic test confirm that the appropriate integration of mathematical programmes into teaching of mathematics can improve the students' attitude towards mathematics and enable them to achieve a higher level of knowledge and efficiency.

Keywords

Cognitive knowledge, efficiency, mathematics, online calculator, open source programme, statistical inference

Introduction

Recently mathematics was an important part of almost all educational programmes at schools and it was one of the most subsidized subjects. People who had mastered mathematics at a high level were previously considered and respected as eminent personalities. Nowadays, mathematics belongs to the second-class subjects with very low hourly dotation. A lot of people are still convinced that they can live without mathematics in everyday life in spite of the fact that the labour market is missing technicians, analysts, engineers and people with a good ability of exact and logical thinking. On the other hand Faculties of Economics produce many graduates without any quantitative and exact knowledge.

This problem is closely connected with a reduced number of mathematical lessons and other science subjects. Discussions of possible mandatory graduating from mathematics at secondary schools have still been a political issue. Fortunately our researches showed that students at Faculties of Economics change their opinions and consider mathematical education as very important for them (Majovska, 2013). Students come to the faculties of economics with the persuasion that they are not able to manage mathematics. These initial fears are changing into the real anxiety after first failures and they refuse everything that reminds them of mathematics and anything exact. This exaggerated fear of mathematics is very often artificially created. Students often disbelieve in their own abilities of learning mathematics.

We deal with the question whether it is possible for university students, who often lack

basic mathematical skills and have a very negative attitude to mathematics, to overcome these problems and to master successfully everything that the mathematical syllabus requires. We do not think that students´ failures in mathematics are due to the decreasing level of intelligence of the young generation or the lack of their interest in intensive study. The problem is somewhere else. We see one of the main reasons in the fact that their education in mathematics has not responded to modern technological changes and opportunities that these changes allow. We are convinced that the problem is also in the ways how mathematics is taught today (Robova and Vondrova, 2010).

With regard to technical changes it is necessary to revise the view of what is and what is not good teaching. Many teachers believe that the main aim of teaching is to provide students with as much knowledge as possible at the highest mathematical level. Unfortunately we see this trend in our schools where encyclopaedic teaching prevails. Teachers examine facts but not understanding, skills and connections among concepts.

The results, however, are paradoxically the very opposite. Many students enrol at a university with poorer knowledge than ever before, they often do not know the basic concepts such as the function or they know the definition but cannot imagine what it means. They are not able to compute either with large figures or with small figures. It is the same with their skills. They know mechanical procedures for solving some standardized tasks, but they do not know what they have really solved and why (Stavy and Tirosh, 2000). Interpretation of their procedures and results is something that they have not done yet. Not surprisingly they have resistance to mathematics and consider this discipline totally unnecessary for their life. The sense of teaching mathematics for non-mathematical branches is not in learning precise and detailed definitions or theorems. Students of these disciplines do not appreciate these strictly logical structures of mathematical concepts. On the contrary it is often the reason for their misunderstanding and failure. We cannot consider an example with unreal data without context and interpretation in other subjects or practice as high-quality mathematical education.

The development of cognitive technologies influences all society transformations from the industrial company or the information company to the knowledge based society. Cognitive technologies present the basic movement from mechanical and uncritical fact downloading to the process of cognition and discovering of new facts and skills. Students do not receive new knowledge directly from their teacher but they look for information themselves (Miller, 2014). Thus teachers lose the role of the source of information. More and more they become the helpmates and guides. Cognitive technologies are usually realized by means of computer programmes (Kunter, 2013).

At the Faculty of Economics VŠB - Technical University of Ostrava mathematics has been taught without computer support. But a small group of teachers decided to include some cognitive technologies in mathematical education. We have used open source mathematical programmes, applets, online calculators and Computer Algebra System (CAS). Nowadays, the usage of suitable cognitive technologies as a support in mathematical education is not a great problem. We do not need to rely on expensive commercial programmes because we can choose many suitable open source programmes from an expanding supply. Many schools have not only a computer classroom but they often have modern technologies which help to the better upgrading of computer technology, for example a projection appliance, an interactive board etc. However, the input of cognitive technologies does not meet with positive public acceptance generally. We have met many opponents among teachers as well as students. But we have just found the majority of opponents of modern trends in the education among mathematics teachers in spite of the fact that the Ministry of Education, Youth and Sports emphasises the importance in this field.

We have encouraged students to use modern technologies in mathematics at the Faculty of Economics VŠB - Technical University of Ostrava for several years. Students have direct access to them in LMS Moodle Fig 1.

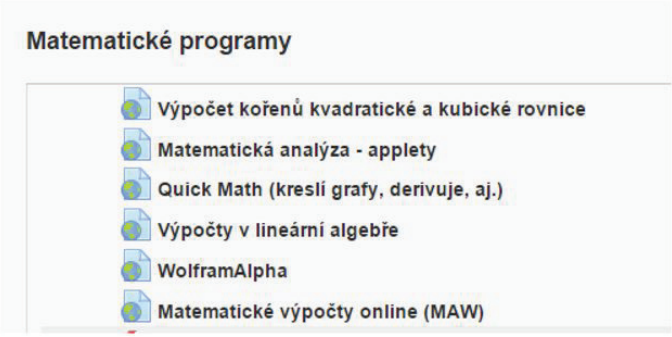

Fig. 1: Open source programmes in LMS Moodle

Although education in mathematical subjects is taught in the classroom without personal computers we have observed increased interest in using open source mathematical programmes, applets and online calculators (Majovska, 2014).
In this paper we argue that the facilitation of access to various cognitive technologies and their using increases the number of students who use new technical acquisitions, changes their attitude towards mathematics and improves students´ knowledge. To assess the suitability of using cognitive technologies in the teaching process we used a questionnaire and didactic test. To evaluate both students' opinions on the changes in their mathematical education caused by including appropriate forms of ICT and the results of the didactic test we used parametric methods of statistical inference (Freedman, Pisani and Purves, 2007).

Materials and Methods

In the academic year 2014/2015 we realized a research. The aim of our research was to explore whether using open source mathematical programmes which also include applets and online calculators in the teaching of mathematics would change students' attitude towards mathematics and improve their mathematical knowledge. We formulated two alternative hypotheses:
H11: Appropriate integration of open source mathematical programmes in mathematics enables students to improve their attitude towards mathematics at the end of the period of experimental teaching.
H12: Active usage of open source mathematical programmes enables students to achieve a higher level of knowledge in mathematics at the end of the experiment than that of students who do not use open source mathematical programmes.
These hypotheses were formulated as a one-sided alternative (in terms of Neyman - Pearson's conception of statistical hypothesis testing) and they always constitute a positive change of parameters tested in accordance with the initial hypothesis (Nickerson, 2000). The corresponding null hypotheses represent a situation where there is no expected positive change. We marked these hypotheses as H01, H02.

Methodology and research organization

The research was realized in the form of an experiment. We examined the relationship between the implementation of open source programmes into the education as the independent variable and the effectiveness of teaching as the dependent variable.

To verify the alternative hypothesis H11 we used the sample of 72 voluntary students from six study groups of the first grade of bachelor study. There were 30 men and 42 women. But we did not compare the results between these two groups. Lectures and seminars of all students from the six groups were taught by one teacher in the classroom without personal computers. But all students had unlimited access to open source programmes which they could download from LMS Moodle outside regular lessons. Students who optionally took part in our research had further special lessons in the classroom which was equipped with computers and the access to the internet. These lessons were taught by the same teacher who helped students to use various open source mathematical programmes, applets and online calculators.

We used a questionnaire to find out the students' attitude towards integration of open source mathematical programmes in mathematical education. The questionnaire had two parts. The first part was used at the beginning of the experiment. It was at the beginning of the winter term. The second part was used at the end of the winter term. The questionnaire was based on the Thurston attitude scale and found out the different polarity of the respondents' attitudes to solving mathematical problems while using open source mathematical programmes. To determine the change of the examined factors, we put two identical questions in the first and second parts of the questionnaire. The first question at the beginning of the experiment (Q1 Beginning) was "Express your feeling to the subject of Mathematics," and at the end of the experiment "What is your opinion of Mathematics now?" (Q1 End). The second question at the beginning of the experiment (Q2 Beginning) was "The subject of Mathematics is for you …" and at the end "The subject of Mathematics is now for you …" (Q2 End). Students had a choice from a five point attitude scale (Chráska, 2007). We used a one-sided paired t-test for the statistical verification of hypotheses H11. We tested the hypothesis at the 5% significance level.

To verify the alternative hypothesis H12 we chose a sample of 148 students from the same six study groups of the first grade of bachelor study. We used a didactic test to examine the level of the students´ knowledge at the end of our experiment. The didactic test is considered as a standard tool of determining the results of the teaching process with high validity and reliability (Turek, 2004). The test involved six tasks.

The students were divided into two groups. The first one was the control group (CG) with 76 students and the second one was the experimental group (EG) with 72 students. The experimental group consisted of voluntary students who attended special extra lessons supported by open source computer programmes, applets and online calculators.

Both groups had the same conditions while writing the test and these conditions were known to both groups before the test. The students of both groups had access to the internet and were informed of the possibility to use any calculators, computers, tables, computer programmes, applets and means.

Results and Discussion

Hypothesis H11

Statistical processing of students´ answers to the two questions gave positive results. We proved by using *t*-test that there was a significant shift in the students´ attitudes towards mathematics and the importance of their study. The students considered mathematics as more interesting and simpler than before the experiment. The obtained results are given in Tab. 1. Changes in attitudes that occurred as a result of the implementation of open source programmes and applets into teaching are expressed in Tab. 2 in Pair 1 and Pair 2.

		Mean	Number	Std. deviation	Std. Error Mean
Pair 1	Q1 Beginning	2.23	72	1.179	0.136
	Q1 End	3.34	72	1.212	0.141
Pair 2	Q2 Beginning	2.32	72	1.018	0.117
	Q2 End	3.41	72	0.977	0.114

Tab. 1: Paired Samples Statistics

		Number	Correlation	Sig.
Pair 1	Q1 Beginning	72	0.796	0.000
	Q1 End			
Pair 2	Q2 Beginning	72	0.722	0.000
	Q2 End			

Tab. 2: Changes in attitudes towards Mathematics

Hypothesis H12

To verify the hypothesis H12 we used the results obtained from the quantitative analysis of the student´ results in the didactic test. We used tools of descriptive and exploratory statistics for the description of results of both compared groups. The average success rate in the didactic test of both the groups is shown in Fig. 1 and Fig. 2.

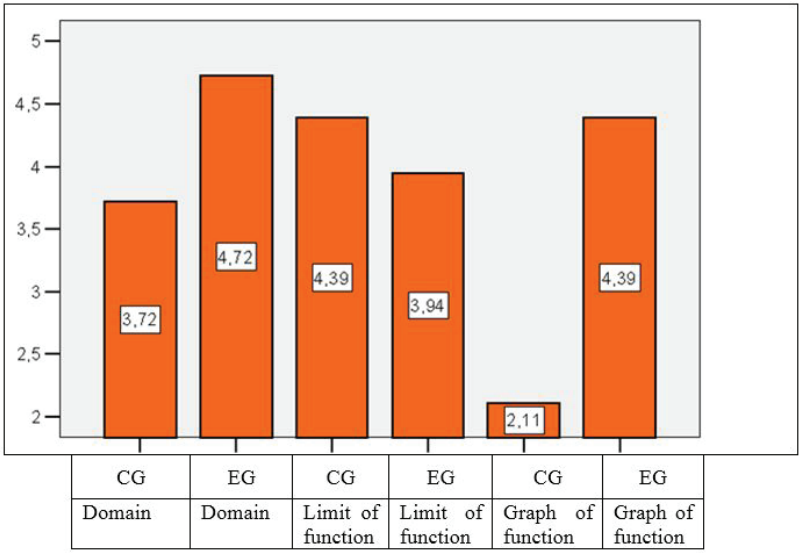

Fig. 1: Average success rate in tasks 1 – 3

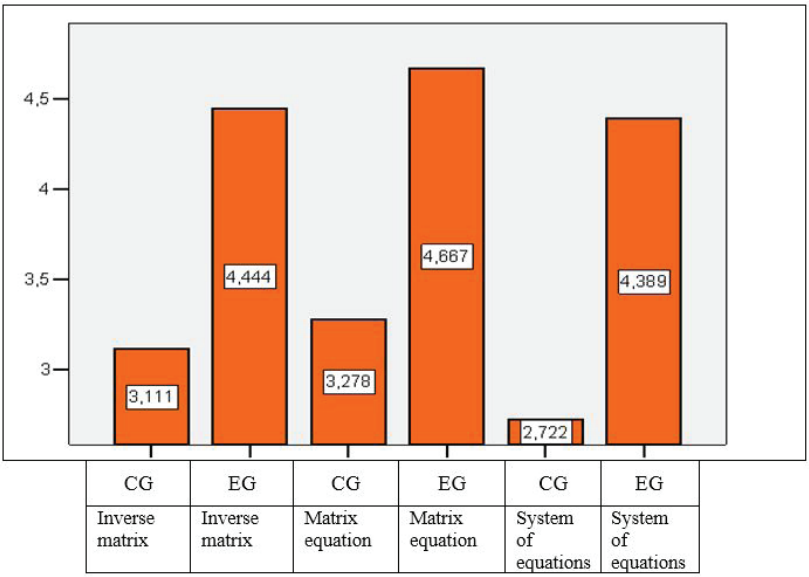

Fig. 2: Average success rate in tasks 4 – 6

Statistical conclusions show that students from the experimental group passed the test better in all tasks except the second one. In this task students mostly did not enter the correct notation of the function when they were using the mathematical programme. We were pleased with results in the task number 3. It is generally known that students have problems to draw the graph of any function and do not try to draw them at all. Using computer programme they overcame their dislike to graphs. The positive differences in tasks 4, 5, 6 are quite clear. If students entered the elements of a matrix without any mistake the result must be error-free.

We have been monitoring the usage of various computer algebra systems in mathematical education for many years. Our results respond to the results of larger researches (Koedinger, McLaughlin and Heffernan, 2010; Luu and Freeman, 2011; De Witte, Haelermans and Rogge, 2014). Appropriate implementation of computer programmes and online calculators can improve student´s attitude to mathematics and can lead to higher test results. But we cannot forget the key role of the teachers. De Witte, Haelermans and Rogge (2014) point out that a key role in the integration of educational technology is played by the two stakeholders most involved in the education process: the teachers and the pupils. Overall, the literature shows that teachers play a critical role in determining whether technology will be used in the classroom and if so, how the educational technology will be exactly used.

Conclusion

The students who enrolled at the Faculty of Economics mostly have negative attitude to mathematics, which is connected with poor mathematical knowledge. The aim of this paper is to show that a suitable implementation of open source programmes in mathematical education can change students' attitude towards mathematics positively and improve the level of knowledge and efficiency. Students take an increasing interest

in using computer programmes to solve mathematical problems, but they have initial troubles with computer programmes. They do not know how to start a programme, how to write down mathematical functions or formulas, how to submit basic information. They need the teacher´s guide in the beginning.

Our research confirmed that a large part of students' approach to modern computer programmes is quite natural if they have removed some initial barriers that prevent the full use of the potential of mathematical programmes.

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P/T PETRI NET THEORY APPLIED AT AUTOMATION OF RECORDINGS OF PRESENTATIONS

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Abstract

Rich-media describes a broad range of digital interactive media that is increasingly used in the support of education. A long term key objective of the MERLINGO project (*MEdia-rich Repository of LearnING Objects*) at the applying rich-media technologies is the development and practical use of methodologies for the automated production and publication of recordings of presentations on-line or on-demand. One of the significant outputs in this area was also the building and opening of the specialized lecture room equipped with the automated conference system that is synchronized with the rotating cameras and other audio-visual components. 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 including automatic editing. The Petri nets theory was significantly applied at the design, verification, simulation and implementation of the programming system 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 being increasingly used for the support of synchronous and asynchronous communication, 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 key aspects of 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, 2015).

A long term key objective at the applying rich-media technologies is the development and practical use of methodologies for the automated production and publication of recordings of presentations on-line or on-demand. One of the significant outputs in this area was also the building and opening of the specialized lecture room equipped with the automated conference system the functionalities of which can be controlled via the central control system while being synchronized with the rotating cameras and other audio-visual

components of this lecture room. Hence the stated audio-visual lecture room contains all the elements of a smart lecture room determined for the implementation of presentation of 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. The lecture room is mainly used for organizing seminars, conferences, specialized trainings, sessions of commissions, and for other purposes.

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). Currently, the operation of the central repository MERLINGO dramatically simplifies the implementation of the new revolutionary technology *EduArt* (EduArt, 2015), featuring unique characteristics in this area complying with demanding requirements of teachers in the availability and quality of presentation recordings.

The design and implementation of the software support of the audio-visual lecture room enabling automated recordings of the presentations including automated editing was the most significant problem solved in the frame of fulfilment of the above objectives. It was necessary to design and implement the single-purpose programming system determined for the parallel computing environment with the stated properties (i.e., especially with the absence of the programming deadlock possibility). It was necessary to apply the formal mathematical theory for that reasons. The Petri nets theory (Kordic, 2008), (Diaz, 2009) was chosen for these requirements and it has been significantly applied at the design, verification, simulation and implementation phases of the mentioned programming system.

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, $\emptyset$ 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 visualized 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 $M = (M(P1), M(P2), \ldots, M(Pn))$.

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 $t \in T$ 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., $(\bullet t_1 \cap \bullet t_2 \neq \varnothing) \wedge (t_1$ ***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 $t_1, t_2, \ldots, t_n$ ($n \in \boldsymbol{N}$) 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 $TP(T2) = 2$).

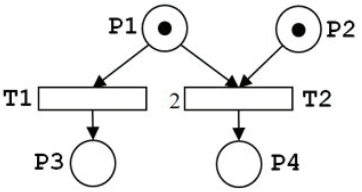

Fig. 1: Conflict transitions in PNP

Let PNP $PTNP = (P, T, A, AF, TP, IF)$. We will denote that PNP $PTNP$ is:

- **live** iff $\forall M \in [IF\rangle\ \forall t \in T\ \exists M' \in [M\rangle$: t ***en*** M',
- **deadlock-free** iff $\forall M \in [IF\rangle\ \exists t \in T$: t ***en*** M,
- ***k*-bounded** iff $\exists k \in \boldsymbol{N_0}\ \forall p \in P\ \forall M \in [IF\rangle$: $M(p) \leq k$.

Audiovisual lecture room with the automatic recording and editing system

The MERLINGO project solving involved the construction of a specialized audio-visual lecture room equipped by all the multi-media components required for the realization of fully automated recording and editing of presentations on the basis of rich media technologies. In the lecture room (see Fig. 2) the central **AMX resource management system** has been installed, to which all the audio-visual components of the lecture room are connected and via which all its functionalities are automatically, or manually controlled. The lecture room of capacity 35 seats offers a ceiling visualizer of **Vadio Ceiling Wiev** series, two projectors of **NEC 1150** series and two screens which could be used simultaneously for running presentations. Moreover, there are 11 monitors available for participants of **EIZO FlexScan** series, on which the content of the selected projection screen is automatically displayed.

Fig. 2: Audio-visual lecture room outfit

The key components of the lecture room is a conference system of **Danish Interpretation System CU6005** series with 35 microphones, two loudspeakers of **BOSE** series, two rotating cameras of **ELMO** series (see Fig. 3), while one camera is located at the front section of the desk being primarily determined for sensing its head where the key speaker (or several speakers) usually give presentations. The second rotating camera is located at the back section of the desk and is determined for recoding contributions during discussion. Each of the participants can actively join discussion by pushing the relevant button on their microphone. The requirement for joining discussion is included in the line of requirements and at the moment, when the speaker, or discussing person finish their contribution and push the button on their microphones, next person is selected from the line of those waiting according to the criterion determined in advance and the particular

camera is automatically directed and switched to the selected participant of discussion and such person can start presenting his/her contribution.

Fig. 3: Detail of rotating camera and microphone in the audio-visual lecture room

Additionally, this audio-visual lecture room has been outfitted with the programming system *EduArt* with editing unit **Roland VR-5** enabling transfer of image (video) of the scanned person and transfer of presentation from the work station, interactive board and visualizer in the high resolution via the computer network of the sufficient bandwidth. The output is a recording viewable by the web browser.

Results and Discussion

The main research goal of the MERLINGO project team was to design, verify and implement the parallel algorithm for the software support of the audio-visual lecture room enabling automated recordings of the presentations. Design and verification of the generally parallel algorithm with the stated properties (i.e., especially deadlock-free 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. It was necessary to design the ***k*-bounded and deadlock-free PNP** (and in the best case the live PNP) then. This research goal was achieved and the simplified PNP model of the given algorithm is shown in the Fig. 4 (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)).

The place P1 of this PNP represents the space outside of the audio-visual lecture room and its 36 tokens of the initial net marking then represent 1 technician and 35 individual attenders of a given lecture or workshop who are about to enter to the lecture room. The token in the initial marking of the place P16 of the initial net marking then represents the desk front section rotating camera and the token in the place P15 the desk back section rotating camera. Both of these cameras are initially in the non-scanning state. If all the participants enter the lecture room (firing of the transition T1), the technician then

activates the rotating camera at the front section of the desk (firing of the transition T18 and T19) and he will then eventually solve the technical problems during the presentations (the token in the place P24). 10 attenders will then sit in the front section positions of the desk (firings of the transition T6) and remaining 25 attenders will sit in the back section positions of the desk (firings of the transition T5). Any attender can at any time leave out the lecture room (firing of the transition T4 or T7). When the chosen attender in the front (back) section of the desk wants to speak, he will then press-on the microphone button (firing of the transition T9 (T8)) and he will wait for the front (back) section camera. When the front (back) section camera is in the non-recording state then this camera (the token in the place P16 (P15)) will rotate in the direction of the given chosen microphone (firing of the transition T11 (T10)) and it will stay ready for the recording such that the only one of the cameras can provide recording at any given time (the token in the place P19 disallows simultaneous recording by both of the two cameras). When the currently speaking attender stops his/her speech and he/she then press-off the microphone button, the front (back) section camera will start its active recording (firing of the transition T13 (T12)) of the next presenter. The front section camera has in this case higher priority for the recording then there is the priority of the back section camera (the value of the transition priority function $TP(\mathrm{T13}) = 2$).

The technician (represented by the token in the place P24) can at any time request the front (back) section camera for the recording of chosen presenter (firing of the transition T21 (T20)) and his request has the highest priority at all (the values of the transition priority function $TP(\mathrm{T18}) = 3$ and $TP(\mathrm{T17}) = 3$).

When the given lecture finishes and all of its participants will leave the lecture room (firing of the transitions T2 and T3) the PNP will then move into its initial state (initial marking).

It can be shown that the PNP is k-bounded (where $k = 36$) and deadlock-free, but it is not live (because for instance $\exists M \in [IF\rangle\ \exists \mathrm{T17} \in T\ \forall M' \in [M\rangle: \neg(t\ \mathbf{en}\ M')$).

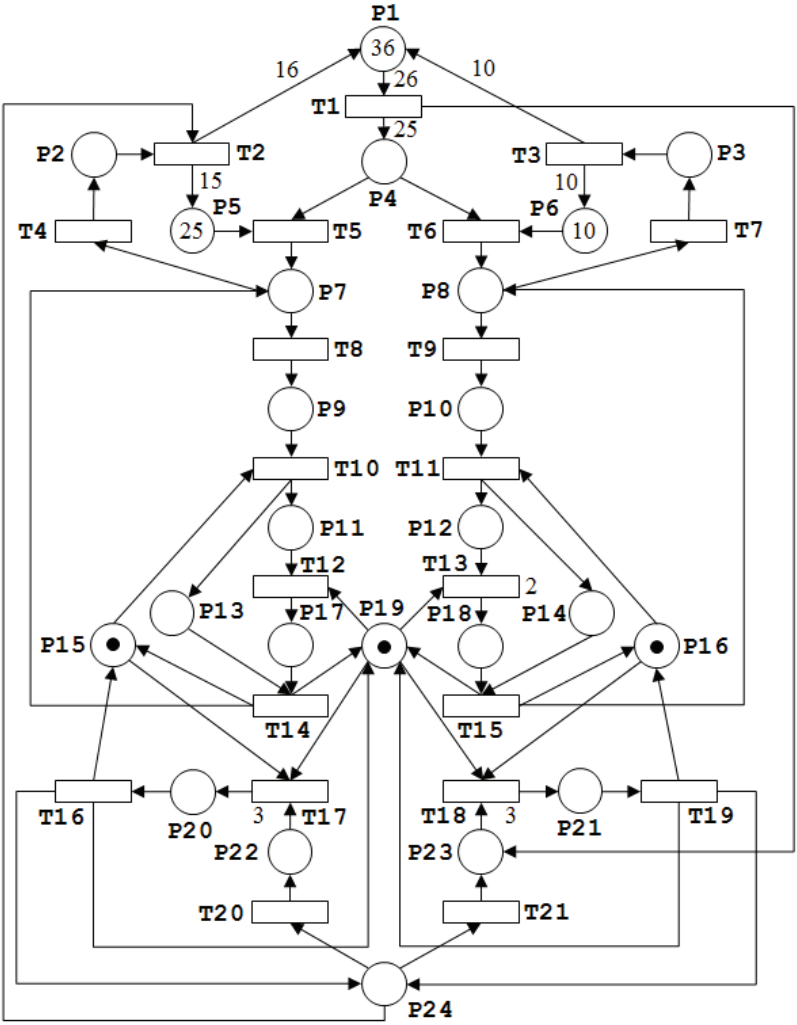

Fig. 4: PNP representing mechanism of automated editing

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 recording and editing and the comprehensive collections of the following subjects are available: Artificial Intelligence and Expert Systems (2nd year of Doctoral studies), Database Systems (1st year of Doctoral studies), Distributed Systems (2nd year of Master studies of Applied Informatics) and Fuzzy Modelling of Systems (2nd year of Doctoral studies). The rich-media recordings were published through the *EduArt Server* programming system that is also integrated with the LMS system *Moodle* in the

present time. The recordings are such then also the part of the study materials for the mentioned subjects in the Master and Doctoral studies in the *Moodle* environment.
The lecture room with the support of automated recording and 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 availability 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 *EduArt Server* 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.

Acknowledgements

This paper has been elaborated in the framework of the project CZ.1.07/2.3.00/20.0296 supported by the European Social Fund.

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EFFICIENCY IN TEACHING MATHEMATICS: ENGAGING STUDENTS THROUGH ELECTRONIC VOTING

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Abstract

This academic year we have introduced a pilot project of integrating online voting into mathematics courses in order to increase students' involvement in the educational process. The paper introduces basic concepts of classroom voting and summarizes our experience with the new interactive technology. The study results of interactively taught students were compared to those with traditional lessons. We found that the success rate was slightly better in the pilot group. We also evaluated students' feedback from the course opinion poll to find out whether students consider interactive teaching interesting and beneficial. It proved that the students' perceptions of the teaching were significantly better in the seminary group using classroom voting.

Keywords

Classroom voting, interactivity, Masaryk University in Brno, mathematics, teaching

Introduction

Classroom voting

Classroom voting is an innovative and very useful method in teaching mathematics. The teacher states the question (it can be stated orally, on the blackboard or in a Powerpoint presentation, etc.), gives time for thinking and peer discussion and then collects the responses. The collecting process can be realized simply by raising hands, papers or colourful cards. More sofisticated approach is recommended in larger study groups. Special electronic device with remote response stations (clickers) is often used. Then the format of answers is usually restricted to TRUE/FALSE or multiple-choice. The voting should be followed by discussion, correct answer should be explained to others by a selected student. Mazur (1997) suggests double round voting (individually and after the discussion). Students are motivated to formulate and to express their own way of reasoning. It is very important that they confront their misconceptions before they have to work on their own (homeworks, tests, etc.). According to Ainsworth et al. (2011), anonymity in voting brings significant benefits to classroom argumentation. Immediate feedback is of great advantage for the teacher so the pace of teaching and the difficulty of the tasks can be adjusted flexibly according to the students' needs.

The online response system Socrative

Socrative is a free multiplatform system for classroom voting. Terms of its use are given by "Socrative, Inc.: Terms and Conditions of Service" (2014). It is available for all web-browsers on iOS, Android, Kindle or Windows making it accessible for all educational technology settings. No special clickers are needed, the response can be entered on any device connected to the internet. The teacher can download the Socrative application for his device or register to "Socrative teacher website" (2015). The system creates a virtual

classroom and the teacher can fill it with his questions, quizzes, etc. The identification number of the room is the only information needed for the students to log in when the quiz is started (no student registration is needed). The question sets for voting can be shared with other teachers through well arranged database on "Socrative Garden" (2015). Sharing quizzes enables users to collaborate on the creation and management of great content. Most of documents are in English, but the imported questions can be translated into Czech language. An example of Socrative teacher application screenshot is in the Figure 1. Features of the Socrative system are described in more detail in Dervan (2014).

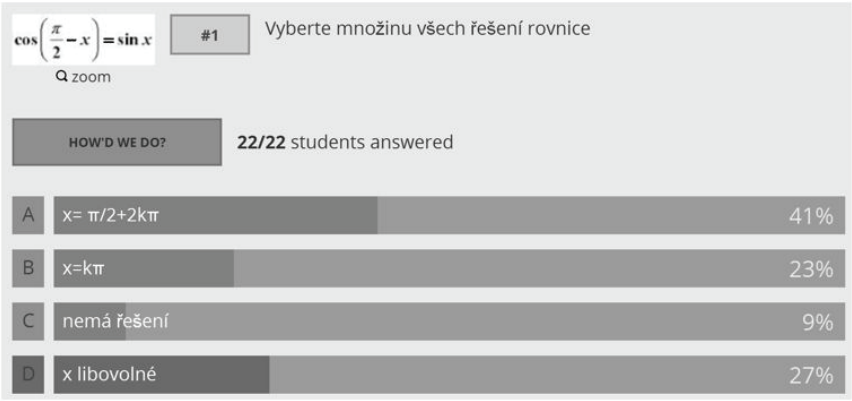

Fig. 1: Screenshot of the Socrative teacher application

Other online response systems

Socrative is not the only system free of charge. System OnlineTED developed at Technische Universität München is very similar (Kühbeck, Engelhardt and Sarikas, 2014). With Australian VotApedia audience response software, the responses can be sent also as a text message or by a call to a free number. (Jain and Farley, 2012, Dunn et al., 2012) The Stanford Mobile Inquiry-based Learning Environment (SMILE) introduced by Seol, Sharp, and Kim (2011) enables students to create their own questions and share them with their peers. The entire process is controlled and monitored by a teacher with an activity management application. Richardson et al. (2014) developed an instrument, called the classroom response system perceptions (CRiSP) questionnaire, which allows for the evaluation of varied response systems on three scales: the usability; the impact on student engagement; and the impact on student learning. The development of CRiSP was undertaken in three universities, using different classroom response systems, and evaluated through focus groups, one-on-one interviews and a factor analysis of the survey responses.

Our aim was to try using response system in our course and evaluate its benefits. The paper is organized as follows. The course taught by a new interactive method and the methodology of the voting in instructions are introduced in the next chapter. In the third chapter we analyze the study results of the students taught innovatively and we also explore their perceptions of the interactive teaching. The advantages and disadvantages of the classroom voting are summarized in the discussion. Conclusions and suggestions for the future are collected in the last chapter.

Materials and Methods

Teaching mathematics at the Faculty of Economics and Administration of Masaryk University

The academic year 2009/10 brought significant changes to the study plans at the Faculty of Economics and Administration. The original courses Mathematics I and II, which were compulsory in the first and second semester for students in all fields of study, included the basics of linear algebra and mathematical analysis. After the reorganization, only one compulsory course, Mathematics, was left, with 2 lectures and 2 seminars a week in the second semester, with the course being concluded, instead of the original exam, with a graded credit test.

As this course contains most of the topics covered in the two original courses Mathematics I and Mathematics II, the reduction in the number of lessons dedicated to the course resulted in a higher pace of instruction, while the students are assumed to have very good knowledge of secondary school mathematics. Nevertheless, it is impossible to give in-depth instruction in the individual topics or practise a greater variety of problems from the areas covered. For students this means increased difficulty of the course, the necessity of intensive self-study and higher demands on previous knowledge. On the other hand, there is the fact of the long-term decline in secondary school knowledge of mathematics that students accepted to universities demonstrate. The newly implemented mathematics entrance test and voluntary preparatory course Mathematics 0 are supposed to bridge this discrepancy.

Electronic voting in the course Mathematics 0

The above mentioned problems contribute to decline in mathematical knowledge and deterioration of study results of our students, more in Bauer and Matulová (2012). That is why the educational process in our courses should be optimized in order to exploit limited time of instructions more effectively. One way could be to enhance students' activity by means of classroom voting. This academic year there were 165 students in the course Mathematics 0 and they were divided into 7 seminary groups of 20 to 30 students (according to the timetable and capacity of classrooms). We performed a pilot study of introducing interactive teaching techniques into one seminary group. After the evaluation of the results we plan to extend the new approach to all groups as a part of a larger project next year.

We use three questions for electronic voting at the beginning (warming up) and at the end of instructions (revision). The questions are prepared beforehand and they are either "short answer" or "multiple choice" questions with carefully selected distractors. Sometimes we also ask students an ad hoc questions in the middle of the lecture (of the type "short answer"). We prefer very simple and clearly formulated questions. The answers are not graded, the voting is voluntary and anonymous, but the students don't boycott (only 2-5 answers out of 30 is usually missing). They are supported to discuss with their peers, the instructor helps them (giving hints, answering supplementary questions, etc.)

We prefer such a system of response collecting that allows for different formats and saving of answers, so we could monitor students' activity in the course. These were the reasons for using electronic voting. At the same time we tried to avoid a purchase of an expansive system with remote stations. Moreover, according to experience of some schools using voting systems, it brings up some difficulties (charging of the remotes, delays in the start, etc.) So we decided not to use any special equipment, but to collect answers via internet

on the server www.socrative.com. At our faculty there are four computer labs and in other classrooms there is a wireless connection for individual laptops, tablets or smartphones. In the beginning of the course more than half of the students declared their willingness to bring their own device in the class, despite this fact we moved the lessons to the computer lab in order to every single student has access to voting.

Results and Discussion

Results of innovative teaching in Mathematics 0

We report results of the final test of the course Mathematics 0 There were 30 in the pilot group taught interactively, the rest (135 students) took the test in other groups. (the tasks were the same in the parallel seminary groups and slightly modified in others). The score of the test was in the range 0-60 points. The mean score of the pilot group was $m_1 = 21.333$ and $m_2 = 15.467$ in other groups. The skewness of the input data doesn't allow for t-test to show whether the results are significantly better in the first group, so we have chosen nonparametric Mann-Whitney test. Results in the Table 1 are on the edge of statistical significance: the p-value of one-sided test is $p = 0.111/2 = 0.056$, so we can say that study results in the experimental group are slightly better.

Mann-Whitney U Test (after continuity correction)							
Variable	Sum of ranks group 1	Sum of ranks group 2	U	Z modified	p-value	N1	N2
Test points	2860	10835	1655	-1.5919	0.111	30	135

Tab. 1: Study results in the course (classroom voting was used in group 1)

We also examined the data from the course opinion poll in order to evaluate students' perceptions of the interactive teaching. Voluntary anonymous survey is held every term in the information system of Masaryk University. Among other topics (content intelligibility, clarity of organization, readiness of the instructor, etc.) there is evaluated the benefit of the instructions. The course benefit is expressed by the degree of truthfulness of the statement "Time spent in lessons was worthwhile for me." Course participants can select a number from the range 1-6, where nuber 1 represents "I strongly agree" and number 6 means "I strongly disagree", other numbers are intermediate. Twelve students of the pilot group and thirty students of traditional seminary groups completed the questionnaire. We used Mann-Whitney test for the comparison of the ratings. As can be seen in the Table 2, the ratings of students taught interactively are significantly better.

Mann-Whitney U Test (after continuity correction)							
Variable	Sum of ranks group 1	Sum of ranks group 2	U	Z modified	p-value	N1	N2
Rating	189	714	111	-1.9993	0.0456	12	30

Tab. 2: Student ratings of course benefit (classroom voting was used in group 1)

Discussion of pros and cons of using classroom response systems

Many authors mention advantages of incorporating classroom voting in the teaching (Chatham and Davidson, 2011 and Dervan, 2014), the main ones being:

- Audience Response System lets teachers engage and assess their students with educational activities.

- Through the use of real time questioning, instant result aggregation and visualization, teachers can gauge the whole class' current level of understanding.
- Online voting saves teacher's time so the class can further collaborate, discuss, extend and grow as a community of learners.
- The possibility to use it as an opinion poll (Should we solve more problems of this type? What task was the most challenging for you? Do you think the method is applicable and where?) Chatham and Davidson (2011) used this technology to ascertain whether the students considered the use of the response system to be worthwhile. They found that great majority (over 90 per cent of 214 students) in their courses agreed and enjoyed the lessons.

Our experience clearly confirmed improvement in students involvement (not only during the lessons, but also the frequency of additional discussions and attendance at office hours increased). The students participated actively on the problem solving and their responses were corrected instantly, whereas in the seminary groups with traditional teaching the misconceptions usually remained undetected until the test. The lesson plan was always adapted to the current situation in the interactive class, so we could spend more time on the most problematic topics. We also successfully used the response system as an opinion poll.

Some negative aspects of using student response systems are mentioned in Dervan (2014), the disadvantages include:

- Time consuming preparation for the first run of the course.
- The effect depends heavily on the quality of the questions (and on carefully stated distractors for multiple-choice questions).
- There is less time for performing other activities during the lesson.
- Constraints of the technology: problems with writing mathematical symbols, etc.
- It is not guaranteed that the web application will work all the time.

As for our perception of the disadvantages, the preparation for interactive lessons is really very demanding, but once prepared voting questions can be used again in the future. We observed no timing issues during the lessons, maybe we solved less math problems but with better level of understanding compared to the traditional lessons. The interface of the Socrative application is not focused on mathematical courses, so inserting mathematical symbols and expressions to the questions and answers is a little bit uncomfortable. We would appreciate some more math friendly upgrade of the Socrative system or perhaps creating another online response system specialized on mathematics. There were registered no problems with the technology and no server failure on www.socrative.com during the whole term.

Conclusion

After one term of using online voting in mathematics we strongly agree with the above stated benefits of interactive teaching and we believe that they outweigh the disadvantages. Namely we appreciate current information on the level of understanding, which allows for flexible pace of teaching. Another important benefit is the instant correction of students' misconceptions, so the instructions are more efficient (which also proved in the summary test of Mathematics 0). Great advantage is that students perceive the interactive teaching as more interesting and beneficial (as was shown by the analysis of the responses from the course opinion poll).

We would like to continue with the introduction of interactive teaching, so we would be able to evaluate its benefits more thoroughly and perhaps we would gain some

institutional support for our project in the future. The promising results of the pilot study show that we should expand the use of classroom voting to other seminary groups and prospectively to follow-up mathematical subjects. We also suggested the use of voting to our colleagues teaching statistical courses, where they can exploit the advantage of scheduling their instructions in computer labs and the availability of statistical software. Especially the results of the tasks based on simulation can be reported directly by the voting system and the teacher can visualize the distribution of the answers immediately. The prospect of interactive teaching does not need to be restricted to the classrooms with school computers. It can be expected that the share of students having smartphone or similar device connected to internet will grow further.

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BUSINESS GAMES FOR MANAGEMENT TRAININGS: AN ILLUSTRATION BY THE GAME DYNACORP

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Abstract

The goal of the paper is to present a new approach to teach system thinking as a game through a business game, which is useful for the development of systems thinking and is designed for use in managers training centres, in companies or in the school environment. The game is intended primarily for Information managers who must orientate in the field of information and communication technologies and manage basic managerial skills, but also have knowledge of economics and the ability of systems thinking. The game aims to entertaining and interesting way to familiarize players with basic principles of systems thinking, systems archetypes by feedbacks and solving decision problems of business informatics management. There is some evidence about game verification based on testing on a sample of players and practical benefits of the presented game towards university teaching process.

Keywords

Business board game, information manager, management training, systems thinking, education, Business Informatics Management

Introduction

A typical attribute of current reality is greater need of awareness of people in the matter of information and communication technologies (ICT) than it was before. Simultaneously ICT-driven performance in global economy as is shown by Pavlicek et al (2011). In this context, the process of gathering and using information to assist the decision making at various levels of an organization so-called by Hinton (2006) „*Information management*", gains its graveness.

Today's word is not reflected only in the growing information needs, but also in the need to perceive the world differently (Sigmund, 2013). The concept of system came in a spotlight and on it was established *systems thinking*, which deals with functioning of the systems (Senge, 2006).

One of the ways to learn successful Information management and systems thinking is by a form of game. However at the management trainings of systems thinking in Czech Republic the games are used only in limited quantities or not at all. Educators consider the game to be a good tool and do not underestimate their educational effects, but use only simple games or other tools to support thinking (Kotekova, 2010).

The goal of the paper is to present a new approach to teach system thinking as a game through a business game, which will be used for the development of systems thinking and will be designed for use in managers training centers, in companies or in the school environment. The game aims to entertaining and interesting way to familiarize players with basic principles of systems thinking, systems archetypes by feedbacks in Senge (2006) conception, and solving decision problems of business informatics management.

Contrary to the majority of games for teaching of systems thinking takes the form of computer games as states Peterkova (2011), this is a board game. Board games went with us for a long history and have their charm. The authors will show that even nowadays, at the time of advanced ICT technogies, using board games have its point. Thus the paper will answer a research question "*Is it possible and effective to learn or train manager's skills and systems thinking for future and present business informatics managers by a business board game?"*

From the business board games used in management training of systems thinking in the world can be mentioned especially the Beer game and the Flip game. The *Beer distribution game* is a role-play simulation game invented to demonstrate "typical coordination problems of (traditional) supply chains, in which information sharing and collaboration does not exist" (Riemer, 2012). The purpose of the second examined game *Flip'em Project Management Board Game* is "to develop dexterity in choosing to defend self or go after others, to learn about synchronizing your strategies, to gain mastery over task and process orientation in management" (Flip'em Project Management Board Game, 2014).

Another ways to modernization of the education process, which include attempts of incorporating multimedia, capabilities of the internet and e-learning as discussed by Turcani (2008), Houska and Berankova (2010), among other, are not discussed in the paper.

Materials and methods

Classical and progressive methods for working were applied; such as induction and deduction; analysis of literature sources and information; construction of the research question and confirmation or refusing on base of a theoretical elaboration and practical implementation; analogy, abstraction and modeling in the part of the game design; game validation and briefing with students for mapping the usefulness of the game; synthesis towards a generalization of results. Thus both theoretical and empirical cognition were applied during the process of the paper creation.

Theoretical background

The business game Dynacorp presented in the Result chapter is intended mainly for Information managers and their education and training for successful management. Therefore game logic and game content must be based on the theory of Information Management with an emphasis on skills, which every Information Manager should have. Understanding of *Information management* varies. The paper is based on a broader concept of Information Management, as described by Doucek, Maryska and Novotny (2014). The definition by Hinton in the Introduction above is extended of thoughts on *systems approaches*, and is focusing on the identification of problems and their solutions. For Information management is typical an effort to maximize the link between business objectives and objectives of enterprise informatics that brings us to *Information manager*, who must orientate in the field of information and communication technologies and manage basic managerial skills, but also have knowledge of economics, the correct way of thinking, methods of identifying problems and their solutions and other skills. The correct way of thinking includes systems thinking. Systems thinking is main paradigm on which the concept of the business board game is constructed.

Systems thinking is as an appropriate tool and technique for helping us to comprehend complex systems. Richmond (1994) states that systems thinking allows formulate

conclusions about the behavior of the system based on deep understanding of its basic structure. Relating systems thinking Senge (2006) specifics systems archetypes as patterns of behavior of a system of organization. Systems thinking is especially based on the following principle in the paper: each of the causes is associated both with its effect and with each other in the causal loop feedback and circles of causality have similar structure.

Background for game design

The answer to the research question formulated in the Introduction will be obtained through creation of the board game Dynacorp, by feedback from players and by teacher evaluation.

The creation of the board game Dynacorp uses a general principle of a game i.e. it is a form of play with structure and all main elements typical for games. From Crawford (2003) was taken over ideology goal-oriented activity with active agents to play against, in which players (including active agents) can interfere with each other. According to Caillois (1958) in the game is highlighted characteristic of uncertain outcome. The very construction of random elements in the game is thus based on Schell (2008). From the game principles are used primarily "Worker placement" by BoardGameGeek (Worker placement, 2014) and purposefulness of business games in relation to organizational performance according to Selinker (2011).

Game testing and game verification of the Dynacorp game were realized with a sample of players in 2014 and 2015. The players were students, who took part in the course System dynamics at the University of Economics in Prague. At the same time the evaluation by the course teacher was conducted.

In the paper we drew on authors' own experiences in creating games and other associates experience with theoretical and practical applications of systems thinking tools.

The paper continues research by Capek (2014), and builds on efforts to strengthen the teaching of systems thinking in the Czech university education, which is documented by many authors from different universities. Recently with connection with System dynamics courses there are Mildeova and Kalina (2013), Krejci, Kvasnicka and Dömeova (2011), Rabe (2005) in connection with the methods of teaching process and Svirakova (2014) in the field of Project management education.

Results

Requirements for Information manager and theoretical background of the business board games specified in the Introduction and in the Materials and Methods are used in, stated below, a proposal for the business game.

Business game Dynacorp and its goals

In the game the players become managers of a project team in the IT company Dynacorp. Prosper of the company and especially the prosper of a manager (player) depends only on his skills and abilities, how he can lead his employees and simultaneously watch the actions of the company and other project teams (other players).

Goal of the game is to keep the company on the market. Player tries to be the leader of the best department, but he must respect sustainability of the company. The company must stay on the market for predetermined time, if company leave market players lose the game. On the other side, the more orders the company solves the more the company becomes prestigious. Players get game points for completing orders. At the end the team with the most points wins the game. Information about game points, account stock and number of used figures is public. That means open information for the other players.

Game preparation, material and progress

The game plan is situated in the middle of the table, and every player gets their game board with description of their office and a record sheet.

To the game is needed:

1. Game board of the company
2. Game board for every player with their office
3. Figures of the workers: employees, manager and top manager
4. Game cards: Events (basics and advanced), card of orders (basic and advanced)
5. Tokens: programming, design, testing, strategic partners and others
6. Record sheets for players and the company
7. Game bank notes

The Dynacorp is a strategic board game with a didactic effect, which works on the principle called "worker placement". This game system is about placing the figures into the game. Each round they have effect according to where they have been placed. The goal of the players is to cooperate to keep the company on the market, while every player tries to be better than the others. Therefore the game principle is combination of both cooperation and competition.

Each player has their employees, which can be hired, promoted and dismissed. The workers can be placed to various departments to do different tasks. In the game there are three levels of workers: employees, managers and top managers. Each level has a different competence, delivering a different profit and also has a different pay-off. The players must balance between the number of workers, which are needed and money they must pay them.

The most *important indicator* is the company's reputation, which grows with the number of completed orders and decreases with every failure. The second indicator of the company's prosper is the number of strategic partners. In case the company doesn't have a good reputation, or it doesn't have any partners, it must leave the market and the players lose.

Influence of environment comes to the game with events. Each round the company can be influenced by a different event either good or bad. Another mechanism through which the players can manipulate the game is through game cards. Influence of coincidence is minimized only on the event cards, which simulate unexpected situations happening to company, and various levels of orders.

Game logic

The game logic is built on expansion of "Growth and underinvestment" model, which is common for most companies (Senge, 2006). On the left side of the schema in Fig.1 there is "reinforcing feedback", describing work on the orders. The greater the number of the orders, the greater the income from them. With raising incomes, we can hire more workers and they do more work orders.

The orders are solved by work on them, so the more is orders that more work is done and negative feedback is, that more is done, that less orders left in a company. For a company grow is important the ratio of reputation, so the goal for the players is keep high reputation. The game difficulty increases with time in the form of more difficult orders. Because of that is necessary to expand a capacity of the company (more workers, more resources from warehouse, more capacity in departments and so on). That more raises needs for capacity that more raise needs to invest. In the game is a few stock ratios, that are account of the player, account of the company and number of the workers. These stocks are good rations of a progress for feedback.

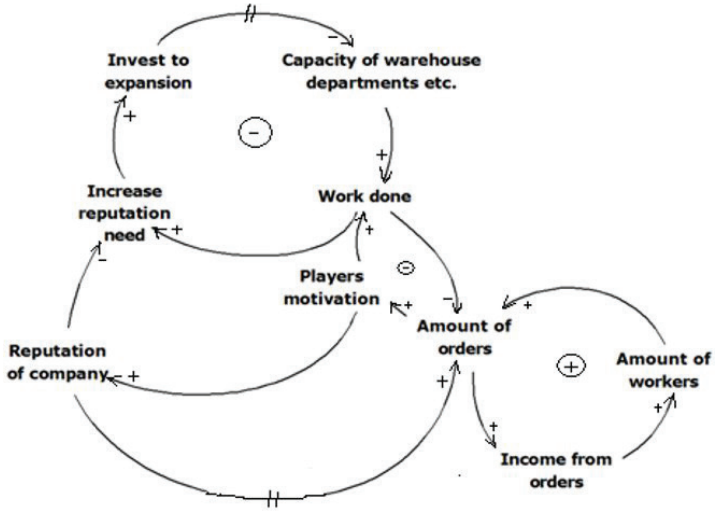

Fig. 1: Basic schema of the game (source: reworked from Capek, 2014)
Note: + (-) positive (negative) causal link; + - (inside circle) reinforcing (balancing) feedback.

Top side of the schema is created by a motivation of the players. The player's primary wants to hold on the company on a market, by solving the orders. The more orders came, the more must players increase push. The more they increasing their push, the more orders are solved and the more growing ratio of reputation. The better reputation means more new orders every round.

Discussion

Practical benefits of the Dynacorp game were confirmed based on testing on a sample of players (students of Information Management specialization), which took place in 2014 and 2015. There is some evidence from game debriefing held with students confirmatory that the purpose of the game as "to learn and train manager's skills and systems thinking in simulated business environment" was fulfilled. Students stated that due to the game they have better understanding of complex tasks in Information management, they see the organization as a whole and themselves as part it. They understand the problems associated with delays, by recognizing feedbacks their comprehension and ability to track the dynamic complexity has improved and as a result to that their ability to diagnose impact of their decisions has improved as well. Also from the teachers side the expectations were met, especially in understanding the problematic by students, which resulted from the record sheets as well as from the game debriefing.

In the Introduction were as the most important business board games used in management training systems of thinking presented The Beer distribution game and Flip'em Project Management Board Game. Compared to thousands plays that these games took plays in the school environment and in the training centers or in the companies all over the world, the Dynacorp is a starting game. To extend the application of the game, it is offered to trainers and consultants in public courses of systems thinking. At the same time the game is submitted to the board games contest. Simultaneously it's considered the use of the game as marketing teasers for new students just like solved by Svoboda, Voracek and Novak (2012).

In future research will be the game developed at first by the success rate of the (above) mentioned efforts, and at second will be evaluated success rate of players' identification of systems archetypes.

Conclusion

Based on the identification of the key skills of information managers and definition of requirements to practice the skills of information managers authors came to the conclusion that for Information managers applies the same rules as for other managerial persons. For optimal performance, it is necessary to appoint the right people to the right place. Traditional management skills are only basis, you need to have basic technical skills in the field of ICT. In addition the professional profile of Information managers must be added even of the knowledge and skills from other areas, in particular knowledge a business running and capability of system overview.

Precisely for the expansion knowledge of Information managers in the field of systems thinking is in the paper described the game Dynacorp learning potential. The didactic effect of the game is primary in game itself, because the players must keep watching, which values and mechanisms affect the company and cope with limited resources. The secondary effect is the feedback of the game from the notes the players make throughout the game. Thanks to the record sheet it is possible to follow the connection between the company and the players as well as the way each step of the player influences improvement of their own team.

On the basis of the creation of the board game Dynacorp, by feedback from by players and the teacher evaluation, the research question "Is it possible and effective to learn or train manager's skills and systems thinking for future and present business informatics managers by a business board game?" can be answered in the affirmative.

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ETHICAL EDUCATION AND THE CLASSROOM CLIMATE IS THERE ANY INFLUENCE?

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Abstract

Ethical education primarily aims at the development of prosocial behaviour of children and youngsters. Since 2010, ethical education has been included in the official Framework Education Programme for Elementary Education in the Czech Republic as a cross-curricular subject and since 2012 ethical education has been, as a subject of study within the Specialization in Pedagogy programme, taught at the University of Hradec Kralove.
In connection to the introduction of the abovementioned subject of study at our university, a research that surveys the impact of ethical education on the classroom climate has been conducted in the academic year 2013/14 and 2014/15. This paper presents gained results.

Keywords

Ethical education, KLIT questionnaire, classroom climate

Introduction

„The University of Hradec Kralove is currently the only Czech university that offers ethical education as a subject of study. Ethical education is taught within the set of basic courses in elementary pedagogical psychology, which are mandatory for students of all pedagogical specializations. Ethical education is covered mainly in the Didactics of Ethical Education course and the Teaching Ethic course. Besides these two courses, the study plan of the ethical education discipline includes courses on applied ethic themes (Media Ethic, Ethical Aspects of Family Life, Bioethics, and Ethic in Entrepreneurship). Graduates in ethical education will mostly become teachers at elementary schools, or will otherwise find employment in pedagogical positions within the education system or in various institutions. The main recommended publications for the above mentioned courses are works by Fontana (2005), Fontana and Slack (2005), Korim (2008), Nováková (2006), Olivar (1992), Vacek (2002) and Czech versions of Pike and Selby textbooks (1994, 2000).” (Milková and Švarcová, 2014)
This paper presents the results gained within the research, comparing the climate in classes where ethical education is taught and in classes where it is not.

Materials and Methods

In connection to the introduction of ethical education as a subject of study at the University of Hradec Kralove and thanks to the fact that we have been in close cooperation with the author of the KLIT questionnaire, a questionnaire surveying classroom climates, (Lašek, 2001), we decided to start a research which investigates the impact of ethical education taught at elementary schools on the classroom climate.

Ethical education at elementary schools

Ethical education currently used at Czech elementary schools primarily aims at the

development of prosocial behaviour of children and youngsters. It consists of an educational program which includes ten issues that stimulate positive development of the pupils´ personalities, see http://www.etickavychova.cz/. The concept of ethical education is derived mainly from the work of Robert Roche Olivar.
At present, Ethical education is, as an optional subject, taught at ca. 20 per cent of Czech schools.

Classroom climate

Numerous Czech authors deal with the concept of the „classroom climate" or „school climate", see e.g. Jan Lašek (2001), Čapek (2010), Grecmanová (2008), Mareš and Ježek (2012), there are many definitions, characterizations and approaches to how it should be studied.

Research methodology

In the study, the KLIT questionnaire according to Lašek (2001) was used at six schools, in three classes where Ethical education is taught and in three classes where it is not. The changes of the climate in classes were followed within 2 school years in each of the monitored classes, namely at the beginning of the school year 2013/14, and in February of this year, i.e. in the school year 2014/15.
The data were collected at six schools, schools A, B and C with Ethics education in comparison with schools I, II and III without Ethics education. All schools are located in the cities with about 30 000 inhabitants and in each class about 26 pupils were examined. Ethical education at chosen schools A, B and C started to be taught in the 6th class, therefore the KLIT questionnaires were filled in for the first time, at all above mentioned schools (A, B, C, I, II, III), by pupils attending the 6th class at the beginning of the school year and for the second time in February this year, i.e. after more than 1.5 year.

KLIT questionnaire

The KLIT questionnaire is anonymous and it was created specifically for Czech conditions. It comprises of statements that are then used to characterize the specifics of respondents and the classroom they attend.
The questionnaire focuses on three types of the classroom climate:

- *Supportive Climate (SUPKT)* – in this part, pupils are to characterize their relationship with the class as a whole and the relationship between one another, as well as how co-operative and compact the class is;
- *Motivation for Negative Performance at School (MONSV)* **–** pupils are to describe the level of their interest or disinterest in school activities, the level of conformity, fear of failure or lack of self-confidence they experience at school;
- *Self-Assertion (SEPROS)* – this part explores the potential of individual performance and self-reliance and it focuses on the desire to distinguish oneself, on the desire to act efficiently as an individual, as well as on the lack of co-operation.

There are 27 statements altogether in the questionnaire. Twelve statements explore SUPKT, nine of them focus on MONSV, and there are six statements that serve the SEPROS purpose. The respondent chooses one of four possible values for each statement. The value, 1 through 4, expresses to what degree the respondent agrees with the statement. The scale of values corresponds to strongly agree (4), quite agree (3), quite disagree (2), strongly disagree (1).
In each KLIT questionnaire the values of the individual classroom climate types are added up and the resulting numbers (sums) are converted to the so-called *sten* (value between 1

to 10) according the table of *sten* values (see Tab. 1). The *sten* ranging from 1 to 4 signals a low level of the given climate category, 5 and 6 signify a norm and values 7 to 10 signal above-average level of the given climate category.

Sten	**SUPKT** sum	**MONSV** sum	**SEPROS** sum
1	18 and less	13 and less	10 and less
2	19-21	14-15	11
3	22-24	16-17	12
4	25-27	18-20	13-14
5 norm	28-32	21-23	15
6 norm	33-37	24-25	16
7	38-40	26-27	17
8	41-43	28-29	18
9	44-47	30-32	19
10	48 and more	33 and more	20 and more

Tab. 1: Table of *sten* norms (see Lašek, 2001)

Using the above described KLIT questionnaire, we get three *stens* for each KLIT questionnaire, one *sten* for each classroom climate type. As the questionnaire is anonymous, the pupils have been denoted by letters.

Let us introduce an example on the fictive class X with 10 pupils denoted by *a, b, ..., j*. The possible results gained in one of the classroom climate types, let us say in *Supportive Climate*, are presented in the table 2.

Pupil	*a*	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*
Sten	4	5	5	6	6	7	7	8	8	8

Tab. 2: An example of the KLIT results for SUPKT type gained in the class X

For each class and each classroom climate type, we created a table containing the number of values below, equal to and above the norm, see the table 3 – result of the fictive class X.

Class X, 2013, *Supportive Climate*	
bellow	1
equal	4
above	5

Tab. 3: the KLIT results for one classroom climate type gained in the class X

For each column of the table, a graph showing the results in percentage was created (see below).

Results and Discussion

With regard to the KLIT questionnaire, an ideal *Supportive Climate* should be within the norm or above it, an ideal classroom climate *Motivation for Negative Performance at School* (negative school performance motivation) should be slightly below the norm or within it, and an ideal classroom climate *Self-Assertion* (the level of assertiveness) would be in the norm. Such a result is optimal in that it signals that the classmates are able to help one another, they are friendly and they cooperate (*Supportive Climate*), they appreciate education, they like school and they do not have a tendency to cheat (*Motivation for Negative Performance*), and at the same time they are able to be assertive without oppressing others (*Self-Assertion*).

Results of our research are clearly visible from the graphs Fig. 1 – Fig. 6.
Although the gained results include only about 75 respondents in each school type (with/without ethical education), one outcome, according our expectations, is evident - the biggest positive impact of ethical education on the classroom climate can be seen in the *Supportive Climate*. There is also a positive impact of ethical education on the classroom climate in the *Self-Assertion*. There is no impact in classroom climate *Motivation for Negative Performance at School*.

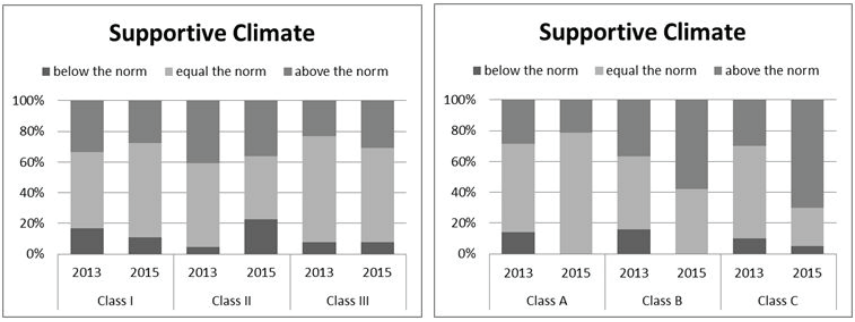

Fig. 1: Results for *Supportive Climate* in classes I, II and III without ethical education and in classes A, B and C with ethical education

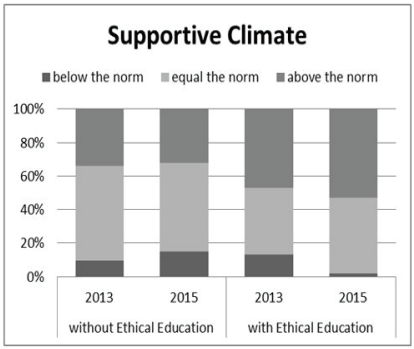

Fig. 2: Results for Supportive Climate in the schools without ethical education and in schools with ethical education altogether

As mentioned above, an ideal *Supportive Climate* should be within the norm or above it. The figures above illustrate that there is almost no changes (difference) between results gained for *Supportive Climate* in the schools without ethical education. However, the number that belongs to results within the norm or above it grown for *Supportive Climate* in the schools with ethical education.

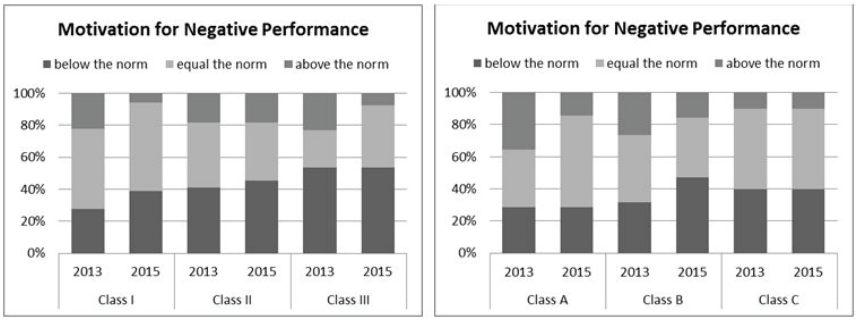

Fig. 3: Results for *Motivation for Negative Performance at School* classroom climate in classes I, II and III without ethical education and in classes A, B and C with ethical education

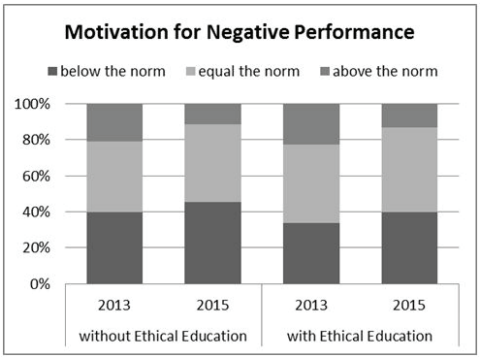

Fig. 4: Results for *Motivation for Negative Performance at School* classroom climate in the schools without ethical education and in schools with ethical education altogether

An ideal classroom climate *Motivation for Negative Performance at School* should be slightly below the norm or within it. The figures above illustrate that there is almost no changes (difference) between results gained for climate *Motivation for Negative Performance at School* in the schools both without and with ethical education.

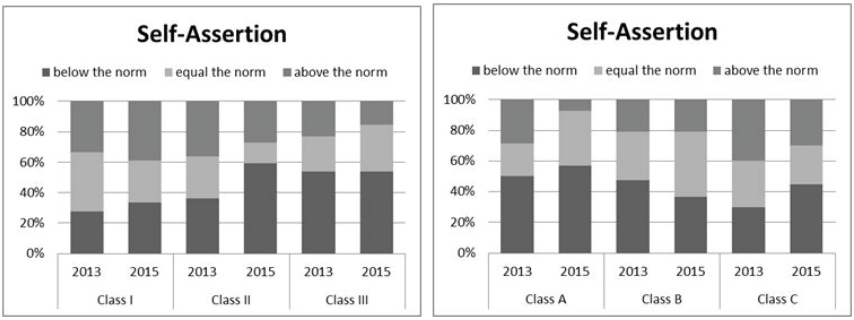

Fig. 5: Results for *Self-Assertion* classroom climate in classes I, II and III without ethical education and in classes A, B and C with ethical education

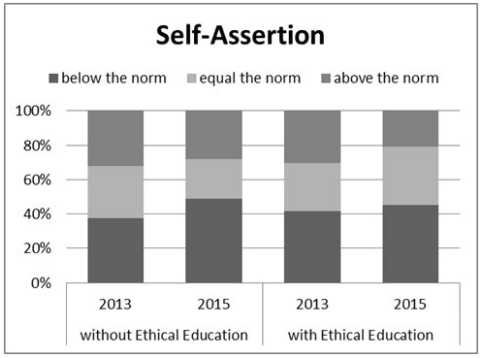

Fig. 6: Results for *Self-Assertion* classroom climate in the schools without ethical education and in schools with ethical education altogether

An ideal classroom climate *Self-Assertion* would be in the norm. The figures above illustrate that the number that belongs to results within the norm even reduced for *Self-Assertion* climate in the schools without ethical education. However, the number that belongs to results within the norm grown for *Self-Assertion* climate in the schools with ethical education.

Conclusion

The paper presented the methodology and results of the study ascertaining the impact of ethical education on the classroom climate. We witnessed the biggest positive impact in the classroom climate of the *Supportive Climate* type.

It is necessary to take into account the fact that there are many factors in the assessment of relationships within any given class, such as the personality of the lecturer of ethical education, the overall environment, context, the personalities of the individual pupils, the impact of family, etc., see e.g. Lašek and Loudová, 2013, Maněnová and Špilka.

However, the authors of the paper are sure that there is a positive impact of ethical education not only on the classroom climate and that in the future more attention should be paid to the Ethics subject, both at primary and at secondary schools.

Acknowledgements

This research has been supported by Specific research project of University of Hradec Kralove, both Faculty of Science and Faculty of Education in 2015.

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GOING INTERACTIVE AND MUTLICULURAL IN CLIL

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Abstract

The presented paper focuses on the issue of use of multicultural topics and teaching supported by smart board and ICT in teaching mathematics in English language at primary and lower secondary level. The paper is based on analyses of CLIL lessons taught at a Prague elementary school in the 5th and 7th grades. The topic of the CLIL lessons was Magic squares and the lessons were conducted within the frame of the project M3EaL, whose goal is development of mathematical teaching units that are sensitive to the linguistic and cultural diversity of classrooms across Europe. Piloting of this teaching unit shows that multicultural topics are a very good learning environment for CLIL as they bring a lot of linguistic material into the lesson and thus support simultaneous development of pupils' abilities in the target language and mathematics. It also shows how beneficial a meaningful use of smart board can be for increasing pupils' motivation in the situation when they have to learn in a foreign language. The findings are based on lesson observation, analysis of the lesson plans and follow-up reflection.

Keywords

CLIL, cultural and linguistic heterogeneity, mathematics, multicultural education, smart boards

Introduction

The fast integration processes in Europe as well as general globalization of the world put an increasing pressure on schools to prepare new generation to life in this "global villages". The so called 21st century skills, whose many various definitions can be come across but in general are built on ways of thinking – creativity, critical thinking, problem-solving, decision-making and learning; ways of working – communication and collaboration; tools for working – information and communications technology (ICT) and information literacy; and skills for living in the world – citizenship, life and career, and personal and social responsibility (Trilling and Fadel, 2009). Integration and globalization also resulted in increasing linguistic and cultural diversity in Europe and increasing heterogeneity in classrooms in schools all across Europe. This trend is reflected in Framework Education Programme for Basic Schools in the Czech Republic where multicultural education is one of the areas that are expected to be addressed in teaching of all subjects across the curriculum including mathematics in the so called cross-curricular subjects (Framework Education Programme for Elementary Education, 2010).

Unlike a few decades ago a teacher can no longer expect to be teaching in a culturally homogeneous classroom and asks for materials and methods that would facilitate their work in this environment. The main goal of the project 526333-LLP-1-2012-1-IT-COMENIUS-CMP Multiculturalism, Migration, Mathematics Education and Language (M^3EaL, m3eal.dm.unipi.it) is to make teachers aware how significant role culture plays in the teaching/learning processes in mathematics. This awareness should help teachers

be more sensitive to the different cultures (and languages) in the classroom and give them a higher value in the educational process. Conditions for an intercultural dialogue in the classroom as well as for better inclusion of pupils from different cultures are thus created. The project partners work on development of teaching units with multicultural settings or with solving procedures and ways of doing things in mathematics in other culture. They hope that if they bring the content of mathematics closer to learners with different backgrounds they will find it easier to follow the instruction and find mathematics their own, not alien. Meaney and Lange (2013) stress in connection to learners' transition between different cultural contexts that learners may have additional difficulties if their experience of home context is very different from contexts they come across at school.

At the same time, another significant trend in education is paying more and more attention to language education (i.e. introduction of compulsory second foreign language and lower secondary school level education in the Czech Republic). This goes hand in hand with the effort of schools to introduce and use CLIL methodology. CLIL – Content and Language Integrated Learning refers to the teaching of a non-linguistic subject such as mathematics through a foreign language. CLIL suggests an equilibrium between content and language learning. In CLIL, the subject understanding and thinking manifested by the language of the subject are developed through the foreign language (L2). Conversely, the L2 is developed through the non-language content, such as mathematics. CLIL provides plenty of opportunities for incidental language learning which has been shown to be effective, deep and long-lasting (Pavesi et al., 2001). The learners' attention is focused on the non-linguistic subject content and thus the foreign language acquisition can become non-conscious.

The famous 4 Cs of CLIL as defined by Coyle (Coyle, 1999), i.e. Content - Progression in knowledge, skills and understanding related to specific elements of a defined curriculum, Communication - Using language to learn whilst learning to use language, Cognition - Developing thinking skills which link concept formation (abstract and concrete), understanding and language, Culture (or Citizenship) - Exposure to alternative perspectives and shared understandings, which deepen awareness of otherness and self are based on the basic principles described by 21st century skills and key competencies and thus CLIL seems to be an approach suitable for the current requirements of education.

The challenge for a teacher facing the task to teach mathematics through a foreign language to learners who have not yet reached B2 level in English according to the Common European framework for Languages is that a thorough *a priori analysis* and very careful lesson planning with respect to the language, vocabulary and language structures that will be needed. The term *a priori analysis* comes from Brousseau's Theory of Didactical Situations in Mathematics (Brousseau, 1997) and refers to such a process of planning a lesson in which the teacher ensures pupils get the chance to discover on their own, there is an *a-didactical situation* in which the learner works without the teacher's intervention and discovers new principles or learns new knowledge independently, reconstructs and rediscovers knowledge known to the teacher but unknown to them. As Moraová and Novotná (2014) show this is possible on the condition that materials are well chosen, carefully adapted and the teacher analyses their linguistic difficulty. In this paper the author also argues that meaningful use of smart board may support pupils' activity and involvement in the lesson, may increase their motivation and general enthusiasm for being taught through English. Needless to say that any support to learners in the situation of learning through a foreign language is welcome.

A lot of recent research focuses on e-learning. However, it seems less attention is paid to

how the potential of ICT is used by teachers in their lessons. The current research in the Czech Republic, e.g. Robová, Vondrová (2013), Novotná (2014); Jančařík and Novotná (2011) shows that Czech in-service teachers lack the confidence, efficacy and skills to be working with ICT to its full potential, feel to be at loss and often use it "for show". The conclusions speak of missed opportunities. Novotná (2014) shows that the materials Czech teachers create for smart boards are more or less merely electronic versions of what can be found in the printed textbooks. Smart boards are very often used only as projectors and the lessons supported by them are very teacher-centred. Their potential remains unused. Similar conclusions can be found in research in other countries (e.g. Wuezer and Elementary, 2008). Although researchers hesitate to answer whether the use of smart board produces "smarter kids" (Clemons, Moore and Nelson, 2014; Warnock, Boykin and Tung, 2011), they do not doubt the motivational power of the smart board if the learners are allowed more than to watch it being used by the teacher. Many research papers also propose examples of good practice, e.g. Volek and Alina (2013), Šimpach (2013), Price (2006), Smith and Pecore (2008).

In the light of the above presented arguments, the author of the paper is trying to answer the following questions:

- Are teaching units arising from other cultural background suitable for CLIL mathematics lessons? If so, what is the additional value?
- Can meaningful use of interactive boards support understanding and motivation in situations when learners are expected to be doing a subject in a foreign language?

Materials and Methods

The paper is based on classroom observation, analysis of lesson plans and video recordings and on reflection of the teacher on teaching mathematics in English language in a Prague elementary school. The lessons were taught in the 5th and the 7th grades. The level of the pupils according to their English teachers and the course book used in lessons of English was A2 in the 5th grade and A2/B1 in the 7th grade. The teaching unit that was used in the observed was *Magic squares,* originally developed by the French partner of the project Multiculturalism, Migration, Mathematics Education and Language (M^{3}EaL), which was not designed for CLIL classrooms but for the culturally heterogeneous classrooms in France where "minority" pupils may be in majority.

The decision to pilot the teaching unit as CLIL was made because Czech schools do not seem to be facing the same situation with cultural diversity yet and the classrooms involved in the piloting were more or less culturally and linguistically homogeneous. The piloting teacher wanted to test whether the unusual cultural background of the teaching unit would prove to provide space for the CLIL Cs', namely communication and culture/citizenship development. At the same time she wanted to make sure that knowledge in mathematics and mathematics thinking and reasoning are developed and that there is at least some *a-didactical situation* in the lesson in which the responsibility for learning is handed over to the learners. The original teaching unit was therefore used only as the starting point for the lesson planning. The lessons were planned in order to develop both language and mathematics, i.e. they started from a language warm-up and introductory stage and moved to mathematical content about 10 minutes after the beginning.

The topic of the lessons was *Magic Squares.* The cultural context was ancient China and the legend of Lo-Shu and the magic square on its shell. This background was used for achieving objectives in language and in mathematics, namely developing speaking skills in the warm-up stage of the lesson when pupils' curiosity was activated through

elicitation and discussion of what legends tales and magic is and listening skills when the teacher was telling the legend of the turtle and in mathematics looking for patterns and regularities, discovering (re-discovering) properties of arithmetic operations and patterns in a square grid. The mathematical content was looking for the regularity that makes a the 3x3 square on the turtle magic (the sum of each column, diagonal and row is 15), looking for what happens if we add the same number to each number in the magic square and what happens if each number in the square is multiplied by the same number.

The aim of the analyses of the lessons was to answer the above formulated research questions, i.e. if the unusual cultural assignments can enrich CLIL mathematics lessons and if the use of ICT (namely smart board) can be motivating but also support understanding and may be help creation of *a-didactical* situation in the lesson. At the same time the teacher explored how efficiently the cross-curricular subject multicultural education can be included into mathematics.

The lessons taught: *Magic squares*

The planned objectives of both lessons were development of speaking and listening skills in English and developing vocabulary in the area of legends and magic as well as in the area of mathematics (*odd and even numbers, multiplication and addition, rows, columns and diagonals*), mathematics goals were looking for patterns and regularities, discovering (re-discovering) properties of arithmetic operations.

The lessons in both classes were opened by a short discussion on magic. The lesson in the 7th grade was taught on Friday 13th, which was a very nice incentive for talking about magic and superstitions. The teacher also asked the pupils to think of some legends they know and to explain the difference between a legend and a fairy tale. The same warm-up activity was used in the 5th grade (without talking about Friday 13th) where the teacher paid more attention to the vocabulary items the pupils might have difficulties with.

This opening stage of the lesson was followed by the teacher telling the legend of the magic turtle Lo-Shu and its shell. The pattern on the shell was projected on the smart board (fig. 1 and 2) and having finished telling the legend, the pupils were asked to find out what the pattern represents, to solve the riddle how many presents to bring to the river. The teacher then drew a square grid directly onto the smart board and let the pupils experiment and reason. In both classes they were quite fast to realize the symbols represented numbers 1 to 9 as the number of knots represents the number itself.

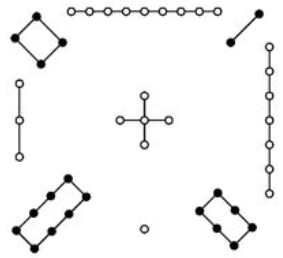

Fig. 1: The Pattern

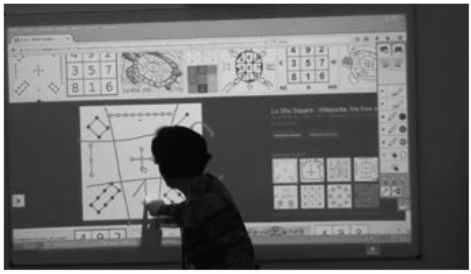

Fig. 2: Use of interactivity

Then in the 7th grade the teacher asked the pupils to answer to the riddle *Why did the God of the river want 15 presents?*). The pupils copied the square into their exercise books and did not need long to see what the answer was. The pupils did not need to experiment much, which made the teacher change the way of conducting this stage of the lesson in the

5th grade where the pupils were not told that the magic number was 15. The pupils were only asked to discover what the magic number was. This had the form of a whole class discussion. The pupils were observing the magic square, were working with it in their exercise books and if they had a conjecture about the principle and the answer, they told the class and together discussed whether that was a possible answer, or not. The teacher wanted this part of the lesson to be an *a-didactical situation* so she tried not to intervene and let the pupils communicate and reason and justify in English as much as possible, but sometimes her intervention was needed to guide the pupils to discovery of the number 15 as they found other numbers and regularities that made sense. The pupils were free to come to the smart board and show their conjecture directly on the smart board, which seemed to be very motivating and kept them active (fig. 3 and 4). At this stage the smart board was there for their use and experimenting.

In consequence to the form of the given task, the 5th graders needed much more time to find the magic answer but as they were not given it by the teacher they were much more active and were experimenting and looking for various patterns and explanations before they actually found the answer. The chance to go and demonstrate on the smart board kept them busy and inquisitive.

Fig. 3

Fig. 4

In the next stage of the lesson, the pupils in both classes were asked to add the same number to each number in the magic square and decide whether the new square will still be magic and then do the same with multiplication.

The pupils in both classes worked on their own with pencil and paper, making the needed calculations, looking for the answer. The teacher's experience in the 7th grade where some of the pupils understood the instruction *multiply each number in the magic square by the same number* in a way that they multiplied 1x1, 2x2, 3x3 etc. made her modify the instruction in the 5th grade where one number was elicited from the pupils for each of the activities (6 for addition, 3 for multiplication), making sure everybody would be working with the same number. This also made the stage of checking the answer easier.

It was very easy for pupils in both classes to verify the new squares were magic. The teacher then asked why it was so. Again the pupils had to think about it on their own and suggest. This was more difficult for the 5th graders. After some proposals the 5th graders realized that the difference between the original sum 15 and the new sum 33 was 18. But they needed the teacher's help to realize that 18 is three times six, e.g. the new number is added three times in each row, column and diagonal.

The case of multiplication was much easier for the 7th graders who very fast to see that multiplication of each summand is equivalent to multiplication of the whole sum by the same number. The 5th graders could not see this even when the teacher offered help and showed that 15 times 3 is 45, i.e. that it is enough to multiply the sum in each row, line or diagonal.

The lesson ended in the 5th grade at this point. The 7th graders still had time to watch the teacher show them the principle of tiling an odd order magic square and had the time to try it out in a five times five square. However, despite fewer activities completed in the 5th grade, the teacher evaluated the lesson in the 5th grade as the better one and more beneficial for the pupils, who had discovered more of the things on their own. There was the *a-didactical situation* at the stage when looking for the answer to the riddle from the legend and more communication in English.

Results and Discussion

The aim of the here presented teaching experiment was to study whether a mathematics teaching unit with multicultural background and supported by the use of smart board would lead to development of language and mathematics skills and whether the setting and the use of smart board could be considered as a meaningful added value. The two piloted lessons confirm the hypothesis. The observations confirm the pupils profited from the cultural content in the warm up activity and were motivated by the possibility to work on the smart board.

When planning the lesson the teacher analysed the language content very carefully to pinpoint the words and expressions that the pupils could have difficulties with. She also analysed the cultural content and based on it the warm-up communicative activity which raised pupils' curiosity and interest. The first stage of the lesson was planned as a mere discussion on magic, tales and legends, which are topic of interest to pupils of this age. The legend from China brought the cross-curricular multicultural education into the lesson very naturally. The teacher's conclusion having taught the lesson is that multicultural settings are of great benefit in CLIL lessons. They are the natural background to making pupils communicate, to achieve language goals which must be an integral part of a CLIL lesson. Telling the legend or giving any other cultural background information is a typical ESL activity in which several language skills are developed (listening comprehension, speaking, vocabulary).

While planning the lesson the teacher also analysed the mathematics content and was trying to find how to present it and work with it in the CLIL lesson in a way that the pupils also discover on their own. After the first lesson she realized the full potential of the material was not made use of and changed the lesson plan for the second lesson taught in order to allow *devolution* (Brousseau, 1997), to let the pupils do more experimenting and work while looking for the answer to the given question. When reflecting on it she was well aware that the situation in the 5th grade was much closer to the desired *a-didactical situation* than in the 7th grade. Her conclusion is that the teacher should not overestimate the fear of the language barrier and should allow the pupils to work on their own. CLIL is much more than carrying out arithmetical operations in English and even pupils with limited language skills can reason in some kind of activities. If Moraová and Novotná (2014) asked in their paper whether *a-didactical situation* was possible with learners who are not proficient in the language of instruction, this study clearly confirms that this does not depend so much on the language skills but the planning and the course of the lesson.

Conclusion

The here presented study shows that multicultural settings are very convenient for CLIL lessons. The experience from the observed lessons shows that if communication is to be part of a CLIL lesson, more than mathematics content is needed. For younger learners it is very hard to speak in English about mathematics itself, to reason and justify in English.

However, they find it easy to discuss the cultural content, in this case to talk about magic or legends. Thus the multicultural content seems to give the needed material for the warm-up, icebreaking activity which helps the get pupils ready and keen to learn mathematics in English. The same can be expected to be the case of real life, everyday settings which can again be a rich source for discussion in the target language. The study also shows that if smart board is used for more than projecting slides with information, it helps pupils understand and discover and keeps them motivated. The teacher's idea to project the picture of Lo-Shu shell and to draw the square grid on top of it, allowing the pupils to come to the board and experiment, turned out to be very important for their discovery of the pattern.

The study points out issues very important for teacher training – pre-service teachers need to be trained not only to be able to use the smart board but also to consider how to use if effectively and for their pupils' benefit. They must be shown examples of good practice. The study also shows that mathematics is a subject that can include the cross-curricular subject multicultural education as topics from other cultures provide a rich source of interesting mathematics to be worked on in the classroom. Pupils can be taught the basic properties of number operations, but they can discover them on their own in the exciting environment of the legend from Ancient China.

Acknowledgements

The research was supported by Rozvojový projekt PedF UK.

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MEASUREMENT OF EDUCATION SERVICES

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Abstract

This paper is focused on the measurement of education services. Education services are mainly provided to households (almost) for free by government. As there are no market prices non-market output of education services is estimated as sum of related costs. Statistical deflation has been traditionally done by input method which is based on recalculation each cost separately. This approach includes assumption of correlation between changes in inputs and changes in output. Direct volume measurement (volume changes of output is estimated independently on changes in inputs) is now preferred for individual services. Methodology of direct volume measurement of education services has been prepared. Results that describe development of education services can be used in volume measures in national accounts. Besides that policy makers may use findings for setting the education policy.

Keywords

Education services, volume measurement, output method, students

Introduction

Education is usually one of the priorities of government which run and control majority of education facilities. Therefore main part of education services is included among non-market services provided by government for free to households. As no prices are observed for non-market services, output of these services is estimated as sum of related costs: intermediates, compensation of employees, consumption of fixed capital and net taxes on production (Hronová et al, 2009). This approach arises from the nature of services and it is applied to all non-market services. The question is how to estimate year-on-year (or quarter-on-quarter) volume changes. Traditionally input method has been used. This approach is based on deflation (recalculation of indicators to constant prices) of each component separately. It leads to the fact that changes in inputs are equal to changes in output, more detailed explanation is available in Atkinson (2005). More inputs mean more output regardless changes in productivity and efficiency.

The issue of estimates non-market services at constant prices is not connected with education services only, but also with other non-market services such as health services, public administration etc. Non-market output can be divided into two parts: collective and individual (EC, 2011). Collective part represents non-market output which cannot be assigned to any individual (e.g. public administration, defence). The input method is supposed to be suitable even if it is not ideal. (EC, 2001) It is quite complicated to develop output method for collective services however selected countries (e.g. the United Kingdom) use them, see Ashaye (2001) or Lynch (2006). In contrast with collective services, individual services should be estimated at constant prices using output method. The most important individual services are health and education services, whose share is about 90% on individual services in the Czech Republic.

Indicators can measure different phenomena. Indicators may be related to *inputs*, e.g. number of employees. This approach leads to using the input method which measures inputs rather than output. The method can be improved by adding ex-ante assumption on changes in productivity. Drawback is impossibility to prove the assumption. In spite of this fact this approach is still applied in many countries including the Czech Republic (ČSÚ, 2008). Indicators can be also connected to *activity* however no indicator is observed for education services. The preferred method is output approach which measures amount of output. Output of education services is defined as 'the quantity of teaching received by the students, adjusted to allow for qualities of the services provided, for each type of education'. (EC, 2001, page 114). It means time which pupils and students spend with learning and it can be measured by amount of time that student spend with learning. The last term is *outcomes* which mean result of the productive activity. Outcomes of education services are skills and knowledge that students get.

This paper deals with measurement of education services. Developed methodology which respects international recommendations is described. The application of the methodology would ensure that deflation procedure respects international recommendations. Furthermore, efficiency can be assessed as development of output does not depend on development of inputs. Finally results, which may be used for volume calculations in national accounts or formulation of education polices, are presented.

Materials and Methods

Definition of output and outcomes of education services are mentioned in introduction. The key issue is to develop methodology to estimate indicator of output or outcomes. Number of student-hours is recommended as the indicator of output (EC, 2001). Atkinson (2005) suggests taking into account only hours actually spent with learning (time of illness or similar should be excluded). The simpler indicator is number of students. This approach is based on assumption on stable number of hours of tuition. On the other hand, Smith and Street (2007) argue that this concept is too narrow. It omits contributions of education services to behave pupils, to provide childcare, to generate social skills etc. Actually these contributions are almost immeasurable and excluded from calculations. Estimates should be done at more detailed level as it is possible in order to obtain accurate results. Different expensiveness should be taken into account and categories ought to be homogenous. Handbook on price and volume measures suggests following stratification (EC, 2001):

- Pre-school,
- Primary,
- Lower secondary,
- Upper secondary,
- Higher education,
- Other education.

Taking into account available data sources and conditions in the Czech Republic we have decided to do estimates at the following level of breakdown of education services:

- Pre-school education,
- Primary and secondary education,
- Post-secondary education,
- Other education.

Suggested stratification is limited by two main data sources: national accounts and education statistics of the Ministry of Education, Youth and Sports. Czech national

accounts offer the most detailed data in classification of economic activities (NACE) as it is mentioned in the previous paragraph. It means that aggregation of indicators of above mentioned categories is done by output. However partial aggregations within categories have to be done using additional information (weights, see below). Industry of education produces also many other by-products (e.g. restaurant and accommodation services). This output is excluded from calculations, only product 'education services' in education industry is taken into account (diagonal elements of output matrix).

Methodology of national accounting has been changed. New standard ESA 2010 became effective in September 2014. Sixta (2014) explains that new standard brings many changes that should reflect changes in economies, globalization etc. Zbranek and Fischer (2010) describe the new concept of research and development (R&D) that is now considered as the asset. It means that expenditure related to R&D is recorded in gross fixed capital formation instead of intermediates as it was in the previous standard ESA 1995. It has significant impact on education industry, especially tertiary education. Non-market output of educational institutions was considered as output of education services regardless the fact that a part of expenditure was related to research and development. Under ESA 2010 methodology these expenditure is capitalized i.e. deducted from non-market output and added to output of R&D for own use. Regarding deflation of non-market services, the new concept is better because non-market output of education industry includes non-market output of education services only.

We have decided that the indicator of pre-school education is number of pupils who attend kindergartens. The reconciliation of data in calendar year (national accounts) and in school year was done. The first 4 months of school year (September – December) belong to one calendar year, the second 8 months (January – August) belong to next calendar year. The same approach is also applied on data on primary and secondary education. Next category is more complicated. It includes primary and secondary education together. The first item is primary education that is almost the same in all schools i.e. all pupils get the same education service. However, schools do not receive the same amount of money per pupil due to different rates that depend on the size of school, share of disabled pupils etc. In spite of this the indicator of primary education is number of pupils. Number of hours per week is stable and it may slightly differ among schools as school can move one or two hours between school years.

Students of secondary education study very different fields of study (grammar schools, schools of engineering, art schools etc.). It is obvious that expensiveness of fields of study differs. Taking into account method of estimating output at current prices (sum of costs), the fact has been incorporated into calculations. The indicator of secondary education is number of student weighted by costs (cost equivalent of the number of students). Each type of field of study has its rate that is paid per student to school. The rate in relative term (the base is rate for primary school) is supposed to be weight, see following formula:

$$I = \sum_{k=1}^{n} S_k . R_k \tag{1}$$

where

I	is indicator of secondary education,
S_k	is number of students (persons),
R_k	is rate,
k	is field of study.

Rates are available in very detailed level and they depend on numbers of factors. However, data on number of students are available for about 30 fields of study only. It is not possible to compute average rates for 30 fields of studies as data on students is not available in this breakdown. Therefore, rates were estimated for 30 fields of study, partly as expert estimates of authors of the paper. Finally indicators of primary and secondary education were put into the composite indicator.

Handbook on price and volume measures in national accounts (EC, 2001) suggests using number of students as the indicator of post-secondary education. Difficulty of different fields vary, moreover study work load depends whether students have a job (Fischer and Lipovská, 2014). Authors have developed indicator that is based on number of studies weighted by expensiveness of fields of studies. This indicator is used for estimation of development of post-secondary education. In the Czech Republic it is not unusual that students study more universities or fields of studies. These students get more education services than students who study just one study. The question is, if student with two studies receives double service than student with one study. It depends on similarity of fields of studies. Number of students who study more fields cannot be calculated precisely. Students can theoretically study even three or more fields. If we assume that students study two studies as maximum, about 10% of students have two studies. As weights we use coefficients of expensiveness of fields of studies that are applied for funding of universities. According to the latest international recommendations (EC, 2012) deflation of other education can be based on input method. Therefore we remain input method for deflation of other education services.

Results and Discussion

Two data sets have been prepared. The first one is focused on pupils and those who studies at schools and universities run by government. This service is provided almost free of charge. Estimated indicators can be used in national accounts as volume indices which describe development of non-market independently on costs incurred.

Type of education / Year	2004	2005	2006	2007	2008	2009	2010	2011	2012
Preliminary education	100.1	99.0	100.3	101.8	103.0	103.8	104.3	104.2	103.4
Primary and secondary education	97.9	97.3	97.1	97.3	97.5	97.8	97.9	97.8	98.3
Post-secondary education	107.0	107.7	107.5	106.2	105.8	104.5	102.4	100.2	98.7

Tab. 1 Development of non-market education services (year-on-year indices)

Data on students of secondary education are available since the school year 2002/2003. Therefore estimated results are available for the year 2004 and onwards. Preliminary and primary educations are determined by demographics. Secondary education is also affected by changes in studied education fields. As students have studied less expensive fields, decrease in person is slightly slower. During the period number of students of technical fields increased by 20%, however number of students of humanities grew by more than 70%.

At the beginning of the period output of post-secondary education increased significantly (about 7% every year). Then the growth slowed and finally the output decreased in 2012. Study at universities was in great demand which was satisfied mainly by less expensive and demanding fields of study. In recent years the Ministry of Education, Youth and Sports has changed the policy of funding of universities under the motto "from quantity to quality". This change consisted in the decrease of the number of studies funded by the Ministry and led to the decrease in the output of educational services. Some aspects of this

policy change is discussed by Mazouch and Vltavská (2014).
The second data set (see Table 2) describes development of education services regardless who is payer of the services. Results of total education and non-market education can be compared. The growth of total preliminary education is usually slightly higher than growth of non-market part. It means that increase of market part is faster that is caused by lack of places for children in public kindergartens (Poloncyová et al., 2013: 148). Indicators for primary and secondary education are same in both data sets. The share of private primary education is very limited (less than 1% of students) in the Czech Republic. Moreover, most of revenues of schools are in the form of payments of for the other non-market output.

Type of education / Year	2004	2005	2006	2007	2008	2009	2010	2011	2012
Preliminary education	100.1	99.0	100.3	101.7	103.1	103.9	104.5	104.4	103.7
Primary and secondary education	97.9	97.3	97.1	97.3	97.5	97.8	97.9	97.8	98.3
Post-secondary education	108.1	108.9	108.7	107.9	106.7	105.4	102.5	99.7	98.0

Tab. 2 Development of education services (year-on-year indices)

Comparison of development of post-secondary education is quite remarkable. During the period 2004 – 2009 the increase of total post-secondary education is faster than non-market output. It means that market output (private universities) rose quite fast as public universities were not able to satisfy extremely high demand of applicants for study. However, the opposite situation happened in 2011 and 2012. Number of studies at private universities dropped significantly, probably due to three reasons: demographic decrease, economic downturn and tightening the rules by the Accreditation Commission of the Czech Republic. Number of studies (not weighted) is expressed in Fig. 1.

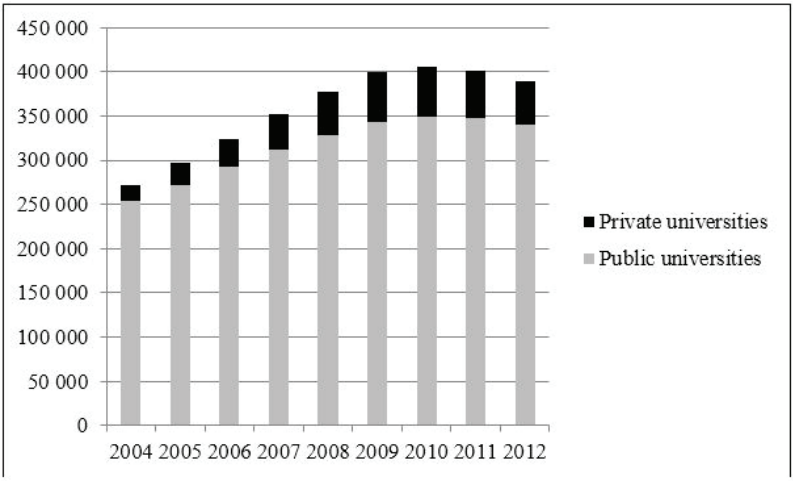

Fig. 1 Number of studies, own calculation

When output indicators are available, it is possible to estimate productivity and efficiency of education services. From the national accounts point of view, productivity can be estimated as output in constant prices (calculated using developed indicators) divided by inputs. Currently, this estimate cannot be done because development of output follows

development of inputs. Vltavská and Fischer (2013) analysed labour productivity at higher education institutions. This work was focused on analysis of relationship between the average wage and research performance measured by RVVI points. According to ESA 2010, research and development carried out at universities is capitalized and it is excluded from education services. Productivity and efficiency of higher education institutions can be separately estimated for teaching activity (using our methodology) and for research activity (using method described in Vltavská and Fischer (2014)).

Our analysis is focused on students and teachers. Indicator 'students per worker' was calculated for each type of education. In order to be in line with national accounts concept of output, number of employees was applied instead number of teachers. Indicator number of employees is in accordance with compensation of employees that is a part of non-market output. We assume that number other employees is low and stable. The ratio was increasing for preliminary education. Next, the ratio of primary and secondary education is fairly steady with slight decrease at the end of period. The upward trend is observed for post-secondary education, which can be explained by shift of students to humanities. These fields can be taught in huge lecture halls in comparison to technical fields.

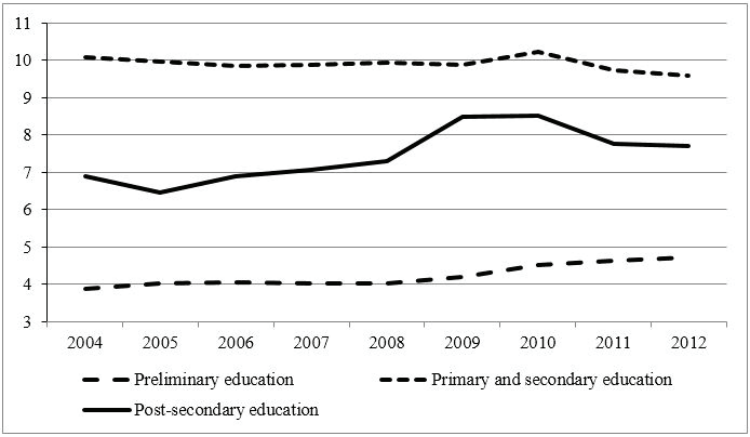

Fig. 2 Number of students per worker, own calculation

Volume indices should include change in quality of product. Nevertheless, new standard ESA 2010 requires not taking into account change in quality for education services. This approach can be considered as unsystematic and the main reason consists in disagreement among countries how to measure quality of education services. There are several suggestions such as standardized tests, results of school inspections etc. System of education differs among countries as well as system of school inspections. Above that, Witte and Hudrlíková (2013) argue that these indicators are simple more complex approach should be based on composite indicators.

Outcome of education services can be measured by standardized tests that provide data on level of knowledge of participants. If the sample is representative, results can be generalized on population. On the other hand, soft skills are not usually included. Theoretically, outcome can be considered as the indicator of quality. However, outcome is the result of output of education services produced in many previous years.

Conclusion

This paper is focused on the measuring of education services. The first initiative came from national accountants who tried to replace input method by direct volume measurement of education services. The results can be also applied in education polices or the system of funding of education services. Although, there is an international framework, the system of education differs country to country. Developed methodology respects international recommendations, but it also takes into account lack of data sources and conditions in the Czech Republic. Our research follows the previous work focused on productivity of research activity. Using both methodologies it is possible to estimate productivity and efficiency of providing education services.

The indicator of primary education is number of pupils as number of school hours is stable over time. The indicator is mainly affected by demographic and it is predictable. Expensiveness of fields of studies is taken into account for secondary and post-secondary education. Regarding the method of estimating output at current prices it is necessary to include changes of studied fields into estimates.

Acknowledgements

This paper was supported by Grant Agency of the Czech Republic GACR No. 13-15771S "Regionalization of GDP estimate using expenditure approach".

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THE EMPLOYMENT OF STUDENTS OF A BACHELOR'S DEGREE PROGRAMME WITH RESPECT TO LABOUR MARKET REQUIREMENTS

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Abstract

This paper describes partial results of a survey among full-time students of a Bachelor's degree programme of Economics and Management carried out in 2015 in FEM CULS (Faculty of Economics and Management, Czech University of Life Sciences). Rising level of unemployment among university graduates is a phenomenon which is notable not only in the Czech Republic, but also in other European states. Acquiring work experience and professional skills during university studies appears to be the key prerequisite for subsequent successful integration of graduates of Bachelor's or Master's degree programmes into the labour market. The aim of this paper is to evaluate the situation of employment of students of the Economics and Management field of study (EM) and to show the importance of acquiring work experience and developing professional skills simultaneously with gaining theoretical knowledge at the university.

Keywords

Bachelor studies, employment, labour market, job performance, education

Introduction

The increasing level of general education, progressing globalisation and internalisation of companies, which are typical for economically developed countries, lead to higher demands on specific skills on the part of employers (Cermakova and Navratilova, 2014). One of the problems of modern education is the fact that not all students who have completed their education are able to integrate into the labour market successfully. This means that a proactive approach of students during their studies is necessary (Romanova, 2014). The rate of unemployment and temporary employment among young people is very high at present and it makes the integration of young people into the labour market more difficult. By contrast, the economic globalization has a positive impact on the integration of young people into the labour market (de Lange, Gesthuizen and Wolbers, 2014). Although in the Czech Republic the youth unemployment is higher than the general unemployment rate, this fact is considered natural from the point of view of functioning of the labour market, given the specificity of the process of looking for employment by young people, school leavers and university graduates (Münich and Jurajda, 2010).

When entering the labour market, the young people are faced with a number of issues, despite their having completed a higher education. Acquiring work experience and professional skills while gaining theoretical knowledge at the university appears to be the key prerequisite for future successful integration of graduates of Bachelor's or Master's degree programmes into the labour market. Work experience acquired during studies may improve soft skills of the students and, at the same time, facilitate professional networking (Scott-Clayton, 2012). According to some studies, higher education, at the

time of unfavourable economic conditions, has a negative impact on future employment possibilities of the graduates (Kawaguchi and Murao 2014).

Although universities try to take into account the current requirements of the labour market in designing their study programmes and they cooperate on various levels with business representatives, there is still a significant gap between demand on the labour market and supply of knowledge and skills of graduates of individual fields of study. In case of students who earned their Bachelor's degree, the gap is even more pronounced as compared to students who completed their Master's (Maryška and Doucek 2012). Linking the labour market and its concrete requirements with the education system is a necessary condition for improving the employment rate especially of university graduates and school leavers. It becomes evident that youth unemployment is high in regulated labour markets and low in liberal markets and also in countries where the education system sends clear signals as to the skills and abilities of the job seekers (Breen, 2005).

Based on the above it is possible to assert that the issue of future employability of graduates of Bachelor's and Master's degree programmes and their readiness for the labour market requirements is key factor for future economic development not only in the Czech Republic, but also in other countries.

The aim of this paper is therefore to evaluate the situation of employment of students of the Economics and Management field of study and to show the importance of acquiring work experience and professional skills simultaneously with gaining theoretical knowledge at the university. In the Introduction, a theoretical background of the examined issue is provided. The Materials and Methods section of this paper describes how the primary research was conducted. The Results section presents the findings which are discussed and compared with similar studies on the given issue.

Materials and Methods

The theoretical background of this paper has been based on an analysis of secondary sources, which were drawn from scholarly papers, specialized literature and official web portals. The primary data have been obtained from a survey conducted within the paper.

The survey has been conducted in an electronic form in February 2015 among full-time students of the 2nd year of EM at the Faculty of Economics and Management Czech University of Life Sciences in Prague. The sample was selected deliberately and it included n=258 respondents out of the total of 472 full-time students actively studying EM in the 2nd year.

The following basic identification characteristics of the sample of surveyed students may be given:

- As for gender, 64% (165) of the respondents were female and 36% (93) male. That corresponds to the gender structure of all students at FEM, where female students prevail.
- From the point of view of secondary education, the structure of the respondents may be described as follows: almost 50% (125) of the respondents have attended grammar school and 42% (109) a secondary school specialized in some economic field. Only 8% of the respondents have attended another type of secondary education facility.
- In terms of size of the municipality where the respondents have their permanent residence, 105 (40.7%) students said that they live in a city with over 100,000 inhabitants. 18 respondents (7%) have their permanent residence in town with 50 to 100 thousand inhabitants and 53 respondents (20.5%) live in a municipality

with 10 to 50 thousand inhabitants. 13.2% (34) respondents have their domicile in municipalities with 2 to 10 thousand inhabitants and 18.6% (48) respondents reside in municipalities of less than 2000 inhabitants.

- Most of the respondents, 114 (44.2%) have their permanent residence in Prague, 64 respondents (24.8%) live in Středočeský (Central Bohemian) region and 19 respondents (7.4%) in Ústecký region. 13 (5%) respondents reside in Jihočeský (South Bohemian) region and approximately 4% live in Pardubický region and in Vysočina region (11 and 9 persons respectively). The remaining percentage is evenly distributed among other regions.
- Almost three quarters of respondents (68.9%, 175 persons) have said that they live in a 3 – 4-member household. The number of respondents living in a household of 1 or 2 members or a household of more than 4 members was similar, i.e. approximately 15% in both cases. Only three respondents live in a one-member household.
- Only 22 respondents (8.5%) live in a household with an income of over CZK 60,000 per month. According to the survey, 44 respondents (17.1%) live in a household with an income between CZK 40 and 60 thousand per month, 58 respondents (22.5%) live in a household with an income of CZK 20 to 40 thousand. 13 (5.1%) respondents said that their household income is between CZK 10 and 20 thousand, two respondents (0.8%) have said that their household income is less than CZK 10,000 per month. 46% of respondents declined to indicate their household income.

Statistical Means for Analysis

The contingency table is used for transparent visualization of mutual 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 et al, 2007). Obviously, $x_2\ n_{ij}\ m_{ij}$ is a measurement of the overall dissimilarity of and. The bigger the difference between observed and expected values, the higher is the test statistic χ^2.

$$m_{i\,j} = \frac{n_i . n_j}{n} \tag{1}$$

$$\chi^2 = \sum \frac{\left(frequency\,observed - frequency\,expected\right)^2}{\left(frequency\,expected\right)^2} \tag{2}$$

$$\chi^2 = \sum_{i=1}^{r}\sum_{j=1}^{s} \frac{\left(n_{i,j} - m_{i,j}\right)^2}{\left(m_{i,j}\right)^2} \tag{3}$$

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 $(r\text{-}1)(s\text{-}1)$ 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

analyse 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.
The following null hypotheses were tested in the data analysis.

- H01: The type of employment during studies does not depend on the students' gender.
- H02: The field in which the students want to work after finishing their studies, is not related to the field in which they work during their studies.
- H03: The field in which the students currently work does not depend on their gender.
- H04: The field in which the students want to work after finishing their studies does not depend on their gender.

The following abbreviations are used in this paper: CULS: Czech University of Life Sciences, EM: Economic and Management, EU: European Union, IT: Information Technology, FEM: Faculty of Economics and Management.

Results and Discussion

Acquiring work experience during studies, whether on the basis of a permanent or temporary employment, appears to be currently a necessary prerequisite for future integration of university graduates into the labour market. Based on the survey it is possible to assert that most students are aware of this fact and only a minority of them is not involved in any practice in any field (Tab. 1). The importance of acquiring work experience follows, among other things, also from the type of high school completed by the students prior to studying at the university. Almost 49% of university students have completed grammar school which is oriented on general education and does not provide students with any practical information from any specific field. Hence the necessity of acquiring professional practice during university studies.
Among the examined sample of students, temporary jobs prevail. The advantage of temporary employment is its time flexibility which allows the students to better combine work and studies, especially, in case of full-time students, during such busy periods as the examination period or preparation for state exams. Temporary jobs (whether short-term or long-term) also make it possible for students to acquire practice in more fields. By contrast, the disadvantage may be the fact that temporary jobs are usually not related to the field of study or the field in which the students are expected to find employment after obtaining their degree. Temporary jobs are taken more frequently by female students. Independent, self-employed students who are engaged in some form of business activity as freelancers are an interesting group. There is a high probability that such students will have no problems with finding employment and that they will be less dependent on fluctuation of the labour market.
The statistical value of 10.45 for Tab. 1 is higher than the critical value of chi-square of three degrees of freedom on the level of 0.95, which is 7.81. Null hypothesis H01 can therefore be rejected. That means that the type of employment during studies does depend on the students' gender. However, the degree of association, as measured by Cramér's *V*, is weak (V=0.20). A more detailed analysis of differences shows that the difference arises in temporary jobs, which are taken by female students more than what would correspond to the proportion of female respondents in the population (100:42 as compared to the pre-calculated proportion of 90:52). By contrast, male students prevail among students who work in their own or a family business. Such type of job is performed by 15% of all male students and only 5% of all female students of the sample.

Gender	No job	Temporary job	Permanent employment	Entrepreneurial activities	Total
Male	16	42	21	14	93
Female	43	100	30	8	165
Total	43	142	51	22	258

Tab. 1: The type of employment during studies does not depend on the student's gender

The statistical value for Tab. 2 is 55.96 and it is therefore higher than the critical value of chi-square of 12 degrees of freedom at 0.95 level (21.03). Null hypothesis H02 can therefore be rejected. The field in which the students want to work after finishing their studies is related to the field in which they work during their studies (Tab. 2). The degree of association, as measured by Cramér's *V*, is of a medium strength (V =0.23). That means that the students, when looking for a job during studies, specifically target the very field in which they expect to work after completing their studies. Almost 40% (102) of respondents said, answering to another question of the survey, that their current job is for them a way of systematic career building during their studies. This corresponds also to the sum of frequencies on the main diagonal in Tab. 2.

Present/ future	No job	Temporary job	Permanent employment	Entrepreneurial activities	Total
Banking, insurance, taxes, accounting, audit	19	1	2	12	34
Tourism, hotel industry, gastronomy	43	17	17	4	26
IT, telecommunications, manufacturing industry	4	2	11	12	29
Commerce, management, marketing, PR	15	5	13	55	88
No job	11	5	7	20	43
Total	66	30	37	125	258

Tab. 2: The field in which the students want to work after finishing their studies, is not related to the field in which they work during their studies

The statistical value for Tab. 3, which is 8.31, is lower than the critical value of chi-square of 4 degrees of freedom at 0.95 level (9.48). Null hypothesis H03 cannot therefore be rejected. The field in which the students work during their studies does not depend on their gender. With respect to gender, there are no significant differences as to the interest in specific field. Given that the surveyed respondents are students of the Economics and Management field of study, their practice during studies tends to be oriented mostly on commerce, management and marketing, but also tourism, hotel industry and gastronomy. The students are also interested in acquiring practical knowledge in industries such as banking, insurance, taxes and accounting (Tab. 3). It is possible to assert that in this case, students should develop and apply in practice the theoretical knowledge gained during studies and within specializations of the individual studied subjects. According to the findings of Fischer and Liptovská (2014) there is a direct relation between the level of salary and employment of students during their studies if the jobs are related to the field of study.

Gender	Banking, insurance, taxes, accounting, audit	Tourism, hotel industry gastronomy	IT, telecommunications, industry	Commerce, management, marketing, PR	No job	Total
Male	13	19	17	28	16	93
Female	21	45	12	60	27	165
Total	34	64	29	88	43	258

Tab. 3: The field in which the students currently work does not depend on their gender

The statistical value for Tab. 4, which is 5.90, is lower than the critical value of chi-square of 3 degrees of freedom at 0.95 level (7.81). Null hypothesis H04 cannot therefore be rejected. Similarly, no relation was established between the field in which the students want to work after completing their studies and gender (Tab. 4). It is possible to note that in case of future field of employment, there is more of a shift towards commercial activities, management, marketing, banking, insurance, taxes and accounting. This fact corresponds to a research conducted by Sperling (2008), who deals with differences in employment of graduates of Bachelor's degree programmes in relation to industry and asserts that after completion of their studies many graduates find employment in IT, telecommunications, financial services, mass media, tourism, hospitality or manufacturing industry.

Gender	Banking, insurance, taxes, accounting, audit	Tourism, hotel industry gastronomy	IT, telecommunications, industry	Commerce, management, marketing, PR	Total
Male	24	6	18	45	93
Female	42	24	19	80	165
Total	66	30	37	125	258

Tab. 4: The field in which the students want to work after finishing their studies does not depend on their gender

Based on the above it is possible to assert that most students are aware of the importance of finding employment opportunities already during their university studies and that they target the field in which they would like to work after completing their studies. This is fully consistent with the findings of a REFLEX 2010 survey according to which 66% of graduates of Bachelor's degree programmes in economic fields of study hold managerial positions within 5 years of completion of their studies, while for other graduates this figure is only 37% (Ryška and Zelenka, 2011).

Conclusion

The results of this study have shown that majority of full-time students of the Bachelor's programme of Economics and Management at FEM CULS perform some type of job already during their studies and that they are aware of how important it is to gain practical experience during their theoretical preparation. The study has shown that there is a statistical correlation between gender of the students and the type of their employment during studies and between the field in which the students work while studying and the field in which they would like to work after finishing their studies.

The practical contribution of this paper is the presentation of the results of the survey among full-time students (n=258) of the EM Bachelor's degree programme at FEM CULS on their current and future employment.

The limiting factor of this paper may be the fact that the survey has been conducted only among students of one economic field of study. The survey should be conducted

also among Bachelor's programme students of other fields of study at FEM CULS. The survey is also supposed to be repeated in future years in order that it is possible to draw comparisons between results obtained in different time.

Acknowledgements

This contribution is a follow-up to the project of University – wide internal grant agency (CIGA), number 20141002 - Human resource branding using of the new strategic trends in organizations in the Czech Republic.

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EVALUATION OF PREFERENCES OF STUDENTS IN A DISTANCE UNIVERSITY PROGRAM

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Abstract

This article aims to present information obtained from a research project to evaluate preferences of students in a university distance program concerning various methods of teaching and their satisfaction with the Moodle learning management system used by the school. The primary data used in the study was obtained as part of a quantitative research project carried out using a questionnaire (n=134) given to students in the Czech University of Life Sciences distance program. The results show 61.9% of students who took part in the survey are satisfied with their combined form of study, and 49.3% make active use of the Moodle system in their studies — almost daily and in all subjects studied during the year.

Keywords

Distance learning, e-learning, Moodle, research, student

Introduction

The rapid pace of economic and political change, the dynamic development of technology, the growth in information, education, knowledge, science and rapidly changing lifestyles influence the life preferences and attitudes of people in all areas in which they are active (Urbancová, 2010). Every sector of the economy places extraordinary demands upon employees who must be developed, supported and maintained by lifelong education (Navratilová and Romanová, 2014). Human capital is the human factor in a firm or organization. It represents a combination of intelligence, skills, and experience, "the human element" - individuals capable of learning, changing, innovating, and making a creative effort (Bontis et al, 1999).

King et al. (2001) say "Distance learning improved capabilities in knowledge and/or behaviours as a result of mediated experiences that are constrained by time and/or distance such that the learner does not share the same situation with what is being learned."

Moore and Kearsley (2011) define it thus: "Distance education is teaching and planed learning in which teaching normally occurs in a different place from learning, requiring communication through technologies as well as specific institutional organisation."

Beldarrain (2007) states that current trends in distant learning are characterized by a shift of pedagogical views and theoretical frameworks for interaction with students and emphasises the importance of new tools being applied in this area.

Romero, Ventura and García (2008) point out a newly emerging discipline – Educational Data Mining – that relates to the development of methods to research unique types of data generated in the area education. Their case study focuses on the application of Moodle.

Furthermore, Koole, McQuilkin and Ally (2010) focus research on usability, education and social interaction as present in a mobile approach to online study materials in Canada, and deal with the level of flexibility of mobile technology and the related quality of interaction for distance students.

Studies by Badge, Cann and Scott (2005) point out the danger of using Moodle as electronic data storage rather than an online learning tool. They state that teachers should pay appropriate attention to make sure the system is being used effectively in the learning process. To summarize, these researchers think that using Moodle as an online learning tool is an advantage, however, there must be security for the data stored. Kucirkova, Kucera and Vydrova (2012) showed no statistically significant difference between the academic results of students studying on-site and those utilizing e-learning.

This allows us to say making use of Moodle.czu.cz for learning is beneficial, even though student educational preferences and preferences for system utility and social interaction may differ.

Therefore, the aim of this paper is to present the results of a research project involving students in the Czech University of Life Sciences (hereafter CULS) distance learning program, who indicated their preferences for various methods of teaching and their satisfaction with the school's Moodle learning management system.

It comprises an Introduction, which describes current views on the issue, followed by a Materials and Methods section, which describes how the research was carried out. The final section presents the results and discusses them in the context of similar studies.

Materials and Methods

The theoretical background for this study was collected from analysing secondary sources in the form of research papers, journals and official websites. The primary data came from the author's research.

The questionnaire was sent out electronically during the winter semester of 2014/2015 and targeted students enrolled in the distance master's program in the lifelong education program of the Faculty of Economy and Management of the Czech University of Life Sciences in Prague. Respondents (n=134) were selected on a non-random basis. Their basic characteristics are as follows:

- From the point of view of individual sectors, three-quarters (101) of the targeted students were employed in the tertiary sector. Twenty percent of respondents (27) operate in the secondary sector as part of their job description and 4.5% in the primary sector.
- Based upon the size of companies in which the students work, 35.8% (48) of the respondents work in small organizations (up to 50 employees). Midsize companies (51 – 249 employees) employ 31.3% (42 respondents) and large companies over 250 employees 32.9% (44) of all students who took part in the survey.
- As regards the ownership of organizations that employ the distance students, most students indicated these companies were Czech (78.4%, 105 students). 21.6% (29) respondents indicated a majority foreigner share in the organizations where they work.
- Companies in which the targeted students are employed are mostly headquartered in the Olomouc Region (21.6%), in the Capital City of Prague (15.7%), the Pilsen Region (15.7%) and the Hradec Králové Region (11.2%). The South Bohemia and Central Bohemia regions were each represented by approximately 7.5% and the Pardubice Region accounted for almost 7% of the total. Other regions were represented as follows: Vysočina 3.7%, Liberec and Moravian 3%, 2.3% Ústecký region. At least were represented Moravian-Silesian region and Zlín. These figures were definitely influenced by the location of individual lifelong education centres in individual regions of the Czech Republic.

- Regarding job description, most distance students 42.5% (57) did administrative work and 24.6% (33) held managerial posts. Roughly 20% of the respondents were specialists and 13% were technicians.
- The age structure of the respondents has been clearly laid out in the following Tab. 1 which depicts the absolute and relative frequency of the share of the individual respondent groups.

Age range	Absolutely	Relatively
18 – 25 years	27	20.1%
26 – 32 years	32	23.9%
33 – 40 years	32	23.9%
41 – 50 years	38	28.4%
51+ years	5	3.7%
Total	134	100.00%

Tab. 1: Respondent Age Structure; Source: own research

The results employ descriptive and inferential statistics. Descriptive statistics were used to calculate the dependencies of selected cells in contingency tables.

The purpose of the contingency table is to test the mutual independence of pairs of cells that may have only a small final number of values. In its simplest form, comparing only binary values, it is called a 2 x 2 table. The criterion tested is the sum of the normed differences of the marginal frequencies and their precalculated values. If there is no dependence, this sum will follow the asymptotic χ^2 distribution. The resulting value is then compared to the critical values for χ^2 (α) with (r-1)(s-1) degrees of freedom, where α is the required probability level of the test, r the number of rows, and s is the number of columns in the table (Hendl, 2009).

For a 2 x 2 table with only four marginal frequencies, the number of degrees of freedom is equal to 1 and the critical value for the 0.05 probability level is approximately 3.84. Dependency strength may be measured by a dependency coefficient. Here the Cramer coefficient was used (Hendl, 2009).

The following null hypotheses were tested:

- $H0_1$: The preferred manner of teaching does not depend upon the students' age.
- $H0_2$: The manner of using Moodle is not dependent upon the students' age.
- $H0_3$: The evaluation of the adequacy of the Moodle system does not depend upon the students' age.

The data was processed and subsequently using the Microsoft Excel table editor.

The following abbreviations are used: CULS = Czech University of Life Science, FEM = Faculty of Economics and Management.

Results and Discussion

The results show 77.6% of CULS distance study students are enrolled because of a personal need to learn. Only 9.7% indicated that increasing education and obtaining a degree was required by their employer. In these cases, the students were public employees (firefighters, police officers and civil servants). The research further focused on determining what form of teaching distance program students prefer. Dependencies between the qualitative features were also determined.

The designated hypotheses were tested using chi-square contingency tables. Because some classes of respondents were not numerous, they were merged into the corresponding row

of the table during the analysis. This concerns the age groups 41-50 years (30 persons) and the 51+ group (5 persons). One respondent indicated he was not using the Moodle system at all and he was included in the passive user group.
Tab. 2 shows the contact-free form of teaching ranked last in respondent preferences. The combination of contact and contact-free forms of study, preferred by almost two-thirds of the respondents, was designated most desirable.

	Contact teaching	Contact-free teaching	Combined teaching	Total
Absolute frequency	43	8	83	134
Relative frequency	32%	6%	62%	100%

Tab. 2: Preferred Teaching Method; Source: own research

32% of respondents prefer contact teaching, i.e., a direct tie to a teacher. Only 6% of persons or willing to study only via e-learning and other methods with no direct teacher contact.

Age	Contact method	Contact-free and combined method	Total
18 – 25 years	10	17	27
26 – 32 years	8	24	32
33 – 40 years	9	23	32
41+ years	16	27	43
Total	43	91	134

Tab. 3: Age and Preferred Teaching Method; Source: own research

Because the number of respondents who prefer contact-free teaching was very small, this group was merged with the group that prefers the combined method of teaching to research the dependency relationship due to age. Tab. 3 clearly shows that the contact form of teaching is preferred by most respondents aged 41 and older (37%) and 18 and 25 years (37%). The contact-free and combined method is preferred by most respondents aged 26 – 32 years (75%) and 33 – 40 years (72%). The statistical value of 1.79 is smaller than the critical value of 7.81. Therefore, $H0_1$ cannot be rejected.
It was not surprising, that the contact-free and combined methods of teaching were most preferred by the age groups 26-40. It can thus be deduced that those respondents prefer the contact-free and combined methods of teaching due to their jobs, the necessity to provide for their families, and a lack of time for full-time study. The dependence of preference teaching method on age noted above is below of statistical significance in the sample.

Age	Active use	Passive use or no use	Total
18 – 25 years	11	16	27
26 – 32 years	17	15	32
33 – 40 years	17	15	32
41+ years	21	22	43
Total	66	68	134

Tab. 4: Age and Manner of Moodle Use; Source: own research

Tab. 4 shows no significant difference between the manners of using Moodle by individual age groups exists. The only exception consists of distance students between 18 and 25 years of age. 16 of them indicated that they use the Moodle system passively or not at all, 11 persons use it actively. The statistical value of 1.17 is smaller than the critical value of 7.81. Therefore, $H0_2$ cannot be rejected.

Age	Sufficient	Insufficient	Total
18 – 25 years	21	6	27
26 – 32 years	31	1	32
33 – 40 years	26	6	32
41+ years	36	7	43
Total	114	20	134

Tab. 5: Age and Moodle Evaluation; Source: own research

The values indicated in Tab. 5 show most students in all age categories consider the Moodle system to be adequate. It is clear that the most positive reaction to the Moodle system comes from the 26-32 age category. This finding may be explained by the fact that most sufficient academic persons of this age have acquired sufficient study and professional experience in their lives to be capable of absorbing the current rapid tempo of PC and IT development. The statistical value of 5.72 is smaller than the critical value of 7.81. Therefore, $H0_3$ cannot be rejected.

Generally it may be said that 85.1% of students evaluate the Moodle system used at CULS as adequate for the needs of their studies and the opportunity for lifelong education to be entirely beneficial (94.8%).

Based upon the results determined and practical experience, it seems adequate study support has been created for all distance program subjects. But even the best materials available on Moodle will not increase distance program students' level of knowledge by themselves. Each person must approach the educational process actively and must be motivated (Urbancová, 2014). Without proper motivation and effort, the desired effect of increasing knowledge and skills, i.e. the development of human capital, cannot be attained, as has been confirmed in a study by Pilkova et al. (2013) and Stacho, Urbancová and Stachová (2013).

Conclusion

The results have shown students are satisfied with their opportunity to take part in distance study, in which they actively use the Moodle system. The system, they think, provides them sufficient information for their studies. But no statistically significant relationships between student preferences and the age group of the respondents were demonstrated.

On a practical level, the benefit provided by paper consists in the presentation of results obtained from researching the use of the Moodle system by university distance program students who fall into a higher age category and may encounter problems using the system. The paper's limits may include the small sample of respondents (n=134). However, because this is the first such sample selected and it is expected a study will be carried out using a larger sample of students, this selected set may be considered adequate. It is also expected the research will be expanded to include other interest areas, such as student satisfaction with the use of individual learning methods at CULS.

Acknowledgements

This contribution is a follow-up to the project of University – wide internal grant agency (CIGA), number 20141002 - Human resource branding using of the new strategic trends in organizations in the Czech Republic.

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ARE HEURISTIC STRATEGIES A DOMAIN ONLY FOR GIFTED PUPILS?

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Abstract

The paper describes results of a 16-month experiment whose main aim was to change pupils' ability to solve mathematical problems and their attitudes towards mathematics through the use of heuristic strategies. The attention in the paper is paid to pupils whose performance in mathematics is below average. The paper shows that these pupils can use successfully especially experimental strategies and strategies based on the use of graphical representation. However, if positive results are to be achieved, didactical situations must be modified in a suitable way.

Keywords

Culture of problem solving, didactical situation, heuristic strategies, mathematics, problem solving

Introduction

The paper is one of the outcomes of the research project GA ČR P407/12/1939 *Developing culture of solving problems in school mathematics.* The research focused on the impact of solving problems using heuristic strategies on this culture. Heuristic strategies were understood in the sense of Polya (2004) and Schoenfeld (1992). The paper develops the results presented in the papers from the Proceedings of the ERIE conferences and ERIES journal. In the most recent ones Novotná, Eisenmann and Přibyl (2014) describe the results of a 4-month experiment whose main aim was to change pupils' culture of problem solving via the use of heuristic strategies, further elaborated in (Novotná et al., 2014) and (Novotná, Eisenmann and Přibyl, 2015). Bureš and Nováková (2015) focus on implementation of heuristic strategies in class preceded by a detailed a priori analysis and followed by an a posteriori analysis and compare the teacher's expectations and the reality in the class. Přibyl and Eisenmann (2014) give a detailed account of the heuristic strategies used in a long-term 16-month experiment. Barak (2013) presents the results of a 2-year research focusing on impacts of pupils' transition from systematic searching to heuristic problem solving. He shows that engaging pupils in challenging tasks and open-ended projects, encouraging them to develop their ideas, fosters their creativity and problem-solving capabilities. While Barak does not focus on one particular group of pupils with respect to their level of mathematics, in this paper we focus on the use of heuristic strategies by below average pupils.

The research was conducted in the theoretical framework of the Theory of Didactical Situations in Mathematics (TDSM) described in (Brousseau, 1997, 2012). Let us start this paper by presenting the key concepts needed for interpretation and explanation of results of the teaching experiment.

Mathematical didactical situation

A *situation* is a system entered by a teacher, pupil, environment, rules and regulations needed for the creation of a particular item of knowledge (Brousseau, 1997, 2012;

Nováková, 2013). By a *mathematical situation* we understand a situation that emerges in a mathematics lesson.

We distinguish between two types of mathematics situations: a *non-didactical situation* is a situation whose intention is not to educate. The aim of any *didactical situation* is "to teach somebody something". The teacher organizes a plan of activities whose goal is to modify or build a pupil's knowledge.

According to TDSM, each mathematical didactical situation should involve at least one *a-didactical situation,* i.e. a situation that enables pupils to gain new knowledge individually, independently on any explicit teacher's intervention. *Devolution* is the process by which the teacher manages to put the pupil in the position of being a simple actor in an a-didactical situation. The goal of *a-didactical situation* is to enable the pupil to acquire new knowledge on their own (*devolution*). These new items of knowledge are then summarized and developed by the teacher to become part of the pupil's knowledge structure (*institutionalization*).

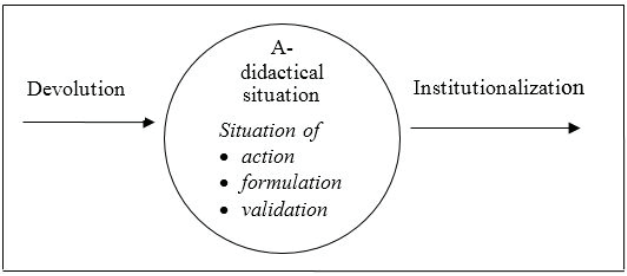

Fig. 1: Scheme of a didactical situation (Nováková, 2013)

An *a-didactical situation* consists of three types of situations:

- *Situation of action* – the outcome is the anticipated (implicit) model, strategy, initial tactics.
- *Situation of formulation* – formulation of the initial strategy and conditions under which the strategy will work.
- *Situation of validation* – checking validity of the strategy.

The sequence of these situations is not rigid, it should constitute the process of learning some mathematical knowledge. The scheme of a didactical situation is shown in Fig. 1.

A teacher has two main tasks in the learning process. The first one is he/she must arrange the process of *devolution.* In this the teacher hands over part of the responsibility for the teaching/learning process to the pupil who accepts it. Devolution is prerequisite to an *a-didactical situation*. The other teacher's task is *institutionalization* of the new knowledge. By *institutionalization* we mean the process in which the teacher collects the isolated items of knowledge discovered by the pupils and transfers them into some knowledge structure, into knowledge a pupil will be able to utilize when solving new problems. *Institutionalization* follows an *a-didactical situation.*

Culture of Problem Solving

In order to be able to describe a pupil's ability to learn heuristic strategies, we introduced the so called Culture of Problem Solving (CPS) construct. In our research we focused on four components: Intelligence, Creativity, Reading comprehension and Ability to use the existing knowledge in mathematics. Let us briefly describe the individual components of CPS.

All the pupils were tested before and after the teaching experiment, with the exception of the intelligence test which was administered only at the beginning of the experiment. The first three components of CPS were assessed by a psychologist, the last component was assessed on the basis of a set of problems developed by the research team.

Pupils' intelligence was tested by the Váňa´s intelligence test. This test was selected because of its verified correlation with pupils' school performance. It is a verbal intelligence test suitable especially for group testing. It is used for assessment of the level of development of cognitive abilities of individuals, especially in research situations which require collection of basic data about pupils.

Pupils' ability to read with comprehension is one of the key competences for successful problem solving. The pupils were set a short text (one paragraph) which they were asked to summarize in four lines without changing the meaning and content. The pupils' text was assessed on the scale 1 – 5, where 1 was the best and 5 the lowest result.

Creativity was understood in the context of divergent thinking. Its level was measured using Christensen – Guilford (Kline, 2000: 479) test that measures four dimensions:

- Fluency – how many relevant uses the pupil proposes
- Originality – how unusual these uses are
- Flexibility – how many areas the answers refer to
- Elaboration – quality and number of details in the answer

The pupils proposed as many 'uses of common objects' as possible. What is important here is how logical and practicable the answers were. Qualitative evaluation of each dimension was translated into points and the total score indicating an index of creativity. The higher the index, the more creative the pupil is proposed to be.

The pupils' ability to use their existing knowledge was considered prerequisite to successful solution of non-routine problems. It was assessed on the basis of a set of problems developed by the research team. Dyads of problems were used for this written testing – the first problem to find out whether a pupil has a particular piece of knowledge and the other to find whether the pupil can use or apply it.

Example of a dyad:

a) Solve the equation: $6x + 4x + 2x = 18$.

b) There are three vessels of water. Each of them has a different volume and in total they contain 19.5 litres of water. The largest vessel contains twice as much water as the medium one and the medium vessel contains four times more water than the smallest one. How many litres of water are in each of the vessels?

Before the beginning and after the experiment the pupils sat tests consisting of four such dyads. The problems in the initial and the final tests were different. They tested the presence (the first problem in the dyad) and the ability to use (the second problem in the dyad) of knowledge the pupils were expected to have learned in the period of six months before sitting the test.

The testing of CPS was supplemented by structured interviews with participating teachers (30 questions). The interview took about two hours. The questions related to the following four areas: relationship to problems (pupils' and the teacher's), changes in pupils, changes in the teacher, opinions on individual strategies. The interviews were recorded, transcribed and the protocol was then evaluated.

Apart from the initial and final testing of CPS, also the success rate of pupils in problem solving was studied. The pupils sat a test at the beginning and at the end of the teaching experiment. The test consisted of eight problems. The problems were chosen after a multistage pre-test so that the problems that could be most efficiently solved by one of

the explicitly taught strategies were selected. The problems in the initial and the final tests were identical.

Materials and Methods

The long-term experiment was conducted in four classes from four secondary schools in the Czech Republic from September 2012 to February 2014 with 68 pupils aged between 12 – 18 years: A – Secondary school Gymnázium, Prague, 20 pupils aged 16-18, B – Secondary School Gymnázium Hořovice, 24 pupils aged 12-14, C – Basic school, Ústí nad Labem, 18 pupils aged 14-16 let, D – Basic School, Prague, 8 pupils aged 14-16.
Classes A, B and D were general, comprehensive classes, class C was a class with focus on mathematics education. Classes A, B and C were classes attended by above average pupils, class D deeply below average. All four teachers can be described as engaged teachers who invest a lot of energy into their teaching, and attended in-service teacher training courses.
In this paper the attention is paid to class D. According to the teacher, class D was made up of pupils with below average level in understanding mathematics and in solving mathematics problems. The experiment was conducted in two subsequent school years during which the composition of the class changed considerably: many pupils when moving from grade 8 to grade 9 either were moved to the "better" (i.e. higher performing groups), others left the school. In consequence, only 8 pupils were involved in the experiment from the beginning until its end. Therefore all the below presented results are the results of only these 8 pupils.
The long-term experiment was organized in a way that would respect organization of didactical situations according to TDSM. *Devolution* was preceded by a very detailed a priori analysis of the problems (Nováková, 2013). *Devolution* took place once, at the beginning of the experiment when the teacher used one example to demonstrate what she expected of the pupils. Further in the experiment the teacher only gave the assignments of the problem the pupils were expected to solve. This was followed by an *a-didactical situation* in which pupils tried to solve the problem using a strategy they had selected. The form of the situation of action was not prescribed, the pupils were allowed to work on their own or in groups. It was crucial that the teacher should not intervene at this stage. The situations of formulation and validation were organized as a whole class activity: individual pupils were presenting their solving strategies and results and discussed them. If the pupils omitted some of the suitable solving strategies, the teacher first encouraged them to look for other possible solving strategies and if the pupils still did not find it, the teacher presented it. *Institutionalization* usually did not take place immediately after the activity. Most often it came in subsequent teaching units while looking and finding strategies applicable for solution of a different problem.

Results and Discussion

CPS in class D

In Tab. 1 we present the scores in Váňa's test of intelligence (VIT) not only in class D but also in other classes to allow comparison of the achieved scores. The other CPS indicators are presented exclusively for class D.

	Class	Range	Average
Váňa´s test of intelligence	D	79 – 113	97,63
	A	109 – 141	121
	B	100 – 145	129
	C	90 – 125	106

Tab. 1: VIT results in all three participating classes

In Tab. 2 we present the results of testing reading with comprehension and creativity.

Classroom D	Beginning of the experiment		End of the experiment	
	Range	Average	Range	Average
Reading with comprehension	1 - 5	2,75	2 - 4	3,13
Creativity	9 - 27	17,25	17 - 32	20,5

Tab. 2: Results of testing Reading with comprehension and Creativity in classroom D

The fourth indicator is the ability to use the existing knowledge. Here the pupils were solving 4 pairs of dyads. The following three cases were considered:

- The pupil has the needed knowledge and can use it (code AA).
- The pupil has the needed knowledge but cannot use it (code AN).
- The pupil does not have the needed knowledge (code NA or NN).

The code AA describes the best performance, the poorest result is coded as AN. With respect to our experiment pupils coded as NA and NN are not relevant.
In the group of pupils who have the needed knowledge, at the beginning of the experiment 40% were coded AA and 60% AN, while at the end 50% were coded AA and 50% AN.
The overall scores in CPS correspond to the teacher's assessment of the class as a class of pupils with average or below average mathematics abilities.

The changes observed at the end of the experiment

Tab. 3 presents the changes in the success rate in problem solving in class D. The values express the proportion of correctly solved problems out of all problems solved by the pupils.

	The value at the beginning of the experiment	The value at the end of the experiment
Success rate in problem solving	21%	35%
The frequency of cases when the pupil wrote nothing	38%	25%

Tab. 3: Changes in success rate in problem solving in class D

Tab. 4 shows the changes in the frequency of the use of those heuristic strategies that pupils in class D selected. The numbers give the number of problems in which the strategy was used, the number in brackets give the number of problems solved correctly using this strategy.

	The value at the beginning of the experiment	The value at the end of the experiment
Heuristic strategies in total	1 (1)	5 (4)
Systematic experimenting	0 (0)	4 (3)
Guess – check – revise	1 (1)	1 (1)

Tab. 4: Changes in the use of heuristic strategies in class D

We can observe a slight increase in the number of problems solved by the listed heuristic strategies. Other strategies (see Přibyl and Eisenmann, 2014) were not used by the pupils in this class.

The strategies Systematic experimenting and Guess – check – revise are experimental. These, together with the strategy Working backwards, were used spontaneously even before the teaching experiment. However, the pupils in class D used the strategy Working backwards neither before, nor after the teaching experiment. We could observe an increase in the use of Systematic experimenting in this class. This was the strategy the pupils found easiest to learn to use actively. Moreover, when using this strategy the pupils were mostly successful.

When comparing our results with existing literature focusing on the use of heuristic strategies, authors do not tend to focus on the benefits of these strategies for weaker pupils, they usually focus on the advantages of their use for the transition between arithmetic and algebra; e.g. Filloy and Rojano (1989: 19) state that 'Recent researches have pointed to certain conceptual and/or symbolic changes which mark a difference between arithmetical and algebraic thought in the individual.' Our research shows the importance of heuristic strategies for the development of understanding mathematics by weaker pupils.

Findings from a structured interview with the teacher of class D

Work with problems developing the ability to use heuristic strategy was included in the lessons in different organizations of *a-didactical situations,* e.g. as warm-up activities or a whole lesson activity – in that case the pupils were told. During the long-term experiment, the teacher decided to change the organization form of work: in January 2014 she introduced work in groups of three. This lead to elimination of the feelings of frustration and hopelessness when the pupils, when working individually, usually had failed to solve the problem. Pupils also tended to think and experiment more if they were working with unusual materials, e.g. they found writing on large sheets of wrapping paper, using markers and highlighters etc. much more enjoyable than work on traditional A4 sheets of paper.

The teacher finds problems that can be solved using a particular heuristic strategy interesting but extremely difficult for poorer performers. Nevertheless, she is convinced that the chance to try to use heuristic strategies, especially experimental strategies is beneficial to all pupils. However, it takes long before poorer pupils are able to use them successfully.

She could observe a change in the pupils. They stopped being afraid to experiment, especially when working in groups. They stopped giving up work if they did not see the solving procedure at once. They did not like failing again and again. But thy appreciated group work, they learned to cooperate. Their attitude to mathematics improved. They also started to pay more attention to feedback – they verified the result. Their ability to communicate with the others and to record their solution also improved.

Conclusion

Sarrazy and Novotná (2013) consider the following questions as key questions of mathematics education: Should the teacher direct his/her teaching towards good mastery of algorithms or towards development of pupils' creativity? Should all pupils or only above average performers be given the opportunity to work creatively?

The here presented experiment showed one of the ways that enables development of the ability to solve problems by pupils of all levels, which in consequence improves their attitude to mathematics. The results show that indicators of CPS have improved even in case of below average pupils, although only moderately. A change in pupils' attitude requires a lot of teacher's patience. The teacher of class D was forced to proceed at a very slow pace, often going back to problems already worked with one or more times. She paid a lot of attention to how to work with her pupils in a beneficial way. This resulted in her decision to organize the problem-solving lessons in a new way – pupils worked in groups of 3 or 4 (the 8 pupils involved in the whole experiment in the groups with other classmates). This was followed by presentations of individual group results and the whole class discussion. This organization lead to higher pupils' engagement and their effort to find a solution, which resulted in the growth in some indicators of CPS.

In the paper the attention was paid to work with below average pupils. A question open for further research is the impact of the manner of presentation of and work on the problems, e.g. use of ICT on a pupil's choice of the solving strategy.

Acknowledgement

The research was supported by Czech Science Foundation project P407/12/1939.

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DETERMINING LEARNING TYPES IN UNIVERSITY GERMAN LANGUAGE COURSES

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Abstract

Increasingly more emphasis is placed on individual responsibility for one's studies and capability of long-term education, which can be achieved by autonomous learning only. In order to enhance such autonomy in learners, it is necessary to pay attention to learning how to learn as well.

The paper deals with the research whether there are distinctive learning types among learners of German language courses at a university level. Based on a learning type questionnaire, the paper compares different activities leading to learning the German language by pre-intermediate and intermediate learners and analyses the activities in terms of the most common classification of learning styles distinguishing visual, auditory and haptic learners.

Keywords

Autonomous learning, learning strategy, learning style, learning type

Introduction

The concept of autonomy in foreign language teaching was developing for a long time and since the turn of the twentieth and twenty-first century effort to make foreign language teaching even more effective has increased. Despite the effort, the Common European Framework of Reference for languages (hereafter CEFR), created by the Council of Europe, did not discover more than what had already been defined by Comenius and his didactic principles (Mareš, 1998). A framework curriculum of teaching German at colleges and universities which evolved from a European project "Curricula und ein Lehrwerk für den studienbegleitenden Deutschunterricht an Universitäten" implemented between 1999 and 2009 (Lévy-Hillerich and Serena, 2009) defines these principles as didactic-methodological pedagogic principles that determine both aims and tasks of German language classes, their content, methods, examination and evaluation. The principles further stress communicative and practical orientation at a student, intercultural aspects together with specialist and professional orientation and development of autonomous ways of study. Particular examples of different learning techniques and the opportunity to test them in order to determine own learning type can be found in all curricula for specialist language preparation (Benišková-Schulze et al., 2002).

Autonomous learning can be understood as a type of learning making maximum use of creativity as students' greatest potential, emphasising their own responsibility for a learning process, freedom, independent decision-making, independence while respecting other students' opinions including those of a teacher, i.e. developing an ability to cooperate, not only the ability of self-reflection and self-realisation (Bimmel and Rampillon, 2000). Such autonomous approach is widely supported by the CEFR and European language Portfolio (hereafter ELP). A successful learning process is a joint success of a teacher

and student's interaction where the teacher acts as a facilitator, advisor and director of a pedagogical process whereas the student is a listener, co-worker, imitator, explorer, researcher, applicant and presenter (Neuner, 2003). The teacher, however, is not a sole source of cognition. Successful implementation of autonomous learning also requires psychological and social prerequisites such as group climate, environment, surroundings and social situations, learning concept and examination and evaluation methods (Tönshoff, 2004). Teaching styles need to be flexibly modified and adapted to learning styles. Both styles – that of a teacher and that of a learner – should create the state of equilibrium (Tandlichová, 2004). This can be achieved by balanced combinations of teaching and learning. Therefore, the enhancement of learning strategies should be integrated into teaching (Neuner, 2003).

Fortunately, a present-day education system is beginning to recognize individual teaching styles and take into account individual learning styles which are diagnosed by experts, psychologists or at least intuitively by teachers themselves. There are numerous learning style theories and models (Cassidy, 2004, Hawk and Shaw, 2007); one of the most widely spread differentiations, based on Neil D. Fleming's Visual, Auditory and Kinaesthetic (VAK) learning style model, distinguishes visual, auditory and kinaesthetic learners (Gilakjani, 2012, Jurickova, 2013). Kinaesthetic learners, together with tactile learners are often regarded as haptic learners (Mareš, 1998).

The present paper focuses on different learning styles in learning German as a specialist foreign language at a university level. The research, which was performed on a relatively small group of 69 German language learners, was primarily conceived as qualitative. The researched group consisted of less advanced, pre-intermediate and more advanced, intermediate German language learners who were asked to complete a short questionnaire containing activities that helped determine learners' learning types. Based on the learners' evaluation of the activities, the paper aims to determine the learners' prevalent learning types and offer possible implications for both learning and teaching process and, in conclusion, areas of further research.

Materials and Methods

Our present study stems from our previous research in which we concentrated on students' learning strategies and their awareness of the academic European language portfolio (academic ELP). Using questionnaires that we adopted from the chapter "Learning how to learn" in the academic ELP we first conducted a survey focusing on learners' knowledge of the academic ELP (Odstrčilová and Jarkovská, 2013). In the second survey we concentrated on learners' use of learning strategies, both general and particular learning activities including team and individual work and, last but not least, on learners' approach and motivation to a learning process (Odstrčilová and Jarkovská, 2014). The findings of the research revealed that the students who took part in both our previous surveys would welcome tests or questionnaires that would help them determine their own learning type. We therefore decided to extend our research, this time with focus on learning types or, learning styles. Since the research was to be performed on learners of German language, a "Lerntyptest" (learning type test) was adopted from the Framework Curriculum of teaching German to college and university students in the Czech Republic and Slovakia (Benišková-Schulze et al., 2002) and used as a questionnaire. As the questionnaire was written in a target language - German, learners were presented with hard copies of the questionnaire in German while both German version and its Czech translation were also available as PDF files in learning online support LMS Moodle and learners could use

them for double check.
Our current research was performed at the beginning of the spring semester 2014/2015 at the Czech University of Life Sciences Prague (hereafter CULS Prague) on learners of the German language at the CEFR levels A2 (less advanced, pre-intermediate learners) and B1 (more advanced, intermediate learners) respectively. It concerned students of CULS Prague Bachelor programmes in present-day form of study who selected their German specialist language course as a part of their compulsory curricula. It amounted to 69 full-time students with 33 on the CEFR A2 level and 36 on B1 level. Apart from this, we also addressed 5 students in combined form of study who took a German specialist language course at the CEFR level B2. Figure 1 shows the English version of the questionnaire for the purpose of the article.

LEARNING TYPE QUESTIONNAIRE

Circle the answer most appropriate for you: 1 poorly, 2 average, 3 well, 4 very well. **Where necessary, add comments.**

I learn and remember a foreign language by:

1.	listening to dialogues, texts, etc. in a foreign language	1 2 3 4
2.	quiet reading words, texts etc.	1 2 3 4
3.	reading and pronouncing aloud words, texts, etc. that I read	1 2 3 4
4.	taking notes while listening to texts	1 2 3 4
5.	underlying words or text and/or of making notes from the text I read	1 2 3 4
6.	reading words or text while simultaneously hearing it	1 2 3 4
7.	seeing the text transcript while listening to it	1 2 3 4
8.	putting to practice what I have just learnt	1 2 3 4
9.	keeping files or cards with new words or phrases written on	1 2 3 4
10.	making my own files or cards with new words	1 2 3 4
11.	watching films in a foreign language	1 2 3 4
12.	taking notes while watching films in a foreign language	1 2 3 4
13.	having someone explain or describe the meaning of new words or expressions	1 2 3 4
14.	cooperating in class with others, by team or pair work or by learning at home with another person	1 2 3 4
15.	applying what I learned to a game	1 2 3 4
16.	applying what I learned to contact with German native speakers	1 2 3 4
17.	add your own comment	1 2 3 4

Fig. 1: "Lerntyptest" – Learning type questionnaire (source: Benišková-Schulze et al., 2002, authors' translation from German into English)

The aim of the questionnaire was to find out learning types, or styles of the learners, i.e. what ways of learning a foreign language they preferred and to what degree. The questionnaire consisted of 16 items (activities) that the learners were supposed to mark on the scale of grades from 1 to 4, with 1 being the lowest grade and 4 the highest. The learners were supposed to circle an appropriate grade for each activity. The learners were also encouraged to add their own comments and/or explanations where necessary. The last item on the questionnaire was an open question. The activity was conceived as a home

assignment.
In all, 74 learners took part, with 69 amounting to present-day form of study and 5 to combined form of study only. Due to such disproportion in number, a more detailed analysis was performed on full-time students' answers only while the answers of the combined form of study students were assessed in a verbal commentary. Another reason for the exclusion of the combined form of study learners is the fact that they did not submit complete questionnaires as such, but they merely discussed their opinions on the activities covered by the questionnaire during their German language study block. While present-form of study respondents were asked to submit their completed questionnaires as part of their home assignment. The submitted answers were then analysed and, based on a number of gained points for particular activities in the questionnaire, learning types were discussed. We used the classification of learning types into visual applying mainly vision, auditory learners applying mainly hearing and haptic applying mainly the sense of touch, trial and understanding (Hawk and Shah, 2007).
As for the difference between learning styles and learning types, suffice it to say that both expressions are used interchangeably, the expression "learning style" preferred over the other. In German theoretical works, however, the expression "learning type" exceeds over the former (Bimmel and Rampillon, 2000). Since the target language of our questionnaire was German, we are inclined to the use of "learning types" rather than "styles" in this short study.

Results and Discussion

Of 69 full-time study students, we received completed questionnaires from 33 learners of German on the CEFR A2 level and 36 on B1 level. After receiving all completed questionnaires we proceeded to another step which was the calculation of individual grades that the learners selected from the scale given for each activity on the questionnaire. Table 1 presents scores that each activity on the questionnaire received in total regardless of the CEFR levels of the respondents (Tab. 1). Table 2 presents scores with regard to the respondents' CEFR levels (Tab. 2). The activities were ordered from the highest score to the lowest based on the number of points they received in total. Percentages were rounded up to the second digit.
Of the total score awarded (2,959 = 100%), the highest number of points and thus the most evaluated score was 244 (7.8%) and the least evaluated was 147 (4.7%). The learners thus evaluated the highest practice with German native speakers and the least taking notes while watching a movie. If we break the score down according to the respondents' CEFR levels (see Tab. 2), we will see that the practice with native speakers was mainly appreciated by the learners on the level B1 where it amounted to 212 (12.81%) out of 1,654 (100%) points gained from B1 learners for whom this was the most highly evaluated activity in the questionnaire.

Learning a foreign language by	Total	
applying what I learned to contact with German native speakers	244	7.8%
quiet reading of words, texts etc.	227	7.3%
putting to practice what I have just learnt	223	7.1%
seeing the text transcript while listening to it	211	6.7%
loud reading and pronouncing of words, texts, etc.	203	6.5%
reading words or text while simultaneously hearing it	202	6.5%
listening to dialogues, texts, etc. in a foreign language	209	6.7%
applying what I learned to a game	201	6.4%
by having someone explain or describe the meaning of new words or expressions	199	6.4%
watching films in a foreign language	192	6.1%
making my own files or cards with new words	192	6.1%
cooperating with classmates, in team or pair work or by learning at home with another person	180	5.8%
underlying words or text and/or making notes from the text I read	179	5.7%
taking notes while listening to texts	167	5.3%
keeping files or cards with new words or phrases	150	4.8%
taking notes while watching films in a foreign language	147	4.7%
Total	2,959	100%

Tab. 1: Scores received in total

Learning a foreign language by	CEFR level A2		CEFR level B1	
applying what I learned to contact with German native speakers	32	2.45%	212	12.81%
quiet reading of words, texts etc.	99	7.59%	128	7.74%
putting to practice what I have just learnt	111	8.51%	112	6.77%
seeing the text transcript while listening to it	99	7.59%	112	6.77%
loud reading and pronouncing of words, texts, etc.	98	7.51%	105	6.35%
reading words or text while simultaneously hearing it	100	7.66%	102	6.17%
listening to dialogues, texts, etc. in a foreign language	100	7.66%	109	6.59%
applying what I learned to a game	100	7.66%	101	6.11%
having someone explain or describe the meaning of new words or expressions	100	7.66%	99	5.99%
watching films in a foreign language	82	6.29%	110	6.65%
making my own files or cards with new words	91	6.97%	101	6.11%
cooperating in class with others, in team or pair work or by learning at home with another person	81	6.21%	99	5.99%
underlying words or text and/or making notes from the text I read	100	7.66%	79	4.77%
keeping files or cards with new words or phrases	60	4.60%	90	5.44%
taking notes while watching films in a foreign language	52	3.98%	95	5.74%
Total	1,305	100%	1,654	100%

Tab. 2: Scores received with regard to the CEFR levels A2 and B1

In contrast, A2 learners gave the practice with native speakers the least score, only 32 points (2.45%) out of the total 1,305 (100%). Such result is rather unsurprising. Less

advanced speakers usually fear conversation with native speakers of the target language as they are not as advanced to follow it and their insufficient skills in the target language prevent them from speaking with native speakers. Although speaking with German native speakers was perceived as the most threatening and least evaluated activity, applying to practice what they have just learnt was the most highly scored activity (111) among the A2 learners. This was explained by their appreciation of communication and practice in class. Also for the B1 learners applying to practice what they have just learnt was one of the most highly evaluated activities (112), sharing the third highest score with seeing the transcript while listening (112), which the respondents explained as reading subtitles while watching a German movie or reading the text of a song while listening to music.

What is also of significance is the fact that less advanced, A2 learners welcomed the help of their teacher and appreciated face-to-face, contact classes (7.66%); having someone explain or describe the new meaning of words or expressions scored as the second most evaluated activity together with listening to dialogues or texts in German while simultaneously reading the texts and underling new words in the text or taking notes from the text. This shows that A2 learners as less advanced language users appreciate more traditional and diverse ways of learning the language both in an outside the classroom such as reading, taking notes, making their own word lists. They positively evaluate the classroom practice of all skills, reading, listening, writing and speaking.

In contrast, for B1 learners the above mentioned activities are not as important. Having someone explain or describe new words or expressions (5.99%) and underlining words in the text or making notes from the text (4.77%) ended on an imaginary bottom of the evaluated activities. This can be explained by higher self-efficiency of the more advanced learners to employ other means of learning and practising the language than those offered by a traditional classroom, which is further supported by their lower dependence on teacher's supervision or guidance.

Both groups were also encouraged to specify or comment their answers where they felt necessary, make their observations and add their own preferences which were not mentioned in the questionnaire. Those were usually particular modifications of the activities described in the questionnaire (e.g. communication with friends on Facebook, studying German at home with another sibling, watching German films with Czech subtitles, reading signs on goods, especially on food products, listening to German songs, etc.). In line with our above mentioned findings, it was mostly B1 learners who preferred communication with native speakers via social networks and highly evaluated computer games in German and work with multimedia. Online university support of language training in LMS Moodle, the use of different Internet learning materials (tests, quizzes found online) and electronic versions of ELP were appreciated by both groups, B1 and A2. However, these supporting activities did not prevail among combined form of study students, which would be expectant due to the lack or deficit of contact teaching hours. This was most probably caused by age category of the learners. It is usually younger students who like to work with digital media and who do not experience technical or user problems whereas for usually older combined form of study students this is a more common phenomenon, caused by their distaste or lack of trust to use such supporting methods. Their discussion about the activities mentioned in the questionnaire confirmed the point.

Neuner (2003) claims that rather than one learning style it is more likely a combination of different types with one or several being predominant over others. As Bimmel and Rampillon (2000) argue, also in our research the most efficient proved activities which

were combinations of more learning types. A clear favourite among them was a combined, interactive type, although very often at the hypothetical level only without being actually performed. While preparing for examination, classical learning types prevailed (learning from hard copy text books) however still in combination with visual and auditory types and with higher time dotation also haptic types.
The VAK model was used in the work of Gilakjani (2012) who researched visual, auditory and kinaesthetic learning styles of university students studying English as a foreign language (EFL). The research revealed that among the EFL students visual learners prevailed who also showed higher academic achievement than auditory or kinaesthetic ELF learners. If we compare the A2 and B1 German learners in our researched group, we will arrive at the conclusion that it was the A2 learners who preferred visual learning to auditory or kinaesthetic. This is supported by their preference for reading what they hear, taking their own notes and thus employing visual memory and reliance on what they visualise.
Our findings are based on too small a group to arrive at conclusive generalisations about German language learners. However, the findings imply that enhancing and developing all language skills - reading, listening, writing and speaking - through various forms of class activities under skilful guidance of a teacher – language instructor - is equally important especially in less advanced stages of foreign language acquisition.

Conclusion

The paper described research performed on a small sample of German language learners who were presented with a learning type questionnaire. The learners in question were present-day form of study Bachelor students at the CULS Prague. Their evaluation of the individual activities covered by the questionnaire showed that among the most common and also the most highly evaluated activities belong communication with native speakers, active practice in class, use of the online support such as LMS Moodle or the Internet, communication via social networks, watching movies in a foreign language but also more traditional activities such as reading books, taking notes or studying with another person. The analyses of individual questionnaires revealed that rather than having one distinctive learning style the learners shared a combination of several learning types.
Besides German, research on different learning types can be extended to other languages taught at the CULS Prague and, what is more, learning types can be compared with different learning strategies and methods. Such research is currently under way.

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ANALYSIS OF DIFFERENCES IN THE SCORES OF STUDENTS FROM DIFFERENT FACULTIES

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Abstract

The paper discusses the differences between the scores obtained by the students of basic mathematics course at the University of Economics in Prague and the authors focus on the differences between the scores of students of different faculties. The dataset contains scores of 2256 students who were enrolled in the course in the academic year 2013/2014. A two-way analysis of variance is used to analyse the differences between the groups of students. At first, the descriptive statistics are given together with a boxplot. Secondly, the violation of Gauss-Markov assumptions are discussed. Then, the analysis of variance with weighted least squares is conducted and results are presented. The possibility of using Box-Cox transformation for the response variable is also described, however due to fact that the sample size is large it does not yield to different results. At the end, the differences and practical implications are deducted.

Keywords

Analysis of variance, weighted least squares, linear regression, test in mathematics

Introduction

Each student of the University of Economics in Prague has to take a mathematics course as the basic concepts of linear algebra and mathematical analysis are needed in other courses throughout the rest of student's studies. The Department of Mathematics of Faculty of Informatics and Statistics offers the basic mathematics course in both, winter and summer semester and this course is compulsory for most of the study programmes. The syllabus of this course is identical to the textbook written by Klůfa (2013b). Beside this course, a similar course is offered in English for foreign exchange students. The latter course follows the textbook written by Klůfa and Kaspříková (2013).

Throughout the course, students have to sit a mid-term test which is worth 20 points, a final test which is worth 40 points and an oral examination worth 40 points. The final grade is calculated as a sum of the scores from the three abovementioned parts and in order to pass, student has to obtain at least 60 points. The scores of the enrolled students provide a lot of information to the staff of the department and may be further analysed in order to improve teaching and testing methods. Different statistical methods can be used for this analysis. Hypothesis testing can be used in analysing the dependence of student's performance on his demographic and behavioural traits (Kaspříková, 2012), while probability is used for analysing student's performance in (Klůfa, 2012) and (Klůfa, 2013a). The analysis of dependence of student's performance on his abilities by using latent variables framework can be found in (Kaspříková, 2013), while correlation between the test scores and areas covered in the test is discussed in (Kaspříková, 2011). Otavová and Sýkorová (2014) analyse the association between test scores in the mid-term and final test by using contingency table.

The purpose of this paper is to verify whether there exist differences in the scores for students of different faculties of the University of Economics and whether the scores are different in winter and summer term. As the instructors can easily verify students of which faculties are enrolled for their lecture or seminar, the results of this statistical analysis can be used for motivating students to study more, or in case that the majority of the students come from faculties which tend to have higher scores, the instructors may chose more difficult exercises to be done in the seminars. The analysis of variance will be applied to the dataset and statistical software R will be used for the analysis.

Materials and Methods

Data Description

The dataset contains information about 2256 students who took the course of Mathematics for Economists in the academic year 2013/2014. The dataset contains the score obtained in the mid-term test, the score obtained in the final test, the faculty to which the student belongs (Faculty of Finance and Accounting – F1, Faculty of International Relations – F2, Faculty of Business Administration – F3, Faculty of Informatics and Statistics – F4 and Faculty of Economics – F5) and the semester in which the student took the course. The sum of scores from both tests is considered as a continuous dependent variable and the other two variables, semester and faculty are considered as categorical factors. Table 1 shows the contingency table with number of observations, i.e. students, in each combination of categories while Table 2 shows treatment means.

		Faculty					Total
		F1	F2	F3	F4	F5	
Semester	Winter	244	310	227	534	3	1318
	Summer	284	382	179	89	4	938
Total		528	692	406	623	7	2256

Tab. 1: Contingency table of number of students in each treatment

		Faculty					Total
		F1	F2	F3	F4	F5	
Semester	Winter	42.39	36.95	38.92	33.16	23.33	36.73
	Summer	40.25	40.02	38.21	32.15	45.00	39.02
Total		41.24	38.65	38.61	33.02	35.71	37.68

Tab. 2: Treatment means

Statistical Analysis

The sum of points obtained from both tests is a continuous response variable, while the independent variables are categorical factors, therefore a two-way analysis of variance (ANOVA) is an appropriate method to analyse the differences between the groups, or treatments. The first factor, faculty, has 5 levels (F1, F2, F3, F4, F5), while the second factor, semester, has 2 levels (winter and summer), therefore 10 treatments, or groups are considered. Both of the factors are fixed factors, or fixed effects, as they are not a random sample from a greater population. For further information about difference between ANOVA with fixed effects, random effects and mixed effects see (Kutner et al, 2005) or (Sahai and Ageel, 2000).

As can be seen from Table 1, the number of observations in each treatment is not the

same, therefore a linear regression approach has to be used instead of the usual ANOVA approach based on between and within group variability. At first, the model with interaction is considered, which allows the effect of faculty to be different in each semester. The considered model is in the following form:

$$\begin{aligned} Y_{ijk} &= \lambda + \alpha_1 X_{ijk1} + \alpha_2 X_{ijk2} + \alpha_3 X_{ijk3} + \alpha_4 X_{ijk4} + \beta_1 X_{ijk5} + \\ &+ \gamma_1 X_{ijk1} X_{ijk5} + \gamma_2 X_{ijk2} X_{ijk5} + \gamma_3 X_{ijk3} X_{ijk5} + \gamma_4 X_{ijk4} X_{ijk5} + \varepsilon_{ijk}, \\ & i = 1,2,3,4,5; j = 1,2; k = 1,\ldots,n_{ij}, \end{aligned} \tag{1}$$

where:
Y_{ijk} is the number of points obtained by the *k*-th student from *i*-th faculty in *j*-th semester,
X_{ijk1} takes value of 1 if student is from the Faculty of Finance and Accounting, 0 otherwise,
X_{ijk2} takes value of 1 if student is from the Faculty of International Relations, 0 otherwise,
X_{ijk3} takes value of 1 if student is from the Faculty of Business Administration, 0 otherwise,
X_{ijk4} takes value of 1 if student is from the Faculty of Informatics and Statistics, 0 otherwise,
X_{ijk5} takes value of 1 if student took the course in winter semester, 0 if in the summer semester,
coefficients α_1, α_2, α_3, α_4 correspond to the effect of faculty,
coefficient β_1 corresponds to the effect of semester,
coefficients γ_1, γ_2, γ_3, γ_4 correspond to the interaction effect between semester and faculty,
λ is an intercept,
ε_{ijk} is the unexplained random error term,
and n_{ij} is the number of observations in treatment defined by *i*-th faculty and *j*-th semester.
In order to test the significance of interaction terms, a reduced model has to be built:

$$\begin{aligned} Y_{ijk} &= \lambda + \alpha_1 X_{ijk1} + \alpha_2 X_{ijk2} + \alpha_3 X_{ijk3} + \alpha_4 X_{ijk4} + \beta_1 X_{ijk5} + \varepsilon_{ijk}, \\ & i = 1,2,3,4,5; j = 1,2; k = 1,\ldots,n_{ij}. \end{aligned} \tag{2}$$

Then a partial F-test is performed:

$$\begin{aligned} &\mathrm{H}_0: \ \gamma_1 = \gamma_2 = \gamma_3 = \gamma_4 = 0, \\ &\mathrm{H}_a: \ \text{not all } {}_i \text{ are equal to 0}, \end{aligned} \tag{3}$$

$$F^* = \frac{\dfrac{SSE(2) - SSE(1)}{df_2 - df_1}}{\dfrac{SSE(1)}{df_1}}, \tag{4}$$

where:
SSE is the sum of squared errors from the model (1) or model (2), calculated by the following formula:

$$SSE = \sum_{i=1}^{5} \sum_{j=1}^{2} \sum_{k=1}^{n_{ij}} \left(Y_{ijk} - \hat{Y}_{ij.} \right)^2, \tag{5}$$

df is the number of degrees of freedom in the corresponding model calculated as the sample size (2256 students) minus the number of parameters in the model, $\hat{Y}_{ij.}$ in (5) is the fitted value estimated by the model.
F^* statistics defined in (4) follows Fischer-Snedecor distribution with corresponding

degrees of freedom: $F^* \sim F(df_2 - df_1; df_1)$. In case of one fails to reject the null hypothesis, the partial F-tests for significance of main effects of factors faculty and semester can be performed. Model (2) becomes the full model and the reduced models are built in the same way as in case of testing for the significance of interaction term, i.e. by omitting the terms and coefficients corresponding to the main effect tested. In this case type II sum of squares will be presented in the ANOVA table. On the other hand, if the interaction term is significant, i.e. the null hypothesis in (3) is rejected, the main effects should remain in the model even though they might be insignificant. In this case type III sum of squares should be used. For further discussion about the different types of sum of squares, i.e. different ways of specifying full and reduced models, see (Kutner et al, 2005). If all the coefficients in the model (1), turn out to be insignificant then there is no significant difference between the results of students from different faculties and in different semesters.

The regression model has to fulfil several assumptions so that the statistical inference is valid. The errors should be independent from each other, the variance should be the same in each treatment, the errors should come from the normal distribution and the mean of the errors should be zero. Apart from these assumptions, outliers should not be present in the dataset. For further details see (Kutner et al, 2005).

Results and Discussion

Descriptive Statistics

Table 3 shows the descriptive statistics for each of the treatments. One can see that the means are different in each group. The apparent problem is that the distribution of the scores in most of the treatments is negatively skewed as the median is higher than the mean of a treatment which is also discussed in (Otavová and Sýkorová, 2014). This usually yields to skewed errors in the regression model, which means that the errors in the model will not be normally distributed. This may then cause the statistical inference to be invalid.

A more severe problem is the presence of heteroscedasticity, i.e. the variances are not equal for each treatment. Table 4 below presents the results of Brown–Forsythe test for homogeneity of variances and it can be seen that the null hypothesis of homoscedasticity is rejected at 5% level of significance. This violation of the assumption of homoscedasticity can be solved by using weighted least squares, where the weight of an observation is set up to be the inverse of the variance of the treatment to which the observation belongs:

$$w_{ijk} = \frac{1}{s_{ij}^2}, \tag{6}$$

Faculty	Semester	Mean	Median	Min	Max	Standard deviation	Number of obs.
F1	Winter	42.39	44.00	8.00	60.00	11.47	244
	Summer	40.25	42.00	2.00	60.00	12.24	284
F2	Winter	36.95	39.00	0.00	60.00	13.34	310
	Summer	40.02	41.75	8.00	60.00	11.98	382
F3	Winter	38.92	40.00	0.00	60.00	12.52	227
	Summer	38.21	38.00	4.00	60.00	12.29	179
F4	Winter	33.16	34.50	0.00	60.00	13.72	534
	Summer	32.15	32.00	4.00	55.00	11.53	89
F5	Winter	23.33	25.00	8.00	37.00	14.57	3
	Summer	45.00	45.50	34.00	55.00	9.35	4

Tab. 3: Descriptive statistics for each treatment

	Df	F-value	P-value
Treatments	9	2.5008	0.008
	2246		

Tab. 4: Brown–Forsythe test for the homogeneity of variances

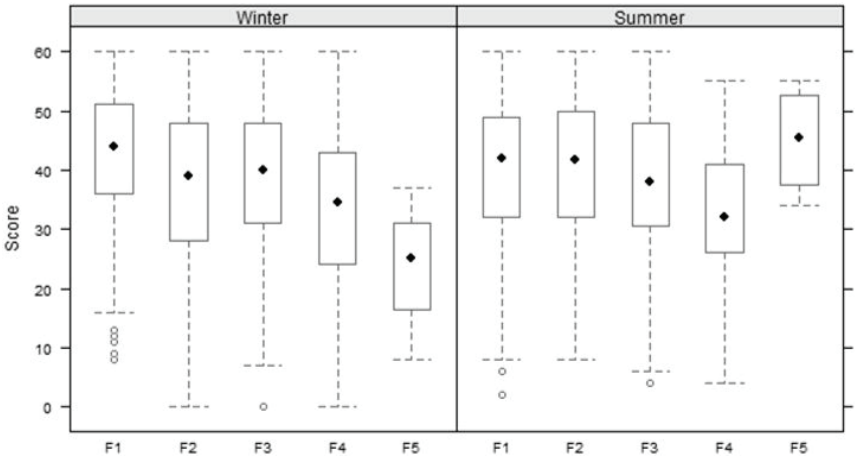

Fig. 1: Boxplots for each treatment

The boxplots on Figure 1 summarize Table 3 and Table 4 in a graphical way. In addition to the presence of heteroscedasticity and non-normality of the response variable score, some outliers are detected. Since the sample size is large and only a few students were considered as outliers, there is no need to remove them from the sample.

Analysis of Variance Results

Table 5 presents the ANOVA table after fitting the linear regression model by using weighted least squares. It can be seen that the interaction between the two factors is significant at 5% level of significance, which proves that the differences in the means of scores for students of different faculties are not the same in each semester. As the interaction is significant there is no need to look at the main effects of semester and faculty and both of them have to be retained in the model. Type III tests are showed in the table as the interaction effect is significant.

Source of variation	Df	Sum of squares	Mean square	F-value	P-value
Intercept	1	4837.6	4837.6	3203.557	0.000
Faculty	4	61.3	15.3	10.157	0.000
Semester	1	6.8	6.8	4.483	0.034
Faculty*Semester	4	32.2	8.1	5.331	0.000
Errors	2246	3391.7	1.5		

Tab. 5: ANOVA table (Type III sum of squares)

Afterwards, the assumptions are verified. Figure 2 below shows the normal quantile-quantile plot of the errors. It can be seen from the plot that the errors do not come from the normal distribution. Apart from this assumption of normality of errors, all other assumptions of linear models, i.e. Gauss-Markov assumptions, are fulfilled.

A Box-Cox transformation could be applied to the response variable score which would made the distribution of the response variable score and the errors of the model more normal. For further information about the Box-Cox transformation see (Kutner et al, 2005) and for further information about the function in R software see (Venables and Ripley, 2002). However, the violation of the assumption of normality of errors in the model with non-transformed response variable does not cause the statistical inference (F-tests) to give invalid conclusions and the results would be similar to those presented in Table 5. This is caused by the fact that the sample size is large enough. Moreover, the scores of students after the transformation loose a meaningful interpretation. For these reasons the results of analysis on non-transformed variable are presented in this paper.

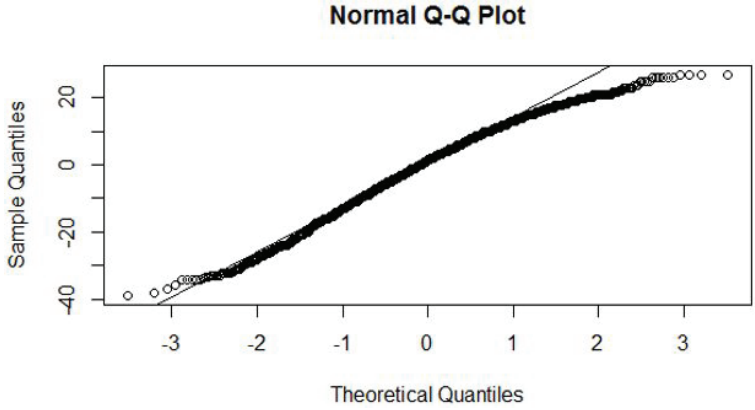

Fig. 2: Normal Q-Q plot of errors

Differences between the Means

Table 2 shows the means for each treatment and semester and faculty means. We can see that on average students obtain 37.68 points from the tests. As the interaction between the factors turned out to be significant, the approach of instructors and lecturers should be different in both semesters. Students of Faculty of Finance and Accounting (F1) have the highest score in both semesters which may be caused by the fact that these students need strong mathematical background in their other courses. In addition, students of this faculty might have showed stronger interest in mathematics before the start of their studies. The instructors may therefore prepare exercises of higher difficulty in case they have a

high number of students of this faculty at their seminar. Surprisingly, students of Faculty of Informatics and Statistics (F4) tend to have low scores in both semesters, although these students need strong mathematical skills in their subsequent courses. Students of Faculty of Business Administration (F3) tend to perform equally good in both semesters while students of Faculty of International Relations (F2) tend to have higher score in summer semester and perform almost equally well as students of Faculty of Finance and Accounting. The course is optional for students of Faculty of Economics (F5) as they are obliged to take different course in mathematics offered by their faculty. It is therefore hard to predict whether the student takes the course because he needs more practice or in order to earn credits easily. Concerning lectures, the audience is bigger and students can decide to come to different lecture than they are enrolled in, therefore it might be difficult to adapt the lecture based on the list of enrolled students.

Conclusion

In conclusion, the paper shows that there are differences between the performance of students from different faculties in different semesters and that based on the results presented in this paper the instructors and lecturers can adapt their seminars and lectures to the audience in order to motivate the students and improve their performance.

The analysis can be extended by analysing the scores separately for mid-term and final test or by including a covariate of points obtained during the entrance exam. However, these data would have to be collected. Furthermore, the differences in scores change in time, therefore another possibility to extend the study is to collect the same data in the future academic years and analyse the changes in time.

Acknowledgements

This paper was processed with contribution of long term institutional support of research activities by Faculty of Informatics and Statistics, University of Economics, Prague.

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DEMAND FOR PRIVATE SCHOOLS IN CR

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Abstract

The paper deals with the demand for private university level schools in the CR. As it means to decide if "to pay or not to pay" the question is legitimate at least in an economic context. A decision to attend such a form of studies is supposed to depend on the current price of education and expected earnings after graduation hence, the price of labour. Taking account of the nature of the process an almost ideal demand system of equations is used to perform relevant analysis. After a brief recapitulation of the method and a data set construction the computations are performed and presented. Discussion follows to justify the reasonability of results as well as the suitability of the model to be used for similar analyses regardless of the level of aggregation. The model is appropriate to time series as well as to cross section data sets. The dependence of private school attendance decision on current fees and future earnings is expected and also confirmed.

Keywords

Almost ideal demand system, private schools, tertiary education

Introduction

After 1989, private schools emerged in Czech Republic covering basic, high and university levels of education. When solving the question of demand for private university level schools, they are the ones meant when referring to private schools in the following text.

As there are very good university level schools in CR which are public a question arises why are the students and/or their parents are willing to pay for a private alternative. It seems to be likely that a decision to attend such a private school depends on some important financial indicators mainly the current price of education and expected earnings after graduation hence, a price of labour. In fact, the author interviewed about two hundreds of private school students privately (not to be published). They stressed two qualitative factors to be important for their choice, (i) the school in question is not far from their home, (ii) the diploma in question is a certain "guarantee" of a good job. Item (i) was proxied in the model by a school fee because there is an evident financial trade off: due to the short distance it is not necessary to pay transport and accommodation costs. As for (ii), expected wages are used to explain the choice of school.

The goal of this paper is to grasp a relatively subtle set of first-time enrolled students of university level schools distinguishing between private and public schools. The universality of the almost ideal demand system, introduced by Deaton and Muellbauer (1980a, 1980b), is supposed to offer a good tool for an analysis incorporating the public sector as an implicit complement to the private one. The system is successfully applied to different economic processes as e.g.by Lee, Kennedy and Hilbun (2008). As a demand for education it is used e.g. in Koç, and Alpay (2015) with respect to the household budget. As a share in a complete macroeconomic system education is treated by this equation system in Attfield (2004).

The method leading to the relevant model and its philosophy are briefly recapitulated and a data set is prepared and described. Necessary computations are summarised and the interpretation of results is given. The dependence of private school attendance decision on current fees and future earnings is expected and also confirmed.

Materials and Methods

The cost function is specified by Deaton and Muellbauer (1980b) as

$$\log c(u,p) = \alpha_0 + \sum_k \alpha_k \log p_k + \frac{1}{2}\sum_k \sum_j \gamma^*_{kj} \log p_k \log p_j + u\beta_0 \prod_k p_k^{\beta_k} \quad (1)$$

α_i, β_i a γ^*_{ij} being the parameters restricted by $\sum \alpha_i = 1, \sum_j \gamma^*_{kj} = \sum_k \gamma^*_{kj} = \sum_j \beta_j = 0.$ As usual, c is for cost, $0 \le u \le 1$ utility based on PIGLOG (= Price Independent Generalized Logarithmic) preferences, p vector of prices of n commodities.
Minimizing cost by a given level of utility or maximizing utility subject to a given budget, an optimal demand q_i concerning a commodity *i* equals, according to the Shephard's lemma (Shephard, 1980) the derivation of the cost function with respect to the price p_i

$$\frac{\partial c(u,p)}{\partial p_i} = q_i$$

or in the logarithmic form

$$\frac{\partial \log c(u,p)}{\partial \log p_i} = \frac{q_i p_i}{c(u,p)} = w_i \,, \quad (2)$$

with w_i representing the budget share of commodity i ; naturally $\sum w_i = 1$.
Inserting (2) to (1) we have

$$w_i = \alpha_i + \sum_j \gamma_{ij} \log p_j + \beta_i u \beta_0 \prod p_k^{\beta_k} \,, \quad (3)$$

where $\gamma_{ij} = \frac{1}{2}(\gamma^*_{ij} + \gamma^*_{ji})$. Instead of (3) we can write

$$w_i = \alpha_i + \sum_j \gamma_{ij} \log p_j + \beta_i \log \frac{x}{P} \,, \quad (4)$$

and by the relation

$$\log P = \alpha_0 + \sum_k \alpha_k \log p_k + \frac{1}{2}\sum_j \sum_k \gamma_{kj} \log p_k \log p_j \,, \quad (5)$$

define the price index P with $x=c(u,p)$ representing total budget disposable for the utility maximization. Then, x/P means real expenses.

The system created by equations (4) with the following parameter constraints

$$\sum_i \alpha_i = 1, \sum_i \gamma_{ij} = 0, \sum_i \beta_i = 0 \tag{6}$$

$$\sum_j \gamma_{ij} = 0 \tag{7}$$

$$\gamma_{ij} = \gamma_{ji} . \tag{8}$$

is known as almost ideal demand system. Relations (6) and (7) refer to homogeneity and (8) means a symmetry of substitution.

The presented equation system has the following interpretation. Not changing relative prices and real budget, the shares are constant. When changing relative prices, the shares are influenced by γ_{ij}. Increasing the price of j-th commodity by 1%, the share w_i changes its value by $\gamma_{ij}.10^{-2}$ *ceteris paribus*. Movements in real budget value exhibit their influence on shares by the help of β_i.

To estimate parameters of the system, the equation (5) seems to be a good starting point. Substituting (5) into (4) we have

$$w_i = (\alpha_i - \beta_i \alpha_0) + \sum_j \gamma_{ij} \log p_j + \beta_i \left[\log x - \sum_k \log p_k - \frac{1}{2} \sum_k \sum_j \gamma_{kj} \log p_k \log p_j \right] \tag{9}$$

As the individual prices very often exhibit an apparent multicollinearity, the usual practice is to switch from (9) to the form

$$w_i = \alpha_i^* + \sum_j \gamma_{ij} \log p_j + \beta_i \log(\frac{x}{P^*}) , \tag{10}$$

where $\log P^* = \sum w_k \log p_k, P \approx \varphi P^*, \alpha_i^* = \alpha_i - \beta_i \log \varphi.$

The equation (10) makes the estimation of parameters more convenient (in comparison with (9)) and the data are easier to be found for (10) as for (3). Looking for a more sophisticated analysis, (10) may be widen by comprising expected prices or by an assumption about partial adjustment process, what are the ways of bringing a certain dynamic into the model.

(10) represents a system of *n* equations which are related by conditions (6), (7) and (8). Thus, the covariance matrix of the equation system is singular what in general influences the choice of estimation methods applied to a reduced system after dropping one (dependent) equation.

Application of the model

Treating the number of all students as a complex of two disjunctive groups arises; one comprising of private schools students and the other dealing with public school students. The shares of both groups may evidently be given. In this case, *n* = 2 in the system of equations (10) and after dropping one equation because of the linear dependency (see the above theory) we may deal with the complement of our interest: either with public or with private students in the form of one equation only.

The value of w is given as the ratio of number of private students to all students in CR, p_j are relevant financial characteristics described below.

Data

The number of students of private schools as well as the number of all students are provided by the CZSO (Czech Statistical Office) with data available from the 2001/02 to 2013/14 school years. For our purposes the items concerning first-time enrolled students were used and as the numbers of students of private schools *nops* are presented in Table 1.

year	nops	year	nops
01/02	2705	08/09	14328
02/03	3941	09/10	14266
03/04	5228	10/11	12525
04/05	6591	11/12	10331
05/06	8284	12/13	8906
06/07	9859	13/14	8144
07/08	13037		

Tab. 1: Number of students of private schools first time enrolled, source: CZSO

The share value w was then computed in a straightforward way.

As p_j (j = 1, 2) in (10) the average wage of graduated employee and the charge for one month´ studies are used.

As for the wages, the CZSO table "Average monthly gross wages and salaries of employees in the national economy: by Section of CZ-NACE and sphere" was a source from which the items *Information and communication*, *Financial and insurance activities*, *Real estate activities*, *Professional, scientific and technical activities* were summarised as representing the highest wages and high qualification requirements contemporaneously.

The data representing the fees are hard to collect; private schools announce their actual fees (per school year or one semester) but not historical prices. So, the average monthly fee related to the last observation was easy to be computed: p_2=4673 (Private school fees, internet: http://www.vysokeskoly, 2015). Fortunately, the author has found a source (Private school fees, internet: https//cuni, 2015) bringing an information about prices in 2001/02: p_2=4452. Besides, a list of schools and fees in 2006 is given in the CZSO yearbook for what p_2=4696; the last one title is a yearbook according to its name but in fact CZSO published it occasionally with no antecedent and subsequent counterparts.

As for the *nops*, the evidence of increasing interest in private school studies is apparent to 2008 in Table 1; after a short stagnation the number of students is decreasing. The payments to charge for the study follow the simplest economic rule: higher fees when the number of students increases and vice versa. That is why the author dared to proxy the missing values by applying such a logic. The values between periods 01/02 and 06/07 periods are modified by adding fifty crowns annually, from 07/08 to 11/12 a stagnation is supposed, a decreasing process concludes. The author is aware of inaccuracies; in this article, the methodology is primarily shown as a tool allowing for a wide range of similar analyses using different data often not of a public nature

To substitute the last member in (10), the average wage representing economic power of student´s parents is used.

Results and Discussion

Having two groups of students, private versus public, the system is created by two equations only. According to theory, one should be dropped; the private one stays as a subject of our interest.

Using the model and data set prepared, the parameters of the model were estimated. The variable representing parental salary is not statistically significant that is why it was omitted. The explanation may be given by the fact that many parents prefer to pay for a good local private school as charging for transport and accommodation in a more distant town providing a public school.

The results of estimation by Eviews8 software are summarised in Table 2.

parameter	value	t-stat-Prob
α	-0.343	0.163
γ_1	0.325	0.045
R^2	0.878	
AR(1)	1	0.000

Tab. 2: Results of estimates, source: own computations

In the first computation an autocorrelation of disturbance term was detected. Next computation (Table 2) comprises the autoregression factor what makes all the results stronger. As for the parameter γ_2, it is $\gamma_1 + \gamma_2 = 0$ and hence, $\gamma_2 = -\gamma_1$. While the constant α has a technical meaning only, parameters γ have a clear economic interpretation. The plus sign of γ_1 says that an increasing average wage of employee with a degreeby 1 % is accompanied by an increase of the share of students enrolling in private schools. This confirms a common experience that people are ready to invest into their future; the temporarily cost will be appropriately compensated by expected earnings. The minus sign of γ_2 is an information about the decreasing number of private students´ share when the fee increases by 1 %. The context is evident, an actual financial situation of the potential student is a considerable factor, of course. These facts as well as other factors are – without any computations – discussed e.g. at http://www.vysokeskoly.cz/ (2015).

The results illustrate the ability of the model to capture the logic of economic relations and to give their quantification. In fact, the model enables to deal not only with the time series but also with the set of different schools if one has an information about fees and the number of students as a cross section data file. In such a case, model may help to perform analyses on the country- wide level which may be useful for authorities. On the other hand, even a more detailed refinement as studied e.g. in Kuncová and Lagová (2008), may be treated with a model of this sort. The availability of data is the only limitation; that means the processing of detailed information collected within the bounds of one school is more probable, bringing internal rather than external knowledge. Using the model, a certain school may obtain an overview of the intensity of an impact of a given subject.

Conclusion

The model based on the almost ideal demand equations system is of a universal applicability in analysing economic relations. Therefore it is also expected to be convenient in studying economic features of private schooling. An illustration was given using feasible quantitative information. The results correspond with the basic economic logic; demand for private university level schools decreases with higher fees and increases with higher wages.

The model is appropriate to time series as well as to cross section data sets. The data necessary to be used may be of a confident nature which limits the possibilities of aggregate analyses; nevertheless, different internal purposes of private schools may be treated with the help of this model and methodological approach.

Acknowledgements

Financial support of VŠE IGA F4/24/2014 is gratefully announced.

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ARTIFICAL INTELLIGENCE IN EDUCATION: CAN THE AI TEACH THEM?

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Abstract

Managerial games are an important tool in teaching strategic management. An experimental tool, enabling to play management games with artificial intelligence, was created at the Czech University of Life Sciences in Prague within the research of possibilities of how to use artificial intelligence instruments. This machine simulates the behaviour of an opponent during a specifically designed management game. To determine and optimise the specific context, it is necessary to ask and answer the following questions: how does a player play in a relatively simple market context; how many rounds does the live player need to optimise playing strategies; in what round a live player wins with certainty over the machine; how to improve the course of the game to allow a player to acquire the necessary tacit knowledge? Answers to the above questions are sought on the basis of an experiment conducted with volunteers. This work deals with the potential of e-learning systems designed on the basis of artificial intelligence instruments, their description and their possible use to obtain tacit knowledge in the area of strategic management.

Keywords

Artificial intelligence, e-learning, managerial games, neural network, strategic management, tacit knowledge

Introduction

The article at first describes the construction of an electronic educational system. Next, we define the rules and the context of the management game designed for the experiment. We describe the players and their results. To answer the questions asked, we chose qualitative research. We presented to a small group of volunteers a simple decision-making task to solve.

Last year, a team of authors: Pavlíček, Švec, and Tichá (2014) presented at the ERIE conference, possibilities for the use of management games in teaching strategic management. The presented solution has been designed as an electronic educational tool enabling students to gain experience. Experience is the knowledge of a subject or event gained through involvement in or exposure to it (Oxford English Dictionary, 1989). Linkage between experience and knowledge supports Kolb (1984:41) with his definition of learning as 'the process whereby knowledge is created through the transformation of experience'.

When we speak about knowledge, we understand the personal level of knowledge. Then we see knowledge as what person knows as well as his/her skill and ability that would determine or help him/her make decisions and take action (Gao, Li, and Nakamori, 2003). Drucker (1989: 242) defines the knowledge as information that 'changes something or somebody either by becoming grounds for action, or by making an individual or an institution capable of different and more effective action'.

Polanyi (1959) divided human knowledge into two categories: explicit knowledge (written and formalized) and tacit knowledge (the action related and unformulated). Gao, Li and Nakamori (2003: 9) expand and explain the characteristics of knowledge in Polanyi´s point of view that 'there are two different dimensions in knowledge: one relates to the scientific, logical or objective dimension; another to the subjective dimension'. In the objective dimension the knowledge is like a "thing' or 'object' that can be articulated, captured and stored. The subjective dimension of the knowledge, however, can be fully understood only by person with enough capacities. (Gao, Li, and Nakamori, 2003)

The proposed tool (Pavlíček, Švec, and Tichá, 2014) uses artificial intelligence mechanisms to support teaching of managerial decision-making through simulation using the so-called electronic agents. By the term electronic agent, we mean a machine simulating the behaviour of a real opponent, i.e. the real opponent's decision-making and strategy used in the given game. This agent is based on artificial intelligence mechanisms. I.e., it is possible to teach it based on empirically played games. By simulating real-world conditions of decision-making then the player gets practical experience in strategic decision-making.

When simulating strategic decision-making, we focus especially on the creation of knowledge as conceived by Gao, Li, and Nakamori (2003), i.e. knowledge that originates and may be understood only by a person who performs the activity and is non-transferable and cannot be obtained otherwise than by one's own experience.

During the development and testing of the electronic client, the game was played by 16 teams (98 students After having played these basic games, rules and behaviour of players were set to be controlled by artificial intelligence – electronic agents. The presence of players of two types, human and electronic agents (artificial intelligence), in a common game resulted in the following research questions being asked:

1. How does a player (only a human) play to whom a relatively simple market context is presented for decision-making?
2. How looks the player approach during game strategy settings?
3. How many rounds does a player need to optimize his/her strategy?
4. In which round, the player begins to safely win over all artificial intelligence players?

The present article answers the presented questions and tries to show the opportunities for further development of electronic educational system and its gaming agents.

Materials and Methods

Electronic Educational System

It is possible to play management games with a computer. 'Management games are used to create experiential environments within which learning and behavioural changes can occur and in which managerial behaviour can be observed. A simulated experiential environment is a simplified and contrived situation that contains enough verisimilitude, or illusion of reality, to induce real world-like responses by those participating in the exercise. Extraneous details, hazards, costs, and inconveniences must be stripped away from the simulation, thereby producing an accelerated frame of action so that they can be more efficient than their real-world operating environments.' (Keys, Wolfe, 1990:308). According to Salas, Wildman, and Piccolo (2009) simulation-based training is ideal technique for management education programs in undergraduate and graduate management programs to give students practical skills, which they need when entering the business or corporate world.

In our case, the emphasis is on a faithful simulation of real-world, yet, in the opinion of Keys and Wolf (1990), simplified business conditions. To create a software environment that meets these conditions, we chose an architecture of a solution based on the model-view-controller design pattern.
The electronic system consists of:

Controller
The controller is a control programme. Each game is defined by a particular context, rules and facts. They are stored in a special data files. The controller, based on these files, carries out calling of individual gaming agents and players. The files practically serve as a model. It says what step follows a previous one and how the controller should serve the players.

Game Strategy Settings
These are files containing the rules of the game. The sequence of game steps is set out in them, intervals of generating random values of the game (e.g. supply of material). It is possible to configure them.

Gaming Agent
Each gaming agent is an independent instance of a neuronal network with one hidden layer. This neuronal network has an input layer of 4 input neurons, 8 neurons in a hidden layer and one neuron in the output layer. The excitation function of neurons is a sigmoidal function. See Figure 2. In the displayed model, the "constructional" neuron is marked with red colour. It does not affect the computational capabilities of the agent in any way. It is a constructional residue of the used framework.

Management Game Rules

Players play a pre-specified decision-making simulation from the area of company management against three electronic gaming agents. The game has 12 rounds (each round corresponds to one calendar month); in each of the game rounds, the following four epochs take place:

1. In the first epoch, the player decides about the terms of purchase of material in the form of a demand auction where he/she competes with his/her price with other players (gaming agents).
2. In the second epoch, the player decides about the manufacture of products.
3. In the third epoch, the player decides about the terms of sale of products in the form of a supply auction wherein he/she competes with a price proposed by other players (gaming agents).
4. In the fourth epoch, the player decides on his/her costs of storing materials and products, fixed costs for factories or other costs.

At the beginning of the round, an electronic banker (artificial intelligence) displays a card with the current market conditions for the given round, i.e. with the amount of material offered for sale, its price, number of products that the market is capable of buying at a predetermined maximum price. The offered numbers are generated randomly in the displayed interval, see Tab. 1.

Material Available	Material Min. Costs	Potential Market for Finished Inventory	Max. Market for Finished Inventory	Number of Players
[1,4]	[300,800]	[4,4]	[3000,7000]	2
[1,9]	[300,800]	[4,9]	[3000,7000]	3
[1,12]	[300,800]	[4,12]	[3000,7000]	4-∞

Tab. 1: Game Card Interval Table

Each player has the opportunity to see the material, product, and financial conditions of the opponent during both rounds and the epoch. The player can watch the results of the first and second rounds. Selling auction is not public. At the end of each epoch, the banker will perform final settlement. The player who goes bankrupt during an epoch, is eliminated from the game and does not participate in the next epoch. By that, the ratio of resources on the market changes. The banker does not respond to this change and generates the playing card at the beginning of the epoch as he did for the original number of players. The player must get the dominance on the market (only financial one, not material or product one) within 12 rounds. Another objective is to force the other players to go bankrupt.

Description of the Players

7 volunteers with university education were selected to play the game. We have chosen players in a broad age range. For young players, it should not be a problem to play with a computer programme, but they have no practical experience. Older players will most likely deal with the problem of how to operate the programme but we expect them to have at least partial knowledge of the simulated situation (at least quicker orientation in the issues). We always explained the game rules to players and instructed them in how to control the programme.

3 gaming agents with an integrated optimization function always play against live players. This optimization function is partially based on the artificial intelligence technology. Auction mechanisms are operated by a neuronal network (in the current test, this means an expert algorithm based on the knowledge of game strategy and stochastic phenomena); mechanisms for deciding on the amount of production is left to the optimization algorithm of minimization of losses. The agents have an integrated offensive strategy. If there are any suitable conditions, their activity is triggered when purchasing material. This means that in case of the lack of material resources in the market and, at the same time, under the condition that an opponent (even another agent) does not have enough material, the agent intentionally buys out all material. The live player is not informed in advance about this feature. However, we think that this strategy will occur also to the players. The objective of the player is to be the market leader. This can be achieved also through forced bankruptcy of the other players

Results and Discussion

The game took place in eleven rounds with seven players. Player 1 did not play all 11 rounds but only 9.

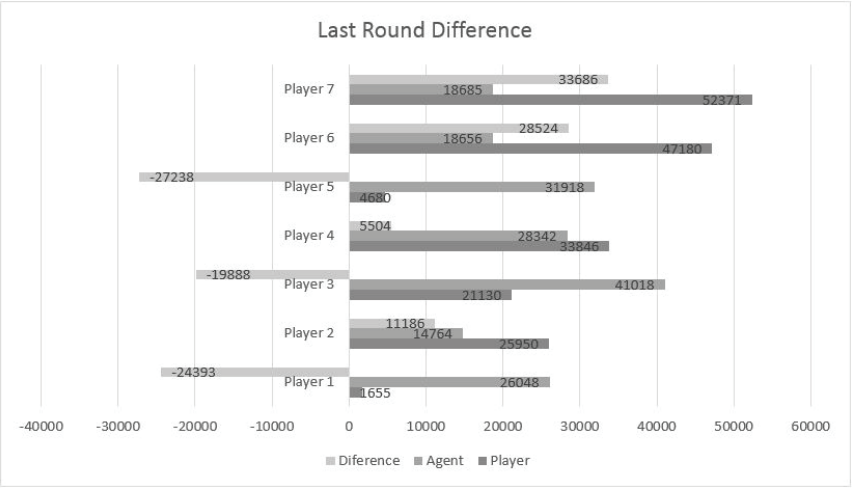

Fig. 1: Last round difference

At the end of the last round, there always remained one live player and the best agent. The graph shows the difference between the player's account and the best agent's account (player – agent). It is obvious that player 7 was the best at the end of the game, player 5 was the worst (Fig. 1).

Use of strategy in the game

As shows Trachtenberg (1991) the history of strategic thinking and strategy making comes from warfare. For our purposes – to evaluate strategic thinking and strategy making of players – we used general classification of strategies to better grasp the players' strategic behaving. The concept we used comes from Greene (2006) and his typology of warfare behaving. There are 33 general strategies which can be used in war (Greene, 2006) which are divided to five groups: 1) self-directed warfare, 2) organizational (team) warfare, 3) defensive warfare, 4) offensive warfare, and 5) unconventional (dirty) warfare. Self-directed warfare describes Greene (2006) as strategies ensuring the mind of strategist stays calm and without emotions affecting the decision. The organizational (team) warfare contains strategies about cooperation in group to ensure fast adaptation to changing conditions. The unconventional (dirty) warfare show strategies going beyond the usual rules, ethic, morality, etc. According to the game, its rules and playing conditions the only groups of strategies which can be used during the play are the defensive and offensive warfare.

Behaving in defensive manner requires to make most of firm´s resources, fight with perfect economy and to engage only in battles that are necessary (Greene, 2006). It means to know own resources and capabilities, as well as opponents resources and capabilities, and to be able to wait for the proper moment to hit in the right spot.

Behaving in offensive style depends on suddenness. The tactic is always the same – you have to strike first, hit the vulnerable spots, take over the initiative and never let it go, and create own conditions.

For the tested game, it is possible, based on observations made, to answer the selected research questions.

How looks the player approach during game strategy settings?

As we supposed the player approach for game strategy settings has two patterns.

- First pattern is based on the iterative game approach: "Play and loose" and improve the skills iteratively. (Fig 2)
- Second pattern is based on the deep study of game rules: "Play and win". (Fig 3).

Booth patterns makes sense. But for real business we should preferred second One.

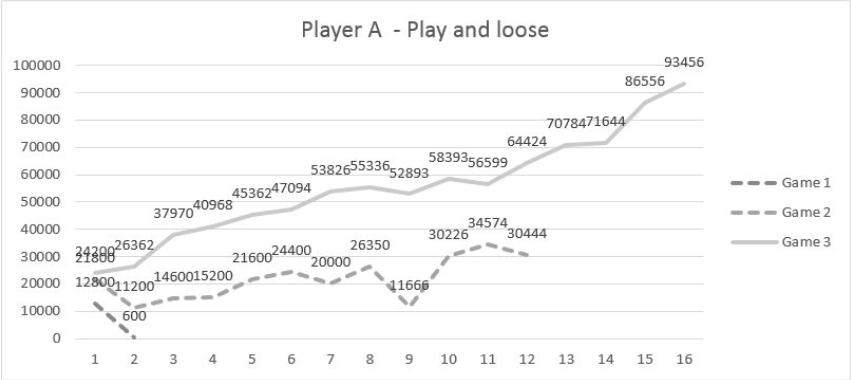

Fig. 2: Players game strategy settings

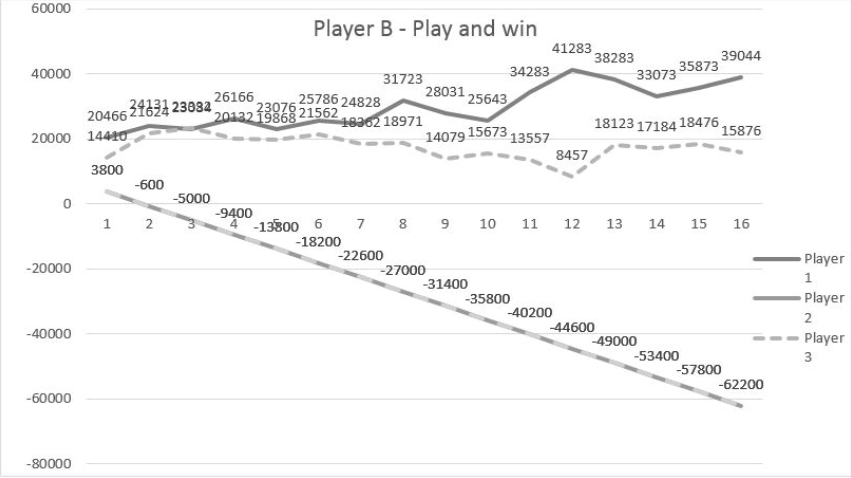

Fig. 3: Players game strategy settings

How does a player (only a human) play to whom a relatively simple management task is presented?

The players' gaming feature has a similar course. In the early rounds, a live player plays defensively. Some players (Player 2 and Player 5) are losing in the second round compared to the previous round. Between the third and fourth rounds, the player is in a phase of stabilization of his/her decisions. At this time, a moment comes when the player decides

whether he/she will continue in his/her defensive strategy or select an offensive strategy. Some players gain (G2,3,6,7), others lose. The sixth and seventh rounds are a turning point because at that time it is almost impossible to make do with a minimalist strategy. The reason is that, at the beginning of the game, each player receives 4 pieces of material and 2 pieces of products. Therefore, in the case of complete minimization of losses, modest financial growth can be maintained until about the sixth round. This is obviously influenced by the occurrence of resources on a playing card, which, however, is random.

How many rounds does a player need to optimize his/her playing strategy?

The player needs about 4-5 rounds to optimize his/her playing strategy. I.e. not to be in danger of getting bankrupt. (Fig 4)

In which round does the player begin to safely win over all electronic competitors?

This question is not easy to answer. Our test shows that four out of seven players gained financial dominance in the market in the seventh round. The Player (Player 7) began to financially win in the third round. The most successful player of all (player 7) gained financial dominance in the fourth round.

Player 2 and Player 4 stabilized their strategy in the seventh round. Furthermore, their financial superiority is already stable.

The sample of players is small. However, the research was taking place on a qualitative basis, i.e., we recorded also other factors that are difficult to quantify. For example, the rate of assistance during the game. All players needed some advice and partial guidance in the course of the first 3 rounds. This was probably the reason why players did not go bankrupt. The guidance provided to the players, however, partially reveals the strategy of the game which is based on minimizing the losses. Although the agents minimize their losses, the parallel algorithm of optimization of the supply is not at such a high level as in the human brain. What logically follows is also the result of the victory of the human player who is able to more quickly put into balance its expenses and income. The original superiority of robots thus logically begins to disappear in the more advanced rounds of the game.

All players mentioned how interesting the game was and proposed various options for its expansion and improvement. All of them confirmed they gained (or refreshed) new practical knowledge, i.e. experiencing a typical managerial issue in a very practical environment.

Conclusion

E-learning educational system based on artificial intelligence can be built and used in teaching. A machine built on a trivial task made it possible to practice strategic decision-making of the players. At the same time, agents' game strategy was not weak. Out of the seven players, it was practically only four players who won over the agents. This shows the great potential for using game systems designed in this way in e-learning. However, the use of neuronal networks in teaching in the similar manner is not currently mentioned. By (Baylari and Montazer, 2009) artificial neural network was used for recommending remaining states. A frequent example is the use of neural networks to recommend a trend in teaching such as prediction of enrolled courses (Kardan, Sadeghi, Ghidary, & Sani, 2013). Yet, it is not a common way to use the tools based on artificial intelligence for direct teaching, namely even despite the fact that our experiment demonstrated the possibility to involve artificial intelligence, in this case, neuronal networks, in teaching. The team is dynamically improving the artificial intelligence powered games on the

Athena application server. This is located at CULS environment. The gained data will be presented at ERIE in the next year or in the ERIE journal.

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EFFECTIVENESS OF SOCIAL MEDIA USAGE IN THE PROCESS OF STUDY PROGRAMME SELECTION

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Abstract

The aim of the article is to analyse the effectiveness of social media usage in the process of selection of study programme by prospective students. Facebook application allowed potential students to find information about each study programme with random recommendations obtained from current students or alumni by the same application. We performed a content analysis of the 44 recommendations collected between 18 January and 22 February 2015 and searched whether they contain relevant information which convince the students to apply for studies.

According to the previous research we divided surveyed areas into three fields: relation to future job and to practice, content of the studies and subjects, and ability to complete the studies. To conclude, the recommendations covered all three fields and attracted 688 people to application form in university information system. We found out that Facebook can be an effective tool for study programme selection nowadays.

Keywords

Content analysis, study programme, social media, word-of-mouth

Introduction

The competition among universities is increasing with the number of emerging private colleges and with higher number of high school graduates. The fact that "the proportion of tertiary educated people will grow very rapidly" (Fiala, Langhamrová and Průša, 2011) implies that it is being harder to select the best future students. The selection is usually done by entrance exams. However, this procedure is able to eliminate only students without sufficient knowledge from the students which had already applied to higher educational institution. Therefore, the stamina to attract the most skilful students should precede. The reputation of the university is one of the important criterions for school selections. Others are whether the students find a job which they will enjoy after they graduate, whether they study a programme which they will enjoy, whether they study a programme which will prepare them for a job which they will enjoy, whether they find well-paid job and study a programme which they will be able to finish (see study of Šťastnová and Drahouňovská, 2011).

Talented students prefer universities with good name and high educational quality standards. "In recent years, rankings are becoming more significant elements in the academic community that influence the development of international understanding of the quality of education, scientific activity and university functioning with regard to the world leaders (Baidenko, 2010)." Therefore, "world university rankings represent not only a tool to meassure university success but can be considered as a new challenge to all universities worldwide" (Sidorenko and Gorbatova, 2015).

And what is more, for the students during the selection of the university and the study

programme is the word-of-mouth probably more important than just a mere ranking. For example the world ranking *Times Higher Education World Reputation Rankings*[1] uses the world's largest invitation-only academic opinion survey. As the survey searches for opinions, the university should be promoted in a way which would build its reputation, preferably through the word-of-mouth. "The popularity of online rate-and-review websites has increased the importance of word-of-mouth volume (number of ratings)" (Khare, Labrecque and Asare, 2011). Word-of-mouth traditionally reached only a few direct contacts, such as family members and friends, but with social media expansion, the reach became wider. Social media are characterized by user generated content, which has been found to be more effective than traditional marketing communications in influencing the attitudes and behaviours of other users (Thackeray et al., 2008). Havlíček et al. (2010) showed in their article that information technologies are an effective tool to enhance the efficiency of collaboration.

Therefore, Faculty of Economics and Management (FEM), Czech University of Life Sciences Prague combined the word-of-mouth with social media and prepared Facebook application for potential students where particular study programmes are recommended by current students or alumni. More than 90% of high-school students consider important the information about the content of the studies, career opportunities, chance to get to the chosen school, and the difficulty of studies (Šťastnová and Drahouňovská, 2011). Concerns about future job are justified as according to the projections of Šimpach and Langhamrová (2014) "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."

Whether the recommendations for the potential students of FEM include important information which make decision making process and the selection of study programme more effective is the subject of this research. It is supposed that Facebook application will help the students to select the study programme which they will enjoy. Hence the FEM will gain more motivated students and possibly also more successful alumni. How to motivate students to learn and how to offer and present them skills and content that they consider and value as relevant and important is further examined for example by Rosická and Hošková-Mayerová (2014).

Materials and Methods

The research hypothesis assumes that social media can be an effective tool providing information for prospective students which they need for their application to Faculty of Economics and Management (FEM) of the Czech University of Life Sciences Prague. Effectiveness is understood as the capability of producing a desired result. Particularly in this paper a Facebook application is analysed whether it provides a way leading to a desired result – i.e. whether it attracts the high school students to the application to the FEM by providing them relevant and important information.

The created application utilized popularity of social media to reach prospective students of the FEM. It was embedded into the Facebook page of the faculty (https://www.facebook.com/pef.czu.cz/app_494252394050118) and into the faculty web page (http://www.pef.czu.cz/cs/?r=4054&i=1175). The application was created using HTML, CSS3, Javascript, jQuery, PHP5 and MySQL5 technologies. Basically, the application informs prospective students about each study program available in bachelor and master degrees of study. The application's homepage also allows them to join official faculty Facebook

[1] http://www.timeshighereducation.co.uk/world-university-rankings/2015/reputation-ranking

page and get the actual official news. Potential students can also go straight to faculty's Facebook group which was created especially for the students of the upcoming first grade of academic year 2015/2016. In this newbie group, they can collaborate together and receive official information from group administrators.

In the application every study program features its summary and also randomly selected recommendations which were obtained from both current students and alumni. These recommendations were acquired by the same application from the other interface, which is automatically offered when the user does not belong to the focus group of prospective students. Authors of recommendations were authenticated by using their university ID. Since the application was connected with university database, they were associated to the particular study programme. As we already mentioned, the important part of the application is the possibility to directly fill-in an online application form. So when users received all necessary information, they could easily apply for study on the faculty through the application. They were redirected to the required web page in university information system. There were two ways how to be redirected to the application page in university information system. First possibility was to simply use the button next to study programme name. The second one was to apply via button placed on every fact-finding study programme page mentioned above. Therefore, the causality between the content of the recommendation and the act of applying could be examined. Mostly the recommendations appeared only once or some of them not at all when the student applied for studies. Therefore, we rather focus on the content of all recommendations and examined the effectiveness of the applications in terms whether it contains relevant information for prospective students which lead to the desirable results (i.e. to the attraction of the students to apply).

The data were collected since the application was published on 18th January 2015 until 22 February. During that time 44 recommendations were obtained by the application and used for consequent analysis. Particularly a content analysis of the recommendations in Facebook application was applied. We divided the data into three groups according to the area they were related to in order to find out whether they contain information relevant for future students. The groups of interests are based on the study of Šťastnová and Drahouňovská (2011): (1) relation to future job and to practice, (2) content of the studies and subjects, and (3) ability to complete the studies.

The collocations frequently appearing and the key words "practise" and "interesting" are analysed and discussed. Then the phrases of two words are analysed. It is applied so-called bi-word expressions analysis – a special case of multi-word analysis. A multi-words expression "is composed of two or more words that together form a single unit of meaning" (Fazly and Stevenson, 2007) For meaningful analysis, so-called stop words (prepositions, articles, pronouns, conjunctions, and other non-significant words according to the list of NLP centre[2]) were omitted. Then the words included in one sentence of the recommendation were combined together. We searched for *k*-elements combinations of *n* words included in one sentence (set *M*). The number of those combinations is equal to (1)

$$C(k,n) = \frac{V(k,n)}{k!}, \tag{1}$$

[2] https://nlp.fi.muni.cz/cs/StopList

where $k = 2$ because the combinations of two words are made, n is the total number of words in a sentence, *C(.)* stands for combination and *V(.)* for variation. In other words this equation expresses the number of permutation of each k-pair. It reads (2)

$$C(k,n) = \frac{n!}{(n-k)!.k!}, \tag{2}$$

where the expressions have the same meaning as in previous equation. The bi-words expressions are analysed in terms of their frequency. Finally, the conclusions are drawn.

Results and Discussion

A research performed by Reuben (2008) among 148 colleges and universities responded showed that mostly the Facebook is used as a tool for communicating with current students, to reach out to alumni, and for recruitment. The same reasons for usage hold for Facebook of the FEM. The Facebook application is a special case of communication aimed at prospective students and was used for the first time. Since the application started (18 January 2015) until 22 February 2015, it attracted 688 people to application form in university information system – i.e. to the possibility of submitting application on particular study programme at FEM. The highest number was on 22 February (58 redirections per day). We expect that the number will increase as the deadline for application submission is closer (on 30 March 2015). The pages as whole were displayed 838 times.

The number of applications for studies submitted through the application according to the study programmes is displayed at Tab. 1. The students were interested the most in programme Business and Economics (PAE) and then Business and Administration (PAA), both thought in Czech language at bachelor level. It is not surprising as those two are the biggest programmes at FEM. Third is Business and Administration (PAAN) at master degree level, followed by Public Administration and Regional Development. The most popular programme taught in English was Economics and Management with 18 applications. Less of applications were submitted to the programmes Business Administration and European Agrarian Diplomacy, all at master degree level. Those programmes have traditionally less students. Besides, the application is in Czech language and therefore mainly targeted on the Czech students, who do not study English programmes that often.

Despite that the recommendations are only a part of the application, in 48 cases (7% of all) they were displayed when the student clicked on application form. The most popular recommendations might have helped two people to choose their study programme (there were 11 of them - e.g. the recommendation nr. 2: "I recommend my study programme, because the subjects are taught are useful in practice and during studies." was visible to two people when they were submitting their applications). So far, the number of applications and recommendations is not that significant. It implies that the link between social media applications and number of applicants is still weak. On the other hand, a study of Broughton, Foley and Cox (2013) shows that many private companies who recruits for the jobs at their Facebook pages are concerned that this will lead to too large number of applicants for a job. Their concerns are justified as the findings of Ramasamy and Raman (2014) indicate that perceived corporate reputation and quality of social networking site does attract high number of job applicant through social media network.

Study programme	Bachelor level	Master level
PAE – Business and Economics	220	54
PAA – Business and Administration	136	101
VSRR – Public Administration and Regional Development	67	34
INFO – Informatics	63	36
HKS – Economic and Cultural Studies	23	9
EM – Economics and Management (EN)	18	8
PRN – Project Management	-	17
INFOA – Informatics (EN)	16	-
BA – Business Administration (EN)	15	3
SYI – System Engeneering	13	2
EADN – European Agrarian Diplomacy	-	3

Tab. 1: Number of views of the study programme in the application; source: own elaboration

Therefore, consequently the attention is paid to the reputation of the university shared by the students via their recommendations provided through Facebook applications. Current students or alumni gave 44 recommendations by 22 February. The most recommendations were given to Business and Administration programme (8 at both, bachelor and master degree level). However, the most applications (220) were submitted to Business and Economics programme where only 6 recommendations were given. We may say that on average 1 recommendation generated 37 applications for studies. One recommendation for Informatics at master degree level (INFON) helped to 36 applications, and one for Public Administration and Regional Development (VSSRN). On the other hand, 8 recommendations for Business and Administration (PAA) helped to 17 and PAAN to 13 applicants.

There were long but also short recommendations, having 55 to 56 words on average. In majority of cases, the name of the advisor was not published. Some recommendations were concerned solely with the curriculum of the programme. Others described personal reasons why the students had chosen particular programme and advice it to the persons with the same interests. Majority of recommendations are general and besides studied subjects describe also other aspects of the school such as non-school activities (e. g. parties, fairs), study atmosphere or the university's facilities. The students especially appreciate the possibility to create their own timetable and select the subjects of their interest. The campus and the advantage of having everything at one place were mentioned 4 times.

We divided the recommendations according to the areas of prospective students' interests similarly as in a study of Šťastnová and Drahouňovská (2011). Firstly, the applicability of the knowledge to future life and job is examined. Than the studies itself are described. Finally the ability to complete the studies is mentioned.

One of the frequented words (appearing nine times) in the recommendations was practice. The students pointed out that the study programmes are useful for further career and that there is a link between curriculum and practical life. According to the students, the programmes provide sufficient knowledge for professional life. There were 18 recommendations in this area. Some students admit that they were even able to start their career during studies. The results correspond to the study of SCIO (2012) which found out that the major reason for the students to study economics is to gain the desired job. In this sense the recommendations gave relevant information. Another important feature stressed

by the students was friendly atmosphere at the faculty. Generally they appreciate good group of people, some admit that they made good friends. Also the absence of rivalry among students and especially good approach of the teachers to the students is highlighted. In total these features were mentioned 18 times in recommendations. It is desirable result because an educational environment plays an important role in academic achievement, satisfaction and success of the students and also because as stated by Taramsaria et al. (2012) the quality of institutions in higher education is perceived as the quality of learning environment. Other widely discussed topics are the subjects and curriculum themselves. A phrase "interesting subject(s)" appears five times. There are also related phrases such as "interesting study programme", "interesting lecture" or "interesting information". All together the word "interesting" appears in 45 recommendations 11 times. The value of received information during studies is mentioned by expressions such as "widen the horizon", "get perspective", "learn many new things", "get something more", "get outline in particular area" and "enriching study blocks" or "complex knowledge".

Less favourable (for the faculty), but more important for students were the information that "it is possible to make it", i.e. to finish studies or pass the exams and that it is "possible to study and work" – i.e. the demands are not that high. The worst was "Except for some subjects, it is not that bad." This "recommendation" might not convince many people. However, mostly in summary, the recommendations were positive and tried to be helpful.

There were 1405 combinations made in bi-words analysis. However, only 48 of them appeared more than twice. Not surprisingly a phrase with word "recommend" appeared 12 times ("recommend programme", "recommend because"). Then the name of study programmes "business administration", "anthropology, sociology", "HKS programme", "informatics FEM", "cultural studies", "management marketing", and "regional development" appeared two times. Regarding the valuation of the university, phrases such as "wouldn't change", "gave me", "utilize well", "I like", "many interesting", and "career opportunities were the most frequent. This points out on positive perception of the faculty. Our results are in line with the findings of Klein, Niebuhr and D'Alessandro (2013) who found that "conducting a national faculty development activity on Facebook yielded excellent participation rates and positive participant impressions, and it affected professional usage."

Those findings show that recommendations give positive information to the prospective students of the university and have the potential to attract them to the application to the study programme. Melanthiou and Fantis (2010) also examined the use of social networks as an effective promotional tool for higher education institutions. They focused especially on the communication of the universities with prospective and existing students. They came to the conclusion that prospective students „look for information about universities on social networks" (Melanthiou and Fantis, 2010). This is in line with our results. We found out that Facebook can be effective tool for study programme selection nowadays. The reason is that social media technologies provide the opportunity to broadcast messages to a larger and more diverse audience than ever before. It is proved by the fact that the application attracted 688 students so far. We suggest utilizing the social media more. For example in Romania, the potential of social media is still not fully exploited. According to Alexa, L. E., Alexa, M. and Stoica (2012) found out that "only few Romanian universities use social networks actively and mainly in the recruitment periods)". However, other resources of information for prospective students should not be neglected. Noel-Levitz (2007) suggests that social networking can be a great resource for recruitment efforts, but still advices that the main focus should be on the official Web site of the faculty.

Conclusion

The aim of the paper was to analyse the effectiveness in the process of programme selection by prospective students of the Faculty of Economics and Management (FEM), Czech University of Life Sciences Prague by using new approach through the social media application. The content of recommendations for the study programmes given by current students or alumni was surveyed in order to see whether they contain relevant information for potential students. We conclude that the recommendations and other features of the application contain information which is important for people interested in the study programmes. The application offers links to the practice, jobs and career, describe the studies and study subjects. Based on recommendations the difficulty of studies is also assessed by candidates. Besides, in the recommendations students stress the friendliness of the university and positive approach of university lectors. Others recommendations contain basic important information and connections. The new social media application is an effective tool. It leads to desirable results, i.e. it attract prospective students and help them to select a study programme because the recommendations contain important information which prospect students need to know. Consequently the well informed students can more easily choose their future specialization according to their interests. With correct specialization choice students will be more motivated to study and to graduate successfully.

The future work will analyse how many students applied to the FEM thanks to the information and recommendation in the application. We plan to define which attractants in recommendations were positively perceived and analyse how to work with them in future advertisements. We will perform interviews about the application feedback too.

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SWOT ANALYSIS: TOOL TO IDENTIFY STUDENTS' PERCEPTIONS OF STUDY PROGRAMS

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Abstract

The aim of the paper is to assess the possibility of using the application of the SWOT analysis methodology as a tool to identify students' perceptions of study programs at a university. To assess the utility of a SWOT analysis for this purpose an experiment was performed which was carried out on 72 students of Economic and Cultural Studies within the Economic politics and administration study program at the Czech University of Life Sciences, Faculty of Economics and Management. The experiment demonstrated the possibility of using SWOT analysis as a tool for identifying ideas from students. In the discussion section possibilities of working with the identified perceptions are described, and in the conclusion the possibilities of improving this method and proposals for further research are discussed.

Keywords

SWOT analysis, evaluation, study program improvement, university

Introduction

SWOT analysis has its origins in the 1960s (Learned et al, 1965). In more recent years SWOT analysis has been seen as being somewhat outdated, and has been superseded by resource-based planning (Wenerfelt, 1984; Grant, 1991) and competency-based planning. The resource-based view focuses on the internal resources, capabilities and core competencies of the organization, and advocates building strategies on these foundations to assure the competitiveness of the organization and the attractiveness of the industrial sector. Barney (1991) further developed the resource-based view arguing that a resource was strategic if it satisfied the criteria of valuability, the capacity to increase the organization (effectiveness and efficiency), rarity (rare and in high demand), inimitability (difficult to imitate) and substitutability (not readily substituted). Likewise the competency-based view identifies organizations' competencies as the foundation for strategy development.

Coman and Ronen (2009) proposed the following criteria for evaluating internal and external factors, i.e. that the components in the list should be concise, actionable, and significant; having considerable impact on an organization's value. Extending this idea it is suggested that marketers must include those components which are of utmost importance, and eliminate components having negligible importance.

Clardy (2013) described SWOT analysis by assessing an organization's strengths (what an organization can do) and weaknesses (what an organization cannot do), in addition to opportunities (potential favorable conditions for an organization) and threats (potential unfavorable conditions for an organization). SWOT analysis is an important step in planning and its value is often underestimated despite the simplicity in creation

Agarwal, Grassl and Pahl (2012) suggest that the gradation and comparative evaluations

of judgments can be more systematic, include quantification, and retain predictive powers, rather than classifying either as weaknesses or strengths only. Chang and Huang (2006) argue that quantified SWOT analysis improves the overall process, hence plays a significant role in strategic marketing planning. Dawes (2008) suggests that items asked on five-point scale lead to maximum reliability and effectiveness, hence enhancing the effectiveness of SWOT analysis. The components should be ranked on a five-point scale, and given weights according to their degree of priority. Subsequently, the components are compared according to their relative importance/priority and listed accordingly.

These more contemporary approaches to strategy formulation are developments of the internal appraisal of SWOT analysis rather that a replacement for it. The advantage of SWOT analysis (or the TOWS matrix) is an attempt to connect internal and external factors to stimulate new strategies. Hence resource and competency based planning can complement SWOT analysis by developing the internal perspective whilst keeping internal and external perspectives in play simultaneously. Rather than seeing SWOT analysis as an outdated technique therefore, it is possible to see it as a firm foundation for resource and competency based planning. However, scenario analysis focuses on the external environment and identifies key external factors in a similar way to the external appraisal of SWOT analysis (Dyson, 2004).

According to Shariatmadari et al. (2013) there are 4 strategies resulting from SWOT analysis. S-O strategies pursue opportunities that are a good fit to the company's strengths. W-O strategies overcome weaknesses to pursue opportunities. S-T strategies identify ways that the firm can use its strengths to reduce its vulnerability to external threats. W-T strategies establish a defensive plan to prevent the firm's weaknesses from making it highly susceptible to external threats.

Theoretical Backgound

Although originally intended for use in business applications, the idea of using this tool in educational settings is not altogether new. For example, Thomas et al (2014) suggested this approach to increase minority enrolment in community and other regional colleges. Management tools, originally intended for industry, can frequently be tailored for application in education due to fundamental similarities in the administrative duties of the respective chief executive officers.

SWOT analysis can be simply understood as the examination of an organization's internal strengths and weaknesses, and its environments, opportunities, and threats. It is a general tool designed to be used in the preliminary stages of decision-making and as a precursor to strategic planning in various kinds of applications (Adepoju and Famade, 2010).

According to Ghazinoory, Mansoureh and Azadegan-Mehr (2011) a SWOT analysis should cover the internal environment of the institution (i.e.: faculty and staff, learning environment, current students, operating budget, various committees, and research programs), and the external environment of the institution (i.e.: prospective employers, parents and families of students, competing colleges, preparatory high schools, population demographics, and funding agencies). One danger in the use of SWOT analysis is that they usually reflect a person's existing position and viewpoint, which can be misused to justify a previously decided course of action, rather than used as a means to open up new possibilities. It is important to note that sometimes threats can also be viewed as opportunities, depending on the people or groups involved.

Dawes (2008) suggested that the SWOT list becomes the basis for further strategic planning. He writes that the results of a detailed SWOT analysis can also provide valuable

material for continued planning and support-generating activities. The strengths can be presented and emphasized to potential supporters. A discussion of weaknesses and threats provides useful information for strengthening the project or plan where possible, or anticipating the effects of environmental threats. Utilizing a SWOT analysis can be used as a means for departure from a strategic plan, thus, making it a flexible instrument. To operate in this manner, the company must concentrate its future objectives on its strengths (Ramooshjan, Sobhanallahi and Khamseh, 2014).

According to Štůsek, Charvátová and Charvát (2014), for a proper operation of the system it is necessary to have well-defined information flows – direct and indirect feedback influenced by many factors. Evaluation of higher education institutions seems to have become a very popular and important decision supporting tool (Furková, 2013). A SWOT analysis is a simple tool that can give feedback and assist faculty to initiate meaningful change in a program, and to use the data for program improvement (Orr, 2013). Fischer and Lipovská (2014) found a relationship in students' opinion between a study program and their chances on the labor market. Orr (2013) also wrote that a SWOT analysis can be used as a high-level and critical thinking exercise for students. The implementation of a SWOT analysis should be considered as just one input to strategic planning.

The aim of the paper is to assess the possibility of the application of the SWOT analysis methodology as a tool to identify students' perceptions of the study programs at a university. The rest of this paper is organized as follows: Firstly, the results of the SWOT analysis are presented, focusing on analyzing the possibility of using this method for idea generation. Secondly, the possibility of using these ideas is discussed, in the context of the management of study programs. Finally, recommendation and possibilities for future research are discussed.

Materials and Methods

To test the possibility of the alternative usage of the SWOT analysis as a tool to identify incentives for management of study programs, an experiment was conducted by modifying the process of making SWOT analysis, as was proposed by Orr (2013). Theoretical backgrounds for SWOT analysis application area are compiled with analysis, comparison and synthesis methods. The basic process is composed of eight steps:

(1) Selection of a work group. For this study, 72 students of Economic and Cultural Studies were enrolled in the "Change management" subject of the Czech "Economic policy and administration" study program at the Czech University of Life Sciences in Prague. The research sample was selected for two reasons: (1) practising SWOT matrix is a part of the course syllabus, and (2) students have appropriate experience to enable them to analyse their study or university environment in comparison to other commercial or public organisations.

(2) Explanation of the purpose and goal of the activity.

(3) Explanation of the concept of SWOT analysis, characteristics of individual areas (Strengths, Weakness, Opportunities, and Threats) – SWOT analysis was theoretically discussed in connection with the usage of SWOT analysis to support innovative initiatives in the company in the course of change management. The theoretical part was supplemented by SWOT analysis case studies based on the Apple Corporation in 2013.

(4) The definition of time and space for the SWOT analysis – after the lecture, the students were divided into blocks of training for 25 people. There were 3 blocks in the academic year 2013/2014, and in each block 5 groups were formed (about 5 people per group), one session lasted 90 minutes.

(5) The selection of a tool for design and presentation of SWOT analysis: Each group had one flip chart sheet attached to the wall, 3 pens and some sticky notes. Following Orr's proposals, different paper colors were used for different factors (Strengths, Weakness, Opportunities, and Threats).
(6) Creation of SWOT analysis – although there had been a theoretical explanation of the process of developing a SWOT analysis in the lecture block, the first 20 minutes were devoted to recap this concept. For the next 45 minutes, students had to construct a SWOT analysis, from their position as a participant of their field of study. During this time, the teacher was walking between groups and answering questions.
(7) Presentation SWOT analysis – In the next 25 minutes, each group had 5 minutes to present their strategic alternatives (SO, WO, ST and WT).
(8) Recording the results - individual responses of partial SWOT analyses were recorded using the camera and then summarized. Suggestions that occurred more than 3 times were included into a resulting matrix.

Results and Discussion

At the beginning of the results it was necessary to mention again that it was not an assessment of a study program at the university, but an experiment to assess the possibility of the application of the SWOT analysis methodology, as a tool that may identify students' perceptions of study programs at the university. Fifteen teams of students were created in total, which generated 46 unique factors in the categories of Strengths, Weaknesses, Opportunities and Threats, and 6 strategic alternatives in areas of SO, WO, ST, also seen in Table 1 below. None of the groups generated ideas in WT strategic alternatives.

Based on these results it is clear that students thought about themselves as participants of the defined study program (strengths and weaknesses), and in relation to external environment (opportunities and threats) during their work on this task. As mentioned above, the results of these analysis cannot be used for evaluation of the study program directly, partly because students were only in the second year of study (total duration of this program are 3 years). The results, however, can be taken into consideration for increasing a program´s attractiveness, satisfaction and future success of graduates.

The results identified by the students can be useful in two ways: (1) it is necessary to address the perceived weaknesses. (2) The strengths of the study field which are not seen by students have to be better communicated. Weaknesses have to be minimized, and in relation to the WO and WT strategies which were developed, it should be possible to derive suggestions which these students consider as being appropriate to eliminate these weaknesses.

Opportunities and threats are factors these students see in the external environment. From the faculty point of view this could be valuable information about factors which are seen by students as having potential for improvement, and also about threats which are perceived by students, and thus the WT strategies may be considered for their removal.

In this case the identified strengths, weaknesses, opportunities and threats just represent subjective feelings, which could also be considered in the management of the study program. In other words, if students identified a lack of foreign language skills, it does not mean it is necessary to add a language course, but it informs management about the students' subjective perception. It could be helpful in managing communication to current sudents, for example, about the possibility of attending an extra course as an official part of the study, or attending additional courses.

Weaknesses		Strenghts	
No foreign language education in Master degree	12	Enough time for work experience during studies	11
Disparity of subjects	7	High cooperation between students	6
Bad language skills	12		
No work experience	9	Modern equipement of class rooms	3
Lower reputatuion of studied university	4		
Group work once in 2 weeks	6		
Worse chances on the labour market in relation to studied program	7	Smaller study field offers higher contact with teachers	2
Limited possibilities of facultative subjects	6		

Oportunities		WO	SO
Possibilities of Erasmus program	11	To get language skills during Erasmus studies	To get an Erasmus internship
Possibility of connection with foreign studensts	4	Part-time job in international NGO	Work experience during studies
Possibility to get a job in NGO	3		
Threats		WT	ST
Graduates of other universities	5	X	Work experience during studies
Work experience requirement of future employers	7		To get language skills during Erasmus studies
Foreign language skills request in a future job position	12		

Table 1: SWOT analysis

On the basis of the case study the biggest problem for students was the creation of WT strategic alternatives, where students were unable to suggest any strategies from their point of view that may eliminate the weaknesses and risks. This result can be seen as a further incentive for study in the field of management.

The SWOT analysis created by students during this session cannot be considered as the equivalent of a SWOT analysis used in the strategic management of a company. Factors and created strategies have to be put into the context of the focus and goals of the study field in which the student is classified, and also the fact, that students are evaluating their whole program after only 2 years' experience. Another problem is not only that the creation of the SWOT analysis requires theoretical preparation and the presentation of their results.

Using SWOT matrix as a tool to identify subjective student statements is appropriate for other reasons. Getting feedback from students itself is very time-consuming (Ackerman, 2010; Altrabsheh, Cocea and Fallahkhair, 2014), thus this methodology represents an alternative way of obtaining feedback based on methodical processing of subjective estimation, and demanding more critical thinking (Orr, 2013), in comparison with the questionnaire method (Hamouda, 2011).

Conclusion

The contribution of the study is in testing the combination of two unlike and time-consuming activities: SWOT analysis practical application and getting feedback from students about their study programme. The main aim of the research results analysis was to test whether the SWOT analysis technique can be used as a tool to identify students' perceptions of their study program. Based on the testing done in this research it can be argued that students do think about the strengths and weaknesses in the context of graduates of this field study. Students are also aware of the opportunities and risks that they will be exposed after their graduation. These results have to be compared with the strategic focus of their field of study, and used to increase the attractiveness of the study field and the students' satisfaction.

The results have only a limited point of view – language skills, Erasmus and it does not apply to every student in Master Degree. Implementation of SWOT analysis should not be considered as just one input to strategic planning. In the other words: alternative usage of SWOT analysis can provide a preview of the actual perception of the present view of students. Based on the communication of the study field´s strengths that are not seen by students, it is possible to reduce the uncertainty in the context of threats that students perceive. By identifying a study field's weaknesses as perceived by the students, the faculty has the opportunity to create the conditions to counteract them.

An example would be the inclusion of a foreign language into the Master Degree in a test group because of its frequent occurrence in the list of weaknesses. The students are aware that employers often require an advanced knowledge of foreign language. The only way, according to the students' opinion, is the possibility of joining an Erasmus program, but it is not a solution in all areas. This feedback allows the faculty to obtain views reflecting the current situation on the labor market from the point of view of the students. In fact, it is the students who will actually be confronted by this reality.

One of the proposed alternatives is work experience during studies. By this strategic alternative student minimizes threats by filling the requirement of the future employers by using strengths – plenty of time for work experience during studies. This initiative opens discussion of the alternative creation for reducing this threat. To design this research by the students in the last year of study would bring more relevant results, due to greater experience in the field of study and the higher interest of student in the job search process. This would open up a new area for future research.

Acknowledgements

Supported by the Internal Grant Agency of the Faculty of Economics and Management (IGA), Czech University of Life Sciences Prague, Project No. 20131053.

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OVERCOMING THE AFFECTIVE BARRIERS TO CLIL IN MATHEMATICS TEACHER TRAINEES

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Abstract

This study maps the attitudes of Mathematics teacher trainees towards Content and Language Integrated Learning (CLIL), and showcases how a specific educational approach in teacher training for CLIL can influence them. When CLIL methodology is taught as a mandatory course, the trainees' affective barriers to CLIL need to be dealt with. This article illustrates the initial affective strain from the teacher trainees in a mandatory CLIL didactics course: most are initially sceptical about the feasibility of mathematics and language integration and express concerns about their (didactic and linguistic) aptitude. Data from two consecutive years of the mandatory CLIL course is presented, illustrating how a change in syllabus influenced the teacher trainees' attitudes towards CLIL.

Keywords

Attitude, affective factors, Content and Language Integrated Learning, CLIL, teacher training

Introduction

Content and language integrated learning (CLIL) is an educational trend of growing significance (see Eurydice, 2006; Ruiz de Zarobe and Jiménez Catalán, 2012). It is defined as 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).

In CLIL contexts, many teachers are challenged to endeavour outside their usual environment, and often out of their comfort zone: content teachers need to demonstrate foreign language (L2) competence and incorporate effective language-teaching practice in their lessons, language teachers need to deal with the specifics of content subject didactics, and both groups need to master tools for effective integration of the two aspects. Certain level of negative affective strain towards such integration can be expected in teachers, especially if the objective of integrated teaching was imposed upon them by an authority (be it e.g. a principal of a school, or the ministry of education). In teacher trainees, this anxiety towards CLIL can be even more pronounced as they have not had enough experience even in their main field of study, and it may influence their capability of learning: as Koteková (2013) puts it, "How students feel is closely related to their ability to learn." It is thus of imminent interest to create a teacher-training model in which the affective barriers are accounted for.

Barriers to CLIL implementation in different contexts are being mapped, including the affective barrier (see Hüttner, Dalton-Puffer, and Smit 2013, Navés, 2009, Seikkula-Leino, 2007, and Kubů, Matoušková and Mužík, 2012) – however, it is typically the students' or the practicing CLIL teachers' attitude that is dealt with. Our study draws attention to prospective teachers. Educational research (outside the specific context of CLIL) also underlines the relevance of affective and/or attitudinal aspects of teacher

training: Schumann (1975) correlates the affective factors to age, and suggests that they play a more significant role in adult education and thus in teacher training. Hofmannová, Novotná and Hadj-Moussová (2003) mapped the attitudes of Mathematics and language teachers in the CLIL course, looking into inner and outer barriers to adopting a novel approach, their causes and consequences, and concluded that CLIL contributes positively to teachers' inner motivation.

Data from two consecutive years of a mandatory CLIL course were collected using two online questionnaires each year. The first questionnaire employed the method of unfinished utterances, we aimed to answer the following questions: Do the teacher trainees express rather positive or negative attitude towards integrated learning/teaching? Do the trainees relate their responses more to inner factors (themselves) or to outer factors? The second questionnaire included open questions designed to confirm and complement the data by having the respondents describe their changes of attitude to CLIL and the causes of such changes.

Materials and Methods

Context of the study: teacher-training CLIL course

At the Department of Mathematics and Didactics of Mathematics at the Faculty of Education, Charles University in Prague, there is a CLIL didactics course, mandatory for all students of Mathematics Education programme. The general aims of the course are to widen the future teachers' professional competence by acquainting them with the specifics of CLIL methodology: borrowing from language-teaching strategies, focusing on formative evaluation, careful and conscientious scaffolding, and deliberate lesson planning.

Throughout the history of the CLIL course at Faculty of Education (which started in 1999 in cooperation with the Department of English Language and Literature, continued as an optional course at the Department of Mathematics and Didactics of Mathematics, where it became an obligatory course in the Masters' syllabus in 2013/2014), feedback has been collected among the participants through a series of collective reflections, interviews and questionnaires. Further changes were embraced with the development of the course at the Department of Mathematics as a blended learning model (see Novotná and Tejkalová 2010, and Procházková 2015 for details on the development and detailed syllabus). When the course became obligatory for the future Mathematics teachers, the affective dimension of the course shifted to the very centre of attention, as it could be safely assumed that the affective strain might be even more pronounced in trainees who did not select the course voluntarily. In 2014/2015, based on the students' feedback, a new e-learning unit was added to the course, focusing on the use of CLIL methods outside CLIL contexts, e.g. to cater for language minorities or learning difficulties.

In 2013/2014, 26 trainees enrolled in the CLIL course, 14 pre-service, 2 pre-service Erasmus programme students and 10 in-service teacher-trainees (teachers qualified to teach other subjects who are extending their qualification to teach Mathematics at both lower an upper secondary levels). Due to faculty-assigned scheduling of the face-to-face sessions (the first one took place only in the middle of the semester), the initial acquainting with CLIL theory and methodology was done through e-learning, with the trainees watching video samples of authentic CLIL lessons and reading materials on both theoretical background and CLIL classroom practice. Discussion fora were open for each of the tasks and the trainees were encouraged to use them.

In 2014/2015, 13 pre-service (including 2 Erasmus students) and 11 in-service trainees enrolled. The introduction to CLIL principles and methodology was done in a face-to-face session at the very beginning of the semester: the trainees experienced a mock CLIL lesson in an unfamiliar foreign language (instead of watching a recording), and were actively included in a follow-up activity of brainstorming the keypoints of effective CLIL methodology based on this experience. They also had access to the e-lesson that had introduced the CLIL course in 2013/2014.

Questionnaires

Two questionnaires were administered in both years. The teacher trainees were asked to fill in the first questionnaire after their introductory CLIL lesson (in 2013/14 after the first e-learning unit, in 2014/2015 after the first face-to-face session). The second questionnaire was assigned at the very end of the course. The questionnaires were anonymous; the respondents used a nickname of their choice to allow for pairing of the two questionnaires, since the aims of the study were not only to provide insight into the attitudes of teacher trainees towards CLIL at the beginning of the course, but also to study their development. In 2014/2015, the students who had not attended the introductory lesson were excluded from the study; in the two years, a few students dropped out during the course, and thus only their data from the first questionnaire is available. The sample represents 92 % of the teacher trainees enrolled in the mandatory CLIL course in 2013/22014, and 92 % of the year 2014/2015.

The first questionnaire aimed to answer the following questions: At the beginning of the course, a) do the teacher trainees express rather positive or negative attitude towards integrated learning? b) does the same trend appear when asked about CLIL in general and when asked about integrating L2 and mathematics? c) do the trainees relate their responses more to themselves (inner factors) or to outer factors?

The method of unfinished utterances was employed, asking the trainees to finish the following statements freely:

1. I think that CLIL…
2. I think that the integration of Mathematics and a foreign language...
3. If the principal asked me to include CLIL activities in my lessons…
4. I am afraid that …
5. I am not sure if…

Items 1, 2, and 3 were designed to answer questions a) and b), phrase 3 was designed to focus on CLIL not just as a concept but rather a possible perspective in own practice. The wording of items 4 and 5 deliberately suggests negative emotional charge, and together with items 1 and 2 is used to analyse the trainees verbalization of inner/outer affective factors (following Hofmannová, Novotná, Hadj-Moussová 2003).

In both years, the teacher trainees filled in the second online questionnaire at the end of the CLIL course. Apart from feedback on the particularities of the course itself, it included two open questions designed to confirm and complement the data from the introductory questionnaire survey: "How has your attitude to CLIL changed by the end of the course? What made you change your mind/what reassured you in your initial attitude?"

Qualitative analysis was used to categorize the statements in terms of expressing positive/negative attitude to CLIL. If the original attitude was mentioned (explicitly or implicitly, e. g. by using the expression such as "unlike in the beginning of the course"), it was compared to the results from the first questionnaire by the same respondent. Responses to the second question were used to list the activities that facilitated the changes in attitude, or its reinforcement.

Results and Discussion

Attitude towards CLIL and causes of improvement

In the first questionnaire, responses to questions 1 and 2 were analysed together to map the frequency of positive/negative attitudes towards CLIL in general and the integration of Mathematics and L2 in particular, expressed by the teacher trainees. We grouped the responses according to the attitude; we distinguished between responses that expressed only positive attitude, only negative attitude, responses that conceded both positive and negative aspects, and responses that were either neutral (inassessible in terms of attitude) or ambiguous (typically being also very brief). Table 1 presents an overview of the responses. The columns list percentage of respondents who verbalized positive or negative attitude in utterances 1 through 3, that is, towards CLIL, towards the integration of mathematics and a foreign language (MA/L2) and towards prospective CLIL practice imposed upon them (Pers.).

Attitude	Key words	2013/2014			2014/2015		
		CLIL	MA/L2	Pers.	CLIL	MA/L2	Pers
Positive	Interesting, motivating, welcome...	13%	8%	8%	22%	26%	35%
Negative	Afraid, impossible, time-consuming	29%	42%	58%	22%	30%	44%
Both		50%	42%	33%	56%	44%	13%
Ambiguous/ neutral	New, challenging...	8%	8%	0%	0%	0%	0%

Tab. 1: Percentage of respondents expressing attitude[1]

There were several linguistic trends noticeable in the two years. First, most respondents felt the need of mitigating their statements by using modal verbs (may, might, could). Second, respondents who verbalized both positive and negative aspects of their perception of CLIL typically sequenced their responses from positive to negative: "CLIL sounds very interesting, but I don't think I could manage". The strictly negative responses were the most emotionally charged, especially when asked about own participation in CLIL (eg "...I would run away screaming").

In the two years, more respondents expressed strictly negative attitude towards the integration of MA nd L2 than towards CLIL in general. The wording the respondents used suggests that this fact may have three main explanations:

1. the respondents are sceptical to the feasibility of effective integration of MA and L2, even if they embraced the general idea of integrated learning;
2. the respondents are influenced by their pedagogical beliefs ("The integration of MA+L2 is impossible, as there is not enough language in MA to practice L2 effectively"),
3. the affective filters are stronger when the outlook on CLIL is more personal (expressions such as "The integration of MA+L2 scares me." or "I will hopefully will never be forced to integrate L2 in my teaching practice.")

Between the two years, we see a significant rise in the percentage of trainees expressing positive attitude towards CLIL as such and integration of L2 in Mathematics, specifically. The most significant rise of positive attitude, however, is in replies to including CLIL in

[1] The values were rounded to a whole number, which may result in the rounded percentages adding up to 99 or 101 %.

own practice, even if many of the responses were cautious (eg. "...I would try" or "I would do my best"). In general, positive statements were shorter than the negative ones, and provided less insight. With cautious optimism our experience suggests that this rise may be influenced by the change in syllabus and organization of the course: including direct experience with CLIL seems to have been notably more convincing about the benefits and feasibility of the approach than reading/watching recordings.

In the second questionnaire, we focused on the development of attitudes towards CLIL in general. In all the responses, if the initial attitude was explicitely or implicitly stated, it corresponded to the data from the first questionnaire (Question 1 – CLIL in general). We mapped the percentage of trainees whose attitude to CLIL has improved/worsened, and, comparing the results to the responses in the first questionnaire, we looked into the responses of those who claimed that their attitude has not changed. Table 2 provides an overview of the responses.

My attitude...	2013/2014	2014/2015
Has stayed positive	14%	23%
Has stayed negative	5%	0%
Has stayed the same (both positive and negative aspects)	27%	5%
Has improved	54%	73%
Has worsened	0%	0%

Tab. 2: Changes in attitude to CLIL

In both years, none of the trainees claimed that their attitude towards CLIL has worsened, and most claimed to have improved their attitude. In those who stated that their attitude had not changed, there was high consistence among those who expressed strictly positive attitude in the first place. There were significantly more students whose attitude improved in the second year of the study, and the reasons for the change in attitude were different from the first year.

In 2013/2014, the reasons behind the improvement of the attitude towards CLIL, were (in descending order by frequency of appearance)

1. trying out CLIL methods in the seminars,
2. planning and discussing own CLIL activities,
3. learning that there are different types of CLIL models to cater for differing L2 levels,
4. sharing experience with the other participants of the course,
5. the videosamples of effective CLIL practice.

In 2014/2015, the five most frequently mentioned reasons were as follows:

1. planning and discussing own CLIL activities,
2. experiencing the CLIL micro-lesson,
3. trying out CLIL methods in the seminars,
4. understanding how CLIL methods can be used in L1,
5. learning that there are different types of CLIL models to cater for differing L2 levels.

The data shows that to overcome affective barrier, to change the teacher trainees' attitude, the most effective tool (as perceived by the trainees themselves) was experiential learning. In 2014/2015, when more students claimed to had gained a more positive attitude towards CLIL throughout the course, two features were significantly different in the syllabus and organization of the course: the introductory CLIL micro-lesson was added, and an e-learning unit focusing on the possible employment of CLIL methods and strategies outside CLIL model (for example to cater for language minorities or students with

learning difficulties). Both of these changes were praised by the students as features that helped them improve their attitude towards CLIL.

Factors in negative attitude towards CLIL

To better understand the factors contributing to the affective strain, we included two unfinished utterances that directly triggered the verbalization of negative attitudes: fear (I am afraid that) and uncertainty (I am not sure if). These statements were analysed together with the negative factors mentioned by the respondents when freely expressing their attitude to their prospective own CLIL experience. Following the research by Hadj-Moussová, Hofmannová and Novotná (2004) we distinguished between inner and outer factors; by inner factors we understand the respondents' allusions to their own beliefs, capabilities and possibilities, typically worded in 1st person, and by outer factors we understand the outside context, both physical and conceptual.

The inner factors among all respondents may be grouped as follows:

- insufficient linguistic competence ("...my pronunciation is terrible")
- losing face/authority in front of the students ("...they would just laugh at me.")
- lack of experience ("...I am not prepared to do this right.")
- personal beliefs on benefits of CLIL ("...it has no benefit.")

It is possible to group the outer factors followingly:

- materials ("...it would be difficult to find a textbook"),
- demands on the teachers ("...it would be a lot of unpaid work", "...my planning time will double", "...I would have to work twice more than my colleagues"), often connected to concerns about financial profit (or rather lack thereof),
- students ("...weaker students cannot manage this", "...it will demotivate the students"),
- feasibility of CLIL in a specific context ("...impossible at our school").

There was no significant predominance of any of these factors in any of the three unfinished utterances: they were distributed evenly among fears, uncertainties and negative reactions towards prospective CLIL implementation. The same concerns appeared among respondents in 2013/14 and 2014/15, with comparable frequency.

Naturally, the results are influenced by the respondents' inexperience, both in CLIL and in teaching in general. Notwithstanding, the findings of this study confirm the data of a National Institute for Further Education research (Kubů, Matoušková and Mužík, 2012) among teachers and principals; in other words, principals, teachers and mathematics teacher trainees with basic CLIL training express the same attitudinal concerns about CLIL implementation. There were no significant differences in the attitude expressed by pre-service teachers and their in-service colleagues, also, the data from the Erasmus students did not stand out from the majority of responses, which suggests that the attitudes may not be strongly influenced by a specific educational context or level of teaching practice.

Hofmannová, Novotná, and Hadj-Moussová claim that adopting a novel approach like CLIL may be challenging for teachers and teacher trainees especially since '...adults find it difficult to change because they invested emotional capital in acquiring their knowledge and teaching skills and that is why they defend the integrity of this knowledge more strongly' (Hofmannová, Novotná, and Hadj-Moussová, 2003:76), however, they highlight the motivational potential of CLIL approach in teacher training and teaching. In our study, outer factors were seen as more pressing at the end of the course, especially after the changes in syllabus and organization. This suggests that such changes may positively influence trainees' attitude even towards an approach they had originally been opposed to.

Conclusion

The affective strain in Mathematics teacher trainees was analysed in the context of Content and Language Integrated Learning. The concerns expressed by the respondents matched the barriers identified in research among teachers and principals considering or practising CLIL.

The respondents' negative attitude towards CLIL lowered significantly when they had the chance to experience the CLIL approach in the role of students, and when they were acquainted with the use of CLIL strategies outside CLIL context. These findings draw significant implications for the CLIL courses: not only in pre-service teacher-training, but also in lifelong education of the teachers. Further interviews with the respondents would provide a more in-depth insight in the weight of the individual changes of the syllabus and its organization.

The data from this study will be connected to the analysis of lesson plans created by the respondents, looking to investigate whether the change of syllabus had impact also on the ability of the trainees to incorporate CLIL principles into their work. A more detailed investigation of inner/outer affective factors identified by the respondents could provide interesting insights in their general attribution trends and pedagogical beliefs.

Acknowledgements

This paper and the connected research is supported by Charles University Research Fund GAUK 1776214:PedF: Lesson-plan analysis for effective in-service teacher training for Content and Language Integrated Learning.

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STUDENT TEACHERS' ABILITY TO INTERPRET NUMERICAL RESULTS IN GEOGEBRA

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Abstract

The article presents a part of design experiment aimed at devising a way to develop Specific Skills needed to work with GeoGebra in future mathematics teachers. The focus is on the skill to interpret numerical results. The research questions are: Are future teachers aware of the way GeoGebra works with irrational numbers? Do they interpret numerical results when solving and posing tasks in GeoGebra? Are they able to recognise decimal expansions of common rational and irrational numbers? The data consist of solutions to a carefully devised worksheet tasks and proposals for teaching with the help of dynamic geometry. The data were analysed in a qualitative way. A substantial number of pre-service teachers do not use the skill to interpret numerical results properly. Examples of such (mis)use are provided as well as possible causes for the lack of attention to the interpretation of numerical results and pedagogical implications.

Keywords

Decimal expansion, GeoGebra, interpretation of numerical results, irrational numbers

Introduction

For dynamic geometry software, Laborde (1998) points out a necessity to understand differences between theoretical-geometric and computer-graphic worlds (e.g., the necessity to construct such figures whose properties are preserved when the objects are moved – i.e., robust constructions). Robová (2013) presents what she calls Specific Skills for work in GeoGebra (or GG) which pupils must acquire in order to use GG productively. Examples of such skills are: making functions visible (on the screen), changing visual appearance of graphs, interpreting points on objects, using dynamic features of GG (see also Mošna, 2013), interpreting numerical results. This article deals with the last skill.

One of the problems with calculators and software including dynamic geometry is that all real numbers (decimal, rational or irrational) appear on the screen in the form of a decimal estimate limited to a number of places. This is the consequence of rounding; calculators and computers work with a finite decimal expansion only. In fact, they work with a rational approximation of irrational numbers. Pupils and more so future mathematics teachers must be aware of this fact and use their theoretical mathematical knowledge to arrive at correct answers. The ability to convert fractions into decimals or otherwise and to use several representations of numbers (i.e., recognise repeating decimals and their relation to the fractions or integers they represent, understand what can or cannot be inferred from a decimal expansion of a number about its rationality or irrationality) is a part of number sense and lies at the heart of building an integrated concept of real numbers.

Measuring in dynamic geometry software has double meaning reflecting the meaning of measurement in mathematics (the result of which is a unique real number associated to a quantity that can be rational or irrational) and physics (the result of measuring depends

on the tool and its sensibility and the product is always a rational number). According to Sinclair and Robutti (2013), this double meaning is not always transparent to pupils and sometimes acts as a black box. This leads to pupils accepting a value of measurement they read on the screen, without treating it with some uncertainty or approximation. The main aim is that pupils and more so future mathematics teachers, are aware of the epistemological implications of the use of measures in GG (given by approximation, pixel counting and calculations in general) and look at the figure in a theoretical way to interpret it within the constraints of the software.

Two studies investigating the skill to interpret numerical values provided by ICT tools will be presented. Mitchelmore and Cavanagh (2000) gave pupils (n = 25) studying mathematics at the highest level available to them in their Year 10 and 11, among others, a task to be solved on the graphics calculator, in which they had to approximate the x-intercepts of a quadratic function with irrational roots. They found that "only three students (12 %) correctly stated that the roots of the parabola were irrational and that the x-intercept was therefore a non-terminating decimal which could not be found exactly. Only one of these students could also explain that the x-coordinate of the vertex of the parabola was a rational number which could be expressed by a terminating decimal." (p. 260–261) The authors conclude that only few students were aware of the differences in the decimal representations of rational and irrational numbers. Many difficulties in using ICT may be due to inadequate understanding of fundamental mathematical ideas including scale, accuracy and approximation.

In the second study, Zazkis and Sirotic (2004) found out that over 40 % of the pre-service secondary mathematics teachers (n = 46) did not recognize the non-repeating decimal representation as a representation of an irrational number and over 30 % of them either failed to recognize a number represented as a common fraction as being rational or provided incorrect justifications for their claim. They also report a tendency to rely on a calculator and a preference towards decimal representation over the common fraction representation.

In our previous research (Robová and Vondrová, 2014) we identified the skill to interpret numerical results (or INR skill) as produced by GG as problematic for pre-service secondary mathematics teachers. The aim of the present study is to confirm this result on a wider population of pre-service mathematics teachers and for more types of mathematical tasks and to look into the nature of their problems in more detail. The specific research questions are: Are future mathematics teachers aware of the way GG works with irrational numbers? Do they interpret numerical results when solving and posing tasks in GG? Are they able to recognise decimal expansions of common rational and irrational numbers?

Materials and Methods

The development of Specific Skills in future secondary mathematics teachers has been the focus of a design experiment (Cobb et al, 2003) aimed at designing a part of a regular mathematics education course focused on GG (Robová and Vondrová, 2014). Five stages of the design experiment has taken place since 2013 (each successive stage informing the content and organisation of the next one), the results presented here concern the first three stages (tab. 1). Prior to their study of GG within the mathematics education course, the pre-service mathematics teachers (hereinafter referred to as students) had completed nearly all their university mathematics courses and a course on GG and other mathematics software.

	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Time	spring 2013	autumn 2013	spring 2014	autumn 2014	spring 2015
Students	full-time	distance	full-time	distance	full-time, distance
Total	9	10	23	11	32

Tab. 1: Design experiment – developing Specific Skills necessary for work with GG

According to Sinclair and Robutti (2013), a delicate balance is needed when deciding between telling pupils about the way they should work in dynamic geometry software, and leaving them to their own devices "since, on the one hand, it is important to introduce schemes of use in a cognitive and metacognitive way, but on the other, this activity should not become a sequence of instructions and rules, but an investigation methodology" (p. 591). We decided for the use of tasks in which the Specific Skills which emerge from the differences between computer and theoretical mathematics become visible. Two worksheets on geometry (synthetic and analytic, WG1, WG2) and two on functions (WF1, WF2) were prepared. The first set of worksheets on each topic comprises less demanding tasks, while the second set puts the pre-service teachers into pupils' role (the tasks are mathematically more demanding). There is a space after each task where skills needed for its solution in GG should be written.

After completing 4 worksheets, the students are to prepare a Project as a course assignment in which they make a proposal for teaching with the support of GG. The project is to include tasks which lead to secondary school pupils' autonomous investigations of the topic in GG, solutions to the tasks, GG figures, the goal(s) of activities, pupils' prior mathematics and technology knowledge, their expected problems and a suggestion of their remedy, etc. The students are to prepare a Project either on geometry or functions. In total, we analysed 30 Projects (distance students from stage 2 (see tab. 1) did not write the Projects, 3 students submitted incomplete projects and 1 student submitted projects on both topics).

Next, we will only present (parts of) tasks in which the students had to demonstrate the INR skill, i.e., they had to realise that some results produced by GG are imprecise and how they can be represented differently. It will be clear from tab. 2 which numbers had to be dealt with.

WF1_1: Using the graph of the function, find zero points for function $h: y = x^2 - 3$.

WF1_2: Use the graph of the function $f: y = x - 3x^2$ and find a) zero points of the function, b) local extremes of the function.

WF2_1: Solve for $x \in \mathrm{R}$ in a graphic way: $|2x - 3| = |x + 7|$.

WF2_2: Solve the system of equation for $x, y \in \mathrm{R}$: $x - 3y = 4$, $x - 6y = 3$.

WF2_3: Plot the graph of $f: y = \sqrt{3x - x^3}$. Using the graph, find a) the domain of the function, c) zero points of the function, e) $f(-2)$.

WF2_4: Plot the graph of $g: y = \sqrt{\cos x}$, for $x \in \langle -3\pi, 3\pi \rangle$. Using the graph, find a) zero points, d) $f(\pi/3)$.

WG1_1: Construct line segment SK where $|SK| = 10$ cm. Construct circle $k(S, r = |SK|)$. Determine the perimeter of circle k.

The data consist of students' written solutions to worksheet tasks, their comments on Specific Skills, GG files with solutions to tasks and their proposals for teaching (Projects)

with all the accompanying material required by the Project assignment. For some students, Camtasia recordings of their work on the screen are available and were used when in doubt how the student solved the task. The data were analysed qualitatively. We looked for such phenomena in the students' written work, recordings or solutions in GG figures they produced which show their awareness (or lack of it) of the Specific Skills and to what extent they are able to use them. Here, only the results of the analysis aimed at the INR skill will be presented.

Results and Discussion

The results of the analysis of solutions to the above worksheet tasks are given in tab. 2 (the data come from the first three stages of the design experiment, $n = 42$). The correct (C) solution means that the student actually wrote the fraction or the square root or π. In some cases, a student recorded an imprecise solution and only afterwards checked its appropriateness. E.g., for WF1_1, one student first recorded roots of +2 and –2 as in his GG file he had set the rounding of numbers into zero decimal points. He wrote: "The correct result is ± √3. The mistake which I have recorded originated by an improper rounding of GG for which I fell hook, line and sinker!"

Partially correct (PC) solution means that a student recorded the approximate value as returned by GG but he/she made a comment that the result was imprecise and/or included the skill to recognise an approximate value in the commentary to the task. Some solutions coded as PC included a student's attempt to raise the number of decimal places up to the maximum of 15, probably to acquire a more precise number. It is not clear whether such a student realises that the precision of the tool does not increase by this process because there is a technological limit to the precision of the measuring tools (the dimension of the pixel).

Approximate number (AN) code means that a student copied the approximate number provided by GG and gave no indication that he/she is aware of the fact that it is an approximate value only. Column N contains other answers or missing answers; namely, students from stage 2 were not assigned task WF2_4.

In terms of fractions, $\frac{1}{3}$ is more readily recognised by the students than $\frac{1}{6}$ (in twice as many cases). The reason probably is that they have more experience with the former in different representations. For square roots, the students were more successful with $\sqrt{3}$ than with $\sqrt{2}$ (again in more than twice as many cases). The reason might be that $\sqrt{3}$ is more visible in the tasks which we set. It can already be seen from the equation of the function for WF1_1 and WF2_3ac while $\sqrt{2}$ is received as a coordinate of an intercept for WF2_3e and WF2_4d. The students probably did not expect an irrational result for the coordinates of this intercept and thus did not check GG results by substituting the numbers into the equation of the function. Naturally, it was easier for them to recognise $\sqrt{2}$ in its decimal expansion than $\frac{\sqrt{2}}{2}$ (tab. 2).

$\sqrt{3}$					$\frac{1}{3}$				
	C	PC	AN	N		C	PC	AN	N
WF1_1	25	3	14		WF1_2a	22	1	19	
WF2_3a, c	23	5	9	5	WF2_1 (–4/3)	21	5	11	5
%	57.1	9.5	27.4	6.0	WF2_2	26	5	8	3
					%	54.8	8.7	30.2	6.3
$\sqrt{2}$					20π				
	C	PC	AN	N		C	PC	AN	N
WF2_3e	14	13	11	4	WG1_1	1	3	37	1
WF2_4d ($\sqrt{2}/2$)	9	3	18	12	%	2.4	7.1	88.1	2.4
%	27.4	19.1	34.5	19.0					
$\frac{1}{6}$					$\pm\frac{\pi}{2},\pm\frac{3\pi}{2},\pm\frac{5\pi}{2}$				
	C	PC	AN	N		C	PC	AN	N
WF1_2b	11	4	27	0	WF2_4a	16	1	7	18
%	26.2	9.5	64.3	0.0	%	38.1	2.4	16.7	42.8

Tab. 2: The INR skill as manifested (or not) in students' solutions to worksheet tasks

We cannot really account for the high number of students who provided the approximate answer for WG1_1 instead of 20π. They know the formula for the perimeter of the circle so they must have suspended their theoretical mathematical reasoning when solving the task in GG and accepted the result at face value. One student used a computer algebra system window in GG which returned the correct answer but still, he recorded the approximate value. For this item in particular we feel the deficiency in our methodology – an interview with the students would be appropriate. The proportion of students who provided the precise number for WF2_4a is much higher than for WG1_1. Both tasks deal with π, however, π is more openly present in the assignment of WF2_4.

If we aggregate the data from tab. 2 for fractions and square roots, we get 45 % of instances in which a correct precise number was recorded in students' work, 12 % of instances where an imprecise number was given but the students were aware of the impreciseness and nearly 35 % of instances in which a student recorded an approximate number as a result of the task. The last case is worrying and might point to content knowledge deficiencies (compare with Zazkis and Sirotic's (2004) results).

On the other hand, the students used their theoretical knowledge of mathematics appropriately for WF2_3ac for which 7 of them used the method of looking for zero points through an auxiliary line with the same zero points, that is, they used function $g : y = 3x - x^3$. Similarly, some students used auxiliary lines $x = \pm\sqrt{3}$ to solve the task WF1_1.

In another task from WG1 ("Construct triangle *ABC* and point *S* outside of the triangle. Construct image *A'B'C'* of *ABC* in homothety with centre *S* and coefficient –2. Find the ratio between the areas of the two triangles."), students were to drag the original triangle, observe the ratio and to check the result theoretically. The vast majority of them solved the task by paper and pencil calculations and could not use GG to help them to formulate

a hypothesis (they lacked technology knowledge for that). However, 6 students (out of 32 solving the problem) commented on rounding when using GG to calculate with areas and thus realised problems stemming from it. E.g., a student wrote: "I found an estimate of the ratio from the areas of triangles provided by GG and also by reflecting on the situation theoretically."

In another task from WG2, the students were to prove that "for each parallelogram it holds that a quadrilateral whose vertices lie in midpoints of sides of the parallelogram is a parallelogram and its area is half the area of the original parallelogram". Only 8 students (out of 23 solving the problem) used their theoretical knowledge to prove the hypothesis. Fifteen students used the GG measures (length of segments, size of angles, area of triangle) to "prove" it without any regard to the approximate values GG works with. Three students even wrote that "using GG, pupils do not have to prove the relationship, GG can do it for them". Thus, they lack the knowledge of distinction between an empirical argument GG provides and the theoretical proof (see, e.g., Hanna, 2000; Prusak, Hershkowitz and Schwarz, 2012; Sinclair and Robutti, 2013). As Sinclair and Robutti (2013: 583) put it, "if students trust measurements and they believe measurements are absolutely exact, they stay at a spatio-graphical field. Instead, if they use the information provided by the reading of the measurements to formulate a conjecture in the standard form 'if … then …' and in a general case […], they connect the spatio-graphical field with the theoretical one".

	Project on:	Geometry	Functions	Total	%
1	Explicitly stated	1	1	2	6,7
2	Unclear	5	0	5	16,7
3	Avoided	2	0	2	6,7
4	Not required	9	5	14	46,7
5	Not used but required by the task	2	5	7	23,3
	Total	19	11	30	

Tab. 3: Awareness (or lack) of the INR skill in students' Projects

The results of the analysis of Projects are in tab. 3. The first line shows the number of Projects in which the INR skill was explicitly stated – a student's aim was to draw pupils' attention to the issue of rounding and GG working with approximate values. For example, one Project includes a task to find out whether two pre-constructed triangles are congruent. The sizes of inner angles are such that differences in angle sizes can only be seen when more decimal places are used for the numbers produced by GG and displayed on the screen.

Line 2 concerns the number of Projects in which it is not entirely clear what the authors' aims were. The INR skill is not explicitly stated but a task (tasks) is included which might require it. The authors make some measurements in GeoGebra but do not explain in the comments how they expect pupils to solve the tasks.

For two Projects (line 3), we can infer that the students tried to avoid the problem of rounding (e.g., by using integer coordinates) rather than presenting pupils with situations in which they would have to deal with the problem. Nearly half of the students made such proposals for teaching for which the INR skill was not necessary (line 4). This does not necessarily mean that they are not aware of it or that they do not consider it important that the pupils know about it. They can simply think that this skill will be developed at another time. The question is what is better, whether the teacher should choose tasks so that pupils avoid the difficulties or whether he/she should plan tasks for pupils to face

them. Mitchelmore and Cavanagh (2000: 266) suggest that it is not an easy question and that there "might be a case for avoiding difficulties in the early stages and then structuring challenges to draw explicit attention to old misconceptions or new developments".

Line 5, "not used but required by tasks", shows the number of Projects in which the INR skill is needed for at least one task but for which we have no indication from the assignments of tasks or the didactic comments accompanying them that the student is aware of it. An example is a task in which pupils are to discover that the result of the composition of two axial symmetries with concurrent axes is a rotation with the angle of rotation twice as big as the angle between the axes. According to the Project, pupils are to display the sizes of the angles and guess the relationship from them. However, the author of the project does not mention that the sizes of angles are rounded and thus in the GG figure made by her, the relationship, in fact, does not hold. No need to prove the relationship is mentioned either.

Conclusion

In worksheets and Projects, we found a considerable number of incidences in which an approximate value was recorded as a result and/or worked with, instead of a precise fraction or square root representations. It can have several causes. The first is that students do not realise that GG works with approximate values and take the number at face value without pondering the relationship between the type of the number and its decimal expansion (see also Mitchelmore and Cavanagh, 2000). They may have insufficient knowledge of number theory, particularly of relating irrational numbers to their decimal approximations, and of the way GG works. The second possible cause is a student's preference of decimal representations over the fraction or square root ones (reported by Zazkis and Sirotic, 2004, too). The third cause is that students realise that results are approximate but do not recognise the appropriate fraction or square root in its decimal expansion. They do not have enough experience with the two representations of numbers. The fourth cause is that when using GG, students suspend theoretical mathematical reasoning, relying heavily on the computer and not checking the results (not only numerical) theoretically (this might be the case of the authors of seven Projects in which the need to use the INR skill was not manifested). Sometimes, we cannot say for sure that students do not have the necessary mathematical knowledge. They may have simply not consider it important enough to record the fact that an imprecise number is provided as an answer. Nevertheless, we would expect that future mathematics teachers have sufficient mathematical knowledge to realise the need for precision in mathematics.

In order to develop proof skills, we agree with Doerr and Zangor (2000) that the continuous call for explanations for results provided by the computer should become part of the mathematical norms established by the teacher. The accepted truth or falsehood of a statement must "be supported by mathematical reasoning or justification, not by an appeal to any authority ascribed to the computer" (p. 152).

The number of participants of our exploratory study is rather small. Yet, it points to some important phenomena which must be taken into account when using ICT tools. The INR skill belongs among the most important Specific Skills needed for work with ICT. It is a necessary prerequisite for pupils to be able to utilise ICT not only for experimenting and creating hypotheses but also as a starting point of proving. We are aware of the fact that only a small number of decimal expansions can be linked to their fraction or square root representations even by mathematicians and that such link is not straightforward – it depends on the number of decimal places we can actually see and we need to check the

appropriateness of the representation theoretically as the period for some rational numbers can be long.

In our next work, we will analyse the last two stages of the design experiment to see whether any improvement in terms of the INR skill can be seen as in these two stages we included more reflection work and more explicit discussion on the topic. We will modify the didactic material accordingly. It would also be appropriate to test our students in terms of their understanding of rational and irrational numbers to see whether the lack of their attention to the INR skill is caused by their insufficient knowledge of number theory – future teachers' knowledge often suffers from the same deficiencies as that of secondary pupils (see, e.g., Mitchelmore and Cavanagh, 2000; Zazkis and Sirotic, 2004; Sirotic and Zazkis, 2007).

Acknowledgements

The paper was supported by the project PRVOUK P15 The school and teaching profession in the context of growing educational demands and GAČR P407/11/1740.

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REJECTING IDEAS IN NOVICES' PROBLEM POSING

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Abstract

The novices pose problems in Mathematics differently than the skilled problem posers. There are many differences – e. g. the way of posing problems which is mostly linear in case of novices and mostly cyclic in case of skilled problem posers (Pelczer and Gamboa, 2009).
In the study we look at the situation where the poser rejects some of his/her ideas. Such situations can be connected with both linear and cyclic way.
Three situations connected with novices (and therefore usually with the linear model) in problem posing were described: Unintentional rejecting an idea, Rejecting an idea because of laziness and Rejecting an entire idea – the completely new beginning.

Keywords

Expert, mathematical problem, novice, problem posing

Introduction

This study is a part of the qualitative research focused on the problem posing process in Mathematics of three groups of participants – novices, specialists and experts (see e.g. Patáková 2013a). Problem posing is understood as an intentional process when the poser creates the Mathematical problem which could be used for pupils. (Problem – according to Henderson and Pingry, 1953 – means a question that is figured out in order to be solved and answered.)
In the study three categories of problem posers are considered. Novices have no experience in problem posing.
Specialists have some experience in problem posing but not more than the teaching profession requires. They work with Mathematical problems professionally but they usually take the problems that are already posed rather then pose them themselves.
Experts are professionals in problem posing who prepare Mathematical problems for the Mathematical competitions, textbooks or who lecture problem posing.
Problem posing is usually difficult for novices. Akay and Boz (2009) talk about these sources of difficulties the novices usually face: The difficulties can arise from the posers themselves (not being creative, being shy or unconfident); their lack of knowledge in Mathematics; inexperience in problem posing which is very different approach from what they are used to; and the nature of problem posing itself.
Shriki (2010) states that students usually don't like the situations where they have to pose their own problems much because of two main reasons: The students have high standards of self-judging in examining the products and an inability to moderate their expectations from themselves. (They feel better satisfaction when they solve a problem then when they pose it.) The second reason is their fear of taking risks, which is essentially an inherent part of working within an environment that does not impose strict rules or procedures and does not necessarily guarantee immediate success.

The problem posing process of the groups of problem posers on various experience levels is different. Pelczer and Gamboa (2009) compare the problem posing process of novices and skilled problem posers. (Skilled problem posers are called 'experts' in their study but this is used in a different meaning than in this study. In their study 'experts' are only the opposite of 'novices', without any further differentiation.) They came with the linear and cyclic model of problem posing. Both of them are based on five problem posing phases – Setup, Formulation, Transformation, Evaluation and Final Assessment. (The importance of Transformations in problem posing is emphasized by Ramírez, 2006 as well – in his model the Transformations stay above all the other phases because the can be present in all of them.)

The linear problem posing way according to Pelzer and Gamboa (2009) is typical for novices. In the linear problem posing way some phases are usually missing. (The Final Assessment is missing nearly in all cases of linear problem posing.) The way is quite straight – e.g. Setup – attempt to make Formulation – Evaluation. The problem posers working in the linear way rarely perform Transformations. If they don't like something about their problem, they usually cancel all their present work and go back up to the Setup phase which is the beginning of their work.

On the other hand the cyclic way is typical for skilled problem posers. The posers, who work in the cyclic way, are able to switch between the phases, to transform the inconvenient ideas instead of skipping them. They evaluate their posed problems. They look back at their work and perform the Final Assessment stage. They are able to learn from their own mistakes.

The further research made by Patáková (2014) showed a surprising fact that there is some 'expert recurrence of linear problem posing'. This means that experts – although they usually work in a cyclic way as it is expected – use a linear way more than specialists. The reason lies just in their expertness – simply said they are experienced enough to afford the work in a simpler, linear way. Of course the experts' linear way of problem posing shows several signs different from the novices' linear way. The most visible difference lies in the frequent presence of the Final Assessment stage in the experts' case.

This paper looks into the situations where the novice rejects his/her idea while posing the problem. The research is qualitative, the aim is to describe and explain such situations. The reflections and self-reflections of problem posers (novices on the one hand and specialists and experts on the other hand) were analyzed to fulfill this goal.

Materials and Methods

The aim of the presented part of the research is to look at novices' problem posing process in detail – especially at the situations where the respondent rejects his/her idea. This aim is meant as an extension of the study of Pelczer and Gamboa (2009). In the linear problem posing way it is very frequent that the novice rejects his/her idea and returns to the Setup stage without any attempt to transform the inconvenient idea. It is interesting to look into the situations where he/she does this – rejects the idea without any attempt to transform it. The frame is widened a bit – we will look at all situations where the novice rejects his/her idea completely, not only at the situations where this leads to the new Setup stage.

In the research the novice participants were students in their last year of secondary school (Mensa secondary school, 2 respondents) or their first year at the university (Pedagogical faculty of Charles University, future secondary school teachers of Mathematics, 24 respondents).

There were 26 novice participants in the research. All of them were asked to pose

a ‘difficult and interesting problem which could be used in a Mathematical competition for the 14 – 15-year-old pupils’. 23 of them worked at home and handed in their posed problems and detailed self-reflections of their work. 3 of them were video-taped while posing problems (commenting all their thoughts loudly). These 3 participants had to pose problems in three different situations. The records were transcribed into reflections. That means that 32 (self)-reflections of novices’ works were analyzed.

The same tasks were processed by specialists (27 self-reflections and 3 video-taped respondents; all of the participants were secondary or lower-secondary school teachers) and by experts (25 self-reflections and 3 video-taped respondents; mostly from members of Mathematical Olympiad problem committee, authors of Mathematical textbooks and organizers of Mathematical correspondence seminars).

It is normal for all problem posers to reject an inconvenient idea when it is necessary. Such a situation is frequently connected with the phase of Transformation (according to Pelczer and Gamboa, 2009). The aim of the research was to find the situations of idea rejecting that are typical for novices.

The methods derived from the grounded theory were used to identify various types of rejecting ideas. There were three levels of coding that lead to the final categories. (The software Atlas.Ti was used in this phase.) Than the differences between groups (novices on the one hand and specialists and experts on the other hand) were seeked. According to the aim of the paper, the situations typical for the novices’ group are described.

Results and Discussion

Although all problem posers sometimes reject their ideas, three types of situations where the poser left their idea were found to be connected with the novices’ group. These were:

- Unintentional rejecting an idea,
- Rejecting an idea because of laziness,
- Rejecting an entire idea – the completely new beginning.

Let’s have a look at the examples:

1. Unintentional rejecting an idea

The poser sometimes rejects his/her idea totally unintentionally (without planning it or even noticing it).

The case of John: John works on the problem about two trains. He plans the question of the problem that will compare which of the two trains arrives earlier to the destination. The passenger train goes slower but its way is shorter. He has some ideas how to describe the way of the passenger train.

While preparing the information about the express train, he wants to use the relation among speed, distance and time. He points out that he doesn’t want it to be an ordinary ‘speed – distance – time’ problem.

He works on an idea of the train going round the well visible point (e.g. top of the mountain or a lookout-tower – see Fig. 1, the point *K*). Various points from where the tower is visible would be described (points *B*, *C* and *D*). The pupils solving the problem would have to use the Pythagoras theorem several times (the triangles *DKC*, *BKC* and *DBC* are planned to be right-angled). Then they would have to make some other computations to uncover the trajectory of the train.

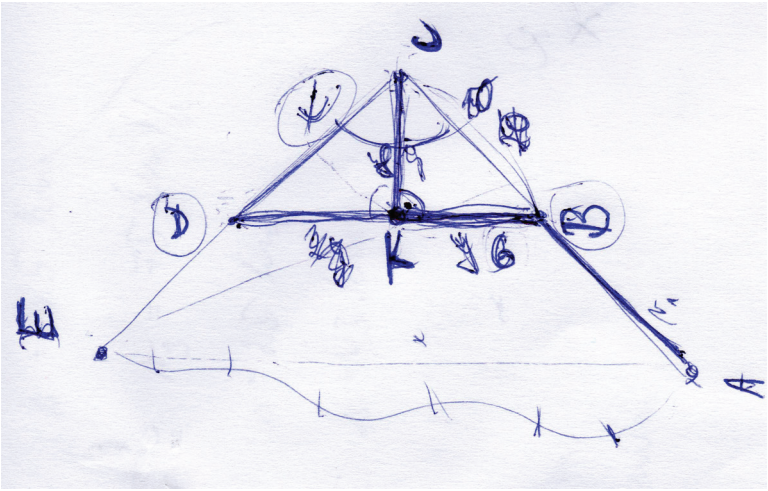

Fig. 1: The express train in John's problem

Then he spends 15 minutes searching for suitable lengths of the line segments *BK*, *CK* and *DK*. (He wants all of them to be rational but not guessable. He uses mostly the trial-error strategy to find them.)

After this work he returns to the passenger train where he also tries to find suitable numbers corresponding with reality. Finally he formulates the problem.

John's problem: There are two possible ways how to get from A to E by train. The first possibility is to go by the express train going through B, C and D. From A to B the speed is 80 *km/h and it takes* 15 *minutes. In B the train waits* 1 *minute. The distance between B and C is* 25 *km and the speed is* 100 *km/h. In C the train waits* 2 *minutes. From C to E the speed is* 75 *km/h. In D the train waits* 1 *minute. The distance between C and D is* 25 *km and between D and E it is* 45 *km.*

The second possibility is to take the passenger train. Its trajectory is 72 *km long. Every* 6 *km there is a station where the train waits* 2 *minutes. Without stopping at the stations the journey would take* 58 *minutes.*

Which possibility is better? How many minutes the difference is?

John hands his problem in. Notice that there is no sign of the tower *K* in the text and that the pupil solving the problem uses the 'speed – distance – time' computation in the straight way. That's what John didn't want to. He was asked why he left the idea of the tower. He answers: *"Well, I made it pretty badly. I messed it somehow – while trying to formulate everything properly, I totally forgot all about the tower."*

Discussion: Despite John is novice, he tried to pose quite a complex problem. However, he had to work with so many data and relations that he wasn't able to process them at the same time. This is the reason why he formulates his problem differently from how he wanted to do it. (It is not any small oversight, it changed the problem in a substantional way.)

2. Rejecting an idea because of laziness

The poser has an idea which he/she considers to be good. Then some obstacle occurs (e.g. he/she would have to compute suitable numbers for the assignment, to think over the formulation in more details and so on). The poser gives it in and rejects his/her 'good' idea without any attempt of transformation.

The case of Jane I: Jane has already prepared her problem; the last step is to formulate it. She works with a straight path. There are three people standing on one side of the path. All of them want to get to the house on the other side. To the 'left' person it takes 20s to get to the house, to the 'right' person it takes 10s to get to the house (see Fig.2). She wants to compute how long it would take the person standing exactly between the 'left' and 'right' persons to get to the house.

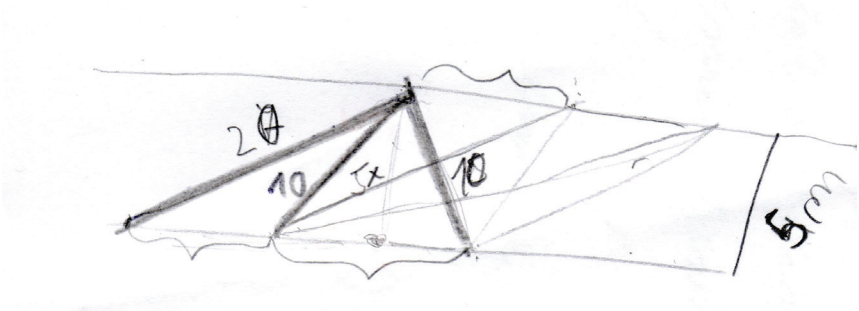

Fig. 2: The persons and the house in Jane's problem

She is asked whether she knows that the situation leads to two different solutions (see Fig. 2 again). Jane doesn't want the problem to have two solutions. (This is another sign of her being a novice, skilled problem posers prefer problems with more than one solution, see Crespo 2003 or Patáková 2013b.) She prefers the situation with a triangle where the angle 'left person' – 'right person' – 'house' is obtuse. (She considers it to be more difficult because this is the situation she overlooked herself.)

But she faces the problem how to formulate it. After a single attempt she comes to the conclusion that it would be too difficult to formulate it properly. She doesn't try to transform the formulation at all. She rejects the obtuse angle and returns to the easier situation.

Jane's problem: The path is 5 m wide. Three persons are standing on one side – the distances between the first and second, and second and third one are the same. On the second side of the path there is a house (standing between the persons). If all of them start going straight towards the house at the same time (the speed of all of them is 1 *m/s), it will take* 10 *seconds to the first person and* 20 *seconds to the third person to get there. How long will it take to the middle one?*

Discussion: It is common that the poser regulates the conditions of his/her problem with respect to an easy formulation. (In Patáková 2013b it is even shown that an elegant formulation is viewed as one of the signs of a good problem by the expert problem posers.) The novices' sign in Jane's work is that she left the idea she considered to be better so early – without any attempt to transform the formulation.

3. Rejecting the entire idea, the completely new beginning.

Sometimes the main idea of the prepared problems shows not to be suitable. The poser cannot see an adequate potential in his/her original idea so he/she rejects it and starts from the very beginning.

The case of Jane II: Let's have a look at Jane's problem again, now at the very beginning of her work. Jane was originally asked to read a theorem about triangle areas. (If the triangles have a common side and the same height, then their areas are the same.) She was asked to start with a theorem and pose a problem. (The problem didn't have to be based on the theorem, she was only asked to start her work from that.)

Jane drew a picture (see Fig. 3) and she could see a crown in the situation. She talked about the crown – that it looks nice and that it would be attractive for the pupils.

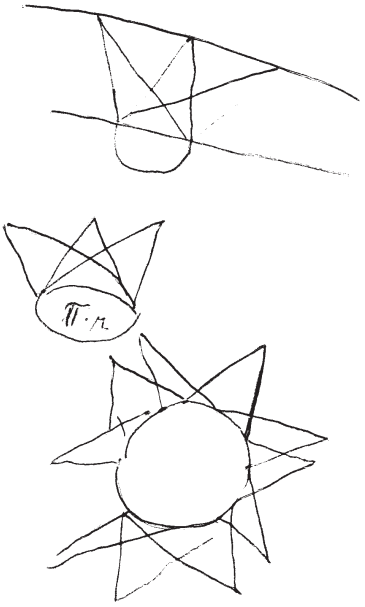

Fig. 3: A crown in Jane's problem

She takes a long sight at the picture. She thinks it over from various points of view. She spends 10 minutes looking at the picture. Then she rejects it because she thinks it is not a good starting point for problem posing. (Three experts were asked in an additional experiment to pose a problem based on her picture of the crown and all of them managed to do it without any problems.)

Jane rejects the situation and then she starts working on the problem we saw in The case of Jane I.

Discussion: This idea type is the only one which is not quite rare even in the work of skilled problem posers, especially specialists. But in the novices' case it is much more frequent. It is connected to one of the signs of linear problem posing according to Pelczer and Gamboa (2009) which is typical for novices. (It is the loop Setup – Evaluation – Setup that is described in the mentioned study.)

Conclusion

Nearly all problem posers sometimes have to reject their idea which shows not to be good enough. Mostly it is connected with Transformations – the poser doesn't reject the idea completely, he/she returns only one or more phases back and improves his/her ideas. The presence of Transformations is one of the signs of the cyclic problem posing way according to Pelczer and Gamboa (2009).

In the study we showed the situations where the idea is left but where this is not connected with Transformations. These situations belong to the linear problem posing way and they are mostly connected with novices.

Three situations in the problem posing of novices were described – Unintentional rejecting an idea, Rejecting an idea because of laziness and Rejecting an entire idea – the completely new beginning. All of them are connected usually with a linear way of problem posing which corresponds with the mentioned theory about linear any cyclic models.

Acknowledgements

The study was supported by *SVV 260 108/2014, Vzdělávání a výchova v kontextu proměn společnosti*.

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STUDENTS' OPINIONS ON INFORMATION ETHICS

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Abstract

At the University of Economics in Prague we have been carrying out researches on students´ approaches towards information ethics. In this article I would like to inform about the latest results. They have shown students consider information ethics important and think universities should teach them some of its principles. On the other hand most students think economic results are more important than ethics. That is not very promising as far as our future is concerned.

Keywords

Information ethics, privacy, accuracy, property, accessibility

Introduction

The development of soft system approaches illustrates the importance of man´s culture, presupposition, ideas, opinions, and worldview. Ethics belongs into this area of man´s soft qualities. In order to find a consensus we need to understand the person´s ethical background. Ethics must be considered when improving human systems and their functioning as it can be a source of conflict.

Information ethics development

Information ethics developed out of librarian ethics which was studied especially by Hauptman (1988). In his famous article Hauptman (1988) addressed topics like censorship, privacy, access to information, balance in collection development, copyright, fair use, codes of ethics, and problem patrons etc. Some issues go back to 1980 when Kostrewski and Oppenheim wrote their article (1980) for the Journal of information science which addressed issues of confidentiality of information, quality of information etc.
The Mason´s paper (1986) represented a summary and classification of the research areas of information ethics. Despite the 30 years from Mason´s article his taxonomy is still valid. Only some aspects need to be updated. Freeman (2005) provided an update of Mason´s view and his ideas are summarized below.

Current problems with privacy

ICT change the dynamics with which information is gathered and shared. It allows for enormous increase in information gathering and sharing. That is why it changes the concept of privacy. H. Nissenbaum (2009) shows in her books how new contexts open new threats and people must react to them appropriately.
With the increase in ICT ability to process and transport information new threats appear (Freeman, 2005). Users´ activity is tracked and monitored. Another problem consists in the tricky character of many technologies. Users very often don´t realize who and how processes the information they enter on the internet. Google´s free email account scans emails in order to better target its advertising (World Privacy Forum, 2004). The internet has made information available to many which wasn´t possible in the past.

These issues get more attention as the threats of international terrorism increases and governments ask for more information on its citizens. Medical information systems are another example of a system where the availability of information helps medical personnel to treat the patient (Goodman, 2010). The information content is very often sensitive.

Current problems with accuracy

Accuracy may cause unintentional harm as it may lead to errors in decision making (Mason, 1986). However inaccurate information is sometimes inevitable. Accuracy is recognized to be a problem if it concerns intentionally falsified information. A striking example of such a problem is the identity theft (Freeman, 2005). In the cyberworld it is difficult to ensure credible identity as the tendency to simple and easy communication and transactions prevails.

Current problems with property

Intellectual property rights are a complex issue. Today the most critical problem we are facing is illegal downloading of software, music and videos (Cronan and Al-Rafee, 2008). We have been experiencing a combat between the streaming companies like Spotify and the music producers. The conflict consists mainly in the discrepancy between easy and cheap content availability preferred by the consumers and old market practices which provided music producers with big profits. The ICT offer new possibilities of content distribution which would deprive the music producing companies of their monopoly position. The traditional definition of property rights is not sufficient in the environment of ICT and pressure on a change is obvious. However a clear definition of the new model has not been found and defined yet.

Current problems with accessibility

Today computer literacy is critical (Childers, 2003). The digital divide between those financially unable to buy necessary devices and participate in the information revolution and those able to do that has been widely recognized. Internet becomes an important source of information and is an environment where a lot of activity is performed. That raises ethical problems regarding its availability.

On the other hand it is also in the interest of the companies that as many people as possible have access to the internet (Freeman, 2005). It is also important for governments because it simplifies distribution of information and helps people solve their issues with the authorities. However we can´t expect a massive companies´ support of ICT availability for customers. That is why accessibility including computer literacy will remain an issue.

The paper´s objective is to identify and analyse the student´s approaches towards various aspects of information ethics indicated above. To fulfil this objective the following methodology was used: A questionnaire was prepared online and students were asked to fill it in. Above all students from the bachelor programme took part. After that the results were analysed with statistical methods.

Materials and Methods

Information ethics is an important issue and that is why we have been analysing it at our university since 2013. In the last survey 54 students took part, 40 males (74.1%), 14 females (25.9%). The number of participants is not high and that is why it could be a base for future research in the future. The age distribution is as follows:

Age	Frequency	Percent	Cumulative Percent
18 years	2	3.7	3.7
19 years	12	22.2	25.9
20 years	18	33.3	59.3
21 years	8	14.8	74.1
22 years	8	14.8	88.9
23 years	2	3.7	92.6
24 years	2	3.7	96.3
26 years	2	3.7	100.0
Total	54	100.0	

Tab. 1: Age distribution of participants

The survey took on the internet place between 15th December 2014 and 31 January 2015. Students in the bachelor courses were asked to participate in the survey. Their participation was voluntary. Out of 182 students 54 participated (29.7%). Students were mostly in the first year of their studies (88.9%). 3.7% was in the second and 3.7% in the third year of their bachelor studies. Only 29.6% of participants don´t work, the rest of them works either in temporary jobs (25.9%), part time jobs (33.3%) or full time job (11.2%). 44.4% of participants is oriented at good social relations, 55.6% at reaching the stated objective. It means the proportion is quite balanced.

For the results´ analysis we used methods of descriptive statistics and methods analysing contingency (Kruskal–Wallis and chi-square test) and correlation (Spearman rank order correlation coefficient r_s). All these tests were suggested by Řezanková (2007) for the respective type of variables.

Results

None of the students knew any codified principles of information ethics. However 3.7% of them think students don´t follow any ethical principles, 33.3% think they follow the ethical principles a little only, 59.3% think they often follow ethical principles and 3.7% think students always follow the ethical principles. In the future research it would be interesting to find out the character of the principles the students meant in the answer to this question as they stated they didn´t know any codified principles of information ethics in the previous answer. The results are on the 5% level of significance independent on gender (p=0.364, χ^2=0.826), independent on study results (p=0.968, r_s=0.006), weakly dependent on age (p=0.042, r_s=-0.278): younger students are more critical, and weakly dependent on the students' orientation (p=0.037, χ^2=4.341): students oriented on social relations are more critical regarding following the principles of information ethics than students oriented on results.

48.1% of students consider the level of corruption in the Czech Republic high, 22.2% at the neither high, nor low level, 14.8% very high and 14.8% low. On the 5% level of significance the results are independent on gender (p=0.118, χ^2=2.449), independent on study results (p=0.802, r_s=-0.004), independent on age (p=0.630, r_s=-0.067), weakly dependent on the students' orientation (p=0.031, χ^2=4.680): students oriented on social relations are more critical regarding following the principles of information ethics than students oriented on results.

As for the relationship between the internet and the real world more than ¾ of students think following ethical principles on the internet is worse than in the real world. See figure

1. It implies cyberspace is considered unethical and that supports the idea of teaching information ethics or cyberethics. That is also supported by the answers on the question if universities should teach their students principles of information ethics. 40.7% definitely agree, 48.1% agree, just 7.4% don´t agree and 3.7% definitely don´t agree to that idea. Students perceive the biggest problems with information ethics in the area of human relations (40.7%), media (37%), copyright (11.1%) and labour relations (4%).

It is interesting to compare these results with the answers on the question if labour productivity is more important than ethical behaviour. 48.1% don´t agree, 40.7% agree, 3.7% definitely don´t agree, 7.4% definitely agree. Even though students consider ethics important, approximately half of them prefer productivity to ethics. On the 5% level of significance the results are independent on gender (p=0.571, χ^2=0.321), independent on study results (p=0.517, r_s=0.09), independent on age (p=0.791, r_s=0.037), independent on the students' orientation (p=0.155, χ^2=2.022).

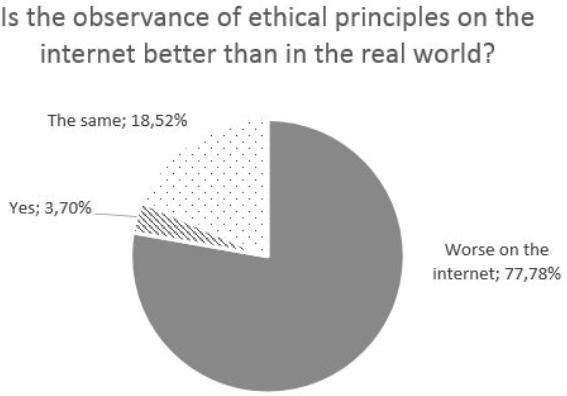

Fig. 1: Ethical principles on the internet

In this context it is interesting to look at participants´ answers regarding current legal regulation of copyright on the internet. 59.3% agree to it partly, 22.2% don´t agree to it at all and just 18.5% agree to it. That shows how big the pressure on legal regulation in this area is. On the 5% level of significance the results are independent on gender (p=0.754, χ^2=0.098), independent on study results (p=0.518, r_s=0.09), dependent on age (p=0.002, r_s=0.410): older participants are more critical, weakly dependent on the students' orientation (p=0.044, χ^2=4.045): students oriented on social relations are more critical regarding current regulation of copyright.

The results regarding processing data entered on the internet were quite balanced (see figure 3). 56% mind it or mind it a lot, 44% don´t mind it or don´t mind it at all. It seems students don´t valuate their privacy a lot. On the 5% level of significance the results are independent on gender (p=0.5, χ^2=0.454), independent on study results (p=0.463, r_s=-0.102), independent on age (p=0.056, r_s=0.262), dependent on the students' orientation (p=0.003, χ^2=9.056): students oriented on social relations are more critical regarding data processing.

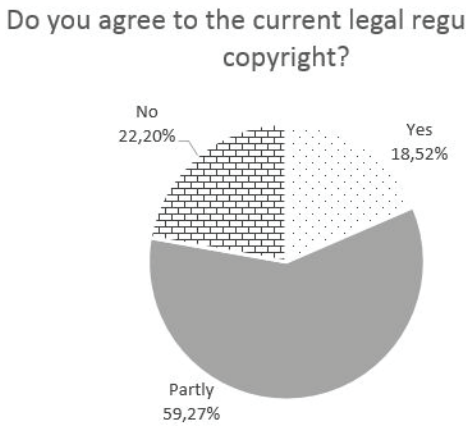

Fig. 2: Current legal regulation of copyright

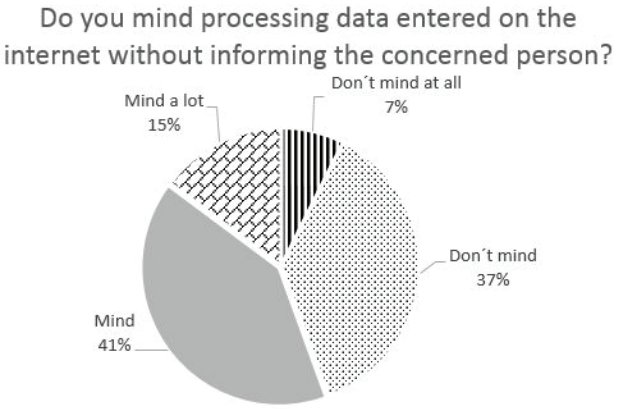

Fig. 3: Data processing

Ethical dilemmas

Participants were also asked to evaluate three ethical situation. The first case was about spreading a secret and sensitive information. 40.7% strongly disagreed with its spreading, 29.6% rather disagreed, 25.9% rather agreed, 3.7% definitely agreed. It shows students respect man´s privacy. However the results are not in accordance with the question regarding using information entered on the internet. Anonymity may be the crucial difference here. On the 5% level of significance the results are independent on gender (p=0.05, χ^2=3.882), independent on study results (p=0.146, r_s=-0.2), independent on age (p=0.2, r_s=-0.177), dependent on the students' orientation (p=0.712, χ^2=0.136): students oriented on social relations are more critical regarding data processing.

The second case was about responsibility for a software mistake. The case was about a physician who blamed a software for a mistake he had made when he was using an expert software system. Here the results were more balanced. 11.1% definitely disagreed with the physician, 48.2% rather disagreed and 40.7% rather agreed. On the 5% level of significance the results are independent on gender (p=0.485, χ^2=0.487), independent on

study results (p=0.445, r_s=-0.106), independent on age (p=0.835, r_s=-0.029), independent on the students' orientation (p=0.356, χ^2=0.852).
The third case was about using employer´s databases of clients for the private purposes of the employee. 14.8% definitely disagreed with such a practice, 25.9% rather disagreed, 55.6% rather agreed, 3.7% definitely agreed. That shows how little the ownership and rights connected to it are respected by the students. On the 5% level of significance the results are dependent on gender (p=0.035, χ^2=4.413): women tend to agree, independent on study results (p=0.445, r_s=-0.106), independent on age (p=0.835, r_s=-0.29), dependent on the students' orientation (p=0.063, χ^2=3.456): students oriented on social relations are more critical regarding data processing.

Discussion

Our research has a relationship to some researches carried out in the Czech Republic, e.g. Vrbová (2013), Preiss, Nohavová and Stuchlíková (2013). Vrbová (2013) analysed various types of cheating of Czech pupils (15-16 years of age) at schools and applied exploratory factor analysis, Preiss, Nohavová and Stuchlíková (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. Our research has confirmed high tolerance of students towards unethical behaviour on the internet, however the students´ self-evaluation had better results than in the researches carried out by Vrbová (2013) and Preiss, Nohavová and Stuchlíková (2013). In the future research we should test students´ truthfulness.
There are also some 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. Our research agreed with Khalil and Seleim (2012) and also with Eining and Lee (1997) that students are sensitive to information ethics´ issues, but don´t agree to the current legal regulation of the internet. Our research has also confirmed their conclusion that universities have a big impact on students´ attitude towards ethics.
Boyd (2012) came to an interesting result regarding the teenagers´ approach to privacy: Many of the teenagers have given up controlling access to content placed on the internet, but have developed a different strategy – they limit access to meaning by using encoded messages, cultural references etc. This may be a hint for further research.

Conclusion

Our research has shown information ethics is considered important by the students. They feel our society has problems with ethical behaviour. On the internet the problems are even worse than in the real world. A positive sign for the future may be the student´s recognition of universities' role in ethical education. Students oriented on social relations tend to be more interested in ethical issues than students oriented on work results.
On the other hand student don´t have very clear and sophisticated ideas in the area of information ethics. It seems they don´t think about it very much. They are influenced by the new technological trends and are willing to give up their privacy in return for some service. They are affected by current disregard of ethics in the business world. Another issue was the tension between the legal regulation of copyright and the needs of consumers. On the other hand if information is bound to a concrete person they understand its value. That is why it has proven to be positive to use the case studies where students were asked to evaluate concrete cases.

Acknowledgements

This article was processed with contribution of long term institutional support of research activities by Faculty of Informatics and Statistics, University of Economics, Prague.

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STUDENTS` ATTITUDES TOWARDS USING THE INTERNET AND ICT

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Abstract

This paper discusses the key place of the Internet and information and communication technologies (ICT) in the life, work and education in the contemporary society and the necessity of effective use of these technologies for students to meet the challenges of developing global labour market. The concept of internet literacy and information competence of students as a basis for acquisition of digital literacy skills is introduced.
The empirical component in the paper is related to a study conducted by the Center for New Media and Digital Culture at South-West University “N. Rilski” - Blagoevgrad in May-September, 2014. It indicates the level of using information technologies by students from different universities in Bulgaria. The author emphasizes the role of the library for the modernization and transformation of university education and its conversion into a center which improves the information and digital skills of students.

Keywords

ICT, Information literate person, university students, library

Introduction

The development of the Internet and information technologies outlined the boundaries of the new virtual space, which is able to embrace and integrate a variety of communication forms and cultural activities, giving rise to a new culture: the culture of real virtuality (Castells, 2004: 330) that requires goal setting, creative thinking, and improvisation. According to Moreira (2010: 2) without connecting and active engagement in media ecosystem created by new technologies, we turn into autistic beings or social orphans who are unable to carry out all the activities that are part of our work, education or entertainment.
Nowadays the Web is more than just searching for information and function for social contact or entertainment. The impact of the Internet and new technologies in education is increasingly becoming a powerful tool for changing many of the educational practices, an indispensable source for learning and constructing the intellectual creative potential of every person (Loureiro and Bettencourt, 2014; Katz and Macklin, 2007; Oliver, 2003; Pérez and Torelló, 2012, etc.).
The proper understanding of internet literacy is essential for improving the skills required for networking, acquiring ability of operating and benefiting from the vast amount of information and Internet resources (Ala-Mutka, 2011: 24). Utilization of Internet literacy skills implies building the capabilities for effective use of World Wide Web, and the ability for creative participation and active involvement in computer-mediated communications for work and collaboration, for learning and research. Mastering these skills and abilities the user can become an active producer, as well as receiver of content, allowing interactivity and participation online (Lingvistone et al., 2005: 6). In addition to availability of skills to access multiple Internet resources for the information

literate person is important to develop critical skills for managing and effectively using information to achieve a particular purpose, and constructing knowledge, which is crucial for lifelong learning (Chakravarty, 2008; Lloyd, 2010; Rambousek et al., 2014, etc.).

In studies conducted on digital literacy of students at South-West University, were identified some gaps in the process of acquiring the skills and abilities to learn using ICT (e.g. Shopova, 2013; 2014). They showed that the majority of them (especially in humanities) have not known and used the resources located in the university e-library catalogue; fewer were those who had the skills to critically evaluate information and use it creatively.

Other studies in this area are examining the role of the Internet in everyday life and information searches of students and the frequency of the library use and its resources, including the scholarly research databases. For example, Head and Eisenberg (2010; 2011) noted that for daily and scientific searching most of students rely on a small collection of "tried and true" sources as Wikipedia and to a lesser extent they consult materials in the campus library. Others established correlation between library and electronic recourse usage and successful performance of students (Cox and Jantti, 2012; Mezick, 2007).

The main objectives and results of the current study are shown in the empirical part of this paper to establish the Bulgarian university students` attitudes towards the use of the Internet, its resources and tools, and their skills for creativity and active participation in various forms and means of expression, communication and learning via the Internet.

The aim of the study was to understand the degree of mastery of internet use and information literacy skills of students, which were suggested to establish: a) The level of absorption of the required skills for working on the Web, mainly connected with using browsers and hyperlinks, b) The level of using various online resources and functions that are important for their daily activities, and the students` attitude to creativity on the Internet, c) The degree of understanding and effective use of computer-mediated communication in their daily activities, d) The students` abilities to search, find, retrieve and critically evaluate information obtained from various internet sources, e) The degree of recognition of issues related to the legality and reliability of information, as well as legal and ethical principles in using the Internet.

Materials and Methods

A team from the Center for New Media and Digital Culture at SWU "N. Rilski" conducted a survey in May-September 2014 among 100 students who were divided unevenly as far as gender 33% men and 67% women from various courses and specialties of four universities in Bulgaria: South-West University "N. Rilski "- Blagoevgrad, Sofia University "St. Kliment Ohridski", Technical University - Sofia and University of National and World Economy. More of the students in the sample were studying mainly in the humanities and social sciences (74%). 72% of respondents were 18-23 years old.

The study introduces the following hypotheses: First, today's students possess different Internet skills as the formal skills for navigating the Internet, the skills for searching, finding and evaluating information retrieved from different types of information sources to perform their everyday activities, and the communication skills, which have become increasingly important given the expanding prominence of the social web, are predominating (Van Deursen et al., 2014). But most students have not yet mastered the ability to express themselves creatively in the Web such as creating and publishing their own content or maintaining own website or blog. Second, students still do not have needed skills for using the rich resources of the electronic library, which hinders their better performance and achieve better learning outcomes.

The survey was conducted by the method of direct individual survey through pre-designed questionnaire comprising 40 questions that the respondents had to fill in (electronically or on paper). The questionnaire was structured into four sets of questions aimed to determine: 1) What was the access of students to the network and their ability to work in it; 2) What were the communication skills of students in the online environment; 3) What was their ability to participate creatively on the Web; 4) What was their ability to learn effectively through using new technology.

Results and Discussion

Regarding the skills of students to work on the Web, the study indicated that 60% of respondents were able to correctly name browsers and 50% - operating systems. However, there were students who identified the following as names of browsers: Google - 26%, Yahoo - 6% and Word - 2%, that showed (even partially) the lack of awareness of a certain part of students on the computer operation and use of the Web. To the question how often they use the Internet, 76% of respondents said they have daily access to the Web, 13% answered "almost every day" and 4% - "1-3 times per week." Moreover, a favourite place was „at home" - 76% and only 13% indicated "at the workplace (at the University)" (Table 1).

How often do you use the Internet?	Every day	Almost every day	1-3 times per week						
7 non-responders	76%	13%	4 %						
How many hours per week do you use the Internet?	To 2 hours	2-5 hours	5- 10 hours	10-15 hours	15-20 hours	20-25 hours	25-30 hours	30-40 hours	Over 40 hours
4 non-responders	1%	11 %	23%	12%	12%	8%	8%	10%	10%
Where do you usually use the Internet?	At home	At friend	At the workplace		In library	In Internet cafe		In other public places with free internet	
	76%	1%	13%		1%	4%		8%	

Tab. 1: Frequency, time spent and main location with the internet

From the technical access devices most preferred was the laptop (60%), instead of PC (15%). Users of smartphones (18%) or mobile phones (12%) and tablet (2%) were still few in number. Among the Internet services most used by students was the e-mail (87%), followed by Skype or another program for video telephony (72%) (Table 2).

Most preferred Internet services	E-mail	Skype	Inter-active maps	Search /Job Applica-tion	Electronic shopping and commerce	Transpor-tation services	Travel services	E-ban-king	Adminis-trative services
	87%	72%	50%	47%	42%	38%	27%	18%	13%

Tab. 2: Using different Internet services

To understand the communicative participation of students in online environment, there was a need to ask students: `When they need advice on the use of the Web, is there someone they can turn to? `The data found that the majority of students were chosen to communicate with friends (68%), and a lot less - with family members/relatives (18%) or teachers (5%) (Tab. 3).

When do you need advice on the use of the Web is there to whom do you turn?	Friends	Family or close relatives	Teachers	Employees of the library	Colleagues	I have no one to turn
	68%	18%	5%	4%	2%	3%

Tab. 3: Search for advices regarding the use of the Internet

A large number of students surveyed have chosen social networks as a preferred communication tool. Facebook was the favourite network (87%), followed by Google+ (45%), Twitter (15%), LinkedIn (8%), My Space (6%), Pinterest and Flickr (2% each). The next group of questions is aimed at understanding the students` attitudes towards participating creatively in the Web, actively using blogs, forums, websites, etc. as a field for expression of personal opinions and comments or creating and publishing own content. As the data showed, most students in the sample have chosen to publish photos (59%) that are probably related to the widespread use of social networking sites (Tab. 4).

Sending comments on blogs, forums, etc.	Yes	Sometimes	No
8 non-responders	9%	46%	37%
Creating and publishing of web content	Yes, often	Rarely	Never
Photos	59%	10%	31%
Texts – e.g. course works, essays, literary creativity	33%	9%	58%
Videos (on YouTube, VBox, etc.)	21 %	-	79%
Maintaining a blog or website	15%	-	85%
Music content	11%	-	89%
Translations	5%	-	95%
Texts for free online encyclopaedias (Wikipedia, etc.)	1 %	-	99%

Tab. 4: Participation in creating web content

The survey included other important set of questions, concerning the capabilities of students to learn effectively in information environment. To the question what sources or forms of education and training they use on the Internet, respondents have indicated firstly "Wikipedia" (49%), secondly - "Read/ download scientific literature (journals, books, websites, etc.)" (68%) and thirdly - "Scientific databases" and "Documentaries" (38 each). It appeared that most students surveyed were used both print (63%) and electronic resources (68%) in the learning process. They showed a preference for online video (54%) when using the e-resources. Fewer were those who regularly use electronic audio recordings, online catalogs, e- libraries, online photo galleries and virtual museums. To a lesser extent, students take advantage of the university e-library collections and resources (Tab. 5).

What kind of resources do you use more?	Electronic	Print	Both types
	22%	15%	63%
Do you use print resources for your learning - textbooks, newspapers, magazines, books, encyclopaedias, maps, documents, etc.?	Yes, regularly	Sometimes	No
8 non- responders	62%	25%	5%
Do you use electronic resources for your learning - textbooks, newspapers, magazines, books, encyclopaedias, maps, documents, etc.?	Yes, regularly	Sometimes	No
2 non- responders	68%	25%	5%
Using other electronic resources such as:	Yes, regularly	Sometimes	No
Video	54%	28%	18%
Audio recordings	39%	37%	24%
Online catalogues	34%	47%	19%
Electronic libraries	33%	46%	21%
Photo galleries	32%	45%	23%
Virtual museums	11%	30%	58%
Do you use the resources of the electronic library in your university?	Yes, regularly	Sometimes	No
5 non- responders	26%	42%	27%

Tab. 5: Use of types of information resources for learning

The next set of questions was focused on the students' skills to find and effectively and responsibly use the necessary information through the Internet and the new technologies for solving individual assignments. Based on the results achieved during their learning, most students admit that they had appropriate abilities to search for needed information (72%), to analyse and synthesize (77%), to interpret and present information (71%). Nearly half of the respondents shared that they were able to compare the information obtained from different sources (52%), know how to combine the received information with their own ideas and experiment to create new information (55%). Fewer students were able to critically evaluate the required information (42%). The majority of respondents (70%) have stated that they could recognize what plagiarism was and how to avoid it, but a considerable part of them only sometimes comply with the copyright and followed the laws, regulations and labels related to the access and use of the Web information resources (41%), while 25% do not do this.

The study confirmed the first hypothesis that students have greatly taken advantage from using the Internet and information technologies in their daily activities and in the learning process, regarding the use of various web resources and services. Concerning their communicative skills, it was found that most students prefer Internet services such as e-mail and Skype, and among the social networks most actively used was Facebook. A large percentage of the respondents are looking for advice on using the internet primarily by their friends. Regarding the opportunities provided to them for more active and creative participation in the Web, most students were lagging behind their creative manifestations in the Internet space and a very few of them were used it.

It is necessary to notice that students take advantage of the Internet and information technologies in the learning process because of the easy and quick access to information but they have difficulties to critically evaluate the found information and use it effectively

in solving scientific problems, cazuses, etc. Students are facilitated in their daily scientific searches and elaborations by the electronic publication advantages of the required information and they regularly use both print and electronic resources. But students have not yet acquired skills to take advantage of the e-library and its rich recourses. Moreover, they only occasionally or never use the electronic library resources in their universities. Most of them tend to use various sources and forms of education; however, they note that primarily use Wikipedia. Thus, it was confirmed the second hypothesis of insufficient mastery of library (information) literacy of students, most of whom do not know well enough the electronic resources of the university library; they still do not have the skills and habits to use various academic search engines, and the abundance of academic databases in their scientific studies.

The study underlines how important it is to improve the information competences of students as one of the main prerequisites for personal fulfilment and professional development in modern society, in which: "Information understandings, systems, management, organization, tools, processes, policies, and services are central to every aspect of human existence" (Eisenberg, 2014: 10).

This poses questions about the role of the Library and expert librarians who can offer information literacy services through self-directed learning and cooperation with lecturers in organized courses to provide for improvement of students' information competency (Gomez Hernandez, 2010). There is a need to recognise a new position in any scientific library - *a trainee assistant*, who has to guide students and lecturers in their searches, surveys and comparative analyzes. In this regard Chakravarty (2008: 16-17) indicates that librarians can serve as change agents who develop and put information literacy policies, programs and projects in place. "Through the creation, with faculty, of curriculum-integrated programs, librarians should actively contribute to the students' learning process in their search to enhance or develop the skills, knowledge and values needed to become lifelong learners". In this way, the library will contribute to upgrading the learning of digital literacy.

Our universities should pay more attention to the role of library to assist students in library programs and learning objects to develop their information literacy skills. It is necessary that all of the library resources to be concentrated in a digital portal that can provide easy access for all students. To improve the conditions of information provision, this asks for revealing some scientific funds in the university library in digital format. Taking appropriate action by the university library would increase the degree of utilization of the library and to identify it in the global information space.

Conclusion

The paper accents on the need for students to acquire skills to work with an abundance of information and digital resources, with scientific databases, electronic library resources to successfully extract the necessary information and understanding its importance to be able to use it to create new content. Equipped with these skills, students will be able to meet the need for lifelong learning, cultural expression and personal fulfilment (Lingvistone, 2008).

The students' participation in the contemporary information learning environment requires not only an effective internet access, but also the ability to use effectively the variety of electronic resources and products, critical and creative engagement in the learning process. As Goulão and Fombona (2012: 351) underline, education cannot pervade into this transformation because "in a globalized world when everything is changing, the need

for people to continue their education, recycle and expand it in order to give answers to the upcoming challenges comes up".

The aim of our study is to intensify the efforts of learners, experts, managers and library specialists engaged with issues of higher education, as will be offered to them new ways and means to increase the degree of acquiring the needed skills to use digital technologies. With outlining effective approaches to develop information literacy of students and their motivation for using digital information and new tools to work in the information environment it will respond and to the European priorities in the field of digital technologies and future education. For this purpose it is necessary to focus on building digital collections as a resource in the University Library and its modernization with new technological applications to work online. By creating the most appropriate model for student servicing in the University Library it will meet the need to supply quality products and provide access to academic information from all branches of science. Offering the rich information resources in digital format the Library will help to ensure the basis for the "right attitude" to the use of digital technologies in the process of education and learning. The empirical data of the presented study will be used as a basis for: 1) Additional studies of the information literacy skills of students; 2) Comparison with data from future research in this area; 3) In the process of identifying the needs and interests of Bulgarian students to improve the skills of using the digital information resources in the university library.

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EXPERTS IN THE FIELD OF EDUCATION AND OTHER POTENTIAL KNOWLEDGE MAKERS IN 2051

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Abstract

The aim of this paper is to estimate the age-and-sex structure of economically active specialists in the fields of education, science and technology and information and communication technologies (ICT) in the year 2051. Used data come from the final results of the Census 2011 by Czech Statistical Office (CZSO). Using the component method and population projection by CZSO – medium variant we calculate how will look the age-and-sex structures of persons who are the main creator of education and intelligence in our population. Especially these three groups have a key influence on education in schools, universities and other institutions. Results, unfortunately, are not quite positive. The number of these specialists will change and age-and-sex structure upsizes in the top and the average age increases. Will be the distribution of those persons in 2051 sufficient to keep the current level of education quality, knowledge, and science in our population?

Keywords

Education, information and communication technologies, science and technology, specialists

Introduction

Specialists in the field of education work both at primary or secondary schools and universities. Specialists in the field of science and technology work the most frequently in the research and development centres, institutes and universities, and specialists in the field of information and communication technologies (ICT) work in all of these organizations as well. All workers of these groups are the essential building blocks for education, knowledge, training and scientific-technological progress in our society (Pechrová, 2014). So if they truly should fulfil their mission, they must be classified as economically active persons from socio-economic point of view (Fiala, Langhamrová, and Průša, 2011). Given the final results of the Census 2011 by the Czech Statistical Office (CZSO, 2012), we know how the age-and-sex structures of the economically active specialists in these fields looked in 2011. Final results of the Census 2011 are currently the most accurate information channel. The results are complemented every year by the selection of information from the mini censuses, which mostly come from the Labour Force Survey. However, until the next Census in 2021, these values are mere estimates with only partial reliability.

The aim of our paper is to calculate the estimates of age-and-sex structures of specialists in the field of education, science and technology and ICT by more sophisticated way, and especially with the impact on the entire population of the Czech Republic. Given that the specialists from CZSO construct a fairly accurate population projection in three different scenarios (CZSO, 2013), we calculate on the basis of component method (Keyfitz, 1964) the estimates of the age-and-sex structures of these groups of economically active persons

with great precision. The conditions of our calculations are as follows: *(I) selected scenario of the population projection by CZSO is medium variant*. This is because the low and high variant is rather referred to as lower and upper bound – the confidence interval. The most likely scenario that occurs according to CZSO is the medium variant. Our calculation *(II) assume the same decline in mortality over time, which is expected by CZSO* (i.e. the increase in life expectancy at birth of males (females) from 74.70 (80.82) years in 2011 to 83.07 (88.04) years in 2051 and linear increase in the total fertility rate from the value of 1.43 in 2011 to 1.56 in 2051. Finally, it is important to note that *(III) our expectations cannot calculate with a dramatic change in the behaviour of immigration and emigration*. If there is for example a conflict in our society between the Ministry of Education, Youth and Sports and the trade unions negotiating the salaries of teachers and experts in public science and research and these workers would have decided to emigrate, e.g. to some of the neighbouring western countries, where the salaries are higher, our model would not take it into account. Census 2011 was processed by the CZSO's methodology (CZSO, 2012), (results of the economically active persons used in this paper can be seen in Fig. 1), and the population projections of the Czech Republic are also calculated by the CZSO's methodology (see CZSO, 2013). Because the beginning of our analysis is the year 2011 and the Census takes place every 10 years, our results are published for the years 2021, 2031, 2041 and 2051.

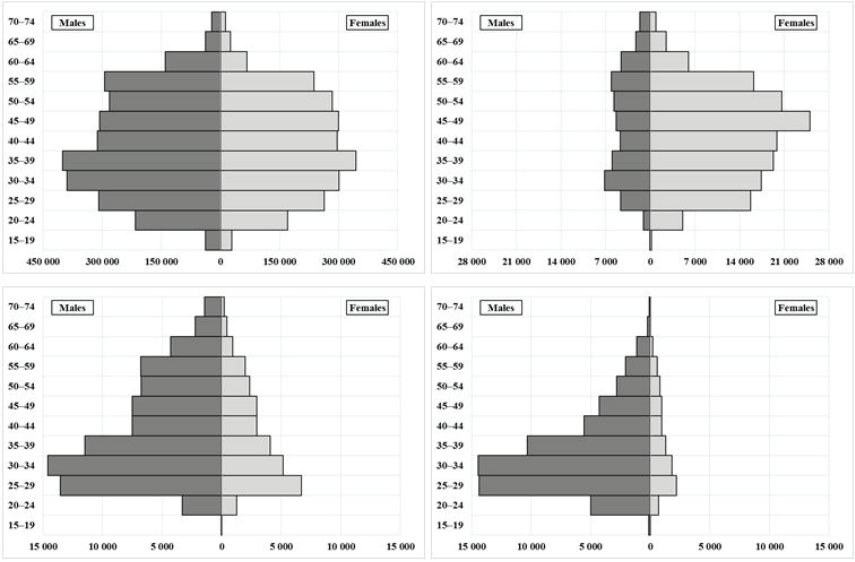

Fig. 1: Empirical data of economically active persons in total (top left), economically active specialists in the field of education (top right), economically active specialists in the field of science and technology (bottom left) and economically active specialists in the field of ICT (bottom right) by Census 2011. Data source: CZSO (2012), author's illustrations.

Estimation of age-and-sex structures of specific (and smaller) populations is not quite simple (see e.g. study by Fiala, Langhamrová, and Průša, 2011, who predicted the Czech population by the highest level of education attained). In this paper we follow the study by Fiala, Langhamrová (2011), who calculated projections of ICT experts in various economic fields and Šimpach, Pechrová (2014), who analysed the predominantly rural

populations of the Czech Republic. The results of this paper are worrying because they show a future increase in the number of specialists in the highest age groups – slimming of the base of the population pyramids (due to low level of Czech fertility) and also increasing of the average age of the economically active specialists. The lower number of specialists in the field of education may mean in the future (with conditions to keep the same number of total population as today) worsening conditions in the education of our descendants and lower quality of Czech schools and universities. The higher number of elderly specialists in the fields of science and technologies and ICT may mean lack of competitiveness. Czech Republic's population according to the CZSO's projection should not diminish in the future (see on-line results of medium variant by CZSO, 2013 and study by Kincl, Novák, and Štrach, 2013). Our population should take into account potentially lower number of specialists in the field of education right now and take the appropriate steps, such as motivational programs for young people to study in the university programs, which are applicable in the field of education and science (see e.g. Jindrová, Vostrá Vydrová, and Dömeová, 2013).

Materials and Methods

From the results of Census 2011 we know the total number of persons in the population (*S*) in 5-year age groups (x–x+h-1) at time t = 2011 by sex (*M* - male or *F* - female), the number of economically active persons in total (*EA_TOT*), the number of economically active specialists in the field of education (*EA_EDU*), in the field of science and technology (*EA_SCI*) and in the field of ICT (*EA_ICT*), also in 5-year age groups (x–x+h-1) at time t = 2011 by sex, where x is completed age and h is the width of age interval 5 years. All the numbers of economically active persons are considered in the age interval from 15–19 to 70+ years. Census 2011 has obviously higher intervals for the total number of persons in the population (*S*), i.e. 70–74, 75–79 ... 100+, but because the number of economically active persons in the highest age group is relatively small, we consider interval 70+ from the groups of (*EA*) as comparable with the interval 70–74 from (*S*) group. This measure is commonly used in similar analyses and as previously stated Fiala, Langhamrová (2011) or Šimpach, Langhamrová (2014), a significant distortion of the results will not happen. Component method of population projection stands on the assumption that the person at the exact age of x will be next year with a certain probability exactly 1 year older (Keyfitz, 1964, Bogue et al., 1993). The exceptional situations are when a person dies, emigrates, or in addition someone else immigrates. Tab. 1 shows initial assumptions for our projection for males' and Tab. 2 for females' experts.

According to Fiala, Langhamrová (2011) methodology, in our projection we supposed that each population (and profession as well) has its own saturation point in particular age group which achieves and which also will not exceed in the future. These saturation points, calculated as the proportion of economically active persons (and experts in the particular field) to the total population by age group are highlighted in the Tab. 1 for males and in Tab. 2 for females. At the same time we are assuming that every expert works in his / her profession until he / she dies or until he / she reaches the retirement age. (Retirement was generally set at the value of 64 years both for males and for females, the sum of emigration and immigration of experts in the particular field is considered equal to zero). Because of this assumption the proportion of economically active male experts in each cohort after the saturation point will remain at the level of 1,68 % (EDU), 3,50 % (SCI) and 3,71 % (ICT) until he reaches the retirement age and at the level of 7,30 % (EDU), 1,86 % (SCI) and 0,62 % (ICT) until she reaches the retirement age. The average

age of the population is calculated as a weighted average (Coale, Kisker, 1986), where the weights are the number of inhabitants

$$\overline{x} = \frac{\sum_{15-19}^{70-74} \left(x + \frac{1}{2}\right) \times EA\_TOT_{x,t}^{M/F}}{\sum_{15-19}^{70-74} EA\_TOT_{x,t}^{M/F}} \quad (1)$$

x is in our case (x–x+h-1), and we have to consider the means of the age intervals. Average ages for the population *EA_EDU*, *EA_SCI* and *EA_ICT* are calculated in the same way.

Age	S	EA_TOT	EA_EDU	EA_SCI	EA_ICT	EA_TOT (%)	EA_EDU (%)	EA_SCI (%)	EA_ICT (%)
15–19	297 860	38 032	33	49	135	12,77	0,01	0,02	0,05
20–24	354 381	215 405	1 053	3 320	4 993	60,78	0,30	0,94	1,41
25–29	387 292	308 904	4 674	13 549	14 361	79,76	1,21	3,50	3,71
30–34	463 655	388 980	7 139	14 593	14 467	83,89	1,54	3,15	3,12
35–39	459 293	400 142	6 008	11 484	10 310	87,12	1,31	2,50	2,24
40–44	364 367	312 658	4 694	7 516	5 575	85,81	1,29	2,06	1,53
45–49	356 929	306 054	5 380	7 510	4 274	85,75	1,51	2,10	1,20
50–54	338 051	282 131	5 668	6 754	2 840	83,46	1,68	2,00	0,84
55–59	369 091	293 794	6 142	6 793	2 080	79,60	1,66	1,84	0,56
60–64	353 635	140 317	4 608	4 284	1 155	39,68	1,30	1,21	0,33
65–69	250 635	38 356	2 253	2 232	260	15,30	0,90	0,89	0,10
70–74	163 771	21 674	1 651	1 457	93	13,23	1,01	0,89	0,06
TOTAL	4 158 960	2 746 447	49 303	79 541	60 543	66,04	1,19	1,91	1,46

Tab. 1: Males' economically active experts in the particular field in the Czech population. Source: data CZSO (2012), authors' calculations

Age	S	EA_TOT	EA_EDU	EA_SCI	EA_ICT	EA_TOT (%)	EA_EDU (%)	EA_SCI (%)	EA_ICT (%)
15–19	282 322	28 799	209	23	12	10,20	0,07	0,01	0,00
20–24	333 971	170 755	5 069	1 240	686	51,13	1,52	0,37	0,21
25–29	359 138	262 753	15 714	6 683	2 212	73,16	4,38	1,86	0,62
30–34	435 335	300 272	17 390	5 169	1 821	68,97	3,99	1,19	0,42
35–39	432 522	343 664	19 266	4 054	1 301	79,46	4,45	0,94	0,30
40–44	343 645	295 954	19 837	2 947	973	86,12	5,77	0,86	0,28
45–49	342 704	300 081	25 017	2 955	949	87,56	7,30	0,86	0,28
50–54	336 610	283 511	20 624	2 331	803	84,23	6,13	0,69	0,24
55–59	386 841	237 045	16 215	1 984	593	61,28	4,19	0,51	0,15
60–64	391 152	67 031	5 997	913	219	17,14	1,53	0,23	0,06
65–69	302 702	25 711	2 507	430	39	8,49	0,83	0,14	0,01
70–74	220 356	12 787	890	196	5	5,80	0,40	0,09	0,00
TOTAL	4 167 298	2 328 363	148 735	28 925	9 613	55,87	3,57	0,69	0,23

Tab. 2: Females' economically active experts in the particular field in the Czech population. Source: data CZSO (2012), authors' calculations.

Results and Discussion

Using the above methodology we calculate the estimates of the economically active population in total, the number of economically active specialists in the fields of education,

science and technology and ICT at 1st January 2021, 2031, 2041 and 2051. We use the multi-tree charts, i.e. the population pyramid, where time is represented by the shadow changes, for the presentation of results. The lightest shade represents presence, the darkest far future. Males are according to the conventions always displayed on the chart on the left side of zero central axes, females on the right. The results of population projection present Fig. 2.

We can see that in almost all young age groups the number of the economically active specialists decline in the future and in almost all older age groups the number of these specialists increase. Mentioned declines are mainly caused due to the fact that the Czech population is aging in general and the age-and-sex structure begins to have a regressive shape such as the population of the Western European type. An increase in the number of economically active specialists in the highest age groups indicates longevity of the Czech population and the need to remain economically active to the later ages due to the later retirement (more e.g. in Potužáková, 2009 or Kubanová, Linda, 2013. Our simplified assumption was that we set the retirement age on the value of 64 years both for males and females. According to current negotiating of pension reform, the retirement age could exceed 70 years in the future). Low level of the total fertility rate, which is (and will be) below the natural level of the population reproduction (below 2.08 children per 1 female during her reproductive period), is not enough to restore the population. To maintain the current state of the population in the Czech Republic immigration can help.

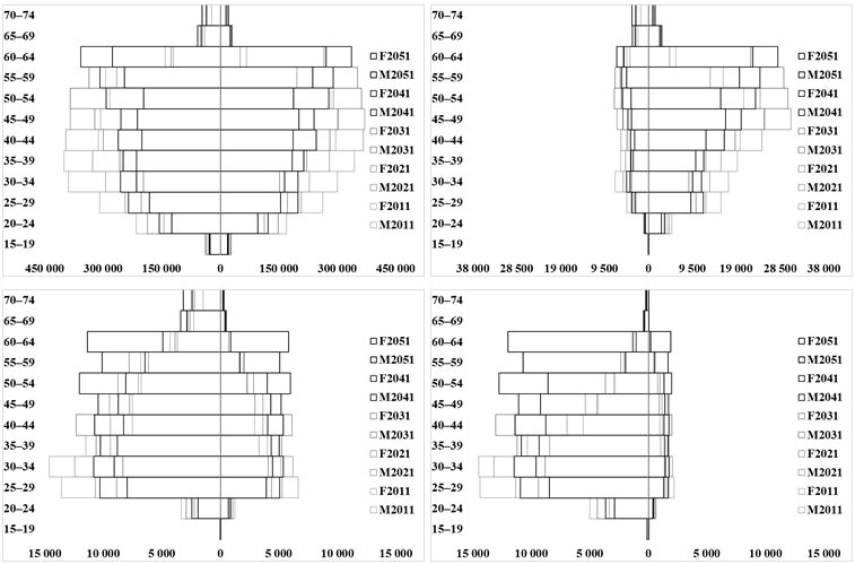

Fig. 2: Projection of economically active persons in total (top left), economically active specialists in the field of education (top right), science and technology (bottom left) and ICT (bottom right) for years 2021, 2031, 2041 and 2051. Males are on the left side, females on the right side. (Source: author's calculations and illustrations)

The empirical data from the year 2011 and projected results up to the year 2051 provide an interesting view on the population of economically active experts in the field of education and ICT. While in education field always dominated (and will dominate) females, in ICT it is opposite. Given that females work as teachers in primary and secondary schools to a

greater extent than males, this result is logical. The number of female teachers begins to equal the number of male teachers only at the universities. In the case of ICT it is clear that the profession which requires working with computers always was and will be the domain of males rather than females. The base of the male ICT pyramid is very young – progressive, because the greatest knowledge potential and economic efficiency have young people in this area. The shape of this population pyramid will be dramatically changed in the future, because if today people working as ICT experts remain in their profession and grow old here, the population pyramid gets significantly regressive form at the (left) males' side. In order to comprehensively summarize these results, we look at the Fig. 3, in which is shown the expected future development of economically active persons in total and economically active population by particular field.

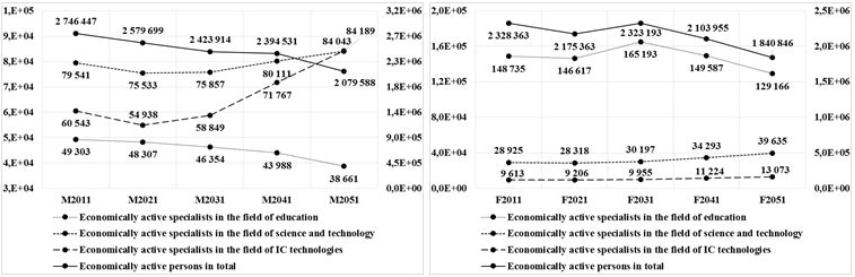

Fig. 3: Calculated total numbers of economically active males (left) and females (right) by various types of their knowledge potential for projected years 2021, 2031, 2041 and 2051. Economically active persons in total are assigned to the right y-axes. (Source: author's calculations and illustrations)

The average ages calculated according to formula (1) significantly rise until 2031 in the case of economically active females in total and economically active female experts in the field of education, where occurs the peak and these ages again slightly fall in 2041 and 2051 (see Fig. 4). The average age of the economically active males in total and all of the analysed expert populations will grow because males have the stronger bases in these age-and-sex structures. It is mainly caused because males do not stay on maternity and parental leave; (the same claim also stated Krebs, Průša, 2013). This strong base will grow old one day. The most significant increase in the case of male population is 50.20 years of average age at ICT experts. This information should not be overlooked, because our society could have a non-competitive ICT sector one day, because elderly structure of experts is not able to keep up with the times. Given that the year 2031 will occur quite early (within 16 years), it is the right time to motivate young people to study scientific disciplines orientated towards the area of education, science and technology and ICT as well. The average is sensitive to the outliers and therefore it would be sufficient to motivate about several thousand young people who would strengthen the base of these analysed structures in subsequent few years, so the mentioned year 2031 should be the peak or the inflexion point only and significant future aging of the expert population would occur with much less intensity. Very significant increase in the average age has also male and female population of experts in the field of science and technology, which may well mark a significant proportion of professors and associate professors in the population, but innovation and new ideas are often produced by a young and ambitious scientific generations.

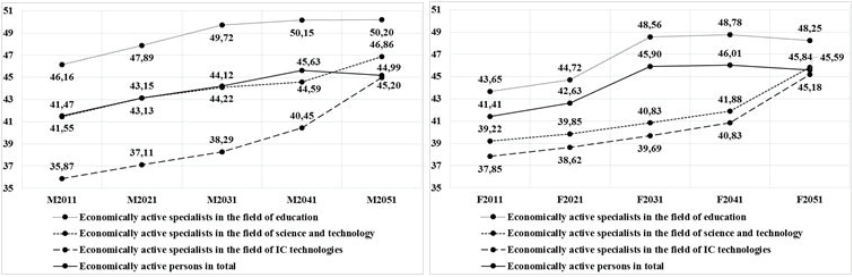

Fig. 4: Calculated weighted average ages of economically active males (left) and females (right) by various types of their knowledge potential for projected years 2021, 2031, 2041 and 2051. (Source: author's calculations and illustrations)

Conclusion

The aim of this paper was to estimate the future shape of the age-and-sex structure of economically active persons in the fields of education, science and technology and ICT up to the year 2051 and point out the possible future adverse development that will mean slimming down the bases of these structures. The highest average age will probably continue to increase in these groups during all analysed period. Our selected groups of people have a key influence on education in primary and secondary schools, universities and other educational institutions. If the ratio of specialists to the population of the appropriate age groups and the appropriate points of interest decreased, it could deteriorate the quality not only in education but also in scientific and technological progress of our society. It is important to note that the results of our projection stand on certain assumptions and that no model can unfortunately take into account the unexpected changes that may occur (such as unexpected changes in people's behaviour, government intervention through legislation and public policy, or the global situation in the world, such as economy, political regimes, wars or diseases).

In the future we will expand our research with similar analysis of the age-and-sex population structures of the economically active specialists in the fields of education, science and technology and ICT based on high and low variants of the population projections by CZSO, which would give us the upper and lower bounds to our analysis. Low variant by CZSO takes into account the relatively strong population decrease (mainly due to the low level of total fertility rate and weak immigration) and high variant works with significant population increase (mainly due to higher level of total fertility rate and stronger immigration). Very interesting modification of this study would occur if we consider the different ages of retirement in our calculations. After the approval of new pension reform, we will be able to recalculate results and use various scenarios of the retirement age.

Acknowledgements

The author gratefully acknowledge to the Czech Science Foundation project no. P402/12/G097 DYME – *"Dynamic Models in Economics"* for supporting this paper.

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LANGUAGE TEACHING/LEARNING WITH MOODLE IN HIGHER EDUCATION

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Abstract

E-learning with the Learning Management System Moodle is nowadays expanding into all levels of education. It is used at colleges and universities to help students learn and study different materials at their own pace, anytime and anywhere. It has a great advantage especially for language learning thanks to its possibilities of using various media elements. At the College of Polytechnics Jihlava all language courses have their own e-learning support with the same structure. The e-courses were prepared during the period of 2009-2011. The main aim of this paper is to compare the study results of language courses of the full time and part-time forms of study in three years: 2008 (before e-learning was implemented), 2010 (the first stage of implementation) and 2012 (e-learning used in all courses). The results are tested via Chi-square test of independence. The paper should answer the question if e-learning has had an impact on the study results and if it is possible to find dependence between results of two different forms of study, two different years or two different study branches. The comparison has shown that there might be a positive influence of the e-learning on the study results in the part-time form.

Keywords

Language study, e-learning, study results, chi-square test of independence

Introduction

Students at universities and colleges are in many cases supposed to master specialized language of their branch of study, which is a demanding complex task for them. After consolidating knowledge and skills acquired before, students have to learn technical vocabulary and deepen their knowledge of grammar, practice reading with understanding, train communication skills. Graduates should be able to read and understand English (or another foreign language) technical texts on topics related to their branch of study or to discuss such topics in English (or another foreign language). At present students are equipped with a range of tools helping them to reach the target. For example, they can communicate with native speakers face to face or through all kinds of social media over the Internet, or they can search for study materials on the Internet. Universities and colleges also prepare their courses with the support of information and communication technologies to facilitate the process of learning to their students and design e-learning courses for all kinds of subjects including languages.

Internet usage for learning and e-learning was widely spread in 1990s as WBT (Web Based Training). Afterwards a Learning Management Systems (LMS) appeared to manage online materials. There exists a range of different LMS systems, nevertheless one of the most popular among the open sources LMSs is Moodle. The web site edutechnica.com shows the most popular LMSs in UK, Canada, USA and Australia – the two most widely spread systems are Blackboard Learn and Moodle. Olmos et al. (2015) describe Moodle as e- (or

b-) learning tool enabling extensive use of digital technologies in learning because of three characteristics: interaction, usability and social presence. As a teaching tool it allows for the management of the subject contents, for the communication with the students and students' assessment. E-learning as the combination of different types of information and communication technologies (computers, internet, software, LMS etc.) can be helpful in the process of language learning. As Clark and Mayer (2011) describe, e-learning uses various media elements to deliver the needed content (words, pictures, videos, sounds, presentations). All of these possibilities can be used for teaching and learning languages. Nedeva and Dimova (2010) mention the flexibility and personalized learning as the main benefit of the e-learning used for learning languages. Besides e-learning Moodle can serve also as the "b-learning" or "blended learning" tool. Blended learning is "an integration of online learning and regular class learning" (Tang 2013).

The comparison of student results related to e-learning, blended learning or distance learning is one of the topics that are mentioned in various articles. Carnwell (2000) analysed the influence of e-learning materials used instead of direct teaching and found out positive impact of adequately designed e-courses with benchmarks and deadlines on the self-study. Other papers trying to find influence of e-learning on study results (Manocheri, Young 2006; Popelkova, Kovarova 2013; Kuncova, Vojackova 2014) show hardly any statistically significant relationship between results and final exam. On the other hand Olmos et al (2015) in their study founded out that the students using e-learning had their scores "significantly higher in evaluation of assignments or video-learning". Brožová, Rydval and Horáková (2014) studied the influence of the self-test usage on the study results and did not confirm any important positive impact on the study results In this article we investigate the influence of e-learning, forms of study and years of study on the final evaluation of language courses, especially English and compare them with similar tests results focused on economic subjects (Kuncová, Vojáčková 2014). Three hypotheses concerning the independence of these factors are tested via Chi-square test of independence. The main aim is to find out if e-learning usage has improved students' study results in language courses.

Materials and Methods

E-learning was introduced at the College of Polytechnics Jihlava with the support of the Operational Programme Education for Competitiveness in the priority axis 2 with the project registration number CZ.1.07/2.2.00/07.0317 within the years of 2009 – 2012 when the first 150 e-learning courses were created and gradually implemented. The project was described and evaluated in our previous papers (Kuncova, Vojackova 2012; Kuncova, Vojackova 2013). At present, the students studying at the College are provided with the total number of 220 e-learning courses created in LMS Moodle. The e-courses were prepared especially for part-time students who have no contact lessons. That is why we still use the term "e-learning" although nowadays also full-time students take advantage of it as the extension of face-to-face teaching and in this case "blended learning" should be the appropriate term.

At the time of the initial phase of e-learning courses implementation, the College was offering six study branches (belonging to 4 study programmes): Applied Computer Science, Computer Systems, Finance and Management, General Nurse, Midwifery, Travel and Tourism. For each of the programme e-learning courses were designed for most specialized subjects including language courses.

Languages are taught in all of the mentioned branches of study, however there are some

differences among them. Only English is taught as a compulsory subject (two lessons per week in four semesters) in Applied Computer Science and Computer Systems study branches. Either English or German (three lessons per week in four semesters) is compulsory for students in Finance and Management, General Nurse and Midwifery study branches. Students in Travel and Tourism have to study English or German as the main foreign language (three lessons per week in five semesters) and also they have to choose another foreign language (two lessons per week in two semesters): English if their main language is German, and German, Spanish, Russian, French or Italian if their main language is English. The primary materials in all language courses are course books focused on language for specific purposes and materials included in the relevant e-learning courses. The above mentioned information applies to both full-time and part-time forms of study, only the numbers of lessons per week concern only full-time study mode. Part-time students are provided with introductory tutorials (1 lesson per semester) and during the semester they work on their own with the support of e-learning.

All compulsory language courses are focused on professional language, therefore the e-learning courses were designed to suit this need. The courses were prepared by respective language teachers at the Department of Languages, College of Polytechnics Jihlava, in Moodle environment and they are available at the web pages elearning.vspj.cz. The structure of all the language e-learning courses is similar. The introductory part includes learning objectives, structure of the course, initial requirements for starting with the course, conditions for successful completion of the course, study guide, recommended literature, questionnaires, etc. The courses are divided into sections according to topics or weeks of relevant semesters. The structure of the content included in weeks/topics is similar in all language courses, however it is always adjusted to accommodate the objectives and needs of each particular study branch. The typical structure of the e-course is following: each week/topic is introduced by Learning Objectives and concluded by Summary. The materials designed for each topic are divided into five parts (Fig.1):

Part 1 – Vocabulary and Topic-Related Exercises - contains a number of items covering relevant vocabulary and offering a range of various materials and exercises for practicing. List of Key Vocabulary presents the key English terms and words related to the particular topic. Key Vocabulary is an interactive exercise which contains the expressions from the List of Key Vocabulary. Students can learn new words in an interactive way while choosing Czech translations for English words. Topic-Related Exercises are a pdf format document with exercises based on the chapter topic. They enable students to prepare for the written examination. Interactive Exercises are a collection of different types of exercises, where students can get extra points. These interactive exercises in each topic are only accessible for a certain time. Interactive exercises include multiple choice exercises, short answer exercises, matching exercises, true or false exercises, etc. (Fig. 2). Audio and Video recordings correspond with each particular topic. The last item, Discussion Topics, supplies questions and issues for discussion.

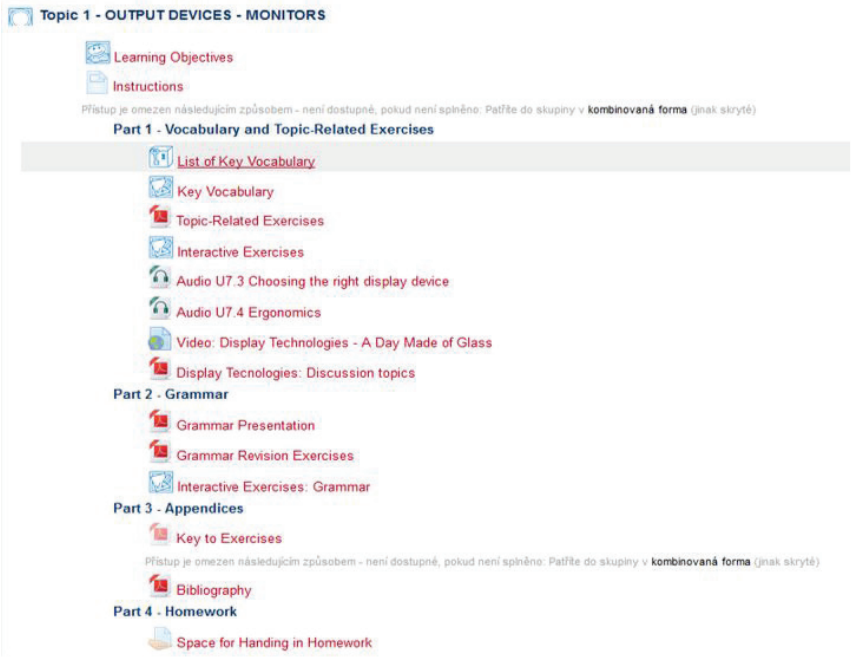

Fig. 1 – Example of E-learning Materials in Moodle for an English Course (source: elearning.vspj.cz)

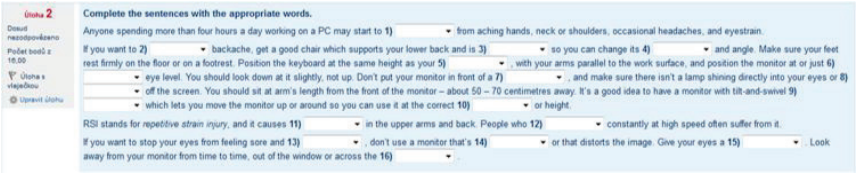

Fig. 2 – Example of an Interactive Exercise in Moodle (source: elearning.vspj.cz)

Part 2 – Grammar - contains Grammar Presentation, which is a summary of the grammar studied in the relevant topic, and Grammar Revision Exercises, which is a pdf document with general exercises reflecting the grammar introduced in Grammar Presentation. The last item in this part is Interactive Exercises: Grammar enabling students to practice grammar from the topic in an interactive mode while using the types of exercises mentioned in the preceding paragraph.

Part 3 – Appendices - includes Bibliography with compulsory and recommended sources and Key to Exercises, which is available only to students in the distant mode of study.

Part 4 - Homework - is space for handing in homework from the given topic.

Part 5 - Classroom Activities - is a section containing material for use in the classroom. Some activities are common for both forms of study, some are designed only for full-time students, others for part-time students. Activities intended just for one of the modes are available only for students registered in the relevant form of study, students from the other form do not have access to these activities (Fig. 1).

The methodology is the same as in our previous studies We used the College Information System to collect data about the final results in all language courses in the selected years and we separated the semesters which are concluded by credits and those which are concluded by final marks(on the scale A-F). The frequency of results is tested by Chi-square test of independence. We compare 3 different years: 2008 when there was no e-learning support for students to use, 2010 when the e-learning materials started to be created and tested and 2012 when all semesters of language courses were using the same e-learning system with pre-prepared materials. Regardless the branch of study, all students must go through several semesters of the respective language course. As the majority of students (70-80%) study in the programme of Economics and Management (2 branches of study: Travel and Tourism – TT, and Finance and Management – FM) we focus on these students and their results. FM and TT Students have to study English or German as a compulsory subject. They make a choice of the compulsory foreign language in the College entrance exams as the language exam forms one of its parts and students admitted for studying at the College have to achieve at least the CEFR level B1. Afterwards they have to study the language in 4 (FM) or 5 (TT) semesters (3 lessons per week). Except for the last one all the semesters are completed by getting credits. The last semester of each language course is finished by an exam (marks A-E in case of passing and F in case of failure). The crucial part of the evaluation is formed by a final written test, which is organized en bloc for all students of the given form of study regardless of the teacher and corrected by few teachers to avoid the subjectivity of the evaluation. The students' knowledge must be at least on the CEFR level B2 to pass. Students from the branch TT have also 1 other language as compulsory subject. All these conditions are valid for the full-time students. Students from the part-time form of study (of both study branches) have only one face-to-face session (45 minutes) and afterwards they have to study everything via Moodle (or using other possibilities like course books, dictionaries, Internet etc.).

Based on the facts mentioned above we formulated these hypotheses:

1. The results describing the relative frequencies of passes in languages in the two selected years of study are independent.
2. The results describing the relative frequencies of passes in languages of the students of full-time and part-time forms of study are not dependent on the form of study.
3. The results describing the relative frequencies of passes in languages of the students of TT and FM branches of study are not dependent on the study branch.

We compare the frequencies of results A-F and because of this type of data (categorical) the Chi-square test for independence is used (Kanji 2006).

Results and Discussion

The first part of our comparison is aimed at the semesters where students get credits (not marks). When we compare all languages and the results in the selected years (of all the students who studied any language during the given year in summer or winter semester) we can see (Fig. 3) that the percentage of the students that failed (did not get credits) is higher for the part-time students but it is decreasing (from 39% in 2008 to 32% in 2012) whereas the trend for the full-time students is different – the percentage of those who failed is rising. As all the *p*-values from the Chi-square test of independence (in comparison of the two years and the frequencies of results) are close to zero, there might be some effect of the e-learning usage especially in the part-time students whose results seem to improve with the usage of e-learning materials – also the percentage of those who get credits is rising. But the results might be influenced also by the number of those who did not attend the courses as

they had studied the language before (at another university or college) and the subjects were credited to them on the basis of the results achieved from the previous studies. The percentage of those students is falling in both forms of study – partly it is because of the fact that the students coming from other universities/colleges did not get credits from the language during their previous study or they desire to study the language again as they consider their knowledge sufficient for passing. Another reason might be falling numbers of students with previous experience from other universities/colleges.

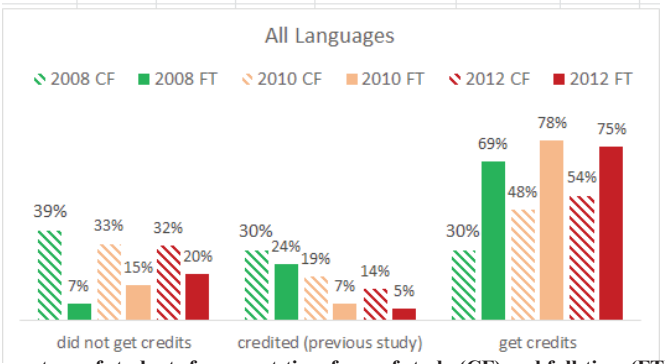

Fig.3 – Percentage of students from part-time form of study (CF) and full-time (FT) (source: College Information System)

The final part of language learning is concluded by an exam. The students who obtain A-E mark have passed, mark F means that they have failed the exam or they have given up the exam (the mark F is assigned by the College Information System not by the teacher). When we divide the results of the exams into the categories "passed", "failed" and "gave up", we see (Fig. 4) that the percentage of full-time students who passed is the highest but nearly the same in all three years. On the other hand, the results from the part-time form of study are different: in 2008 (the first 27 students who did the language exam) most of the students gave up the language exam. In 2010 a lower percentage of students gave up, more of them passed but some of them failed. In 2012 majority of students passed the exam and only few of them gave up the subject. So it seems that students in 2010 and 2012 were prepared better for the exam than in 2008. E-learning usage can be one of the reasons for the better results.

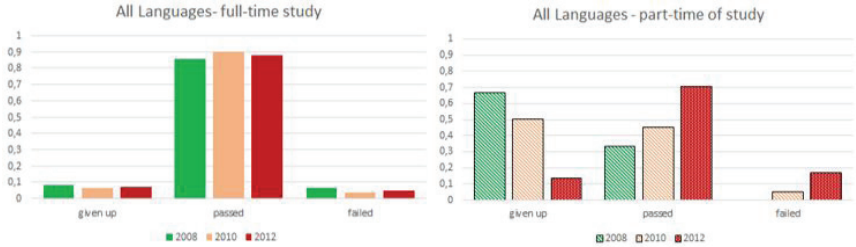

Fig.4 – Percentage of students who passed, failed or gave up a language course (source: College Information System)

On the basis of the first hypothesis we have tested the independence of the frequencies of results in different years. Tab. 1 shows all *p*-values for both forms of study when two years results are compared. The significance level is equal to 0.05. Three *p*-values in Tab.1 are

lower than this (grey background) and in these cases we reject the first null hypothesis and we may say that there exist differences between the results in selected years. So the Chi-square test shows that for the full-time students the results were different in the year 2010 compared with 2008. This fact does not indicate that there is any influence of e-learning on the success in language subjects. On the other hand the Chi-square test for part-time students' results shows that the difference between the results from the year 2012 and other 2 years exists. From the Fig.4 it is clear that the results depend on the study form and also all the *p*-values for the comparison of the same year but different study forms of study confirm this outcome (all are close to zero).

	Year comparison		
form of study	2008/2010	2008/2012	2010/2012
Full-time	0.00000	0.06693	0.12063
Part-time	0.21999	0.00000	0.00000

Tab. 1: *p*-values obtained from Chi-square test of independence

We have obtained the same results when only the students of the two main study branches (FM and TT) were selected. So we have decided to compare results according to the frequencies of the final marks. As there are only few students who studied German as the main foreign language we have compared only the results of English. Unfortunately in 2008 there were no part-time students doing final exams in English courses and in 2010 only first few of them did so. On the basis of these facts we have compared the results of full-time students in those two study branches in three selected years. The number of students that finished their English studies at our College in 4th semester with final exam oscillated from 76 (in 2008 and FM study field) to 207 students (in 2012 and TT study field). The *p*-values in the years 2008 and 2010 for the TT/FM comparison of the relative frequencies of marks are lower than the significance level (they are 0.007 and 0.000) and so we may say that the results were dependent on the study branch. It can be caused by the extremes (Fig. 6). In 2008 significantly more students of TT obtained mark "B" than students of FM who had more "E" marks. In 2010 there is a big contrast in the number of "A" marks in the group of the FM students. This fact was also confirmed in the questionnaire designed in our previous research (Kuncová, Vojáčková 2012). When only the English courses in all levels were taken into account, we can see (Fig. 5) that the question "Has the e-course helped you during the study of this subject?" had more positive answers from the FM students (maybe because at FM the Moodle in other subjects than English was used earlier than at TT).

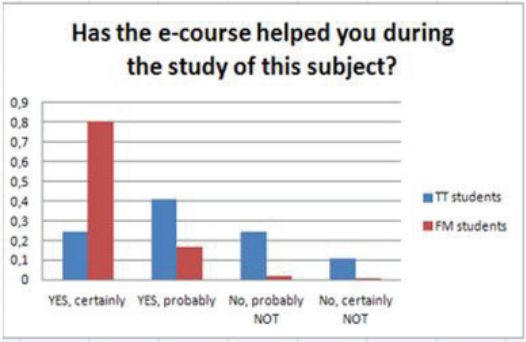

Fig. 5 – Answers of the students to one of the questions in the questionnaire (source: own questionnaire results from the year 2010/11 for the paper Kuncová, Vojáčková 2012)

In 2012 only, the results are closer to each other for all marks and both study branches and the third hypothesis is valid (p-value is 0.17). It is hard to say if this might be caused also because of the same structure of the e-learning materials.

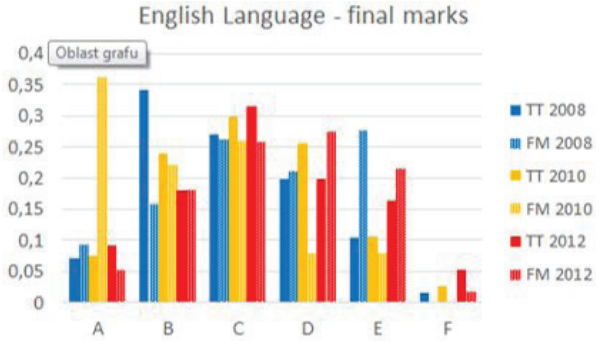

Fig. 6 – Comparison of final marks in English language in full-time form (final semester (source: College Information System)

We may say that the final marks in English language in 2012 are normally distributed although students have to achieve at least 70% of the total score to pass. Compared with other researches (Brožová, Rydval and Horáková 2014; Kuncová, Vojáčková 2014) where the tendency to pass rather than to obtain better marks was proved, the results in English do not confirm the same trend. To explain the reasons (if English is easier than other subjects or the Moodle materials are better) further research including students' opinions would be desirable.

The differences among the results achieved in language courses have been proved for the part-time students only. Their results differ from the full-time students results (full-time students have better results) but the students' tendency towards improvement when using Moodle is noticeable (similarly as in Brozova, Rydval and Horakova, 2014). These differences can be caused by e-learning usage but also by a wider range of materials that students have at their disposal. Moreover, learning abilities and willingness to study may also be at play, but these factors are difficult to measure. As in other similar studies (Brozova, Rydval and Horakova, 2014; Carnwell, 2000; Popelkova and Kovarova, 2013) we cannot confirm that the usage of e-learning materials has a significant positive impact on the study results of full-time students.

Conclusion

Language e-learning courses at the College of Polytechnics Jihlava offer a range of activities for practice and further study and thus provide students with a valuable support. Some of the activities are assessed and the results achieved create a part of the final mark. All language e-learning courses are continually updated and amended to reflect new developments in the relevant branches and to suit the needs of both students and teachers. The comparison of results between different years of study – before the implementation of e-learning and after e-learning has become inseparable part of the courses – showed that there are some differences especially in the part-time form of study and with reference to the relative frequencies of passes in the language course. This fact indicates that e-learning can have some positive impact on language study results especially as a tool that helps students in their self-study process.

Acknowledgements

The paper was processed under the sustainability of the project No. CZ.1.07/2.2.00/07.0317 and under the internal grant of the College of Polytechnics Jihlava "Analýza systému fungování veřejných vysokých *škol*".

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EVALUATION OF FACTORS INFLUENCING THE LEVEL OF ICT SKILLS IN BACHELOR COURSES

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Abstract

The paper summarizes the analysis of skills and knowledge in ICT course of first year bachelor freshmen from the economy and technical study programmes at Czech University of Life Sciences in two different forms of study in the academic year 2014/15. The goal of the paper is to describe the influence of factors on performance of first year bachelor students in ICT courses at various study programmes and to compare results with the analysis from the year 2013/2014. The analysis of the influencing factors is based on data of students from six different study programmes. Total count of respondents was 653. Twelve factors were evaluated and their impact on entry test, examination test, number of exam attempts and number of attempts to pass tests to get credit.

Keywords

ICT knowledge, school-leavening exam, ICT skills, informatics, bachelor students

Introduction

Current higher education brings many questions and challenges especially when it comes to ICT skills and competences that the students are offered by university courses. Even if most of university degree programmes provide some sort of ICT related courses, the question is what will the students eventually gain? Are today's undergraduates better prepared in terms of ICT skills than were students of earlier generations? To what level are they ICT proficient? Computer literacy is also a part of broader information literacy (Breivik, 2005)

The terminology has undergone a long development since mid 1970's when the term Computer Literacy was introduced through 1990's when the term Digital Literacy was firstly coined till 2010's (Boechler, Dragon and Wasniewski, 2014) when a plenty of subcategories are used in the literature such as 'digital competence' (Leahy and Dolan, 2010). According to the expert's view digital competence is built up of knowledge, skills, and attitudes (Janssen et al., 2013). In the following text we will refer to ICT skills as part of the digital literacy and digital competence.

ICT skills are important to the current young population to increase their employability (Papadopoulos et al, 2013) and to support the inclusion in the society (Novo-Corti et al, 2014). There is also some evidence that efficient use of ICT in education brings better educational outputs and also has positive impact on ICT sector (Hanclova and Doucek, 2011; Aristovnik, 2013,). The availability of education is one of the value with impact on the measures of quality of life (Jarolímek, Vaněk and Šimek, 2009). ICT sector drives 20 % of all productivity in European Union (European Commission, 2009) and well-educated graduates with appropriate level of ICT skills are needed (Maryska, Doucek and Kunstova, 2012).

The gaps between university ICT curricula and business requirement have to be measured

and reduced by improving training and teaching of ICT skills in higher education (Miloš and Petr, 2012). Regarding the disparities between university ICT curricula and secondary school educational programmes the systematic analysis of ICT skills and competences are needed and has been realized (Ocenasek, Ulman and Vydrova, 2013; Ulman et al, 2014).
The different studies were focused to find the influencing factor on ICT skills. The commonly mentioned factor is gender (Kubiatko et al, 2012). The influence on ICT skills can have changes in learning or change of expectation towards ICT competences and computer use (Verhoeven et al, 2010).
The goal of the paper is to describe the influence of factors on performance of first year bachelor students in ICT courses at various study programmes and to compare results with the analysis from the year 2013/2014.

Materials and Methods

Data for analysis were based on information about bachelor students from six different study programs at economy and technical faculty in winter semester 2014/2015. We collected data from the same study programmes as in year 2013/2014 to be able to compare results. Students from bachelor study programmes Economics and Management and Business Administration taught at the Faculty of Economics and Management in Czech and English languages and 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 at the Technical Faculty participated in the survey. Two of these study programs taught at Economics and Management faculty are tutored in English language. Two of these programs are of distant type. We gathered data from 653 students. For comparison it was 507 in year 2013/2014
Some of influencing factors were the same as in the analysis in year 2013/2014 – gender, secondary school, country, state school-leaving exam, and graduation in the year of entry, maths at state school-leaving exam, faculty and entry test result. There were 4 new factors added – first language, English at state school-leaving exam, office software type and form of study. Influencing factors first language and English at school-leaving exam were considered only for students from English study programs taught on Economics and Management faculty.
Data for the study were gathered through Moodle system. This system is widely used for courses on Czech University of Life sciences. Like in year 2013/2014, students were first asked to take entrance test to provide information about their gender, type of secondary school, year of graduation, country and if they took state school-leaving exam and from which subjects. Questions about type of office software and first language were added. Part of this entrance test was 11 questions from ICT topics. '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' (Ulman et al, 2014: 3).
The results of the examination and number of examination attempts were downloaded from the Moodle system and study information system of Czech University of Live Sciences. We only took into consideration result from the first attempt.
Last part of the study was the correlation between 12 influencing factors and number of MS Word test and MS Excel test attempts. The requirements to get credit from ICT courses on some of the study programs on economy and technical faculty of Czech University of

Life Sciences are the same. Students must pass two tests, they have 3 attempts for each of these tests and minimum of points they must get to pass. Only students in the Czech study program on the economy faculty have different requirements to pass the subject. This is reason why their data were eliminated from this part of study.
SAS program was used for the analysis of influencing factors. The factors were evaluated by hypotheses testing and regression analysis. To be able compare results with the analysis from the year 2013/2014 we tested hypotheses by means of two-sided test and by means of linear regression model (Sigel, 2011).

Results and Discussion

The main objective of our study was to analyse 12 different factors and their influence on five characteristics – entry test, examination test, number of exam attempts and number of attempts to pass test from MS Word and MS Excel. The list of factors and hypotheses are represented in Table 1. There is couple of new hypotheses and new factors in comparison to analysis from year 2013/2014. New hypotheses and factors are in bold.

	Factor	Entry test	Examination test	**Exam No. of attempts**	**MS Word test no. of attempts**	**MS Excel test no. of attempts**
H1	Gender	x	x	**x**	**x**	**x**
H2	Secondary school	x	x	**x**	**x**	**x**
H3	Country	x	x	**x**	**x**	**x**
H4	**First language**	**x**	**x**	**x**	**x**	**x**
H5	State school-leaving exam	x	x	**x**	**x**	**x**
H6	Graduation in the year of entry	x	x	**x**	**x**	**x**
H7	Maths at state school-leaving exam	x	x	**x**	**x**	**x**
H8	**English at school-leaving exam**	**x**	**x**	**x**	**x**	**x**
H9	Faculty	x	x	**x**	**x**	**x**
H10	**Office software type**	**x**	**-**	**-**	**x**	**x**
H11	**Form of study**	x	x	**x**	**x**	**x**
H12	Entry test result	-	x	**x**	**-**	**-**

Table 1: Hypotheses overview

The influence of office software type on examination test and number of exam attempts were not included in the study because the skills and knowledge of how to work with office software is not part of the examination test. The questions in the entry test have theoretical character and they weren't focus on using MS Word and MS Excel software. Students take the tests from MS Word and MS Excel after they attend seminars focused on the use of this software that is why these hypotheses were eliminated from study.
The null hypothesis stated that the averages of both groups are equal. All of the hypotheses were tested with non-parametrical tests because the normal distribution of the dataset was not confirmed (Siegel, 2011; Ulman et al, 2014). Results of the analysis are summed in the Table 2.

	Entry test	Examination test	Exam No. of attempts	MS Word test no. of attempts	MS Excel test no. of attempts
H1	0.0019	0.6255	0.3488	0.0001	0.2290
H2	<.0001	0.0012	0.0663	0.0002	0.0344
H3	0.5608	0.0001	<.0001	0.0716	0.2302
H4	0.6052	0.0013	0.0009	0.4223	0.7783
H5	<.0001	0.0609	0.1757	<.0001	0.0083
H6	0.4729	0.1365	0.1760	0.1054	0.6782
H7	0.5421	0.0838	0.4670	0.2979	0.5104
H8	0.6019	0.0586	0.1799	0.7089	0.6627
H9	0.6889	0.0001	0.0234	<.0001	0.0171
H10	0.0030	x	x	0.7049	0.9322
H11	0.0001	0.5473	0.2742	x	0.1095

Table 2: Hypotheses results, α=0.05

The influence of gender (H1) was confirmed in the relation to result of entry test. However, the analysis provided different result in the relation to examination test. In study from 2013/2014 the gender has influence on result of examination test. In the current study the hypothesis was rejected.

The Kruskal-Wallis test was used for hypothesis of impact of secondary school type (H2), because we compare more than two groups (Siegel, 2011). Students on the economy and technical faculty of Czech University of Life Sciences graduated on grammar, technical, business, lyceum or other type of secondary school. The type of secondary school (H2) has impact on result of entry test and examination test. This was also confirmed in the study in year 2013/2014. The hypothesis of state school-leaving exam (H5) according to analysis has influence on result of entry test.

The analysis provided the same results for some hypothesis as in year 2013/2014. Study confirmed that faculty (H9) has influence on examination test result at the 0.05 significance level. The impact of graduation in the year of entry (H6) and mathematics at the state school-leaving exam (H7) were not confirmed and hypotheses were rejected at the 0.05 significance level same as in year 2013/2014.

The hypotheses first language (H4), county (H3) and English at school-leaving exam (H8) were tested only for students from English study programs. Data of 107 respondents were used. The analysis confirmed reliance between first language and result of examination test and number of exam attempts. English at school-leaving exam has no influence at any of the characteristics. The Kruskal-Wallis test was used for testing of impact of country. Students on the English study programs come mostly from Czech Republic and former Soviet Union countries as Russia, Kazakhstan, Ukraine etc. and Asia. The influence was confirmed in the relation to examination test results and number of attempts of exam. The influence wasn't proved on the entry test results as it was in the study in year 2013/2014.

Three new characteristics were added to study – number of examination attempts, number of MS Word and MS Excel test attempts. From all twelve factors only faculty (H9) has impact on the number of examination attempts. Because students in the Czech study program on the economy faculty have different requirements to pass the subject. Their

data were eliminated in this part of study. And the analysis of number of MS Word and MS Excel test attempts was made only for 326 respondents. It was proved that gender, type of secondary school, state school-leaving exam and faculty has significant influence on the number of MS Word test attempts, but only type of secondary school, state school-leaving exam and faculty has impact on the number of MS Excel test attempts.

Office software type (H10) was influencing only on the results from Entry tests. For analysis was used Kruskal-Wallis test, because students state that they use one of these type of office software: Microsoft Office (MS) 2007, MS 2010, MS 2013, MS 365, MS for Mac, Open Office, Apple iWorks or other. The influence can be explained by the questions from entry tests. Some of them were focused of knowledge MS office software.

It was proved in study that entry test results and examination test results don't have normal distribution. No test in SAS software could confirm it. Results of tests are summed in Table 2.

Tests for Normality								
Test	Entry test				Exam test			
	Statistic		p Value		Statistic		p Value	
Shapiro-Wilk	W	0.97138	Pr < W	<0.0001	W	0.990271	Pr < W	0.0003
Kolmogorov-Smirnov	D	0.101592	Pr > D	<0.0100	D	0.061695	Pr > D	<0.0100
Cramer-von Mises	W-Sq	0.858636	Pr > W-Sq	<0.0050	W-Sq	0.298073	Pr > W-Sq	<0.0050
Anderson-Darling	A-Sq	5.228582	Pr > A-Sq	<0.0050	A-Sq	1.751139	Pr > A-Sq	<0.0050

Table 3: Basic statistical measures (entry test, exam test)

Count of students included in this study was 653. The average result from the entrance test was 60 points. The maximum what students could get was 100 points. The median value reached 64 points. The most common value from the entrance test was 73 points. The standard deviation was ca. 22.5. The negative kurtosis points out on the flat distribution and the inverse skewness points out on the distribution with the skewness to the right. The not normal distribution of the entry tests is visible on charts below (Figure 1 and 2).

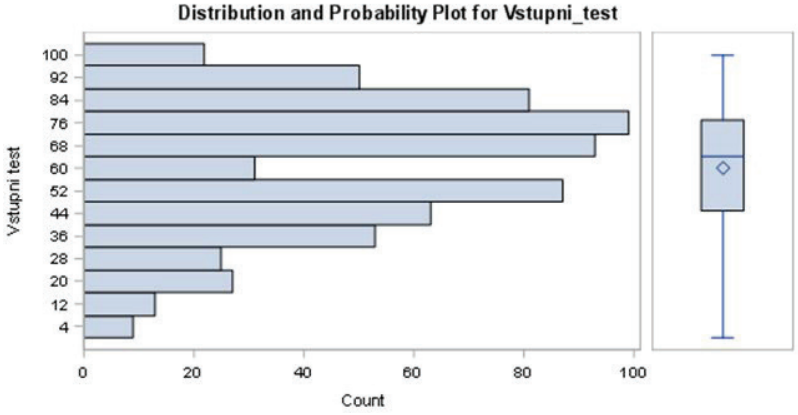

Figure 1: Distribution and Probability Plot for Entry test

The data of examination test had similar results. The average from the examination test was 59 from 100. 61 points represents median value of examination test results. The most student got 50 points from the first examination test and standard deviation had value 17. The kurtosis was negative and it points out to the flat distribution.

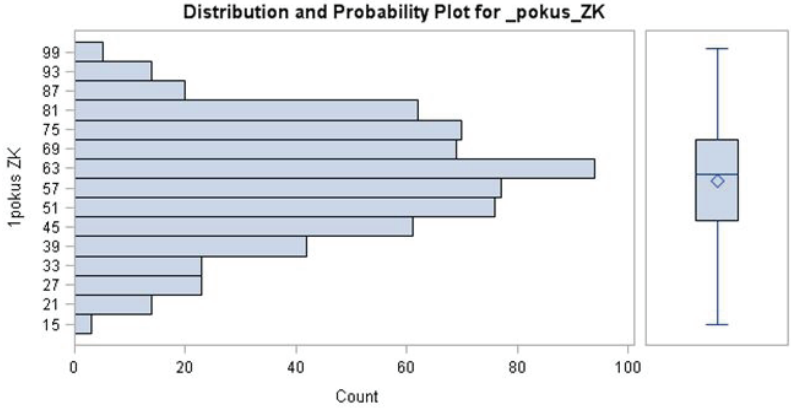

Figure 2: Distribution and Probability Plot for Exam test

There was a statistically significant correlation detected between results of the entry test and results of the examination test. The model for % score of examination test was produced: 48.53334 + 0.17587* entry test score. All parameters are statistically significant. The R-Square value was 2.24. The relation between these two characteristics wasn't found in the study in year 2013/2014. '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'. (Ulman et al, 2014:5) However, the change is not so noticeable. According to study from this year the result from examination test can be explained by result from entry test from 5 %. Reasons for this change are not revealed and we didn't include these factors into the study.

Hypotheses	Pearson coeff.	Spearman coeff.
Entry test – examination test	0.22817	0.20773
Entry test – number of exam attempts	-0.18271	-0.18471

Table 4: Correlation coefficients

The significant correlation was detected also between entry test results and number of exam attempts. The median value was set to 1. The most of students succeed to pass exam on the first attempt. There is according to analysis inverse reliance between result from entry test and number of attempts. The model for % score of examination test was produced: 1.82417-0.00556*entry test score. Both parameters are statistically significant, but the result from entry test explains number of exam attempts only from ca. 3.5 %.

The study provided new and different results with comparison of study from year 2013/2014. Study proved the statistically significant relation between results from entry test and examination test. The type of secondary school and faculty were the most influencing factors.

Conclusion

The paper summarizes the results from analysis of influencing factor of learning in the first year ICT courses at the Czech University of Live Sciences on two faculties. The survey was based on the data collected from six different study programs taught in Czech and English language and on-site and distant type study. Twelve different factors and their influence on entry test result, examination test, number of exam attempts, number of MS Word and MS Excel test attempts were explored. The influence of gender, secondary school type, state school-leaving exam and form of study and faculty was confirmed.

There are different results in the study in comparison to study from year 2013/2014. The characteristics entry test and examination test don't have normal distribution. The influence of entry test results on the examination test results was found and this influence is statistically significant. However, the influence of the entry test on examination test was calculated to ca. 5 %. These changes can be caused by many different factors we didn't include in the study. It will be appropriate to take the study again in the next year and compare results to see progress or differences to the current study and study from the year 2013/2014.

Acknowledgements

The results and knowledge included herein have been obtained owing to support from the University Internal Grant Agency of the Czech University of Life Sciences Prague, grant no. 20151007 – "Inovativní přístupy využití ICT ve vzdělávání jako prostředek snižování sociálního vyloučení" (Innovative approaches to the use of ICT in education for mitigation of social exclusion).

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TRANSFERABLE COMPETENCES: INTERNATIONAL COMPARATIVE RESEARCH

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Abstract

The paper presents the results of comparative research between the Czech Republic and the Netherlands. The subject of the research was the degree of student satisfaction with the acquired transferable competences. The research sample consisted of final year students of courses focused on vocational education. A deliberate selection was made at the Institute of Education and Communication of the Czech University of Life Sciences Prague (representative of the Czech Republic) and Stoas University of Applied Sciences (representative of the Netherlands). With the use of statistical methods, conclusions are drawn as to whether there are any significant differences detected among the respondents of both countries. The interpretation of the data reflects the setting of the curriculum in the form of an elaborate system of competences (the Netherlands) and in the form of specific target requirements formed in the project Sirius (the Czech Republic) and it subsequently compares their effectiveness in the context of transferable competences.

Keywords

International research, the Czech Republic (hereinafter CZ), the Netherlands (hereinafter NL), transferable competences, vocational education

Introduction

Social aspects are becoming more and more significant for economic environment. These social aspects include e.g. so-called corporate social responsibility which ´is one of the useful tools to positively affect society and develop relationships with stakeholders´ (Kvasničková Stanislavská, Kvasnička, Kuralová and Margarisová, 2014: 95), or corporate education, also employment and employability. The employability is closely related to so-called transferable competences.

The term transferable competences is not defined unambiguously in the specialized discourse. It would be necessary to conduct its theoretical analysis, however, this is not the subject matter of the paper. Nonetheless, it is necessary to note that (1) the terms ability, skill and competence get confused, and (2) the attributes core, key, generic (or general) and transferable (or transversal) are used variously in relation to the given terms. Reflections on the characteristics of the terms or their differences can be found e.g. in: Stephenson (1998: 3); Connell, Scheridan and Gardner (2003: 142); Merriënboer, Van der Klink and Hendriks (2002); Yorke (2006: 11–13); Dearing (1996) etc. Therefore, different variations of these terms will occur in the paper due to the influence of the references to authors, e.g. generic/key/transferable skills or generic/key/transferable competences. The authors of the paper prefer the term transferable competences.

Transferable competences are ´the generic capabilities which allow people to succeed in a wide range of different tasks and jobs´ (Training Agency, 1990: 5). York (2006: 12) specifies that ´the basic idea is that skills learned in one context could fairly readily be

transferred to another´. In other words, ´transferable skills are important for individuals to enhance their employability, for employers to find qualified and able employees and for the economy that needs highly skilled workforce for economic growth and competitiveness´ (Ylonen, 2012: 804). To become sustainable competent for functioning in the continuously changing labor market, a student has to develop metaskills and transferable competences (Kuijpers and Meijers, 2009).

In the given context, it is necessary to realize the difference that Strádal points out (2014: 4–5): transferable competence is bound to more professions whereas professionally specific competence is bound to a particular profession. The subject matter of the research are transferable competences. Yorke (in Ylonen, 2012: 803) mentions that transferable competences ´are attributes acquired in education and training that are not specific to the subject studied, but are skills and abilities that can assist students to enter the world of work or other activities´. Therefore, they are applicable both in academic as well as professional situations (Blagg, Ballinger and Lewis 1993; Bridges 1992; Chadra 2006; Gibbs, Rust, Jenkins and Jacques 1994).

The subject of the research is the degree of student satisfaction with the acquired transferable competences. The aim of the research then reflects two research queries: *(1) Are there any significant differences among the respondents of both countries (CZ and NL) in the level of satisfaction with transferable competences? (2) Are there any significant differences between the transferable competences of both countries (CZ and NL) expressing the level of students´ satisfaction with them?*

If the transferable competences are important for the employability of the students at the job market, then it is necessary to find out what level the students have acquired the particular transferable competences to (that is, how satisfied they are with their competences). The given issue is related to a target group of university students (future graduates) of fields focused on vocational education. The research results compare the current state of CZ and NL.

To be specific, eight transferable competences were chosen and researched; they were described by means of their characteristics. The respondents noted down their answers on a 5-grade Likert scale with percentage expression. The research form was a short questionnaire including the questions about students´ gender and age. The questionnaire was distributed and processed in February 2015. Due to personal contacts of the research team members with target groups, the rate of return was nearly 100%. After data sorting, there were 58 valid questionnaires for the CZ and 68 questionnaires for the NL. The total number of respondents in both countries was 128 students.

The data were processed so that each grade of the scale was attached with a point score. The double summarising then made it possible to represent both the number of points for each respondent and the average number of points for each transferable competence. This way, it is possible to compare two groups of students, each of them representing their country, CZ and NL. Moreover, it is possible to compare the level of individual transferable competences among themselves again for both countries. To find out about the statistical conclusiveness, non-parametrical U-test of Mann and Whitney was chosen.

Materials and Methods

The research sample was gained by a purposeful selection of last-year students. The sample consists of the third-year students of the bachelor programme in the combined form of study at Institute of Education and Communication of the Czech University of Life Sciences Prague. The Dutch part is represented by the third- and fourth-year students

of undergraduate and graduate programme in the daily and combined form at Stoas University of Applied Sciences.

The choice of these two institutions was based on the information about their curriculum: the curriculum of Stoas University of Applied Sciences has the form of an elaborate system of competences and the curriculum of the Institute of Education and Communication of the Czech University of Life Sciences Prague has the form of specific target requirements formed in the project Sirius. This project was focused on innovating the teaching in bachelor study programmes, that is on integrating new procedures, strategies, methodologies and organisation forms of vocational education. The competence framework of Stoas is based on a national framework for teaching competences, designed by the Association of Professional quality Teachers (Stichting Beroepskwaliteit Leraren, (SBL) and leading to the principles in the Dutch law Professional In Education (Beroep in Onderwijs, BIO). Stoas has added some more competences based on entrepreneurship and research. Mittendorf and Kienhuis (2014) defined a structure for guiding students in their professional development. It could be divided in three different elements: (1) Guidance in study progress: guiding the student through the study course, stimulating motivation and training transferable competences of skills; (2) Assistance with career development: counseling, reflection on professional tasks and responsibilities; (3) Assistance with professional development: development of a professional identity.

Inspiration was also found in Letschert´s question (2004: 9): ´Are competence-driven curricula a better answer than, for example, the standards approach to the complexity of societal and personal demands, and how do school systems respond to these demands?´ However, the authors of this paper are aware of the fact that other factors beside the curricula differences play its role, too. Primarily, the relationship between the curriculum and the results of satisfaction with transferable competences was not searched. This statement is a subject matter of discussion in the next part of the paper.

The issue of choosing transferable competences was not an easy task. There are many lists of transferable competences supported with research findings, e.g. Allen (1993); Gibbs, Rust, Jenkins and Jacques (1994); Karásek (2014) etc. This research included those competences that appeared most frequently. Their characteristics was grounded in particular sources: item No. 1 - 5 (The European Framework for Key Competences for Lifelong Learning, 2006), item No. 6 (Šuleř, 2003: 61–66), item No. 7–8 (Mühleisen and Oberhuber, 2008). The following transferable competences were chosen: (1) Communication in the mother tongue, (2) Communication in foreign languages, (3) Work with digital technologies, (4) Learning to learn, (5) Sense of initiative and entrepreneurship, (6) Problem solving, (7) Teamwork, (8) Sense of responsibility.

The responses to individual items (competences) represented a scale with a choice of percentage representation in the rate of satisfaction with a given competence in the following way: (1) 0–20 %, (2) 21–40 %, (3) 41–60 %, (4) 61–80 %, (5) 81–100 %. The responses were transformed in ascending order to a point score that ranged from 1-5 points for each response.

Non-parametrical U-test of Mann and Whitney enabled a statistical processing with a significance level of 0.05 for frequencies $N_1 = 58$ and $N_2 = 68$ (see research question No.1) and for frequencies $N_1 = 8$ and $N_2 = 8$ (see research question No. 2). Mann and Whitney´s U-test was processed for the research question No.2 manually according to the prescribed procedures for very little ranges of choice. The interpretation of Mann and Whitney´s significance test consists in the following rule (Chráska, 2007: 93): *if the calculated figure U is lower or equal to the highly critical one, we reject the null hypothesis on the chosen significance level and we accept the alternative hypothesis.*

Mann and Whitney´s U-test for the research question No.1 was calculated on the basis of a statistical programme located on a website (U-test, 2015). In this case, the test criterion for big groups (bigger than 20) has an approximately normal division. For the calculated standardized normal quantity, one seeks a figure attesting the distribution function and the density of probability of standardized normal division. On its basis, it is possible to interpret the significance test in such a way that if the calculated probability is smaller or equal to the chosen significance level, it is possible to reject the null hypothesis and accept an alternative hypothesis (Chráska, 2007: 96).

Results and Discussion

The empirical research includes a research sample with the following average age of students: the Czech respondents are on average 5 years older (their average age is 33.5 years) than the Dutch respondents (the average age is 28.5 years). The age profile in relation to their experience may affect the research results, but a five-year interval may seem insignificant.

When comparing the average number of points reached by the men and the women in both countries, the results of respondents´ satisfaction with transferable competences are similar (see Fig. 1). The women even reached the same point score (30.1), the men from CZ reached 2.0 more points (31.4 points) than the men from NL.

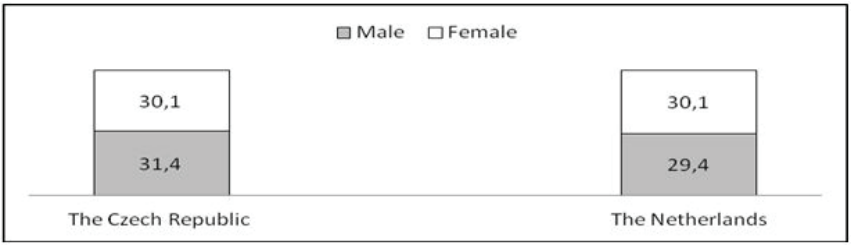

Fig. 1: The average number of points of the men and women in both countries

Since the results create an average point evaluation, it is not possible to draw conclusions among individual respondents. Mann and Whitney´s U-test will be used to assess the statistical significance of respondents´ individual differences between the countries.

The research question No. 1 is explored: *Are there any significant differences among the respondents of both countries (CZ and NL) in the level of personal satisfaction with transferable competences?* The verification is done on the basis of the hypotheses testing: (a) *Null hypothesis:* There are not statistically significant differences between respondents´ results (expressed by a point score) of both countries; (b) *Alternative hypothesis:* There are statistically significant differences between respondents´ results (expressed by a point score) of both countries.

By means of a statistical programme, a test criterion (the smaller one from the calculated figures) was calculated for the significance level (0.05) and for frequencies ($N_1 = 68$ and $N_2 = 58$), that is $U = 1528.5$ and subsequently a standardized normal quantity was calculated, that is $u = -2.17$. There is a probability occurrence $u = -2.17$ (the nearest table figure) $\varphi_{(-2,17)} = 0.0440$ for the distribution function and for the probability density of a standardized normal distribution. The interpretation of the significance test is then the following: Since the probability (0.0440) is smaller than the chosen significance level (0.05), we reject the null hypothesis and we accept the alternative hypothesis. That means

that there are statistically significant differences between the respondents´ results of both countries (expressed by a point score). Therefore, we can rightly argue that *there are significant differences between Czech and Dutch respondents in the individual level of satisfaction with transferable competences.*

If the research results show that there are statistically significant differences between respondents of both countries, we are interested in whether it is also possible to trace statistically significant difference in the transferable competences themselves of both countries. The average point score for the researched transferable competences are presented in the graph below (see Fig. 2). It is evident that the students from CZ feel more satisfied with transferable competences than the students from NL. With regard to the competence communication in foreign languages only, the Dutch students reach up to 0.9 point higher satisfaction than Czech students.

The presented results give rise to a following reflection: are the respondents from CZ more self-confident, more competent or more experienced? The age might play its role, since Czech students are older than the Dutch ones. Another factor is the fact that the Czech students study in the combined form in contrast to the Dutch respondents' group that involves also students in the daily form of study. There is a higher probability of employment at the job market and related experience of students in the combined form rather than of students in the daily form of study.

Looking at the graph below (see Fig. 2), it is found out that the average point number is nearly comparable, with the exception of the competence communication in foreign languages and the competence learning to learn. The interval reaches among the competences from 0.2-0.5 point (the most frequent is the interval with a difference of 0.3).

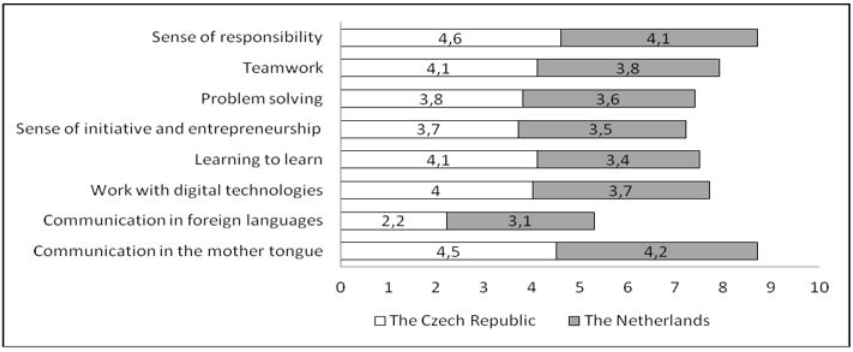

Fig. 2: The average number of points for particular competences for both countries

Another factor might be the work with the curriculum at the given institution. For the empirical research, it was attractive to explore transferable competences at institutions that work with a given curriculum in a different way. However, the research was not primarily aimed at exploring the relationship between the work with the curriculum and the subjective level of satisfaction with transferable competences. Despite that, it is possible to substantiate the gained results hypothetically with reference to curricula. If the curriculum of Stoas University of Applied Sciences has the form of an elaborate system of competences, it is possible to presuppose that the students are used to working with the category of competence. A competence is not static, but has several levels. One of the competence´s attributes was proved here, i.e. that competences are developable (Slavík, Dytrtová, Hanušová, Husa, Krahulcová, Kučírková, Linhartová, Miller, Oudová

and Votava 2012: 74). In this context, the result of the Dutch respondents might be understandable because they can expect another level of development in the area of researched competences. It follows that their attitude, that is the subjective level of satisfaction with transferable competences does not reach the highest point score.

The curriculum of Institute of Education and Communication of the Czech University of Life Sciences Prague has the form of specific target requirements formed in the project Sirius. Therefore, it is possible to substantiate hypothetically that the students from CZ primarily know the category of aims including the requirement fulfilled vs. not fulfilled. On the basis of their subjective interpretation of the described researched transferable competences, the students respond in the framework of the requirement fulfilled vs. not fulfilled at the given competence as a whole. Therefore, it is assumed that the respondents concluded the satisfaction with transferable competences according to the range of listing of its content (i.e. quantitatively) rather than according to the level of saturation of the given listings of competence content (i.e. qualitatively). This fact of the interpretation of the competences might have caused certain colouring, that is some differences in results of both countries. Naturally, the personality of the respondents ought to be taken into account as well; they might have stylized the answers so as not to feel ashamed.

Although the discussion is varied, the conclusions are made on the basis of the collected data which are valid for the given sample of respondents and their statistical conclusiveness is verified. The research question No. 2 is explored: *Are there any significant differences between the transferable competences of both countries (CZ and NL) expressing the level of students´ satisfaction with them?* The verification is done on the basis of hypotheses´ testing: (a) *Null hypothesis*: There are not statistically significant differences between the results (point score averages) of the explored transferable competences in both countries; (b) *Alternative hypothesis*: There are statistically significant differences between the results (point score averages) of the explored transferable competences in both countries. By means of a manual calculation according to the prescribed methodology (Chráska, 2007: 92), a test criterion (smaller from the two calculated figures) was calculated for the significance level (0.05) and for frequencies ($N_1 = 8$ a $N_2 = 8$). It is U = 21 that was compared to the critical figure which is $U_{(8,8)} = 13$ for the given ranges. The interpretation of the significance test is then the following: since the calculated figure (21) is higher than the critical figure (13), we accept the null hypothesis. It can be rightly asserted that *there are not significant differences between the transferable competences themselves of both countries (CZ and NL) expressing the level of students´ satisfaction with them.*

The stated conclusions prove that the data for both countries are comparable at the competence level (except competence learning to learn, see Tab. 1). It is only interesting to note that while the students from NL place communication in the mother tongue first and Sense of responsibility second, their Czech counterparts do it vice versa.

The stated conclusions cannot be compared with other researches due to different context of the research or its methodology. Another interesting researches in the field of transferable competences brings e.g. Frey, Balzer and Ruppert (2014), OECD (2012), Rocha (2014), Yorke (2008).

The Czech Rep.		TRANSFERABLE COMPETENCIES	The Netherlands	
score	order		order	score
4.5	2.	Communication in the mother tongue	1.	4.2
2.2	8.	Communication in foreign languages	8.	3.1
4.0	5.	Work with digital technologies	4.	3.7
4.1	3.-4.	Learning to learn	7.	3.4
3.7	7.	Sense of initiative and entrepreneurship	6.	3.5
3.8	6.	Problem solving	5.	3.6
4.1	3.-4.	Teamwork	3.	3.8
4.6	1.	Sense of responsibility	2.	4.1

Tab. 1: The order of transferable competences in both countries

Conclusion

The empirical research has proved on the explored sample that: (1) there are significant differences between the respondents of both countries in the individual level of satisfaction with transferable competences; but (2) there are not significant differences between the transferable competences themselves of both countries expressing the level of students´ satisfaction with them. At the same time, the students from the Czech Republic are more satisfied with the transferable competences than the students from the Netherlands.

Acknowledgements

The paper was written in cooperation between Stoas University of Applied Sciences and Institute of Education and Communication of the Czech University of Life Sciences Prague. Stoas is a faculty of Vilentum University of Applied Sciences, one of the Aeres Group institutions. Stoas has trained educators for 'land-based' subjects in environmental vocational education. Stoas has many connections with other schools, universities, businesses, and research institutions, both on a national and international level.

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CHANGES IN THE STRUCTURE OF THE ADMISSION PROCEDURE RESULTS ON UEP

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Abstract

In the last five years, a substantial reduction occurred in the number of people of university age. The demographic turning point can be found in the year 2012 when the students born in mid 90s, a low birth-rate period, reached university age. This situation has caused a decrease in the number of bachelor students applying for admission to universities. The aim of this paper is to examine how this situation affected admission of bachelor students. The analysis was performed on anonymized data of applicants for bachelor study at the University of Economics in Prague (UEP) in years 2010 and 2014. The main findings are as follows: an increasing number of foreign students, especially from post-Soviet countries, 30% decrease of admitted applicants, and equalization of applicants' average test results among all faculties.

Keywords

Admission examination, bachelor study, University of Economics Prague

Introduction

State investment in university education is profitable both for the individuals who successfully graduate and for the society in the Czech Republic and it has a lifelong impact on achieving higher income (Finardi, Fischer, Mazouch, 2012). Currently, Czech tertiary education faces two longstanding problems. The first is connected with the fact that those born in weaker population years are currently applying for university. After 1993 there was a decrease in the number of births from approximately 120,000 to 90,000 between 1996 and 2001. Starting in 2002, there was a slight growth, which reached its peak in 2008, when there were born nearly 120,000 children. Since this year the number of births has been falling again (ČSÚ, 2015).

The second problem, which arose from the first, is the large number of colleges that compete with each other for a number of high school graduates which decreases each year. The problem lies in their funding, which is directly dependent on the number of admitted students. There currently exist 72 schools (26 public, 2 state and 44 private) approved by the Ministry of Education, Youth and Sports of the Czech Republic (MSMT, 2015a), but also other foreign institutions operating in the grey area of tertiary education. Often listed among possible consequences of this development are the following: declining quality of students entering university study, decline of the overall quality of studies at individual universities (increasing the manageability of individual fields), and therefore targeting foreign students, older age groups (utilising the so-called deferred demand) or creating specialized courses for the general public (Smutny, Nedomova, Mikovcova, 2014).

The solution to this situation should be the long-planned reform of tertiary education system, which has been repeatedly postponed – see also (Fischer, Finardi, 2010). The currently proposed amendment to the Higher Education Act (MSMT, 2015b) should

among other things introduce a new way of evaluating the quality of higher education institutions. UEP has for several years been analysing the data available from its integrated study information system in order to monitor the quality of study applicants (Smutny, Nedomova, Mikovcova, 2014; Maryska et al., 2013), new students (Maryska, Doucek, Mikovcova, 2013; Doucek, Maryska, 2014), and the course of their studies (Kunstová, 2013; Kunstová, Řezanková, 2012), including comparisons with foreign institutions (Masatova et al., 2010; Strizova, Smutny, 2013). Based on this insight, university management can take short- and long-term measures to ensure the quality of studies. The same thematic direction has also this contribution dealing with changes in the structure of admission procedure between 2010 and 2014 in connection with the reducing the number of people in the university-age cohort in the last few years.

The purpose of this paper is to analyse the results of the admission procedure at UEP in 2010 and compare them with the results obtained in 2014. The available data concerning the admission procedure at all undergraduate fields of study accredited at the UEP was from 2010 and 2014. Our intent is to analyse these data and answer the following questions:

- What are the differences between the faculties, in terms of gender, nationality, mode of study?
- What development is there in the area of foreign students?
- How different is applicants' knowledge in the admission procedure in 2010 and 2014 on UEP?

These questions are important in connection with the findings of Poláčková and Svatošová (2013), which suggest that the results of an entrance test can predict the success of study in the field with sufficient reliability. The data used here and other data related to the course of study of students admitted in 2014 (not yet available) can be used for a future discussion of whether the quality of education remained the same or what changes occurred.

Materials and Methods

The data used in this contribution was obtained from UEP's integrated study information system. In accordance with the provisions of Czech Law No. 101/2000 Coll., on the protection of personal data, the data of applicants are rendered anonymously. This means that no personal identification information was exported from the original database. It was only such anonymised data that we were allowed to analyse.

The primary data used for evaluation were imported to the database of the Microsoft SQL Server 2008 R/2 (Microsoft SQL). We implemented a specific data model in the application Microsoft SQL that supports the requirements on the analysis of data sources. Data were imported into IBM SPSS statistical program, where they were purified and subsequently analysed. Because the complete data were available for all students, the so-called population set, methods of descriptive statistics (mostly frequency distribution table) were sufficient for the analysis. There was therefore no need for the conclusion to be verified by statistical tests. In order to determine the dependency structure among several categorical characteristics, Multiple Correspondence Analysis (MCA) was used, which shows multidimensional relationships between categories of all variables in a two-dimensional graphical form called the correspondence map.

The analysis was carried out in three steps. The first part of the research is focused on conversion rates, which originally come from funnel analysis used in marketing surveys. Its objective is to determine the sequence of ratios (or percentages), from a certain starting point (e.g. the percentage of applicants who actually took the entrance exams) to a certain

goal (e.g. the percentage of admitted students who really entered study). It enables a thorough monitoring of the admissions process and finding places where applicants encounter problems. The second part compares applicants between 2010 and 2014 in terms of individual characteristics (e.g. the national composition, studied faculty or reason for (un)acceptance in the admission examination). In this way there may be identified the most significant changes in the structure of applicants at UEP which occurred over the period considered. The last part of the analysis is the application of multiple correspondence analysis, which examines multidimensional relationships between applicants' characteristics and thus provides a comprehensive view of their structure.

Results and Discussion

In the admission procedure in 2014 there were registered by about 30% fewer applicants than in 2010. The percentage of students admitted without admission procedure on the basis good study results remained almost unchanged between the two years and makes up about 10% of the total number of applicants and approximately 27% of all accepted applicants. Further information about the admission procedure is provided by the outputs of funnel analysis, which are presented in Table 1. In order to maintain comparability of data, those students were excluded from the analysis who were admitted without admission procedure and thus did not undergo the admission process.

	Applied	→	Came to the exam	→	Passed the exam	→	Accepted	→	Commenced study
2010	100%		77%		52%		73%		80%
2014	100%		72%		43%		94%		80%

Tab. 1: The admission procedure.

From Table 1 it is evident that in 2014 there was a decrease in the number of applicants who came to the admission examination and the number of applicants who passed the exam. This is confirmed by Figure 1, which describes the reasons why students were not admitted. An improvement was observed in the fulfilment of admission requirements and the availability of individual fields of study. In 2014, almost all applicants (94%) who passed the admission examination were admitted to study. The percentage of admitted applicants who really entered study remained constant.

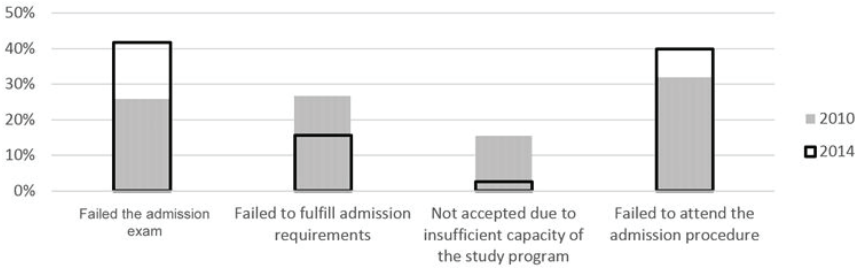

Fig. 1: Reasons for non-acceptance in the admission procedure.

Significant changes also occurred in the national composition of applicants at UEP. Table 2 shows data concerning accepted applicants as relative frequencies, which are nearly identical to those obtained from the total number of applicants.

Nationality	2010	2014
	in %	in %
Czech	82.4%	76.1%
Slovak	8.7%	8.4%
Russian	3.4%	7.0%
Ukrainian	1.1%	2.1%
Vietnamese	1.4%	2.6%
Other	2.9%	3.8%
Total	100.0%	100.0%

Tab. 2: National composition of accepted applicants.

Between 2010 and 2014 there was a reduction in the number of students with Czech citizenship by more than 6%, but students with Slovak citizenship constitute almost the same number (around 8.5%). In the third place there are students from the Russian Federation, the relative number of which almost doubled over the period. A similar situation is in number of students from Ukraine, Vietnam and former Soviet Union countries, who are predominantly in the Other category. The positive news is that UEP is more and more internationalized. Unfortunately, there is a shortage of students from Western Europe, the USA and East Asia.

Faculty	2010	2014
	in %	in %
F1 – Faculty of Finance and Accounting	18.5	14.1
F2 – Faculty of International Relations	20.6	22.7
F3 – Faculty of Business Administration	17.3	20.4
F4 – Faculty of Informatics and Statistics	20.3	17.9
F5 – Faculty of Economics	12.7	12.6
F6 – Faculty of Management	10.6	12.5
Total	100.0	100.0

Tab. 3: Shares of accepted applicants at UEP faculties

Table 3 shows that faculties admitted fewer students because of weaker population years, see (ČSÚ, 2015). Relatively the greatest reduction in the number of accepted applicants occurred at faculty F1, followed by faculty F4. Faculties F3, F2 and F6, on the other hand, admitted relatively more applicants. Faculty F5 keeps relatively equal number of admitted applicants.

Figure 2 presents the outputs of multiple correspondence analysis, the correspondence maps, of admitted applicants in 2010 and 2014. Categories that are closer to each other on the map are connected by greater dependence (they are more associated) than distant categories. The left correspondence map shows association structure in 2010. When comparing the faculties and nationalities of students, it becomes evident that the number of Czech students is evenly distributed among all faculties, while Slovaks prefer to study at faculties F3, F1 and F2. Other nationalities show similar characteristics and it is typical for them to study at faculties F1, F3 and F4. In terms of gender, men are more likely to study at faculty F4, while women at faculty F2. Distance students constituted only 2% in 2010, most of them being from faculty F6. Although the correspondence map for 2014 is differently oriented, the association structure did not change much. The most significant change is the greater number of other foreign students at faculty F2. In

2014, international students of Vietnamese, Ukrainian and Russian nationality studied more often at faculty F1. The scale of y-axis shows that foreign students moved closer to the centre of correspondence map. This indicates a reduction in disparities between students of different nationalities. Part of correspondence analysis is also the naming and interpretation of correspondence maps' axes. The x-axis for both years can be named *nationality* and it separates Czech students from foreign. The y-axis can be named *gender* and it separates men and women and thus also the faculties with a higher proportion of men (F1 and F4) from the faculties with a higher proportion of women.

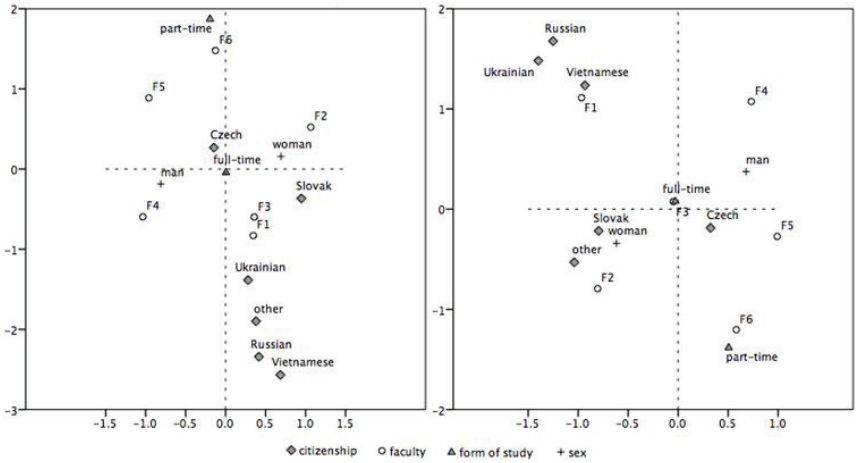

Fig. 2: Multiple correspondence analysis of admitted students in 2010 and 2014.

Faculty	Applicants		Accepted	
	2010	2014	2010	2014
F1 – Faculty of Finance and Accounting	135	125	164	151
F2 – Faculty of International Relations	209	180	241	215
F3 – Faculty of Business Administration	132	134	169	157
F4 – Faculty of Informatics and Statistics	118	123	134	146
F6 – Faculty of Management	95	111	108	118

Tab. 4: Average score of applicants and accepted applicants in years 2010 and 2014.

Table 4 displays the average total score reached by applicants and accepted students in the admission procedure. Faculty F5 was excluded from the results, because it uses a different type of tests (SCIO tests) and does not provide test scores of accepted applicants. The admission procedure of faculty F2 consists of three tests (maths, two foreign languages), each test with a maximum score of 100 points. The admission procedure at faculties F1, F3, F4 and F6 consists of two tests (maths, one foreign language; faculty F6 has tests from managerial decision making and a foreign language). Each of the tests is evaluated by a maximum score of 100 points.

When comparing the admission procedures in 2010 and 2014, there is an apparent trend towards equalization of average results of applicants across all faculties. On the basis of these data, it is not possible to determine whether the applicants' skills are equalized or whether the faculties have adjusted admission test difficulty. If the former is true, it would

suggest a worsening of applicants' knowledge. While the applicants at faculties F3, F4 and F6 got better average scores, the opposite situation is at faculties F1 and especially F2, at which the greatest decline (absolute as well as relative) was observed. Although the average score at faculty F6 rose in comparison to 2010, it remains the lowest of all faculties. Analogous conclusions can be reached when using the medians of entrance examination results.

Conclusion

In this paper, we examined the changes in the structure of admission procedure, which were caused by the reduction in the number of people in university age cohort. Although two distant years were analysed, there can still be identified some positive and negative trends valid for the University of Economics in Prague. The most interesting ones are as follows:

- Between 2010 and 2014, the number of applicants decreased by 30%. It did not fully correspond with the decrease of university age cohorts, which was 25%.
- The number of the accepted applicants with Czech citizenship decreased by 6%, whereas the number of accepted applicants from post-Soviet countries rose substantially.
- There are more international students at UEP.
- The applicants' scores have been equalizing across all faculties. From the data available it was not possible to determine whether the applicants' skills equalized or whether the faculties adjusted admission tests difficulty.

It can be said that the number of foreign students is increasing, the number of accepted students is decreasing, and the average scores of applicants are equalizing. More detailed information can be found in section Results and Discussion. In future research, it would be interesting to study the convergence (or divergence) of the structure of admission procedure, and changes in the number of people in university age cohort.

Acknowledgements

This paper was prepared thanks to the institutional support VSE IP400040.

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ARE PRECONDITIONS FOR ECONOMICS STUDY RELEVANT TO ITS GRADUATION?

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Abstract

This paper presents the analysis of entrance examinations results for the University of Economics, Prague (UEP) in the subject of Mathematics and results from standard examination in the course of Mathematics. It shows outputs from the project of the analysis of entrance requirements for the study at 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 between years 2010-2014. Correlations between results of entrance and standard examinations in the subject of Mathematics are also analysed. 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. Conclusions then point to better results in the admission tests found in the case of foreign students and to declining number of points acquired in time for all applicants. Overall the analysis may be evaluated as a declining number of points acquired while maintaining the unchanged difficulty of the examination.

Keywords

Entrance examination, knowledge, mathematics, standard examination

Introduction

Czech universities have considerably changed during the past decade and the end of these changes is nowhere in sight. (Jarkovska et al, 2011; Doucek, Maryska and Novotny, 2014) Among the most distinct changes belongs the effort to internationalize studies expressed in the past years by foreign students' entering the Czech education market and, on the other hand, by Czech students' leaving for foreign countries. (Doucek and Maryska, 2014; Maryska, Doucek, 2012). Just like Czech students leave to seek experience or education in the sometimes rather idealized West (Fischer and Finardi, 2010), students come to the Czech Republic especially from the East. As Mach (2015) mentions, the majority of students come from Slavic countries and thus it is easy for them to learn Czech. There are also many students from the Slovak Republic, who typically represent the largest community of foreign students in the Czech Republic. According to (Mach, 2015), Slovaks come to study mostly medicine, economics and informatics. A total of 82% of the Slovak applicants mention the quality of studies and 27% better job opportunities in the Czech Republic as the main motivation for studying in the Czech Republic (Mach, 2015). Regardless of where a student comes from, he should have certain initial knowledge that, according to authorities, is necessary for successful studies of economics and economic fields (Hanclova and Doucek, 2012) taught at the UEP (Doucek, Maryska and Novotny, 2013). There is plenty of other similar research, for example (Kunstova, 2012; Kunstova, Rezankova, 2012; Doucek, Maryska, Nedomova, 2011).

Problem Formulation

As a part of the surveys performed at the Faculty of Informatics and Statistics, we focus on a relatively specific area – the analysis of results of entrance exams at the UEP and the analysis of exam results during the studies in **the study programs taught in Czech**. These analyses support the solution of the key problems that we are currently dealing with, such as in particular whether or not the number of points achieved in the admission procedure, which cannot be quite exactly referred to knowledge, corresponds with the knowledge that the UEP expects from applicants, whether or not there is a correlation between entrance exam results and regular exam results and whether or not there is a correlation between the type of university or nationality and entrance or regular exam results. In this article, we will focus on whether or not the knowledge base of foreign students is in compliance with the knowledge expected in the entrance exam, whether or not this compliance relates to the specific country of origin, what are the entrance exam results of students from selected countries and what is then their success rate in bachelor's degree exams.

This article analyzes the following work questions:

- Q1: Is there any correlation between mathematics entrance exam results and mathematics exam results with respect to all applicants for studies at the UEP?
- Q2: Is there any correlation between mathematics entrance exam results and mathematics exam results with respect to all applicants for studies at the UEP who have Czech nationality?
- Q3: Is there any correlation between mathematics entrance exam results and mathematics exam results with respect to all applicants for studies at the UEP who have Slovak nationality?
- Q4: Is there any correlation between mathematics entrance exam results and mathematics exam results with respect to all applicants for studies at the UEP who have Russian nationality?
- Q5: Is there any correlation between mathematics entrance exam results and mathematics exam results with respect to all applicants for studies at the UEP who have Vietnamese nationality?

The main objective of this research is to found out, whether or not the number of points achieved in the admission procedure from mathematics corresponds with the knowledge of mathematics that the UEP expects from all applicants even they are from different countries and apply for different faculties and if there are any differences between them. We analyzed a data file that only included those applying for Czech study programs, i.e. study programs that are taught in the Czech language.

Material 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 the evaluation were imported to the Microsoft SQL Server 2008 R/2 (Microsoft SQL) database through data extracts (MacLennan, Tang and Crivat, 2009).

These were exported from the central database systems of the UEP. (Maryska, Doucek, Novotny, 2012)

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 by two different approaches. The first one was based on usage of OLAP cubes in the Microsoft SQL, where a larger number of statistical indexes were created. These statistical indexes enable to statistically describe the data gathered from 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 descriptive statistical methods.

The data were then assessed using the "R" tool that allows performing advanced statistical analyses of extensive data sources. We used this tool to crosscheck the results identified in MS Excel and for analysis of correlations that cannot be performed by a simple procedure in MS Excel.

With the use of descriptive statistic conducted in R we described the data file to determine the basic characteristics of the data. Correlations were conducted with the parametric Pearson correlation coefficient as we found similar variance and normal distribution in both random variables.

General Data Characteristics

The data file with entrance exams currently includes 103,829 records with history since the year 2010. Each record contains information about every single concrete applicant in a specific year. If a student went through the admission procedure several times, he is included in the file several times. We have the results of bachelor's and master's degree entrance exams as well as the results from individual study fields, information about a specific entrance exam result, whether or not a student was accepted, etc.

We also have results of students during individual years. This data file currently contains over 615,000 records. These records cover the entire study history of students from 2010 to September 2014. It is obvious from the aforesaid that the full study history is available only for bachelor's degree students who started their studies in 2010, 2011 and 2012 and for master's degree students who started their studies in 2010.

An important fact, which should be mentioned, is that not all students must pass a course in the same year. The UEP makes it possible for students to set up their own schedule and only requires the passing of all required courses before the date of the state bachelor's degree exam. However, considering the goal of this article, this fact does not affect the results since we have included only those students who have already passed the course.

Results and Discussion

As we have already mentioned in the introduction, the article analyzes mathematics entrance exam results and mathematics exam results of the applicants for the studies at the UEP and of the UEP students and their correlation, regardless of the applicants' nationality, and also subdivides the applicants based on Czech, Slovak, Russian and Vietnamese nationality.

To make the article more understandable, we divided this chapter into three sections:

- Basic characteristics of source data (number of students, division of students, etc.);
- Analysis of mathematics entrance exam results and exam results;
- Analysis of the correlation between entrance exam results and regular exam results.

The analysis shows the data from different perspectives. The data are classified by faculty, to which the students applied, and by time period. The article analyzes the data from the years of 2010-2014.

Basic Data Characteristics

The basic characteristics of the data file based on applicants' nationality in individual years are shown in Tab. 1. It shows that students from Slovakia represent the second largest group of applicants, which supports the claim of Mach (2015) about the popularity for Slavic nationalities to study in Czech. Their share in individual years is almost identical and fluctuates between 7.22% and 7.64%. Students with Russian nationality represent the third largest group. However, compared to the previous group, this group shows a very interesting trend. The number of Russian applicants keeps growing considerably. Between the years of 2010 - 2014, their number went up by almost one thousand, from 3.97% to 7.39%. Russian applicants thus almost caught up with applicants from Slovakia. We will keep monitoring this trend also in view of the political situation in the world. Vietnamese and Ukrainians represent other major groups. Students from Kazakhstan represent another good-sized group; their share keeps decreasing by each year, from 1.82% in 2010 to 1.62% in 2014.

Year	Czech	Slovak	Russian	Vietnamese	Ukraine	Others
2010	82.90%	7.22%	3.97%	1.31%	0.97%	3.63%
2011	82.50%	7.25%	4.06%	1.54%	1.34%	3.32%
2012	81.38%	7.33%	4.69%	1.72%	1.60%	3.28%
2013	79.35%	7.64%	6.06%	1.93%	1.84%	3.17%
2014	76.90%	7.47%	7.39%	2.38%	1.73%	4.13%

Tab. 1: Representation of nationalities in % in the admission procedure at the UEP during the years of 2010 – 2014, source: authors

Analysis of Mathematics Entrance Exams

Based on the data analysis, we found out that the number of points that the applicants for studies at the UEP achieved in entrance exams keeps decreasing by each year in all basic statistical indicators – Tab. 2. The average number of points of applicants, regardless of faculty and nationality, dropped between 2010 and 2014 from over 65 to current 53.82 points. The median, which dropped from 70 to 55, confirms a similar trend as well. The standard deviation and variance fluctuated on similar level, only in 2014 significant rise is observed. Skewness and kurtosis provide additional information related to distribution. In our case skewness is negative with small values that means, that our sample has small asymmetrical distribution. The situation in kurtosis is different negative values are more than -0,8 and our sample has flatter distribution. More detailed analysis results are provided in Tab. 2.

Year	N	Avg	Med	Mod	Min	σ	σ^2	δ	τ
2010	6120	65.56	70.00	100.00	5.00	23.96	574.01	-0.34	-0.86
2011	6276	59.49	60.00	60.00	5.00	23.49	551.88	-0.09	-0.87
2012	6064	59.57	60.00	100.00	5.00	23.62	557.81	-0.09	-0.87
2013	5421	54.63	55.00	50.00	5.00	23.17	536.96	0.07	-0.81
2014	4197	53.82	55.00	50.00	0.00	28.70	823.74	0.10	-0.86

Tab. 2: Total mathematics entrance exam results at the UEP, source: authors

Very interesting is the comparison of entrance exam results of applicants having Czech nationality to those of other analyzed groups. This comparison is shown in Fig. 1. It clearly shows that the tested knowledge of Czech students is the lowest and keeps dropping the most in comparison to other applicants. On the other hand, applicants from Russia have the best knowledge and are followed by students from the Ukraine. All groups show a similar trend, i.e. a decreasing number of achieved points.

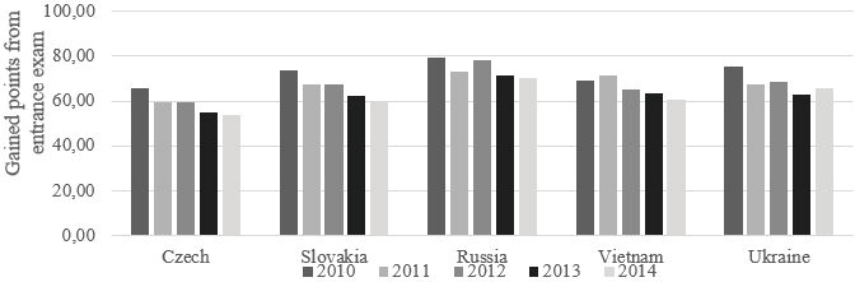

Fig. 1: Comparison of the mathematics entrance exam results of applicants by nationality, source: authors

The figure shows that the Russian and Ukrainian school systems prepare students for entrance exams the best. On the other hand, students from the Czech Republic came out of this comparison as the worst prepared. One of the explanation can be the fact that only the best students from abroad apply to Czech universities (Mach, 2015). Of course, another reason is the motivation to successfully complete studies, which is considerably higher for foreign students than for Czech students.

The last of the general characteristics of the data file is the frequency of grades that students receive in mathematics during their studies. It is important to mention that student may have more than one grade in the file because if he failed the exam with the grade F, both, an F and another grade that student received later are recorded. The contingency table Tab 3 represents how many percent of the students who got a particular amount of points from the entrance exam got which grade. Intervals chosen for entrance were chosen in compliance with the scale of points that students must achieve in order to get a certain grade, that means <90,100> for A, <76,89> for B etc. The values A, B, C, F are standardized results from exams that can be explained also as 1, 2, 3, 4 and N/A. N/A means that student was registered for the course, but for some reason (e.g. illness,) he did not go to the exam. For the entrance exams N/A means that student was enrolled without examination or the result is not known.

The analysis shows that C grade is the most frequent grade, which also correspond with the normal distribution of the grades. The distribution of the gained points from entrance exams is bimodal. The largest share of students with the highest score from entrance exam got the grade C. But we can observe that the share of the grade is declining with the gained points in terms of grades A and B and increasing in terms of grade F and has normal distribution in case of grade C. From this basic characteristics it look there could be a correlation between grades from exam and points from entrance exams. We conducted this analyses in next section.

Number of points from entrance exam	Mathematics grade					
	A	B	C	F	N/A	Sum
90 - 100	20.50%	27.26%	29.21%	7.27%	15.76%	20.12%
76 - 89	11.54%	22.48%	32.55%	11.77%	21.66%	14.07%
60 - 75	6.20%	17.54%	33.44%	16.62%	26.20%	19.65%
< 59	1.92%	11.92%	28.56%	22.21%	35.38%	6.70%
N/A	6.50%	13.28%	29.64%	23.08%	27.50%	39.45%
Total	9.66%	18.13%	30.64%	16.98%	24.59%	100.00%

Tab. 3: Grade frequency, source: authors

Correlation Analysis - Analysis of Work Questions

The tables below analyze in detail the results of individual work questions.
The first table (Tab. 4) provides the analysis results with respect to all work questions, focusing on individual years that were assessed.
The analysis shows a weak to medium negative correlation between mathematics entrance exam results and mathematics exam results during all years with respect to the first four work questions. The strongest negative correlation was discovered with respect to Q4 in the year 2013 and with respect to Q3 in the year 2010. On the other hand, a positive though weak correlation was discovered with respect to Q5 that concerns Vietnamese students; the correlation is slightly positive in all years, except for the year 2011.

Assessment questions	2010	2011	2012	2013	2014
Q1	-0.3575	-0.3107	-0.3258	-0.2177	-0.4073
Q2	-0.3693	-0.3053	-0.3796	-0.1705	N/A
Q3	-0.4396	-0.2935	-0.3063	-0.3736	N/A
Q4	-0.1089	-0.2480	-0.3087	-0.6932	-0.1089
Q5	0.0378	-0.2165	0.1118	0.1285	0.0378

Tab. 4: Assessment of work questions, source: authors

The second analysis focused not on the year of the entrance exam but on the faculty to which students applied. The analysis shows only four of the six faculties of the UEP - Faculty of Finance and Accounting (FFA), Faculty of International Relations (FIR), Faculty of Business Administration (FBA), Faculty of Informatics and Statistics (FIS), since the Faculty of Economics and the Faculty of Management do not accept applicants based on their entrance exam results but based on SCIO test results. The second analysis, which is characterized in detail in Tab. 5, shows similar conclusions as the previous analysis. A negative correlation between mathematics entrance exam results and mathematics exam results was identified with respect to Q1, Q2 and Q3 in the case of all faculties. An exception is Q4 where we identified a stronger positive correlation in the case of the FFA as well as the FIS. A positive correlation was also identified in the case of applicants for studies at the FBA. We identified a stronger negative correlation with respect to Q3 in the case of the FFA and with respect to Q4 in the case of the FBA. The last analyzed faculty was the FIR where we originally expected a positive correlation between entrance exam results and regular exam results. However, the analysis shows a weak negative correlation, i.e. that there is just weak correlation between entrance exam results and mathematics regular exam results – students can have worse results from regular exam than from the entrance exam, where in the case of FIR almost 100% score is required.

Assessment questions	FFA	FIR	FBA	FIS
Q1	-0.2689	-0.3287	-0.1274	-0.3220
Q2	-0.2836	-0.3139	-0.1591	-0.3091
Q3	-0.4130	-0.3376	-0.1113	-0.3634
Q4	0.5501	-0.5323	-0.4225	0.05437
Q5	-0.3386	-0.2257	0.3109	0.4872

Tab. 5: Assessment of work questions, source: authors

The last analysis included the entire data file regardless of individual faculties, to which students applied, and years. The analysis shows a weak negative correlation between mathematics entrance exam results and mathematics exam results, which does not exceed -0.35.

Assessment questions	Total
Q1	-0.3186
Q2	-0.2836
Q3	-0.3518
Q4	-0.2614
Q5	0.02564

Tab. 6: Assessment of work questions, source: authors

Generally the weak to medium negative correlation can be caused by the fact that for the entrance exam the higher score is always necessary to be admitted to study (for some faculties as FIR the necessity is almost 100% score), while during the study students' focus is spread among multiple exams and the results may vary (60% is enough to pass the exam) and not always correspond with the enter exams score.

Conclusion

The analyses were performed based on the data obtained from entrance exams at the UEP. Our goal was to analyze the number of points achieved in mathematics by students, who applied to individual faculties, by year and nationality and to compare them with the mathematics exam results of the students who passed the entrance exam.

The survey follows up on the survey that primarily analyzed the correlation between baccalaureate results and entrance exam results and identified a slight to medium negative correlation between baccalaureate results and entrance exam results.

The presented survey results not only compare the initial mathematics knowledge of students and their knowledge after they passed the mathematics exam but also points out the problems at the level of tertiary education that all faculties of the UEP have to deal with. It concerns the drop in achieved points that goes hand in hand with the lower number of applicants and leads to a decrease in minimum points required for acceptance.

Based on the performed analysis of mathematics entrance exams, we reached the following conclusions:

- The number of points achieved by students in mathematics entrance exams keeps dropping with time, and this drop is permanent and significant. The only exception concerns the Ukrainians where, in comparison to other nationalities, the drop was not proven. During the past five years, the number of points achieved by Czechs dropped by 15 and the number of points achieved by Slovaks dropped by 14. Therefore, this drop amounts to three points every year on average.

- With only one exception, we have not proven any positive correlation between mathematics entrance exam results and mathematics exam results with respect to the year of the entrance exam. The exception concerns Q5 where we identified a weak positive correlation in 2010, 2012, 2013 and 2014, showing a slightly provable relationship between mathematics entrance exam results and mathematics exam results in the case of applicants from Vietnam.
- With only four exceptions, we have not proven any positive correlation between mathematics entrance exam results and mathematics exam results with respect to the faculty to which students applied. Students from Russia applying to the FIS represent an exception. In this case, we identified a very weak positive correlation but, in the case of students applying to the FFA, we identified a medium strong correlation. A similar situation was in the case of students from Vietnam applying to the FBA and the FIS where we identified a slight and medium correlation between mathematics entrance exam results and mathematics regular exam results (the data sample is, however, relatively small, representing a total of 69 records).
- We identified only a slight negative correlation between mathematics entrance exam results and mathematics exam results with respect to the entire data file. Students from Vietnam, where we identified a very weak positive correlation, represent an exception.

In the end we can say that:

- The focus of mathematics entrance exams does not correspond with the knowledge of applicants coming from high schools (this level of compliance keeps dropping), regardless of nationality. This may not be the case of Russian and Ukrainian students whose entrance exam results are better than those of other nationalities.
- In general, there is only a weak to medium strong negative correlation between mathematics entrance exam results and mathematics exam results. Therefore, we can conclude that it is not possible to estimate the potential success of students in exact science courses and fields of study based on entrance exam results.

Acknowledgement

Paper was processed with contribution of long term institutional support of research activities by Faculty of Informatics and Statistics, University of Economics, Prague.

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THE EXTENT OF EDUCATION OF EMPLOYEES IN ORGANISATIONS OPERATING IN SLOVAKIA

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Abstract

It is conditioned by the current demanding and turbulent environment requiring constant improvement, enhancement, adaptation and development of the level of education. It means that education needs to be permanent, reflecting all current needs resulting from the reality of changes. Education of employees can be characterised as a permanent process in which adaptation and changes of work behaviour, level of knowledge, skills and motivation of employees of an organisation by means of learning on the grounds of using various methods occurs. It results in reducing the difference between the current competence of employees and requirements posed on them. The objective of the article is to characterise the level of the focus of organisations operating in Slovakia on continuing education and development of employees. This article aims at presenting the results of research conducted each year between 2010 and 2014.

Keywords

Development of employees, education of employees, organisations operating in Slovakia

Introduction

Workforce potential is a basic precondition of fulfilling the current and future tasks of an organisation in market economy. Workforce potential means not only the number of employees but also their knowledge, abilities, skills, intelligence, talent and personal characteristics necessary to meet set out goals and mission of an organisation. To recruit these employees is therefore among the most important and permanent activities of personnel management. (Kachaňáková et al, 2008; Wood, Reynolds, 2013; Bureš, 2007). However, it is important to realise that not only the use of external sources but frequently primarily the use of internal sources is concerned at recruiting. The use of internal sources is evaluated very positively by employees, and such behaviour of an organisation motivates them. In order for an organisation to be able to focus on internal sources at recruitment, continuous education of employees is necessary.

In many organisations, learning is perceived as a necessary evil, or costs the organisation has to exert in order for an employee to be able to press the correct button on a new device. However, successful innovation in the given organisation also depends on whether management is able to see learning as an investment in creation of the organisation understanding why innovations are being implemented and which is able to manage processes related to innovations. (Stachova, Stacho, 2014; Stacho, Stasiak-Betlejewska, 2014).

Considering investments in people, many managers worry that they will sooner or later lose these people. However, there is a worse thing than investing in training and education of employees and losing them – not investing in their education and development and keeping them. To gain and keep top people in an organisation is one of the key tasks

of management in organisations focused on innovations nowadays (Wang, Wang, 2012; Cagáňová et al, 2012; Urbancová, Königová, 2010).
Each organisation has adopted a certain educational philosophy, reflecting the meaning and importance of education in the organisation. Approaches of organisations towards education differ. Some organisations are absolutely passive in this sphere and try to gain "ready" people from organisations investing in education. On the contrary, other organisations often waste means for employee education without a prior identification of the need to educate (Stachova Stacho 2014).
Education of people is among the key objectives and consequences of the modern society at the same time (Závadský, et al., 2015; Šatanová, Potkány, 2004; Gubíniová, Pajtinková-Bartáková, 2014). It is conditioned by the present demanding and turbulent environment, requiring constant enhancement, deepening, adaptation and development of the educational attainment of people. It means that education needs to be permanent and should reflect all current needs brought about by the reality of changes (Dudová, 2013; Bačík et al, 2014; Urbancová, Urbanec, 2012). Employee education can be characterised as a permanent process in which the adaptation and change of working behaviour, the level of knowledge, skills and motivation of employees take place on the grounds of learning based on using different methods. It results in a decrease of the difference between the present competences of employees and requirements posed on them. (Papula, Volná, 2012; Šujanová, et al, 2012).
Trends in the education of employees are directed towards the development and education of employees leading to performance increase and quality efficiency measurement under the impact of the increasing pressure on constant change of environment. That results in the need of a change from occasional, respectively unscheduled education (i.e. education when necessary courses and trainings are only carried out on the basis of the need to obtain the given knowledge, respectively experience) to the general approach to education, i.e. to so called learning organisation. The aim of the learning organisation is to achieve the permanent education of employees focused on performance increase immediately but also in a longer time horizon on the basis of continuously provided feedback.

Materials and Methods

Research presented in the paper was conducted each year between 2010 and 2014 at School of Economics and Management in Public Administration in Bratislava. Its objective was to find out the present state of human resources management and organisational culture in organisations operating in Slovakia. Organisations engaged in the research were interviewed by means of a questionnaire delivered personally to a person responsible for human resources management in the given organisation.
In order to determine a suitable research sample, two stratification criteria were set out. The first criterion was a minimum number of employees in the organisation, which was determined at 50 employees. The given stratification criterion excluded micro and small enterprises from the research on the one hand, however, on the other hand, the justness and need to focus on a formal system of human resources management in companies with more than 50 employees were observed and especially declared by means of this criterion. The second stratification criterion was a region of organisation´s operation, while the structural composition of the research sample was based on the data of the Statistical Office of the Slovak Republic.
According to the Statistical Office of the Slovak Republic the number of companies with a number of employees 50 and more was between 3,261 and 3,359 over the period between

2010 and 2014. The regional structure of companies with more than 50 employees in the given years is shown in Table 1.

Region	Whole Slovakia	Western Slovakia	Central Slovakia	Eastern Slovakia
Districts	All districts	Bratislava, Trnava, Trenčín, Nitra	Banská Bystrica, Žilina	Košice, Prešov
Year	**Number of companies**			
2010	3,308	2,031	655	622
2011	3,359	2,061	666	632
2012	3,295	2,025	652	618
2013	3,268	2,017	645	606
2014	3,261	2,005	644	612

Source: data processed according to the Statistical Office of the Slovak Republic

Table 1: Regional structure of companies with more than 50 employees

Determining an optimal research sample of the given basic group of companies, Confidence Level of the research was set at 95 %, and Confidence Interval of the research was set at H = +/- 0.10. On the grounds of the given criteria an additional, respectively relevant research sample for individual regions of Slovakia was set in the analysed years (see Table 2).

Region	Western Slovakia	Central Slovakia	Eastern Slovakia
Districts	Bratislava, Trnava, Trenčín, Nitra	Banská Bystrica, Žilina	Košice, Prešov
Number of companies over 2010 - 2014	2,005 – 2,061	644 - 666	606 - 632
Size of the research sample	92	84	83

Source: Own processing

Table 2: Size of the research sample for individual regions of Slovakia

Approximately 500 organisations were included in the research each year, however due to a great extent and the form of data collection only approximately 65 % of questionnaires used to be returned comprehensively completed. Subsequently, 259 organisations, corresponding to the optimal research sample determined on the grounds of stratification criteria, were selected from these organisations.

Key methods used in the conducted research include logical methods, adopting the principles of logic and logical thinking. Particularly the methods of analysis, synthesis, deduction and comparison were applied from this group of methods. Mathematical and statistical methods were also applied in the paper. From software products available on the market, a text editor, a spreadsheet and statistical software were used in the research work, particularly including MS Word 2007, MS Excel 2007 and SPSS 15.0 statistical software for Windows®.

Results and Discussion

Our research focused on the education of employees, as appropriate education ensures that employees have knowledge and abilities necessary to carry out their work, not only the present one but also a future one. The level and intensity of education in individual organisations differs according to particular needs, set out goals and possibilities of an organisation. Generally, in order for education to be effective, it needs to be well arranged

and systematic, and needs to be continuous within a repeating cycle. Analysing the process of employee education, we found out that organisations most frequently provide basic unplanned education, when courses necessary for desirable performance at the given position are carried out at the moment of finding a deficiency, respectively a change - so called random approach. The second most frequently implemented approach is organised approach, within which educational activities are planned and requirements for courses are precisely specified according to the requirements and needs of an organisation. However, quite high number of organisations marked the level of their education as so called zero approach, when organisations only educate their employees in the compulsory, i.e. statutory sphere (Table 3).

The course of education	2010	2011	2012	2013	2014
only compulsory trainings	17%	26%	28%	27%	23%
not scheduled but necessary courses,	35%	37%	34%	29%	28%
scheduled, educational activities are not scheduled for a period,	39%	29%	29%	25%	26%
scheduled, educational activities are scheduled for a certain period,	6%	5%	8%	15%	15%
permanent education	3%	4%	2%	4%	8%

Table 3: The course of education in the interviewed organisations

We also analysed the effects of the place of headquarters of an organisation on the process of employee education. Results obtained from the 2012 research comply with the results of a research conducted by the Business Alliance of Slovakia, which implied that mostly educated are citizens working in four Bratislava districts, and the level of education is decreasing eastwards (Hajko et al, 2011). Our research also showed that organisations themselves mostly educate employees working in organisations operating in Bratislava, however not even at an average level of 2.46, as the range of the level of education is set out at five levels on the grounds of five approaches of organisations to education, from so called zero approach, having value 1 up to a learning organisation with value 5. Five approaches of organisations to education correspond probably with five courses of education in Table 3. Slightly above average approach to employee education was only reported by organisations with nationwide operation, achieving the average level of 2.83. To make the learning organisation concept implementation possible, it is necessary to establish so called personal perfectness, i.e. the employees should be aware of the need to improve and educate themselves continuously. Our research showed that 65 - 80 % of the interviewed (see Table 4) use self-education as an educational method (sometimes supported by lectures, seminars and handbooks), which of course sounds more than positive at the first sight. However, majority of these organisations leave the whole educational burden on individuals, while they do not realize that self-education is appropriate for obtaining new knowledge, but only to a limited extent for obtaining new skills obtainable mainly on the basis of active educational methods. However, the research showed that educational methods supporting education by the situation experiencing form are rather little used in the interviewed organisations, e.g. outdoor learning is used in 15 - 27 %, a stay in a subsidiary abroad in 9 - 14 %, mentoring in 13 - 23 %, and the assessment centre only in 2 – 10 % of the interviewed organisations, while the mentioned methods are efficient for the model situation training.

The educational methods used in the interviewed organisations:	2010	2011	2012	2013	2014
Lectures, seminars, handbooks	80%	66%	72%	68%	65%
Self-education	80%	66%	70%	62%	58%
Internet	63%	42%	38%	30%	29%
Work on projects	60%	37%	29%	31%	34%
Rotation at workplace	41%	23%	26%	26%	24%
Electronic media (e-learning)	39%	20%	22%	25%	20%
Coaching	39%	26%	21%	24%	20%
Outdoor learning	27%	17%	15%	15%	18%
Mentoring	23%	15%	13%	14%	15%
Stay in a subsidiary abroad	14%	13%	10%	12%	9%
Video conferences	24%	12%	6%	7%	6%
Assessment centre	10%	8%	4%	2%	3%

Table 4: Methods used for the education of employees

Permanent evaluation of the employee education efficiency has an impact on reaching and sustaining of the learning organisation environment, while this evaluation is at the same time the basis for other educational needs identification. The evaluation should be an answer to the question to what extent declared educational objectives have been fulfilled. When we compare the results of our research to researches conducted in 1998 and 2000 at the University of Economy in Bratislava (researches were conducted on comparable respondent samples) (Kachaňáková et al, 2002), we can see that the number of organisations systematically evaluating their employee education efficiency has currently decreased (see Table 5).

Year of systematic evaluation of employee education efficiency	Share of organisations in %
1998	66%
2000	70%
2010	56%
2011	48%
2012	41%
2013	41%
2014	40%

Table 5: The evaluation of employee education efficiency

Organisations systematically evaluating education effectiveness most frequently use the method of evaluating responses of employees immediately after education and the method of evaluating the fulfilment of goals set out in the education plan of employees. Detailed analysis showed that at education evaluation, organisations prefer rather formal methods and evaluating an actual change in performance before and after education is only used in a small extent (see Table 6).

The evaluation methods of employee education effectiveness used in organisation	2010	2011	2012	2013	2014
Reporting the overall number of education days of an employee	49%	35%	28%	25%	22%
Evaluation of the fulfilment of goals set out in the education plans of employees	74%	47%	53%	48%	31%
Evaluation of responses of employees immediately after education	71%	54%	57%	49%	36%
Performance measurement before and immediately after education	20%	12%	11%	10%	6%
Performance measurement before and after education (following several weeks or months)	29%	17%	11%	13%	12%
Informal feedback from direct superiors	67%	54%	35%	34%	28%
Informal feedback from employees	65%	42%	40%	38%	26%
Observation at work	X	32%	27%	26%	X

Table 6: Evaluation methods of employee education effectiveness

Analysing the part focused on education and development of employees, we were also interested in the opinions of managing employees concerned with the given sphere in analysed organisations. In this relation, we asked them about their personal opinion on what they consider to be three key spheres of education in the period of upcoming three years. Table 7 shows the most frequently repeated education spheres marked by managing employees as prospective in the period of upcoming three years.

The prospective spheres of education	2010	2011	2012	2013	2014
Managerial skills	42%	35%	40%	37%	41%
Higher level of education qualification (university, school-leaving examination),	21%	15%	15%	10%	8%
Economics and marketing	15%	20%	20%	11%	9%
Technical and technological spheres of education	15%	20%	25%	48%	47%
Foreign languages	14%	34%	50%	14%	20%
PC skills	14%	20%	22%	23%	24%
Legislation	8%	4%	4%	4%	3%

Table 7: Spheres of education considered by organisations to be prospective in the period of upcoming three years

Conclusion

Organisations in Slovakia need to adopt the idea that permanent education and employee development are necessary, and that they can only succeed with qualified workforce. It is also the initiative of the EU policies in the given field focused on the increase of investments in human resources and in emphasizing the lifelong education priority. However, Slovakia is still a country where organisational managements have not realised the importance of the education of their employees. In the situation when organisations try, as a result of the crisis, to make all their activities more effective the threat of savings in employee education is becoming real. Such solution would be very short sighted. Employee education is a necessity and knowledge is the key factor of economic prosperity. If organisations understand this and if they manage to survive

on the market during the crisis thanks to good management, they should also consider scenarios topical after its weakening. However, it is all conditioned by the existence of efficient and qualified employees bringing forward creative ideas and having the courage to experiment. Like all the activities of human resources management, the education and development of employees also have to be well-grounded and effective, i.e. interrelated to performance objectives. Therefore, the concept of performance management is becoming topical in organisations, suggesting the interconnection of performance evaluation and the employees´ further education and development.

We see justification of the given research part in practice particularly in revealing irresponsible behaviour of organisations operating in Slovakia in directing and advancing in the sphere of education. On the basis of our presentation of obtained results, organisation managements can compare their own present state within the given sphere to state that interviewed organisations declared, and subsequently consider options of its enhancement. At the same time, we consider as necessary to continue in this research in order to improve, modify, enhance and develop individual approaches on the basis of new information.

Acknowledgement

The article is related to Grant Agencies of VSEMvs project No. 3/2013, The Key Functions of Personnel Management in the Context of the Development of Organisations Operating in the Slovak Republic and Czech Republic

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INCIDENTAL VOCABULARY ACQUISITION FROM A BILINGUAL TEXTBOOK OF FINANCIAL MATHEMATICS

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Abstract

This paper deals with the incidental acquisition of vocabulary of a foreign language by university students who work for one semester with a bilingual textbook of financial and actuarial mathematics. The conducted case study investigates if students when working with the textbook incidentally acquire significantly more of the basic terminology from the field of finance in a foreign language than before they start using the textbook even though they undertake the whole course of Financial and Actuarial Mathematics in the Czech language and the students' interest in acquiring the vocabulary is entirely voluntary. The use of bilingual textbooks could be an effective incentive to raise interest in the foreign language learning.

Keywords

Bilingual textbook, CLIL, incidental vocabulary acquisition, second language acquisition

Introduction

Nowadays, it is an indisputable fact that university students and graduates whose mother tongue is not English should master the English terminology of the field they study. They should be attentive to any relevant English vocabulary they encounter during their university studies, not only in the classes of the English language, but also, for example, in English newspapers, on the Internet and in specialised English textbooks. Bilingual textbooks are used today at university level to serve both home and foreign students coming to a particular university within various mobility exchange programmes. They can also serve as a suitable supplement material in CLIL classes, primarily in the initial phases of the CLIL implementation (more about CLIL, for example, in (March & Langé, 1999)). The necessity of the knowledge of the English terminology makes us expect that home university students when working with a bilingual textbook would acquire unintentionally, as it is not compulsory for them, some of the specialised vocabulary contained in it.

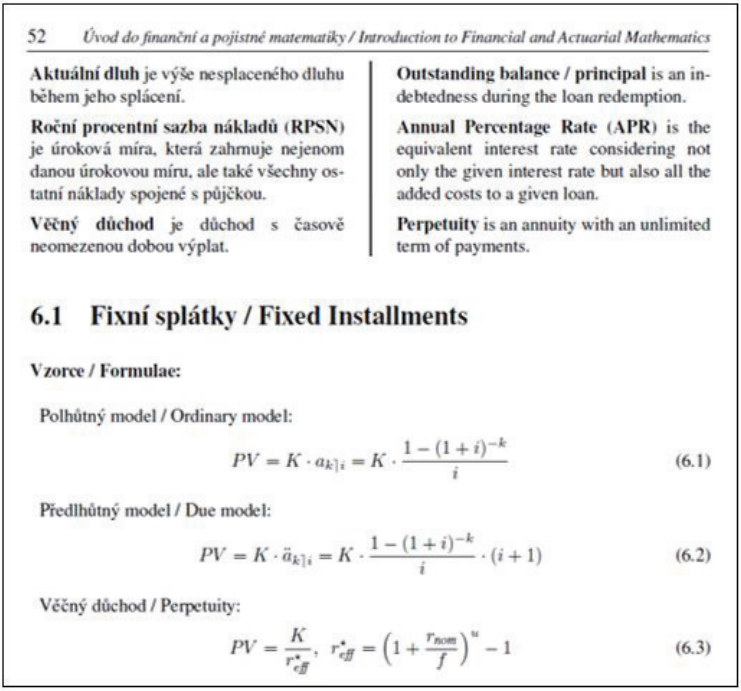
As the main topic of the paper is the incidental acquisition of vocabulary by students, it is necessary to mention that to define the incidental (or unintentional) vocabulary acquisition is not trivial. When talking about incidental vocabulary acquisition, the main pedagogical activity or the main aim of the learners are differently emphasized (Gass 1999, Paribakht, Wesche 1999). The reasons for this may be that a specific linguistic structure or item may not be the focus of attention in the teaching activity or that learners are focused on something other than learning itself. Therefore, a very general definition of incidental vocabulary acquisition characterizes it as the 'unintentional picking up of information' in situations where learners 'are not forewarned of an upcoming retention test for a particular type of information' (Hulstijn, 2005: 131). The incidental vocabulary acquisition given above seems to suggest that incidental learning occurs unconsciously.

As Gass (1999:319) notes, however, defining incidental vocabulary acquisition as the 'side-effect' of another activity neglects the active role of the learner in this process.
The fact that learning occurs as a by-product of reading does not automatically imply that it does not involve any conscious processes. The seeming equation of 'incidental' with 'unconscious' is also criticized by Ellis (1994: 38), who states that incidental vocabulary acquisition is non-explicit in so far as it does not involve an explicit learning intention (the overall goal of the learner is text comprehension), but that neither the process nor the product of such learning is necessarily implicit in the sense of non-conscious. In Hulstijn's (1998: 49) article on implicit and incidental second language learning, implicit learning is initially defined as 'without teaching' and 'without conscious inductions', while it is also stressed that implicit lexical learning does in fact require the learner's attention to word form and meaning.
Incidental learning, on the other hand, is defined as "learning without intention", and does not appear to form a contrast to implicit learning here. Rather, both terms are used side by side, jointly referring to the process of 'picking up' a language. The inconsistent use and unclear status of the term consciousness in the literature has been noted by various researchers (e.g. Marcel & Bisiach, 1988); some even go as far as stating that it is a concept which is too elusive to be criterial (e.g. McLaughlin, 1990).
It is generally believed that second language learners know more words of the second language than they can actually use actively. However, there is no precise evidence to indicate a consistent ratio between active and passive vocabulary knowledge and there is great variation between passive and active vocabulary. Eyckmans et al. (2007) claim that the active knowledge is only half the size of the passive one. Erigna (1974) reported that the proportion is only 40%.
There also seems to be a broad consensus that extended exposure to meaningful and functional foreign-language input is a crucial, although not sufficient, prerequisite for foreign-language acquisition (e. g. Klein, 1986; Krashen, 1985). For this reason, it is a question, if a mere exposure to a target language, in the form of a bilingual textbook, may be significantly beneficial from the educational point of view.

Material and Methods

The research was based on the analysis of chosen vocabulary from the field of finance of two groups of university students of economics at the Faculty of Economics of the University of South Bohemia in České Budějovice. One group (Group A), consisting of 43 students, were students who undertook a semester course of Financial and Actuarial Mathematics and who were using a bilingual Czech-English textbook (Šulista, Nýdl, Akehurst-Moore, 2008) which is used in the course conducted solely in Czech as well as in the course conducted in English (see sample of the textbook in Fig. 1). The latter group (Group C) were 35 university students of the same study year who did not undertake the course and therefore they were not using the bilingual textbook.
The language of instruction of the course of Financial and Actuarial Mathematics was solely the Czech language – the mother tongue of the students. No materials or lecturing in English were presented to the participating students, except the textbook. The two different groups of students were chosen in order not to raise interest in the tested vocabulary when testing students for the first time in case there would be only one group. To avoid a possible influence on the post-course testing, the pre and post-course testing was rejected. All students were tested at the same time after Group A students had completed the given course of Financial and Actuarial Mathematics. Regarding the command of English, we

can consider the both groups of the students to be at the same language level (A2+/B1). All students are tested during the first study year in English and they do not take, usually, specialised courses of English (e.g. Business English) during first two years of study.
As the used textbook was bilingual, the first group of students could see everything written in Czech and also in English any time they were working and studying from the textbook. The aim of the research was to identify if the first group of students pay attention also to the English part of the textbook and if they are interested in the vocabulary and financial terminology in English.



52 *Úvod do finanční a pojistné matematiky / Introduction to Financial and Actuarial Mathematics*

Aktuální dluh je výše nesplaceného dluhu během jeho splácení.

Roční procentní sazba nákladů (RPSN) je úroková míra, která zahrnuje nejenom danou úrokovou míru, ale také všechny ostatní náklady spojené s půjčkou.

Věčný důchod je důchod s časově neomezenou dobou výplat.

Outstanding balance / principal is an indebtedness during the loan redemption.

Annual Percentage Rate (APR) is the equivalent interest rate considering not only the given interest rate but also all the added costs to a given loan.

Perpetuity is an annuity with an unlimited term of payments.

6.1 Fixní splátky / Fixed Installments

Vzorce / Formulae:

Polhůtný model / Ordinary model:

$$PV = K \cdot a_{k\rceil i} = K \cdot \frac{1-(1+i)^{-k}}{i} \tag{6.1}$$

Předlhůtný model / Due model:

$$PV = K \cdot \ddot{a}_{k\rceil i} = K \cdot \frac{1-(1+i)^{-k}}{i} \cdot (i+1) \tag{6.2}$$

Věčný důchod / Perpetuity:

$$PV = \frac{K}{r_{eff}^{*}}, \quad r_{eff}^{*} = \left(1+\frac{r_{nom}}{f}\right)^{u} - 1 \tag{6.3}$$

Fig. 1: Sample of bilingual textbook of Financial and Actuarial Mathematics

As the question is posed as if the students learn some of the basic terminology themselves without being told to do so, it is considered that they might pick up some of the terminology unintentionally. Of course, some of the students could concentrate on the vocabulary in English as they would be interested in it and so they would learn it on purpose. However, as mentioned above, the border between incidental and intentional acquisition is difficult to define. Therefore for the purpose of this paper, the incidental acquisition is considered as acquisition of specific terminology by the students who have an opportunity to learn the vocabulary in a foreign language when working with a bilingual textbook while studying a particular course in their mother tongue.
The research was based on the comparison of active and passive knowledge of chosen financial vocabulary of the two groups of students. Both groups of students were given, in the LSM Moodle, a set of 16 terminological items in their mother tongue (Czech) and were asked to translate these items into English. This part tested their active knowledge of the vocabulary.

Then, the students were given the same set of terminology, this time with a multiple choice test, each item with four possible answers and the choice "I do not know". The students were asked to choose one of the possible answers only if they thought they recognised the right translation. If not, they were supposed to choose the choice "I do not know". This part tested their passive knowledge of the vocabulary (see Fig. 2).

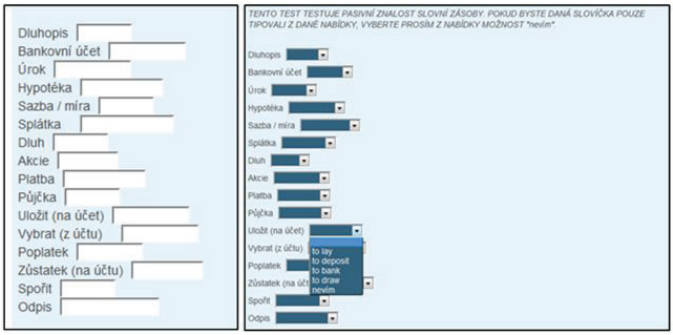


Fig. 2: Test on active vocabulary (on the left) and on passive vocabulary (on the right).

The list consisted of the following items with indicated language level, according to The Common European Framework of Reference for Language, in the brackets: *bond* (C2), *bank account* (B2), *interest* (C1), *mortgage* (C2), *rate* (B2), *instalment* (C1), *debt* (B2), *share* (C2), *loan* (B1), *payment* (B2), *to deposit* (C1), *to withdraw* (C1), *fee/ charge* (B1), *balance* (B2), *to save* (A2), *depreciation* (C2). The language level was determined using online dictionaries such as, for example, Cambridge Dictionaries (http://dictionary.cambridge.org) and the online English Vocabulary Profile (http://vocabulary.englishprofile.org/dictionary).

The students' answers were analysed and the hypothesis if both groups of the students evince the same passive and active knowledge of the given vocabulary was tested using the Mann-Whitney Test – a non-parametric test for assessing whether two samples of observations have the same distribution. The significance level $\alpha = 5\%$. The analysis of the data was conducted using software Statistica 12 by StatSoft. The following null and alternative hypotheses were formulated:

H_0: *The students of Group A have* ***the same*** *active and passive knowledge of the tested vocabulary as the students of Group C.*

H_A: *The students of Group A have* ***better*** *active and passive knowledge of the tested vocabulary as the students of Group C.*

Results and Discussion

The analysis of the students' answers using the non-parametric tests mentioned above came up with several findings. First of all, the analysis revealed the following:

- Regarding the active knowledge of the terminology, there is no significant difference between the answers of both groups of students (*p*-value equals 0.5737).
- Regarding the passive knowledge of the terminology, there is a significant difference between the answers of both groups of students. The students of Group A evince better passive knowledge of the given vocabulary (*p*-value equals 0.0337).

In other words, the students who were working for a semester with the bilingual textbook possess better passive knowledge of the financial terminology in English than their

counterparts, as they were able to recognise passively the meaning of the vocabulary presented in the textbook. However, in the case of the active knowledge, there is no statistical difference between the two groups. The scores of both groups are presented in Fig. 3. This finding is important to consider when working in the CLIL environment, as it affirms that just the mere exposure to a foreign (target) language, which is not even challenging, may secure, partially, a successful foreign-language acquisition as stated by (Klein, 1986; Krashen, 1985).

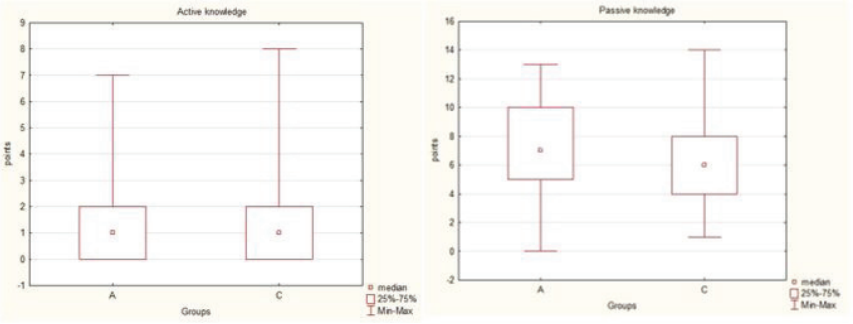


Fig. 3: Point scores

The active and passive knowledge of the tested vocabulary regarding the two groups of students is presented in Fig. 4 and Fig. 5. The graphs present successful scores (in percent) of the particular tested terminology.

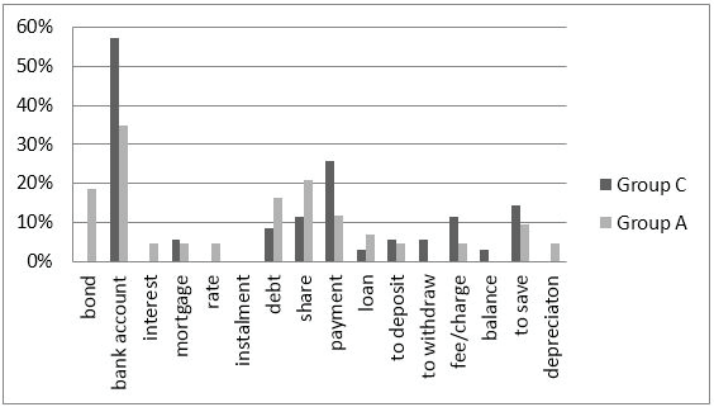


Fig. 4: Active knowledge

The same figures show that the success rate of the knowledge of the given vocabulary is closely connected with the language level. Both groups of students know the vocabulary of the lower language levels (levels A2–B2) such as *bank account*, *payment*, *rate*, and *debt* to a higher extent than the rest of the vocabulary (levels C1–C2), which is highly specific and used almost only in the context of business and economics. For this reason, the potential knowledge of these words of the students from Group A is attributed to the work with the bilingual textbook.

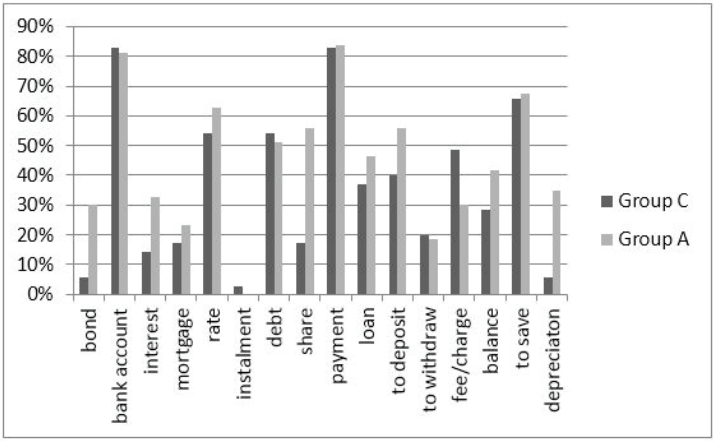


Fig.5: Passive knowledge

It is not surprising that the success rate is significantly higher in the case of passive knowledge of the given vocabulary. The calculated arithmetic means of the correct answers (to the 16 vocabulary items) and the ratios of the active to the passive knowledge were as follows:

- Group A: passive – 7.16, active – 1.47, ratio – 20.5%
- Group C: passive – 5.77, active – 1.51, ratio – 26.2%

This finding is not in accordance with the findings of Eyckmans et al. (2007) or Erigna (1974) who claim, as has been mentioned above, that the active knowledge is half the size of the passive one. This may be caused by the fact that the nature of half of the vocabulary is purely specialized. However, we could say that it is in harmony with (Golkar and Yamini, 2007: 98) who state in their work that the ratio is 29% considering the language level of B1, academic level, and 5,000 words corresponding with the language competence in English of the majority of the participating students.

Conclusion

The presented study shows that the work with a bilingual text during one semester aroused university students' interest in the foreign terminology contained in the text, although they undertake the course in their mother tongue. Even though university graduates should master the English terminology of the field they study and therefore it could be expected that the students themselves would learn some of the basic terms when working with the bilingual textbook, this study case shows that this assumption is true only in the case of passive knowledge.

The use of bilingual text may be a suitable first step of the CLIL implementing in schools. Pupils and students come into contact with a foreign (target) language and may acquire incidentally some of the key terminology typical of the given subject. However, it is obvious that to make any generalisation, it would be necessary to conduct more research in this field.

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SYSTEM DYNAMICS IN EDUCATION: CASE STUDY OF A MUSIC FESTIVAL

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Abstract

This article shows how system dynamics modelling may be suitably used as an intermediary between theory and practice. The research is aimed at creating a simulation of the implemented project in order to improve teaching project management. The main research method used was the creation of a model using system dynamics methodology and knowledge from the international standards for project managers: A Guide to the Project Management Body of Knowledge (PMBoK) and Projects in Controlled Environments (PRINCE2). Both international standards are taught in Project Management, an academic subject. As a subject for our case study we chose a music festival and subsequently we drafted a project plan, i.e. a system dynamics model. Final discussions with students on the modelling results enabled us to determine not only particular deficiencies of the theoretic teaching, but also threats resulting from the actual music festival project development when comparing it with the plan.

Keywords

Culture and creative industries, project management, system dynamics, system thinking

Introduction

We are certain that knowledge is only the first step that need to be taken before university graduates can be successful on the labour market. Once a university graduate starts walking this path, they will be facing the same challenges as managers coping with competition. In addition to knowledge, new graduates will have to mobilise all their experience they have gained working on real projects. The trial-error method in a working process when financial reward for their work is at stake may be much more difficult than when they were only acquiring new knowledge and skills in an educational process. The team members are exposed to considerably lower risks when they work on projects at university. That is the reason why we encourage our students to try more roles when working on real projects in cultural and creative industries so that they could find out where their talent actually is. It is vital to find ways for interaction among study programmes and the demand on labour markets, e.g. through cooperation of employers and educational institutions (Göttlichová and Soukalová, 2014: 171). At the same time we are aware we cannot omit theory either. This article offers an example of a new approach to teaching project management. We focus on real projects from the cultural and creative environment, analysis of their plans and continual monitoring of the project implementation and assessment.

The problems of experimental education of cultural managers are also discussed by Giep Hagoort (2009: 69), who describes the progress and results of a management game for art and media management students. The objective of the game was to strengthen student's strategic thinking through direct experience from real life. As Giep Hagoort (2009: 70) claims, the lecturers and students involved appreciated the way how this management

game helped them gain new practical experience. Students had the chance to experience enjoyment from a dynamic simulation of cultural strategic and communication processes close to their field. How knowledge can be gained through playing a game is also dealt with by Michal Čapek, the author of Dynacorp, a prototype of a desk management game that boosts systems thinking. As he claims, the advantage of this type of learning is that active participation in events or activities leads to the accumulation of knowledge or skills (Čapek, 2014: 64).

Krejčí, Kvasnička and Dömeová (2011: 195) point out that including modelling in teaching certain subjects (economics, sociology) improves students' judgement and decision-making. Methods leading to the improvement in managers' decision making are highly required, as the authors go on to state. With our approach, using systems thinking and system dynamics we teach students how important a plan is, which parameters we plan, which we should plan and which ones we actually monitor. Modelling is considered an unconventional means of gaining new knowledge so that it could be further used in real life.

Using the case study of a music festival, we can show students the actual state of development of their project using a system dynamics model. We can simulate the problems they have to cope with under the project and reveal hidden interdependence, highlight obvious problems and what impacts these may have on the success of the whole project. This interesting approach of the article offers new considerations to teaching planning in Project Management and also new perspectives to implementing a project under Communication Agency, a practical subject. Both subjects are included in the curriculum of the Faculty of Multimedia Communications.

The aim of the article is to create a system dynamics model for the purpose of improving education concerning project management. With the support of project management we use the model for visualization of the project plan development over time. When implementing the project, we document that the standards, methodologies and tools of project management may be applied in practice. The main method for achieving the aim of this article is system dynamics (Forrester, 1961, Sterman, 2000), which is based on the concept of systems thinking (Bertalanffy, 1976, Senge, 2006).

Materials and Methods

System dynamics is a scientific research method focusing on solving problems in the real world. System dynamics focuses on studying the behaviour of complex social systems. This scientific methodology contributes to better understanding of systems where a higher rate of detailed and dynamic complexity occurs. The methodology of system dynamics lies in representing problems in systems that we want to solve. These systems are networks of closed feedback loops forming levels and flows, they happen in time and are subject to delay. System dynamics relies on simulation to the effect that in can, using a model, present a system in a simplified way and describe a problem in that system that needs to be solved. Feedback loops and delays are visualised and formalised using levels and flows (Mildeová and Kalina, 2013).

System dynamics model for project management is based on the principles of company management following the international methodology PRINCE2 (2009) and uses the Earned Value Management method from the standard A Guide to the Project management Body of Knowledge (PMBoK, 2000: 114), a traditional technique Triple constraints from the National Competence Baseline of Project Management standard, (Pitaš et al, 2008: 275) that is referred to in this text with the acronym ICB. The model is a suitable platform

as it represents a simplified reality. The model is an intermediary and interpreter between theory and practice. We can use the model for testing if a creative project plan has been correctly set and compare it with the real progress of the project. We obtain data for the model using a qualitative research of the project.

The System Dynamics Process

Jay W. Forrester (1994: 3) suggests a process for the creation of a system dynamics model consisting of six steps. The first step of the research starts when we notice undesirable behaviour of the system. First of all, we need to come to understand the problem, only then can we suggest measures for solving the problem. According to the research results (Krátký, 2013: 6) the issue generally is not meeting the deadlines as set in the time schedule (mentioned by 83% of respondents), failing to meet the set objective of the project (64% of respondents), exceeding the budget (66% of respondents), not assessing the benefits of the project (50% of respondents). On the basis of a problem defined in this way we may proceed to formulating a research question we will try to answer: What is the reason why project managers fail to run a project so that at least four of these aspects are observed: time, scope, costs and benefits?

In the second step we formulate a simulation model. The system is visualised using levels and flows. Creating this model means that we will have to rewrite the description of the system problem from Step 1 in order to increase its accuracy, as it is often rather vague. The third step is launching the model simulation. This presumes we are ready to enter numeric data into the model so that the dynamic simulation could show the progress of the project on a timeline. We can measure and simulate not only the planned (estimated) progress of the project, but also its actual progress in case we have relevant data at hand. The fourth step is using charts as a tool that clearly (explicitly) expresses a simplified description of the reality and the problem that has occurred in the project. The fifth step has direct implications for the educational process. The modelling results need to be shared, students should be given enough space for discussion so that they could express their opinions on the real progress of the project as well as on the causes of issues or say what further course of events they expect. According to Jay W. Forrester (1994) it is the greatest challenge for project management, its sponsors and team members. This challenge is also linked with the last, i.e. sixth, step: implementation of changes to the team management policy or changes to the project scope, quality control, approach to measuring benefits as an issue of successful implementation of the project intention.

The sequence of elements that repeats in the complex system dynamics model is shown in Figure 1. It contains all the step-stones of system dynamics, i.e. levels, flows, variables, feedback loops.

Project Management Standards and Methodology

For the preparation of the data for the project model we used tools and techniques of A Guide to the Project Management Body of Knowledge (PMBoK 2000: 114): the method of Earned Value Management and Triple constraints technique following the ICB standard (Pitaš et al 2008: 275). As a methodological support we elaborated Projects in Controlled Environments (PRINCE2 2009), an internationally renowned methodology.

PRINCE2 is a process-focused methodology for project management that includes established standards and procedures that have proved in practice (best practices). The methodology includes management techniques for efficient and objective project management and offers a manual how projects shall be management from the beginning to the end including description of exact procedures and templates. From the PRINCE2

methodology (2009) we chose for the design of system dynamics model mainly the principle of management by stages, the principle of focusing on products, the issue of plans, the process of managing a stage and stage boundaries, managing product delivery and the issue of progress (Svirakova 2014: 36). According to PRINCE2 there are six aspects of a project implementation that always need to be controlled: time, scope, costs, benefits, quality and risks. We can work with all these features of a project in the system dynamic model.

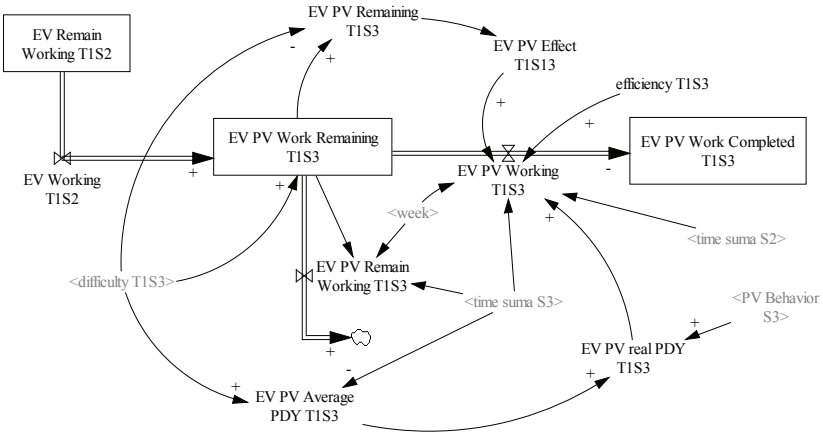

Fig. 1: A part of the system dynamics model of a case study (Team 1-Production, Stage-3) (Source: own work)

Qualitative Research

We chose BusFest, a music festival project, using purposeful selection (an intentional sampling method for qualitative research). The project is organised by students from the Faculty of Multimedia Communications at Tomas Bata University in Zlín. The team of BusFest consists of 28 students - volunteers who work for credit hours and it is divided into five specialised teams: 1-Production, 2-Promotion, 3-Public Relations, 4-Fundraising, 5-Art. It is followed by describing the research of the six aspects of the project implementation that have to be controlled (PRINCE2 2009). We merged the first three ones that are interdependent and called them Triple constraints, which is in line with the ICB standard (Pitaš et al, 2008: 275).

Triple constraints of the project (time, scope, costs), benefits, quality, risks

The project started in September 2014, its end is planned for 15 April 2015, i.e. the festival day. For the sake of simplifying the work with continual reports we suggested the team divides the project into 8 stages, each of them lasting 4 week, the last stage is planned to last 2 weeks and ends on the festival day. The qualitative research in the BusFest project team ended on 31 January 2015, i.e. at the end of the fifth stage, when we were looking into the actual status quo of the project. Interviews with the production team and project manager revealed that the total number of planned creative products of the project is 56 (pieces), their planned difficulty has been estimated to be 3275 points. The planned budged of the project is 7 thousand €. The budged was recalculated into points so that its

total value in points equals to the total difficulty value for achieving the project products (i.e. 3275 points). On 31 January 2015 we completed and delivered 25 products, while 15 were being developed, the total value of finished vs. unfinished products was 1730 points. According to the information from the economic department of the Faculty of Multimedia Communications TBU in Zlín, no costs relating to the budget of the project has been ordered or accounted for so far.

Generally speaking we can say that the benefits are the aspects that does not often manifest during the project implementation. Benefits are evidenced much more often later and they are present after we complete the project. The delay may be several months or years. The project manager declares the benefit (which is the promotion of the Faculty of Multimedia Communications TBU in Zlín and satisfying the festival attendance) within a logical framework. However, no objectively quantifiable indicator that would measure the benefits has been defined. The project team does not work with quality control of products, its project documentation does not include structured description of products. The project manager does not consider this part of the project documentation important. The project team does not work with risk control. The team only provided a list of uncertain events within a logical framework. This lists clearly shows the team members do not respect the importance of the risk control process. As a consequence, we could not include this project in the model.

On the basis of the information gathered we created a register of creative products of the project, gave points to the planned difficulty and real degree of completion and used the qualitative research for adding the date into the project model. Chart 1 shows a part of the register that we were able to compile on the basis of the above described qualitative research. PV is a recognised acronym for the Planed Value indicator and EV stands for Earned Value in line with the international standard PMBoK (2000).

Creative Product (name)	Team	Deadline (Plan)	Difficulty (PV)	Deadline (Reality)	Difficulty (EV)	Cost (Plan)	Cost (Actual)
Contracts	1-Production	5	30	5	15	1005	0
Prints printed	2-Promotion	7	50	-	-	268	0
Copywriting	3-PR	4	30	4	30	0	0
Partners ensured	4-Fundraising	4	40	5	5	0	0
Audiovisual spot	2-Promotion	5	30	3	30	0	0

Chart 1: Sample of a part of the numeric data registry for the model (Source: own calculation)

Results and Discussion

We filled the model with data gathered under the qualitative research which we transformed into numeric (Chart 1). The graphs that are the outcome of the model show the planned development of the BusFest project in its three monitored aspects: time, scope and costs. With regards to the fact that the project team did not have available data for monitoring the other three aspects that always need to be controlled (according to PRINCE2), we did not create a modelled development of the project for these aspects: benefits, quality and risks. As we have mentioned above, the project has been divided into 8 stages, the first 7 stages last 4 weeks each, the last stage is going to last - according to the project manager - 2 weeks, which is 30 weeks in total. We are analysing the project in its 20th week, when we last received information about the actual progress. The following figures

show the plan of the project and its actual development according to the scope by teams (Fig. 2, 3, 4, 5).

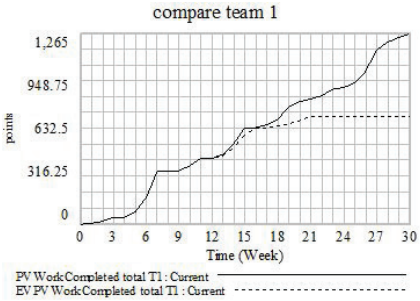

Fig. 2: Team 1-Production, comparing PV and EV

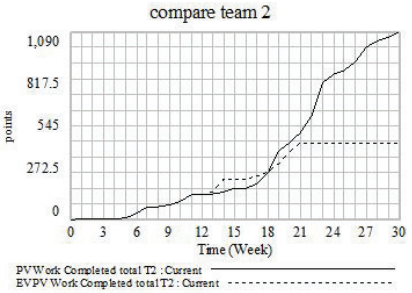

Fig. 3: Team 2-Promotion, comparing PV and EV

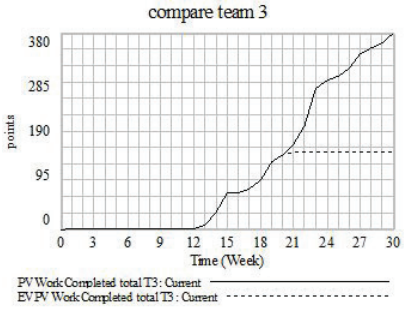

Fig. 4: Team 3-PR, comparing PV and EV

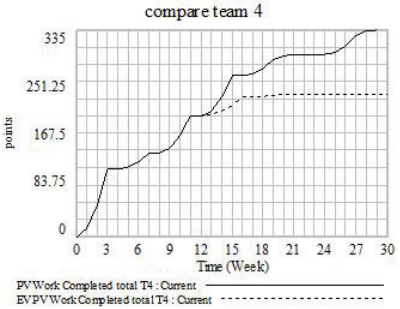

Fig. 5: Team 4-Fundraising, comparing PV and EV

For the sake of clarity we do not include in the article the chart that would depict the development of team 5-Art, since it only includes 3 products that were almost completed at the end of stage 5. The planned difficulty for team 5-Art is 205 points, the real achieved value at the end of stage 5 is 180 points. The project development in team 5-Art is included in the overall graphic depiction (Fig. 6).

The charts above show that Team 1-Production is to prepare the highest number of products for the project and has the highest difficulty level of all the teams. Until the 16th week of the project it did not have problems with meeting partial deadlines of the project, however, now it is behind the plan. This delay is due to the delay of Team 4-Fundraising, as we found out from the interview with the project manager. For the time being, Team 4-Fundraising has not signed contracts with sponsors, which means the production cannot buy performers or prepare binding agreements for their participation in the music festival. Team 2-Promotion was even ahead of the plan in the third stage (i.e. in the 14th week), however, now, in the 20th week, it is also behind the plan. It got ahead of the plan thanks to the audio visual spot (teaser) for the music festival, which was put on a website for video-file sharing before it was planned. Team 4-Fundraising declares a rather low level of difficulty in comparison with other teams, however, its work is absolutely essential. As funds limit the extent of the project, the project manager should pay utmost attention to this team. If it is not the case, the whole project is threatened, as we could see on the

modelled curve of reality when compared with the plan for Team 1-Production. Edification of the project is one of the documents the team has to elaborate after completing all project activities and by which it asks the management of the organisation to approve the completion of the project. This document will also serve to the manager of the following BusFest. Nevertheless, elaborating this document or preparing other ones including accounting for entrance fees, acknowledgement to the sponsors, processing direct emails for the partners and subsequent building of relationships with all partners is not a part of the project team plan, since the last planned date in the project schedule is April 15th 2015, i.e. the day when the music event takes place. This fact can be shown on the model and the team can be notified it is necessary to accomplish the plan by adding further compulsory products and include them in the subsequent 9th stage of the project.

The following chart (Fig. 6) offers a summary view of the development of certain aspects over a period of time. Until the 17th week all teams worked on the project products in accordance with the time schedule. As of 18th week it is behind with its deliveries. Moreover, the chart shows the planned development of costs over time. The largest part of the costs is to be (according to the plan) consumed between the 16th and 20th week. However, the team has not started ordering (thus purchasing) and this aspect will not result into savings, but it may have entirely opposite effect. The team manager must discuss this undesirable project development with the economic department of the organisation and take a position. The situation with the project costs is clearly illustrated in the chart (Fig. 6).

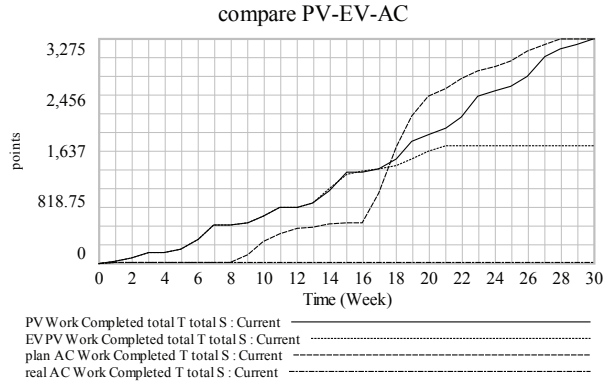

Fig. 6: BusFest project total, comparing PV, EV and costs (AC) (source: own work)

The results are compared with research findings (Krátký, 2013). We find a consensus which points at the biggest problem, which is adhering to the project time schedule (stated by 83% of respondents). This delay results to a delay in purchasing, which may threaten the project budged (stated by 66% of respondents). Another problem which proved to be fundamental, is underestimating the difficulty of the work to be done by members of Team 4-Fundraising in comparison with other teams. Underrating the extent of the work and delay of this team results to the failure to meet the project objective and subsequently to the reduction of its scope (according to the research by Krátký, 2013 stated by 64% of respondents).

Conclusion

We presented the results of the modelling to the BusFest project manager, to the 4-Fundraising manager, to three other members of the BusFest team and to twenty members of teams working under the Communication Agency projects. The purpose of the presentation was to arouse discussion about the current and future development of the project. Students were given a lot of space so that they could comment on the results. The most frequently stated cause of the problems in the BusFest project was the lack of time for the project (due to their other duties or engagement in other projects), lax attitude to the assigned tasks in the case of some team members, low quality of the completed products (particularly creative texts for the website and Facebook).

Students appreciated especially that part of the BusFest project simulation which clearly showed the high difficulty level of the tasks to be completed by Team 1-Production and underestimation of the difficulty of tasks to be performed by Team 4-Fundraising. During the discussion the students came to a better understanding of the dependency between Team 1-Production's work on the work of Team 4-Fundraising and of the consequences resulting from this dependence. The team members also commented on the lack of monitoring those aspects that need to be managed under the project with the same intensity, such as time, scope and costs. They do not considering monitoring the project benefits to be their task, but a duty the organisation has to fulfil. They are only concerned with the product quality only when at the moment of their submission, they do not have any quality measures predefined for the products and they are afraid of excessive bureaucratisation of the project. They do not deal with the project risks systematically, they do not have any specific tasks that would address the negative impact of uncertain events on the project. Risks are only dealt with during the project intuitively, being of rather Ad-hoc nature. Students also raised the question of their lack of theoretic knowledge, so the conclusion for their teacher is: focusing on the importance of the aspects of the project implementation when teaching project management and offer better explanation of their importance and possibilities how they can be managed using case studies as examples.

In total the students commented on the information they received thanks to the project model. Students considered the project simulation as beneficial in terms of how it presented the transfer of theory into practice.

Acknowledgements

We would like to thank all the students, members of the BusFest project team for kindly agreeing to be interviewed and for their active participation in the final discussion concerning the assessment of the system dynamics model. The article was supported by the grant project IGA TBU grant in Zlín, Creative project management: development of new research methods with potential for use in practice.

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DEVELOPMENT AND COMPARISON OF ICT SKILLS AMONG CZECH SECONDARY SCHOOL PUPILS

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Abstract

Results of the survey that was conducted as a part of an educational project at secondary schools that aimed to develop and improve ICT skills of pupils are presented in the article. Differences in ICT skills between ten secondary schools of various kinds in the Central Bohemia region are examined in the paper. Twelve learning modules were implemented in actual courses at schools. 377 pupils filled final tests and showed that there was a significant difference in results between schools at six modules, while at one module it was not proved. Second part of the survey was aimed at evaluation of learning modules from the perspective of pupils. Out of 924 responses, the modules were assessed positively in terms of extent, content and structure. Most of pupils needed more than one hour to prepare for the test. Modules that were far from the actual syllabi received lower score.

Keywords

ICT skills, information literacy, secondary school, learning modules, comparison

Introduction

ICT competencies have emerged on important place among key competencies and are basis for information literacy. Information literacy (IL) is a set of skills taught to identify and find the information needed to solve a problem (VanderPol et al., 2008, ACRL, 2010, Várallyai and Herdon, 2010, Monge and Frisicaro-Pawlowski, 2014), as well as the ability to evaluate information and to use it in the context (Bawden, 2001, Sundin, 2008, Limberg et al., 2011). High school or secondary school students obtain their ICT skills, competencies and IL gradually during their studies. Transition from secondary school to university is a major shift for most of students due to higher expectations of one's own learning management. Some surveys revealed that among Canadian and American high school graduates the IL score is rather below proficient and did not match the expectations of university studies (Gross and Latham, 2012, Smith et al., 2013). In the study of 15,558 middle school students in South Korea, more than half of middle school students were ranked with the basic level of ICT competences (Kim and Lee, 2013).

Development of ICT skills among pupils at Czech primary and secondary schools has been always depicted positively in media through a number of implemented projects related to ICT at schools. However, the reality often lags behind the media picture of projects and the actual level of ICT skills of both pupils and their teachers is different (Štípek and Vaňková, 2014).

Czech secondary schools are highly selective when compared to western schools because the social background has close ties to the actually studied school (e.g. family of higher education graduates connects with studies at the grammar school) (Bednařík et al, 2001). The discrepancy in status among Czech pupils was even pointed out by the OECD examinators who recommended to discontinue the grammar schools and replace them

with secondary schools that are able to differentiate the syllabi to the needs of pupils (Walterová et al, 2004).
The goal of the paper is to examine the differences in ICT skills among various types of secondary schools in the Central Bohemia region in the Czech Republic. The other goal is to evaluate opinions of the pupils that participated in additional ICT related learning course implemented in their regular schedule.

Materials and Methods

Our article presents results of the survey that we conducted as part of the project focused on the development and improvement of quality of secondary education by looking for innovative ways of cooperation and utilization of ICT. The project was realized between years 2012 and 2014 in cooperation with ten secondary schools from the Central Bohemia region.
Teachers were provided with 12 learning modules related to information and digital literacy to implement them in their classes. Each learning module consists of the introductory video, compact text on the topic, list of recommended and used resources, set of review questions and self-test. Learning modules were developed by three authors that were holders of Ph.D. or higher degree and by two authors that had master degree in the field. Learning modules have been annually upgraded since then and the authors have received feedback regularly from teachers that have been using the modules in their classes.
Main goal of learning modules was to extend the syllabi in particular study programmes, to foster interdisciplinary approach to the application of ICT skills and finally to increase information and digital literacy of pupils. Table 1 presents twelve learning modules that were eventually utilized by teachers at schools that were sampled. The teachers could select modules according their syllabi and their actual course schedule.

M1	Data and information in business	M7	Cloud computing
M2	ICT in business	M8	Computer and information literacy
M3	Internet business	M9	ICT and environment
M4	Social networks	M10	Green computing
M5	eGovernment	M11	Project management in IT
M6	Security in electronic communication	M12	Digital economy

Tab. 1: Overview of ICT learning modules

Despite the high number of students that registered in the LMS where learning modules were published, there were only 377 pupils who actually took part at least in one learning module and finished the final module test. Their results in the final test were compared with results of pupils from other schools involved in the same module. Learning and testing were done in the first half of the school year 2013/2014.
Results of the module tests were collected and evaluated after the end of February 2014. The module tests were of a multiple-choice nature with ten randomly selected questions where each question had four choices to answer. There was one point per each question with the maximum score ten points.
Those teachers that worked with learning modules were asked to tell pupils to fill final survey for each module that they took. In total, 924 pupils filled final questionnaires after completing learning modules. The number is much higher than number of tested pupils (377) because there were more schools and teachers that utilised modules in classes than

those that finally tested their pupils in the module content. The purpose of the questionnaire was to receive feedback from learners and to estimate the impact of learning materials. We have examined pupils' answers to the questions listed in Table 2.

No.	Survey question	Answer choices
Q1	Was the extent of the learning module sufficient?	No, rather not, I don't know, rather yes, yes.
Q2	How would you evaluate the content of the learning module?	Bad, sufficient, I don't know, positive, excellent.
Q3	Was the structure of the learning module appropriate?	No, rather not, I don't know, rather yes, yes.
Q4	For how long did you need to study before attempting the module test?	0 - 5 mins, 5 - 30 mins, 30 mins - 1 hour, 1 hour or more.
Q5	How do you suppose to use the knowledge?	None or barely, certainly some use or particular use.

Tab. 2: Questionnaire for pupils participating in learning modules

The common null hypothesis for all questions was that the answer to the question does not depend on the topic of the module. The alternative hypothesis says that there is an effect on the respondents' answers. Chi-square tests were conducted to verify hypotheses related to the pupils' opinions on particular learning modules. Only modules with more than ten responses were considered in the calculation. Responses were not sorted according schools.

Results and Discussion

Firstly, we have examined module test results and their relationships to the type of school where the learning modules were used. We have gathered test results only from 7 modules where at least 10 pupils finished the test. In total, results from 11 schools were obtained. There were samples from 1 business academy, 3 grammar schools and 7 vocational schools.

We found that the test score data does not have normal distribution and samples are of different size. ANOVA test assumptions were not satisfied, so non-parametric tests were conducted, namely Kruskal-Wallis, Leven's and Welch's test (Zimmerman, 2011, Lantz, 2013). The reliability of final tests was verified with Kuder and Richardson Formula 20 (KRF20) (Richardson and Kuder, 1939). The test does not require growing tendency in difficulty of questions and can be used also for randomly generated tests. Values of $\rho > 0.5$ indicate a good reliability.

KRF20	M3	M4	M5	M6	M7	M9	M10
Σpq	1.4385	1.0598	1.0113	1.1044	0.59921	1.3336	1.0486
var	8.0237	2.5928	5.5396	6.8499	2.56293	3.5555	4.2665
ρ	0.9119	0.6570	0.9083	0.9320	0.85134	0.6943	0.8380

Tab. 3: Reliability of final module tests with 10 randomly generated questions.

Further, differences in test results among schools were tested. Non-parametric tests proved that in case of six modules (M4, M5, M6, M7, M9 and M10) the null hypothesis has to be rejected at 0.05 level of significance. Thus, we can conclude that there are significant differences in test results among schools. The first module that was tested was M3. The *p*-values are such as 0.176 (KW test), 0.136 (Leven's test) and 0.272 (Welch's test), so the

null hypothesis about the equality of variances between two schools cannot be rejected (Table 4).

Groups	Count	Sum	Mean	Variance	SS	Std Err
vocational school 1	11	79.3	7.2091	9.2009	92.0091	0.7459
vocational school 6	27	225.8	8.3630	4.9340	128.2830	0.4761

Tab. 4: Descriptive statistics of test results in the module no. 3

In M4 test results, the KW test produced *p*-value = 0.1764. The null hypothesis cannot be rejected and we have to conclude that there is no significant difference (Table 5).

Groups	Count	Sum	Mean	Variance	SS	Std Err
grammar school 1	14	131.9	9.4214	0.4095	5.3236	0.3555
grammar school 2	44	405.8	9.2227	2.3748	102.1173	0.2005
grammar school 3	21	178.8	8.5143	1.8343	36.6857	0.2903
vocational school 1	13	110.1	8.4692	1.7390	20.8677	0.3689
vocational school 3	17	160.3	9.4294	0.4610	7.3753	0.3226
vocational school 6	14	131.9	9.4214	0.4095	5.3236	0.3555
vocational school 7	95	810.8	8.5347	2.0812	195.6354	0.1365

Tab. 5: Descriptive statistics of test results in the module no. 4

KW test *p*-value is 0.0028, which indicates that we reject null hypothesis and conclude that there is significant difference between two schools in M5 test results (Table 6). The module had the largest number of students that took the test (218 pupils).

Groups	Count	Sum	Mean	Variance	SS	Std Err
grammar school 1	19	187.3	9.8579	0.1059	1.9063	0.3775
vocational school 4	20	157.6	7.8800	5.1712	98.2520	0.3679

Tab. 6: Descriptive statistics of test results in the module no. 5

KW test produced *p*-value <0.001, which indicates that we reject null hypothesis and conclude that there is significant difference between schools in M6 test results (Table 7).

Groups	Count	Sum	Mean	Variance	SS	Std Err
business academy 1	15	115.1	7.6733	4.4807	62.7293	0.5492
grammar school 1	11	108.7	9.8818	0.1076	1.0764	0.6414
vocational school 3	37	345.2	9.3297	4.1305	148.6973	0.3497
vocational school 4	47	400.6	8.5234	5.8070	267.1243	0.3103

Tab. 7: Descriptive statistics of test results in the module no. 6

KW test brought *p*-value <0.001. We reject the null hypothesis and conclude that there is significant difference between the four schools in M7 test results (Table 8).

Groups	Count	Sum	Mean	Variance	SS	Std Err
grammar school 1	14	130.8	9.3429	1.3057	16.9743	0.3403
vocational school 1	27	228.5	8.4630	2.6893	69.9230	0.2450
vocational school 3	12	108.3	9.0250	5.2275	57.5025	0.3675
vocational school 5	71	658	9.2676	0.7156	50.0955	0.1511

Tab. 8: Descriptive statistics of test results in the module no. 7

KW test produced *p*-value <0.002, which indicates that we can reject null hypothesis

about the equality of variances of samples. It means that there are significant differences in M9 test results (Table 9). The module had become the second most used in classes (124 pupils).

Groups	Count	Sum	Mean	Variance	SS	Std Err
vocational school 3	24	225.8	9.4083	0.9364	21.5383	0.2869
vocational school 7	22	157.4	7.1545	3.1131	65.3745	0.2996

Tab. 9: Descriptive statistics of test results in the module no. 9

According KW test *p*-value is <0.001, which indicates that we can reject null hypothesis about the equality of variances of samples. It means that there are significant differences in M10 test results between both schools (Table 10).

Groups	Count	Sum	Mean	Variance	SS	Std Err
vocational school 1	23	173.6	7.5478	5.5506	122.1124	0.3682
vocational school 3	21	201.4	9.5905	0.4439	8.8781	0.3854

Tab. 10: Descriptive statistics of test results in the module no. 10

As to the differences in test scores, there could be several factors that might have effect on the results. Firstly, the actual use of learning materials and testing was completely based on the teacher's decision. Some of them used full content of particular modules while others implemented just certain topics. Secondly, pupils could take a sample test before they opened the final test. However, the chances of successful passing final test might increase, significant differences among schools still remained. Thirdly, due to the limited data we could not verify what was the level of pupils' knowledge and skills before and after taking part in the learning module. Also the influence of knowledge from other subjects that were related to the presented modules was unknown. Lastly, there is an obvious influence of different levels of ICT skills among schools, which was already proved by previous surveys among fresh graduates that enrolled to the first year of bachelor studies at the university (Očenášek, Ulman and Vydrová, 2013, Ulman et al., 2014) and it corresponds with outcomes of the Czech national survey (Štípek and Vaňková, 2014). We can also agree with Ryška (2009) that 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.

Evaluation of modules from the learner's perspective

The second part of the study was devoted to the examination of the pupils' perspective on learning modules. Based on the experience from Germany, it is important to utilize competence assessment of pupils on individual level and receive the feedback on regular basis. The alignment of everyday classroom teaching with formative and summative assessments and to establish competence models as common ground is a challenge (Bogeholz and Eggert, 2013).

The results of Chi-square test that were run over given set of questions are presented in the Table 11. The null hypothesis could not be rejected at Q1 (extent), Q2 (content), Q4 (time before test) and Q5 (use of knowledge) so we can conclude that the answer to the question does not depend on the topic of the module. Responses were related to eleven out of twelve modules and there were no significant differences from the pupils' perspective. Only the answers to Q3 (structure) showed significant differences between modules, which may indicate that pupils found some unbalance.

	Count	Rows	Cols	df	chi-sq	*p*-value	H0
Q1	228	5	11	40	39.3963	0.4973	accepted
Q2	280	5	11	40	46.6357	0.2183	accepted
Q3	183	5	11	40	66.2304	0.0057	rejected
Q4	924	4	10	27	12.9724	0.9894	accepted
Q5	489	2	11	10	10.2467	0.4191	accepted

Tab. 11: Chi-square test for evaluation of pupils' opinions about the modules

Due to the limited space, only selected remarkable findings from pupils' questionnaire survey are presented further. The extent (Q1) of eleven evaluated modules was found as sufficient (more than half of responses were 'rather yes' or 'yes'). The content (Q2) of eleven modules was also positively evaluated in more than half cases. Significant disproportions might be observed in the evaluation of the module structure (Q3), where M3 (Internet business) was perceived as unsatisfactory in slightly more than half of responses and M5 (eGovernment) obtained almost same number of satisfactory and unsatisfactory evaluations. Several remarks from students in open questions were such as 'I can learn better this than Czech Literature'.

However, the information about the type of school of respondents who were not satisfied was not available in the questionnaire. An interesting finding was brought by the question about the time needed for study before the module final test (Q4). Prevailing amount of pupils needed more than 1 hour for preparation for ten out of twelve modules. This might indicate that the learning topics were either new to the pupils, or their self-confidence in the subject matter was lower. Some pupils stated that: 'I did not need to study before the final test' (M4), The opinions of the learners about the future use of gained knowledge were quite consistent because they claimed that they could see certain use of the knowledge or they had some specific idea for its utilization in ten particular modules, e.g 'I can use the knowledge in some practical web development project' (M3). Constrained opinions about further usage were provided for M12 (Digital economy) where equal number of pupils either could not see any use or could see some usage. The learning content of the module was more abstract and closer to the bachelor degree level, which might cause certain inconvenience for pupils that might have missed underlying contexts.

Conclusion

Based on the personal experience of authors the learning modules were highly appreciated by involved schools and teachers. According to previous research and feedback from teachers, the current curricula at most of secondary schools lack an interdisciplinary approach to ICT education and application. The pupils enjoyed compact form of learning modules accompanied with short videos.

We found that the level of ICT skills significantly varies among vocational schools, grammar school and business academies despite the effort of teachers, school principals and the Ministry of Education, Youth and Sports. Also students' attitudes and access to ICT are subjects of change during the time. Young learners know what they are interested in and what they can use in practice or in further education.

We can see two specific research opportunities. Firstly, it is very important to gather data about evaluation of learning tools, content and form both in schooling and higher education on regular basis. Learning analytics provides tools and methods to evaluate and manage further development of learning materials, which in turn has impact on the efficiency of education. Secondly, more effort should be also put on developing more

holistic approaches to the evaluation of learning outcomes and comparison of schools because mere comparison of average exam results is flat and could be biased.

Acknowledgements

The paper was realized due to the project no. CZ.1.07/1.1.32/01.0004 granted by ESF. The results and knowledge included herein have been obtained owing to support from the University Internal Grant Agency of the Czech University of Life Sciences Prague, grant no. 20151007 – "Inovativní přístupy využití ICT ve vzdělávání jako prostředek snižování sociálního vyloučení" (Innovative approaches to the use of ICT in education for mitigation of social exclusion), and from the Internal Grant Agency of the FEM CULS Prague, grant no. 20151053 – "Rozvoj a využívání informačních a komunikačních technologií ve venkovském prostoru" (Development and use of ICT in rural area).

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EVALUATION OF MATHEMATICS TESTS – RELATIONSHIP BETWEEN THEORY AND EXERCISES

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Abstract

The article deals with the analysis of tests results evaluating the knowledge of students of mathematics course at University of Economics in Prague. The knowledge of definitions and the ability to solve exercises were tested. This article focuses on the theoretical part. The aim is to assess the ability to formulate the definitions and to analyse the relationships between the study of the theory, the ability to formulate definitions and to solve exercises. For this purpose the statistical evaluation utilizing the log-linear models was used.
The results lead to pondering on how much to emphasize the theory in mathematics courses at non-technical universities.

Keywords

Definition, exercise, log-linear model, mathematics, test, theory

Introduction

The mathematics course at University of Economics in Prague is taught for a period of one semester and it includes the basics of mathematical analysis and linear algebra in the range corresponding with textbooks such as Batíková (2009) or Klůfa and Kaspříková (2013).
Except for the final exam (consisting of a written test and an oral part) at the end of the semester, students of mathematics course are tested using a written test in the middle of the semester – more in Otavová and Sýkorová (2014). Until the academic year 2009/2010, these mid-term tests consisted of exercises only. In summer semester 2009/2010, the author of this article included (as a part of the research for her doctoral thesis) an extra task to formulate given definitions into the mid-term test.
The primary aim of this article is to evaluate the effect of the study of the theory for the results of the tests and to assess the relationships between the study of the theory, the ability to formulate the definitions and the ability to solve exercises. Although the tasks in the tests, which the research was focused on, were from the area of linear algebra only and students of the mathematics course at University of Economics were tested in particular (see also Kaspříková (2012)), the results could be transferable to other fields of mathematics and other similarly oriented universities (see e.g. Milková (2011), Brožová and Rydval (2014)).

Materials and Methods

Three teachers of the Department of Mathematics administered tests with the theoretical part to 300 students of different study groups and fields of study. Students were required to formulate five definitions (linear combination of vectors, linear dependence of vectors, rank of a matrix, invertible matrix, matrix inversion). They did not expect this theoretical part in the test and it can be assumed that they did not study for it. Students were informed

that the results of this part would not be taken into account for the official rating of the tests, but they were asked to try to formulate the definitions the best they can.
The theoretical part in all the tests was evaluated by the author of this article. The correctness of formulations and the most common errors were determined (in detail in Ulrychová (2013)). The evaluation of the accuracy of formulations was very moderate – for example, the non-generic definition of linear combination of vectors expressed just for two vectors was accepted as correct. In addition, in the case of tests comprising an exercise related directly to one of the five given terms, the relationship between the correctness of the solution of the exercise and the correctness of the formulation of relevant definition was examined.
In the academic year 2010/2011 the head of Department of Mathematics made it mandatory to include a task to formulate one definition or theorem (not necessarily from linear algebra field) in all mid-term tests. Students were informed in advance about this fact and the results of this part were counted towards the official rating of the tests. In that year the author of this article took the exceptional opportunity to compare the results of the tests in the group of students who did not expect the theoretical part in the test (the group A) with the results of tests in the group of students who did expect this part (the group B).

Evaluation of Tests in the Group A

The group *A* was the group of 300 students who did not expect the theoretical part in the test. Table 1 shows the number of correct answers in group *A*.

	number	%
linear combination	93	31%
linear dependence	89	29.67%
matrix rank	186	62%
invertible matrix	205	68.33%
matrix inversion	95	31.66%

Tab. 1: Success rate in formulating particular terms (the group A)

As we can see in Table 1, in three cases (linear combination of vectors, linear dependence of vectors, matrix inversion) the success rate was about 30%, in the case of rank of a matrix and invertible matrix the success rate was more than double (62% and 68% respectively). Interestingly, the terms rank of a matrix and invertible matrix are built on the term linear dependence and hence on the term linear combination, formulation of which was much less successful.
In addition, the relationship between knowledge of the term rank of a matrix and invertible matrix, respectively, and the terms on which these terms are built (linear dependence and linear combination) was examined. As we can see in Table 2, 186 students (out of 300 total) defined correctly the term rank of a matrix but only 41 (about 22%) of them defined correctly the remaining terms. In the case of the invertible matrix it was only 40 (about 20%) out of 205 total.
In the following tables “yes/no” means “the definition (exercise respectively) is correct/incorrect”.

MATRIX RANK yes **186**				INVERTIBLE MATRIX yes **205**			
Linear dependence yes **67**		Linear dependence no 119		Linear dependence yes **71**		Linear dependence no 134	
L. comb. yes **41**	L. comb. no 26	L. comb. yes 29	L. comb no 90	L. comb. yes **40**	L. comb. no 31	L. comb. yes 33	L. comb. no 101

Tab. 2: Definitions (matrix rank, invertible matrix)

In addition, 230 out of 300 tests included an exercise related either to linear dependence or to matrix inversion. In these cases the relationship between the correctness of the solution of the exercise and the correctness of the formulation of relevant definition was examined. Considering this relationship, only the correctness of the solution procedure of the exercise (not numerical errors) was taken into account. The evaluation is in Table 3.

Evaluation of Tests in the Group B

The group *B* was the group of 230 students who expected the theoretical part in the test. In the academic year 2010/2011 the task to formulate one given definition or theorem (not necessarily from linear algebra field) was mandatory in every mid-term test. It was impossible to incorporate more than one definition into the test, so it was not possible to make a direct comparison to the year 2009/2010 in all aspects. In order to make it possible to compare to the year 2009/2010, the relationship "knowledge of definition – correctness of the solution procedure of the exercise", exercises of the same type and definitions related to them as in 2009/2010 were given. The tests intended for comparison with the year 2009/2010 were administered by the same three teachers as in 2009/2010 to the same number of students taking the test allowing to compare the relationship between the definition and the exercise (i.e. to 230 students). The total number of tested students in this group (the group *B*) was smaller than in the group *A* (230 in comparison to 300) and only the definitions of the terms linear dependence of vectors (100 students) and matrix inversion (130 students) were asked in the group *B*. The assessment criteria were the same in *A* as in *B*.

The number of correct answers and the evaluation of the relationship "knowledge of definition – correctness of the solution procedure of the exercise" are summarized in Table 3.

Comparison of Results in the Groups *A* and *B*

The Table 3 shows summary results in both groups *A* and *B*.

	LINEAR DEPENDENCE				MATRIX INVERSION			
	A (in total 100)		*B* (in total 100)		*A* (in total 130)		*B* (in total 130)	
	number	%	number	%	number	%	number	%
Definition								
yes	36	36	42	42	43	33.08	88	67.69
no	64	64	58	58	87	66.92	42	32.31
Exercise								
yes	90	90	88	88	97	74.62	93	71.54
no	10	10	12	12	33	25.38	37	28.46
Def. – Ex.								
yes – yes	35	35	40	40	39	30	66	50.77
yes – no	1	1	2	2	4	3.08	22	16.92
no – yes	55	55	48	48	58	44.62	27	20.77
no – no	9	9	10	10	29	22.31	15	11.54

Tab. 3: Comparison of results in A and B

Statistical evaluation

Students in the group *A* did not expect the theoretical part in the test – we can assume that they probably had not studied the theory. Students in group *B* expected the theoretical part in the test – we can assume that they had studied the theory.

Let´s denote T = the student did/did not expect the theory in test, E = the exercise was/was not correct and D = the definition was correct/incorrect.

The obtained results were statistically evaluated using the log-linear models (Agresti, 2002) in order to examine the level of dependence in each of pairs „the student can/cannot formulate the definition – the student can/cannot solve the exercise" (pair DE); „the student can/cannot formulate the definition – the student did/did not expect the theory in test" (pair DT); „the student can/cannot solve the exercise – the student did/did not expect the theory" (pair ET).

Using the log-linear hierarchical models (saturated, homogeneous association, conditional independence, joint independence) and function "glm" (generalized linear models) in R-software (https://stat.ethz.ch/R-manual/R-patched/library/stats/html/glm.html), the best model in each category was determined. The statistical tests of their feasibility were performed using the standard statistical testing of submodel (the deviance test) (see Agresti, 2002).

The saturated model corresponds to reality (obtained data). In the homogeneous association model all three pairs DE, DT, ET were retained (denoted DE.DT.ET). In the conditional independence model (a reduced model of the homogeneous association model) one of the pairs DE, DT, ET was always omitted. Among these reduced models, the one which best coincided with the reality (and with the homogeneous association model too) was chosen. The pair, whose omission leads to the least breach of the accordance with reality, shows the weakest relationship between its members (compared to the other two pairs). In the joint independence model (a reduced model of the conditional independence model) another pair was omitted and again the model conforming the best with the reality was chosen. In the pair, which remained as the last, the relationship between its members is the strongest (compared to the other two pairs).

1) Linear dependence

Table 4 shows the predicted counts in each category, Table 5 presents the fit of the model following Agresti (2002). The deviance G2 is defined to be the likelihood-ratio statistic for testing the null hypothesis that the model holds against the saturated model; it has a chi-squared asymptotic null distribution. The bigger the value of G2 (unbounded), the more we tend to reject the null hypothesis (i. e. the tested model). The quantity df is the degree of freedom and p-value is the probabilistic level on that the null hypothesis is/is not denied. Table 5 confirms that none of the tested models is denied at the significance level of 0.05. The right column (delta) shows the dissimilarity index.

LINEAR DEPENDENCE							
	Definition	Exercise	Theory	number	DE.DT.ET	DE.DT	DE.T
1	yes	yes	no	35	35	35	37
2	yes	no	no	1	1	1	2
3	no	yes	no	55	55	54	52
4	no	no	no	9	9	10	9
5	yes	yes	yes	40	40	40	37
6	yes	no	yes	2	2	2	2
7	no	yes	yes	48	48	49	52
8	no	no	yes	10	10	9	9

Tab. 4: The best models – linear dependence

	G2	df	p-value	delta
fitDET	0.0	0	1.00000000	0.000
fitDE.DT.ET	0.1	1	0.81071295	0.004
fitDE.DT	0.4	2	0.80054144	0.014
fitDE.T	1.2	3	0.75249357	0.035

Tab. 5: Goodness of fit of the linear dependence model

All models DE.DT.ET, DE.DT and DE.T fit the data sufficiently. The model DE.DT omits the insignificant ET pair, meaning that given level of D, E and T are independent. Thus the weakest relationship is in the pair ET – in the group of students having (or not having) the definition correct, the correctness of exercise is independent on study of the theory; i.e. the ability to solve exercises is independent on study of theory. The model DE.T shows that the strongest relationship is between D and E; i.e. the relationship between correctness of the definition and the exercise.

From the model DE.T the odds ratio of DE was calculated: let Dy, Dn denote „definition yes“ (the definition was correct) and „definition no“ (the definition was incorrect), analogically for the exercise Ey and En. Then $(Dy/Dn)/(Ey/En) = \exp(1.529) = 4.614$, meaning that increasing the ratio Ey/En, the ratio Dy/Dn increases about 4.6 times. In other words, if the ratio of students having the exercise correct to students not having the exercise correct increases, the ratio of students having the definition correct to students not having the definition correct increases 4.6 times.

2) Matrix inversion

Table 6 shows the predicted counts in each category; Table 7 shows the goodness of fit test and dissimilarity index (delta) of the models.

MATRIX INVERSION							
	Definition	Exercise	Theory	number	DE.DT.ET	DE.DT	DE.T
1	yes	yes	no	39	37	34	31
2	yes	no	no	4	6	9	12
3	no	yes	no	58	60	57	64
4	no	no	no	29	27	30	23
5	yes	yes	yes	66	68	71	64
6	yes	no	yes	22	20	17	24
7	no	yes	yes	27	25	28	31
8	no	no	yes	15	17	14	11

Tab. 6: The best models – matrix inversion

	G2	df	p-value	delta
fitDET	0.0	0	1.00000000	0.000
fitDE.DT.ET	2.5	1	0.110956	0.038
fitDE.DT	5.0	2	0.080695	0.040
fitDE.T	11.8	3	0.008067	0.071

Tab. 7: Goodness of fit of the matrix inversion model

The models DE.DT.ET and DE.DT fit the data sufficiently. As in the case of linear dependence the conditional independence model DE.DT is the best among all conditional independence models (DE.DT, DE.ET, DT.ET); the weakest relationship is again in the pair ET. The remaining pairs DE and DT hold their (significantly) positive association and could not be omitted from the model without losing its statistical significance.

Although the joint independence model DT.E fits the data insufficiently, this model is the best among the other joint independent models. The relationship DT can be considered to be the strongest among the relationships DE, DT, ET.

From the model DE.DT (the best of the statistically significant models) the odds ratios of DT and DE were calculated: let the meaning of Dy, Dn, Ey, En is as above, let Ty, Tn denote „theory yes“ (the theory was expected) and „theory no“ (the theory was not expected). Then (Dy/Dn)/(Ty/Tn) = exp(1.44) = 4.239 and the odds ratio of DE is (Dy/Dn)/(Ey/En) = exp(0.74) = 2.096. This means that increasing the ratio Ty/Tn, the ratio Dy/Dn increases about four times. Similarly, increasing the ratio Ey/En, the ratio Dy/Dn doubles.

Results and Discussion

The results of the tests and their statistical evaluation lead to the following conclusions.

The most common errors have the same character in both groups *A* and *B*; i.e. regardless whether the students studied the theory or not. These are consistent with the author's experience during oral examinations.

The detailed list of errors, numerous samples of formulations and some remarks to the method of teaching the problematic terms are in Ulrychová (2013). In general, in most cases the students were not able to formulate terms in generic way, struggled with generalized notation, ignored quantification, did not make any differences between definitions and theorems. Formulations often did not make any sense at all. When the definition was formulated correctly, in most cases it was formulated in exact literal wording using exact

notation as in the textbook. Only in very sporadic cases the students managed to formulate the definition correctly in his/her own words.
As shown in Table 2, the students formulated a given term correctly based on other terms, which they could not formulate correctly. The importance of such knowledge is then questionable.
The statistical evaluation gives an interesting result. One can expect the relationship between learning the theory and correctness of the definition (DT) to be the strongest among the tested relationships (DT, DE, ET). In the case of matrix inversion, the result is in agreement with this expectation, but in the case of linear dependence, the relationship between correctness of the definition and the exercise is the strongest. This means that more than the study of the theory, the level of students' general mathematical skills is crucial. That is probably caused by the fact that students find the definition of linear dependence rather difficult to understand and formulate. On the other hand, the definition of matrix inversion is easy to understand and remember. That also corresponds with the result of the tests – while the correctness of definition of matrix inversion doubled by learning the theory (from 33% to about 68%), the correctness of definition of linear dependence increased much less (from 36% to 42%).
The statistical result in both cases (linear dependence and matrix inversion) shows that the relationship ET is the weakest; i.e. the correctness of exercise does not depend on learning the theory. This means that the ability to solve exercises did not increase by learning the theory.
There are some essential disadvantages of written form of testing. It is impossible to determine with certainty whether the student memorized the definition (without understanding it) or not. Moreover, the teacher cannot gradually correct the errors and help the student to reach the correct expression as in the case of oral examination. During the oral examination the teacher is able to differentiate if the student does not understand the term at all or if he/ she has a pretty good understanding about the term but is just not able to express it. The latter case is certainly more beneficial than the case if the student just memorizes the terms without understanding them.
In case of University of Economics in Prague with one-semester course of mathematics with a relatively wide curriculum, it is impossible to exercise the students to make them able to formulate mathematical terms precisely. The students solve this problem by memorizing definitions and they are not able to interpret results obtained by calculations. It is questionable whether in such case one should insist on precise wording of the definitions or to be satisfied at least with a general idea and to prefer the knowledge of relationships, the ability to make right conclusions and to interpret the results.

Conclusion

The statistical evaluation of the results of the tests is in accordance with teaching experience – at non-technically oriented universities the students' ability to solve exercises is independent on study of the theory.
Students of universities of 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 (Pražák, 2014). The main aim of the mathematical course at non-technically oriented universities usually is to make students able to use mathematical procedures for solving tasks in specialized courses. The fact that the students of these schools need primarily to master calculus rather than theory, definitely does not mean that the theory should not be taught at all. However

the method of explaining the curriculum should be adequate to the specialization of the school and the teacher should consider the extent to which it is beneficial to ask students to formulate the definitions precisely (if there is no opportunity to practise it). On the other hand if the course provides enough time to practise correct formulations, students may benefit from it and apply them not only in the course of mathematics but also in other courses, as well as in their professional life (cf. Milková (2011)).

Acknowledgements

The author would like to thank Mgr. Jan Voříšek, the Ph.D. student at Faculty of Mathematics and Physics, Charles University in Prague, for designing the statistical models used in this article.

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SELECTED METHODS OF EMPLOYEE TRAINING AND THEIR USE: RESULTS OF ANALYSIS IN THE CZECH REPUBLIC

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Abstract

Developing employees and sharpening their knowledge, skills and abilities is an important focus for Human Resources Departments in organizations. But proper training methods must be used, methods that will be an effective part of the training process and will increase individual participants' knowledge. This paper evaluates the utilization of selected training methods in a set of Czech organizations and tests for correlations among selected qualitative features. The results show that whether a company utilizes training methods depends upon internet use and whether the company has an HR Department (with the strength of the dependency between 0.133 and 0.268). Organization size is a predictor for the utilization of most methods researched as, to a lesser extent, is economic sector. Regular use of individual methods and their effective combination are recommended. Coaching and mentoring may also be used as tools in career planning and management. It can be summarized that the need of employee training is important for all sectors and many of organizations invest in it about 1-5% (64.29%) of their staff salary amount.

Keywords

Human Resource Management, development, training, learning, costs, benefits

Introduction

All organizations aim at possessing educated, talented employees with the potential to grow (Bedrnová and Nový, 2012). If organizations have such employees available, they must ensure their motivation and willingness to continue developing their abilities and skills (Urban, 2012; Seibert et al., 2001); last but not least, they must ensure that these employees do not depart for a competing organization (Morongová and Urbancová, 2014). With continuous learning and development, employees' work potential increases (Kong and Yan, 2014). This is beneficial to the organization, because employee development reflects positively in all organizational processes. But this is only one reason HR management of education should be one of the key objectives in all organizations operating in the contemporary world. In practice, educational opportunities are frequently related to career growth and focus only on talented employees who possess high potential for their companies (Boudreau and Ramstad, 2005). In this way, however, less ambitious employees are left out and may leave without their potential being tapped (Bedrnová and Nový, 2012).

Urban (2012) states that the efficiency of training methods is based upon two requirements. Firstly, training topics should be as close as possible to the nature of the actual working tasks the trainees must handle or ready themselves for. In this case, the participants' motivation and ability to learn new procedures is highest. Secondly, there must be an opportunity to try out new methods and procedures immediately and "hands on" as part of the training. Even here, one thing is recognized – learning is most effective if it takes

place on the basis of one's own experience, and sometimes experience acquired through trial and error. Effective training allows and supports participants' own activity, among other things by increasing their willingness to take part in future training as well. This is also confirmed by Cambridge (2008).

This paper evaluates the use of selected training methods in Czech organizations and tests the dependency among selected qualitative features (i.e. whether a dependency exists between the method used and the organization size, the existence of an HR Department, or the economic sector in which the organization operates). The partial goal is to characterize the changes in this area in time and accent the assessment of economic value and information regarding costs and benefits of this area. The first section of the paper summarizes the views of individual Czech and foreign scholars on employee education and development (Introduction and Theoretical Background). The second section describes the methods and techniques used, including any data sources used in the paper in detail. The subsequent section presents the results of the primary research. Further, the article includes a discussion and summary as well as an outline of a future research opportunities.

Theoretical Background

In fulfilling organizational goals, specific HR activities are performed. Specific HR activities managed in a quality manner result not only in the organization's having quality employees available and being able to use the potential of these employees to implement the company strategy (Boudreau and Ramstad, 2005) but also in employee satisfaction, loyalty and motivation to stay in the organization in question (Kociánová, 2010; Hroník, 2006). According to Hroník (2006), employee training and thereby development of the entire organization is a tool to achieve higher performance by the entire firm.

Bedrnová and Nový (2012) as well as Urbancová (2014) indicate that all organizations aim to hire employees with professional expertise who express initiative and deal flexibly with challenges faced by their particular position at all levels. Further, Dvořáková (2004) and Koubek (2007) agree that employee development is more focused on employees' professional potential, their future and career rather than their current position. According to Koubek (2007) and Kociánová (2010), it may be stated in summary that education is an activity which must always be planned, that helps individuals or groups attain necessary competence and that helps people acquire knowledge and skills in their professional lives. The aim is to provide organizations with competent, trained employees who will be able to fulfil both current and future expectations and objectives of organizations. Employees must be prepared for this. In the contemporary world, employees must educate themselves. However, they themselves should desire this. To do so, they must know their organization's strategy for education and development and must identify themselves with the organization's goal for this area.

Employee training and development, i.e., the identification of employee needs, planning training, implementing it and subsequently evaluating it is integral to HR, something which is also confirmed by Bedrnová and Nový (2012). They indicated that education and development hold a uniquely important place in HR management for every organization. However, HR specialists must include methods in education planning that lead to increased knowledge and skills and reflect positively in employee actions and results attained by the organization. There are a number of training methods (on-the-job, off-the-job) whose applicability depends upon whether the individual method is focused more on the passive or active aspect of learning while using specific applications. For example, Urban (2012) indicates that the current practice of solving actual or simulated

work challenges is particularly important in positions (including managerial positions) where employee failure may result in serious issues. One of the training objectives is to make employees aware of any potential errors even before they can make them during their tasks. Based upon Urban (2012), Lee, and Bruvold (2003) it may be summarized that in terms of training methods, it is desirable for training sessions to be organized in practice using short but frequent blocks. Such a system is more beneficial, not only because long training sessions tire participants, but also because participants may try to make use of the newly acquired knowledge in practice as soon as possible. Based upon research by Kong and Yan (2014) and Cambridge (2008), the most effective training connects the actual training with individual counselling, thereby aiding employees to remove specific obstacles that prevent them from heightening their performance.

Koubek (2009) sites the following reasons that employees should be trained: Continuous development of technology – employees must be ready for new technology to be able to work with it in the most effective manner; Everyday modification of the product and service marketplace, and of the job market; Innovation in companies, streamlining work processes and on-the-job performance; The focus has shifted from quantity to quality and customer satisfaction; Development of new technologies and information technologies and their introduction into everyday practice; Cost reduction while achieving same-level or improved results – people must be able to accommodate to changes which take place in organizations; Educated and properly qualified workers give the company a good name. Based upon the above facts, it may be summarized that employee training is a key task that – if carried out properly – leads to the creation of a quality work team equal to the competition and that builds the good brand name of its employer. Employee training is a comprehensive process which should involve all employees for the entire time they work at an organization and may be considered a potential bonus offered by the organization to its employees.

Materials and Methods

The article presents the results of a original quantitative survey focused on Human Resource Management, specifically in the area of learning, training and development in organizations operating in the Czech Republic. It presents part of the large survey through all personell activities. The questionnaire was completed by managers of these organizations in mid-level and top management. The questions employed specialist terms generally known to mid-level and top management. For potentially ambiguous questions, terms were explicitly defined. The formulation of questions grew out of long-term collaboration with the School of Economics and Management in Public Administration in Bratislava (SEMPA). The survey began in 2011 in the Slovak Republic and in 2013 in the Czech Republic. The author of the article is also co-author of the long-term international survey "The Key Functions of Personnel Management in the Context of Development of Organizations Operating in the Slovak Republic and Czech Republic".

Research in the Czech on this topic had long-term character and it was held in the Slovak Republic as well (n=340 organizations every year). There was made comparation between the results of these countries. 364 randomly chosen organizations operating in the Czech Republic participated in the survey. The categories are according to CSO and the results are generalizable on selected sample. The structure of these organizations was as follows: According to business sector: 63.5% from the private sector and 36.5% from the public and state sectors; According to organization 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.

The results are focused on managerial aspects and marginaly on economic aspects. The survey had 12 questions and 4 identification questions in the area of learning, training and development in organizations. The research shows that whether an HR department is established in an organization depends upon the number of employees. The greater the number, the better the chance the organization has established an HR department. Of small organizations (up to 50 employees) only 10.4% have an HR department. For large organizations, the figure is 79.8%. Overall, the research focused on 45.6% of organizations possessing an HR department. Given the fact that employee hiring concerns all organizations and small and midsize enterprises, which make up 99.8% of all companies in Europe (SME Union Czech Republic, 2014, European Commission, 2009) and that the same is true in the Czech Republic (SME Union Czech Republic, 2014), it is important that Czech research also focuses upon the situation of small organizations (up to 50 employees), whether or not they possess an HR department.

This methodology agrees with Stacho et al. (2013). Their systemic approach was used in this paper and with the survey results to objectively evaluate knowledge and processes and understand the nature of the interconnections between them, and to eliminate details due to random events. Was used upon the article creation and the survey evaluation. The methods of induction, deduction and comparison were used to derive conclusions. To evaluate the survey outcomes, descriptive statistics techniques were used (absolute and relative frequency, correlations among qualitative characteristics, and statistical power analyses of the correlations). Pearson's Chi-square test and Cramer's V were used (Hendl, 2012). 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 2013 and statistical software IBM SPSS 22.

Results and Discussion

This chapter presents the results of the research carried out in selected organizations in the Czech Republic. The results are compared to those from prior years of research and discussed. The results showed that organizations most frequently employed on-the-job methods. (Respondents could mark more than one method). It was determined that lectures are most-used (190 organizations; 63.46%). A lesser focus is placed upon employee self-training (181; 62.02%). There is a significant difference between the support for self-training and other methods used. This may be because not all organizations, particularly the small organizations most numerous in the Czech Republic, have adequate funding to invest in the development of their employees. For this reason, it is understandable that, e.g., the Outdoor Training method is used in only 12.09% (55 organizations). These are large organizations which may make use of this relatively costly method for team building and acquiring experience. Video-conferences are also used relatively infrequently by the organizations researched, in only 6.04% (34 organizations). It may be deduced that this is due to the technologically demanding nature of video-conferences. Coaching is preferred to monitoring and its use continues to broaden, in particular because coaching is currently preferred as a potential tool for career control and planning. Career places a greater focus on deepening knowledge, experience, specialization and help provided to younger co-workers than support for vertical career with advancement to higher positions. Detailed results are indicated in Table 1.

Methods	Relative frequencies	Dependency on existence HR department (p-value/Cramer's/ power)
Self-training	62.09	YES (0.000/0.215/weak)
Outdoor training	12.09	YES (0.010/0.134/weak)
Coaching	19.78	YES (0.000/0.252/weak)
Mentoring	10.71	YES (0.000/0.236/weak)
Internet	31.87	NO (0.355/-)
Videoconference	6.04	YES (0.008/0.138/weak)
E-learning	29.95	YES (0.000/0.268/middle)
Practical learning abroad	11.54	YES (0.000/0.205/weak)
Rotation	17.58	YES (0.000/0.244/weak)
Lectures	63.46	YES (0.011/0.133/weak)
Case studies	25.55	YES (0.000/0.210/weak)

Table 1: Using the methods by existence HR department in organization

Results from prior year (Urbancová, 2014) show that the use of video-conferences, internet and e-learning has been increasing. For instance, in 2013, video-conferences were used by 3.67% of organizations (n=109) but are currently employed by more than 6%. Key reasons for the increased interest in training without the face-to-face participation of lecturers and employees include: cost savings for travel to an external training facility, the chance to determine the tempo of instruction or use an individual approach, reduced costs for involving new employees in the work process (especially advantageous in fields with high turnover, frequently including IT companies – the creation of intranets and extranets) and the location of company outlets.

The research determine the statistical dependency between the existence of an HR department and the individual methods used by the organization. The correlation ranges between 0.133 and 0.268 (weak dependency). Only for a single training type did a correlation between the existence of an HR department and that training type obtain. This involved the use of the internet for education (p-value=0.355). Thus it can be stated that the internet is also used for education by small organization without any HR department. In the Czech Republic, HR departments are established in organizations with at least 30 to 40 employees. Further, correlations between the use of educational methods and the economy sector/field in which a particular company operates were determined. Respondents could mark more than one method. Table 2 indicates detailed results.

Based upon these results, the correlation between the use of individual methods and economic sectors was proven. Correlations were shown for five methods: Outdoor Training (strength 0.143), Coaching (0.133, weak), e-learning (0.168, weak) and lectures (0.221, weak). It may be stated that the tertiary sector, in which it is important to communicate and establish relationships with people, makes the greatest use of Outdoor Training activities. These abilities are also related to coaching and mentoring and, for this reason, these methods are also frequently used in the tertiary sector. The tests conducted revealed that in nine out of eleven cases, there was a correlation between the use of individual methods and organization size. Only in the cases of Outdoor Training and the Internet was there no correlation, probably because of the number of small organizations researched, which is in line with the facts above. The situation in the Slovak Republic is similar, Internet usage does not depend on size of organization (p-value is 0.223).

Methods	Dependency on economy sector (p-value/Cramer's/power)	Dependency on organization size (p-value/Cramer's/power)
Self-learning	NO (0.119/-)	YES (0.000/0.248/weak)
Outdoor training	YES (0.024/0.143/weak)	NO (0.169/-)
Coaching	YES (0.039/0.133/weak)	YES (0.003/0.180/weak)
Mentoring	NO (0.070/-)	YES (0.002/0.185/weak)
Internet	NO (0.174/-)	NO (0.737/-)
Videoconference	NO (0.143/-)	YES (0.000/0.223/weak)
E-learning	YES (0.006/0.168/weak)	YES (0.000/0.303/middle)
Practical learning abroad	NO (0.169/-)	YES (0.010/0.159/weak)
Rotation	NO (0.134/-)	YES (0.005/0.171/weak)
Lectures	YES (0.000/0.221/weak)	YES (0.000/0.209/weak)
Case studies	NO (0.375/-)	YES (0.000/0.167/weak)

Table 2: Using individual methods by economy sectors and size of organization

The results show that only 34.62% of organizations and in the Slovak Republic 41.2% organizations assess efficiency of training methods. Organizations use assesment of goals fulfillment in employees training plan (21.15%), assesment of feedback of employees after training (20.33%) and informal feedback from employees (19.23%) which corresponds with results Königová and Fejfar (2013). These methods are used mostly in the Slovakia. It can be summarized that 14.29% of organizations in the Czech Republic do not put any money to training, 64.29% of them invest 1-5% of the annual staff salary amount, 14.29% of organizations invest 6-10% of annual salary amount and 7.13% invest from 11-20%. None of observed organization put more than 20% of the annual salary amount. It can be also summarized that the investments stimulated dicrease of employees turnover and increased employees satisfaction, thus increasing a number of new customers.

In practice, frequently contradictory opinions or issues which originate with an educational process in a particular organization arise. These issues include high training costs and costs for implementing training in the work process, or that the need to participate in most assigned training may become a source of conflict among employees at work. Other issues arise when employees leave. When employees whose training was costly leave the organization, it loses two valuable things – a quality employee trained in many fields and the money invested in the employee in question. Training carried out in a non-qualified manner may result in de-motivation, confusion and loss of time for employees, as a result of which employee interest in similar training sessions in the future drops. Šerák (2009) considers the following to be the benefits of training in organizations: a positive impact on organizational politics, helping to maintain company strategies and designated objectives, motivating employees, contributing to the feeling of belonging to the organization, improving the image of the organization, increasing the organization's competitiveness in the marketplace and boosting effectiveness and improving the use of work time which corresponds with the result of Volná and Papula (2013). These conclusions are in accordance with Koubek (2009) who says that good, systematic organization of training is the most important element in effective employee training and it is the most important tool for improving organizational performance in the long term perspective. The need for education should be important for all industry and many of large organizations invest to it about 3-6% of their staff salary amount but he effectiveness, however, is often problematic.

Lee and Bruvold (2003) determined that company investment in education and employee development contributes to the employees' positive perception of the organization. It may be deduced from Schmidt (2007) that, in general, employees appreciate opportunities for development, education and training, and consider them an inseparable part of their work. Because they may be trained and developed, human resources are of supreme importance to organizations, testimony to which comes from a renowned statement by Tomáš Baťa: "Take my machines but let me keep my people. I'm going to build a new factory within a year. Take my people and let me keep the machines and I'll never recover from the loss."

Conclusion

Organizational management must acknowledge loyal employees can actively build a brand by themselves and contribute to the brand's development, which will help the entire organization. The impact of the human factor on a company may be characterized as strong. It creates and dynamically forms the company as a whole as well as its individual organizations. Employee knowledge may be formed by training and may be utilized for the needs of the organization in question, for building its brand and reinforcing its position in the marketplace. The results show that the utilization of online training methods has increased moderately versus 2013. Organizations have increased their support for the use of video-conferences and e-learning applications, which go hand in hand with technology development. According to research in 2014 and 2015 (n=286) organizations use video-conferences in 12.23% and more employees give a tip on training courses themselves (36.3%) and the organization systematically plan these activities (26.6%). The results show that only 34.62% organizations and in the Slovak Republic 41.2% organizations assess the efficiency of training methods. The research confirmed that a statistical dependency exists between the use of training methods in organizations and the existence of an HR department, organization size and business sector. Because especially small organizations have limited funding for training and developing their employees, future research might focus on determining the funding level at which organizations annually invest in employee training, and compare these findings with the results obtained by Urban (2012). The theoretical and practical contributions of this paper consist in the presentation of the research into training and employee development in selected Czech organizations, comparing the opinions of the study's authors on HR management of employee training and development, and discussion of the results obtained.

Acknowledgements

This contribution is a follow-up to the project of University – wide internal grant agency (CIGA), number 20141002 - Human resource branding using of the new strategic trends in organizations in the Czech Republic.

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THE INFLUENCE OF DEMOGRAPHIC DECLINE ON THE ECONOMIC POLICY COURSE PARTICIPATION AND THE STUDY RESULTS

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Abstract

Most faculties of economics in the Czech Republic are currently facing a loss of students, which is caused by decline in the quantity of live births at the turn of the 80s and 90s of the 20th century. The Faculty of Economics of the VSB-Technical University of Ostrava is no exception. The aim of the paper is to determine whether the demographic decline of students has a significant impact on the availability of the Economic Policy of Selected Countries (EPSC) course. The second aim of the paper is the evaluation of students´ results since the year 2008. The authors are also trying to suggest possible solutions how to stop the decline in the number of students of the course by increasing its attractiveness and accessibility.

Keywords

Attractiveness, correlation, demographic decline, economic policy, global changes

Introduction

Demographic trends are long-term under study of various researchers due to many, sometimes contradictory, changes in the global economy. In one part of the world, demographic changes are reflected by population ageing, in other parts by rapid population growth and by many other trends which influence many aspects of national and global economy. Many developed countries, and the Czech Republic as well, struggles with population ageing as fertility rates decrease and people live longer. According to the UN projections, the 18-24 age group, which usually represents the major of university students will fall on average by 9% by 2025 in OECD countries. In the case of the Czech Republic, the fall is expected in amount of more than 15% by 2025 (OECD, 2008). Certain studies suggest increasing rates of access to higher education or changing the length of studies (Anderson and Cook, 2008). There are also thoughts to reduce or cancel education fees, but some studies show that it has no effect on education rate (Marks and McMillan, 2007). Ageing population in OECD countries will also effect strongly the public expenditures (Grob and Wolter, 2007; Harris, Evans and Schwab, 2001). A higher level of education has impact on the productivity, innovations and competitiveness. The European Union suggests in its long-term strategy to target at least 40% of 30-34 years old people with tertiary or equivalent education (European Commission, 2010). For example, the European Commission identified the main challenges for every EU member state. The Czech Republic should especially broaden access to higher education (European Commission, 2013). On the other hand the decrease of students can positively influence the teacher-student ratio that can positively improve the quality of teaching and otherwise. In both cases it is important to adapt the education system to new challenges (Willekens, 2008). On the other hand, many studies shows that people with higher education usually have lower fertility rate. Then the demographic changes cause educational changes and vice-versa.

The authors of this paper know that they cannot change the demographic trends, but it is also necessary to increase the number of students visiting EPSC courses or at least to stop the declining. Therefore, we want to increase the attractiveness of this course by its innovation, accessibility for other students and use modern teaching methods. The innovation of the EPSC course must react to global changes mentioned above. The main attention will be paid to developed countries (EU, USA of Japan) but it will be extended by countries under dynamic growth such as BRIC (Brazil, Russia, India and China) too. The main attention will concentrate on present economic policy of the countries, their future challenges and sources of their economic growth. The important point is the innovation of discussion among students about strong and weak sides of each economy, their reforms and position of the EU countries in the global economy. There is a plan to extend the accessibility of the EPSC course to higher amount of students not only at the Faculty of Economics but also in Uherské Hradiště. We would like to raise the attractiveness of the EPSC course by creating a new syllabus of the course, publish a new book about the economic policy of selected countries and actualise interactive internet network and the system of evaluation and exams. As a part of that, there will be also changes during teaching exercises. The exercises will become more interactive. The main study part, literature and papers, will be based on students homework. The exercises will contain topic discussion from lectures, modern approaches of analysing assumptions of each country and its government policy, brainstorming methods to diagnose a problem and propose the solutions, groups' cooperation, the concept mapping of historical economic development of the country, etc.

Materials and Methods

The paper deals with the influence of the demographic decline on the economic policy course participation and results. Therefore, the paper uses the demographic dataset from the Czech Statistical Office (CSO), data from the Czech Education, Youth and Sports and the Annual reports of the Faculty of Economics (EkF), VSB-Technical University of Ostrava and data from the interuniversity data system EDISON. The time period of data contains 1985-1994 from the CSO for annually number of live births and academic years 2008/2009-2013/2014 from the Annual reports of the Faculty of Economics and interuniversity data system EDISON.

The sample for evaluation of students performing in the *Economic Policy of the Selected Countries* course was taken from the academic year 2008/2009, when the course began to be taught, until the academic year 2013/2014, as a latest available data. The dataset was consisted of 368 students who chose the EPSC course. There were 81 male and 287 female students, 347 of them from the Department of European Integration and 21 students from the Department of National Economy. The analysis uses evaluation of male and female students separately, monitors the number of terms needed for the exam, the final grade that could be Excellent, Very Good or Good and also the number of unsuccessful students. The Paerson correlation coefficient is the most often used technique for calculation correlation. It can take a range of values from +1 to -1. The closer is the value of correlation coefficient to -1, the stronger is inverse proportional dependency between variables. The closer is value to +1, the stronger is proportional dependency between variables. Values of Paerson correlation coefficient close to 0 mean "no mutual relationship" between variables. The correlation coefficient can be expressed as follows:

$$r_{xy} = \frac{\sum_{i=1}^{n}(x_i - \bar{x}) * (y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2 * \sum_{i=1}^{n}(y_i - \bar{y})^2}} \quad (1)$$

where x_i, y_i means the value of the variables in a given year under study, and $\bar{x}, \bar{y}$ expresses the mean value of the variables *x* and *y* for the entire period. The four correlation relation was carried on. The first is the mutual relation between variables of "Number of students who visited the course" and "The number of students to whom the course has been offered". The more students in each department, the more students attend the course, especially if the course is mandatory for them. Number of students, which is dependent on the demographics, then affects the amount of students in the EPSC course. The assumption spoken in the previous sentence was tested by the second correlation. That connects "The number of live births in the years 1987-1992 (3rd year)" and "The number of students who visited the course". The third correlation aggregates the previous level and measures the mutual relation between "The number of live births in the years 1985-1994" and "The number of EkF students". Normal period of study at the Faculty of Economics is 5 years. Therefore, for this correlation was used EkF total number of students in each academic year, and five-years totals of live births in the years 1985-1994, which have an impact on the number of students in the Faculty of Economics from 2008 to 2014. The last correlation should improve, if there exists the correlation between "The number of students who visited the course" and "The number of "excellent" students", that means students who passed this course with the best mark. Many studies show that the lower the number of students on the course, the better the results (Schanzenbach, 2014).

Results and Discussion

Most universities in the Czech Republic are currently facing a loss of students, which is caused by decline in the quantity of live births at the turn of the 80s and 90s of the 20th century. The Faculty of Economics of the VSB-Technical University of Ostrava is no exception. The figure 1 shows the number of students of the Faculty of Economics in the academic years 2008/2009-2013/2014 and number of live births in the years 1985-1994. As can be seen, five-year moving totals number of live births was declining already since mid-80s, when there were born 661 181 children. The last five-year totals were affecting the number of students of the Faculty of Economics last academic year. Since 1990-1994 there were born only 609 227 children. It is a decline by 8%. The Faculty of Economics faces serious decline in the number of students since the academic year 2010/2011, when it was attended by 6 735 students. Although until that academic year the number of students increased significantly, since then, the drop of number of students greatly copies the decline of live births at the turn of the 80s and 90s of the last century. The growing number of students until the 2010/2011 academic year was primarily due to administrative measures of the Faculty and changes in the Higher Education Act.

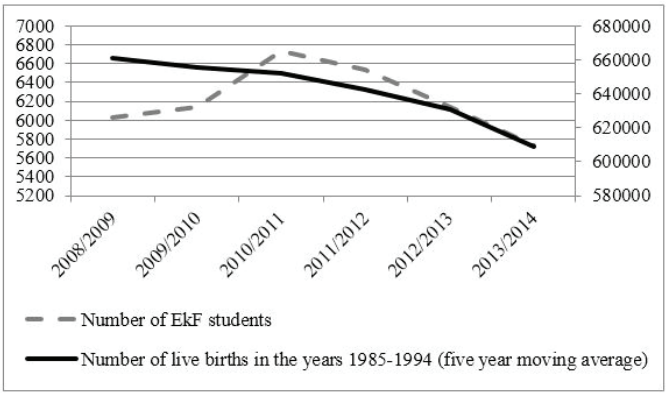

Fig. 1: Accordance of number of students of the Faculty of Economics VSB-TU Ostrava and number of live births in the years 1985 and 1994 (Source: Faculty of Economics, VŠB-Technical University of Ostrava, 2015; ČSÚ, 2015; own elaboration, 2015)

On the other side, other economic studies are struggling with the loss of students as well as the whole high education in the Czech Republic. As there can be seen on the figure 2, the number of students of Economic Sciences declined from the number of 90 271 in the academic year 2008/2009 to 85 352 students in 2013/2014 while the top was in the year 2010/2011. Since the academic year 2010/2011, the total number of students at the Czech universities also declines. While there were 403 561 students in that academic year, there were 30 000 students less in 2013/2014. Both decreases copy the decline of number of live births more than 20 years ago.

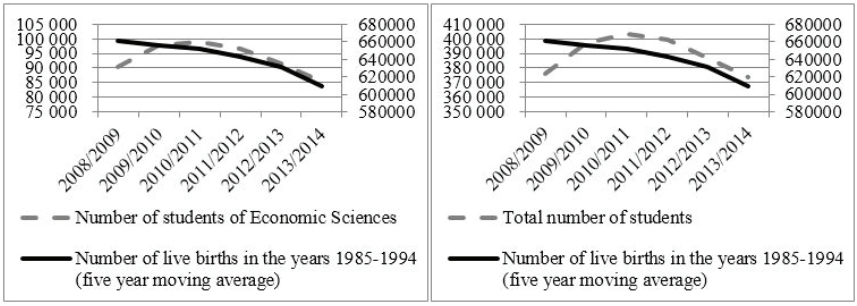

Fig. 2: Accordance of number of Economic Sciences and total number of students in comparison to the number of live births in the years 1985 and 1994 (Source: Ministry of Education, Youth and Sports (2015).; ČSÚ, 2015; own elaboration, 2015)

The following tables picture the results of bachelor students visiting EPSC courses during the period of 2008-2014. The tables are selected as follows: the results of students by gender that had EPSC course as obligatory finished by exam; the final results of students to see trend of results; and the results of students by gender that had EPSC course as optional. More than 75% of students were women every year in average. Women reached the highest rate in academic year 2011/2012 (82.7%), while men reached that in 2013/2014 (31.6%). In the first half period, women were more successful to finish the exam on the first term, but in the second half of selected period, men were. The average ratio by gender

is very similar. The same can be applied to the second term of the exam. On the other hand, no men needed any third term for exam of EPSC course, but the number of women who needed the third term to pass the exam rapidly increased in the last three years. In the academic year 2013/2014 it was already 23.1% of women who studied the EPSC course during that year. Women were more successful to reach excellent results in the exam. But between the years 2011-2013 no men neither women reached excellent results. In the last academic year, the number of women with excellent results was twice higher than the number of men. This year, the results of students were much better than in all previous years. A higher ratio of men reached the second best mark from the EPSC course (almost 61% on average). But a higher ratio of women reached the good result on average. Also on average, a higher ratio of men was unsuccessful at finishing this course. During the selected period, the ratio of men and women in the results of EPSC course was changing very often as well as differences of results between men and women.

	2008/ 2009	2009/ 2010	2010/ 2011	2011/ 2012	2012/ 2013	2013/ 2014	Average
Men (%)	21.8	18.3	25.9	17.3	19.4	31.6	22.4
Women (%)	78.2	81.7	74.1	82.7	80.6	68.4	77.6
Term 1 - Men (%)	66.7	53.8	85.7	85.7	100.0	66.7	76.4
Term 1 - Women (%)	81.4	77.6	97.5	74.6	79.6	61.5	78.7
Term 2 - Men (%)	8.3	23.1	7.1	7.1	0.0	16.7	10.4
Term 2 - Women (%)	7.0	10.3	0.0	14.9	13.0	15.4	10.1
Term 3 - Men (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Term 3 - Women (%)	0.0	0.0	0.0	1.5	1.9	23.1	4.4
Excellent - Men (%)	0.0	15.4	0.0	0.0	0.0	16.7	5.3
Excellent - Women (%)	11.6	1.7	0.0	0.0	0.0	30.8	7.4
Very good - Men (%)	66.7	53.8	28.6	71.4	76.9	66.7	60.7
Very good - Women (%)	41.9	67.2	45.0	77.6	59.3	61.5	58.8
Good - Men (%)	8.3	7.7	64.3	21.4	23.1	0.0	20.8
Good - Women (%)	34.9	19.0	52.5	13.4	35.2	7.7	27.1
Unsuccessful Men (%)	25.0	23.1	7.1	7.1	0.0	16.7	13.2
Unsuccessful Women (%)	11.6	12.1	2.5	9.0	5.6	0.0	6.8

Tab. 1: Final results of students by gender (Source: Faculty of Economics, VŠB-Technical University of Ostrava, 2015; own elaboration, 2015)

The following table 2 shows the final trend of students´ results. Since the academic year 2011/2012, the total number of EPSC students has decreased. In 2013/2014 felt under 30% of students in previous academic year (only 19 students). There was recorded no continual trend in the number of terms needed to finish EPSC exam. But in the last year, many more students needed second or third term to finish the exam, resp. more than 15% of students needed to repeat the exam once, the same amount of students twice. It was probably caused by tightening the conditions for completing the course in the form of combined tests. In the last year, there was a high increase of students who finished the EPSC course with the final mark “excellent”, while the share of students did not reach even 10% in the previous three years. There was also increase of the share of students who finished with the mark “very good” and decrease of students with the mark “good” and students who did not succeed.

	2008/ 2009	2009/ 2010	2010/ 2011	2011/ 2012	2012/ 2013	2013/ 2014	Average
Number of students	55	71	54	81	67	19	57.8
Term 1 (%)	78.2	73.2	94.4	76.5	83.6	63.2	78.2
Term 2 (%)	7.3	12.7	1.9	13.6	10.4	15.8	10.3
Term 3 (%)	0.0	0.0	0.0	1.2	1.5	15.8	3.1
Excellent (%)	9.1	4.2	0.0	0.0	0.0	26.3	6.6
Very good (%)	47.3	64.8	40.7	76.5	62.7	63.2	59.2
Good (%)	29.1	16.9	55.6	14.8	32.8	5.3	25.7
Unsuccessful (%)	14.5	14.1	3.7	8.6	4.5	5.2	8.5

Tab. 2: Final results of students finished by exam (Source: Faculty of Economics, VŠB-Technical University of Ostrava, 2015; own elaboration, 2015)

Although the number of students who finish the EPSC course by credits rapidly decreased, the share of women on the course increased from half to 75% in the followed years. No students needed more than one term to finish the course successfully. There were also no students who did not succeed.

	2011/ 2012	2012/ 2013	2013/ 2014	Average
Number of students	13	4	4	7
Men (%)	53.8	25.0	25.0	34.6
Women (%)	46.2	75.0	75.0	65.4
Term 1 - Men (%)	100.0	100.0	100.0	100.0
Term 1 - Women (%)	100.0	100.0	100.0	100.0
Term 2 - Men (%)	0.0	0.0	0.0	0.0
Term 2 - Women (%)	0.0	0.0	0.0	0.0
Successful (%)	100.0	100.0	100.0	100.0

Tab. 3: Final results of students finished by credit (Source: Faculty of Economics, VŠB-Technical University of Ostrava, 2015; own elaboration, 2015)

The table 4 shows the results of correlation between selected variables. The first mutual linear relation between "Number of students who visited the course" and "Number of students to whom the course has been offered" is very strong at the one percent level of significance. The coefficient of correlation reached very high value that shows strong proportional dependency between the numbers of students in all departments who have the possibility to take EPSC course and the real number of students visited this course during the selected period. This result is supported by the second research of variables. Correlation between "Numbers of live births in the years 1987-1992 (3rd year)" and "Number of students who visited the course" is also very strong at the ten percent level of significance. It clearly shows that the number of students attending the chosen course is heavily dependent on demographic trends in the past. The value of correlation coefficient shows strong inverse correlation between "Number of students who visited the course" and "Number of "excellent" students". Unfortunately, this result is not significant. In this case it is not true that courses with lower number of students would have better academic results. Other three correlations deal with number of students and number of live births in the years 1985-1994 (measured by five-year moving average). The fourth correlation shows insignificant results in mutual proportional dependency between "Number of live

births in the years 1985-1994" and "Number of EkF students". The reason is the growing number of students in the early selected year which was not caused by demographic trend, but administrative changes of EkF. But after the removal of the academic years 2008/2009 and 2009/2010, the value of Pearson´s correlation coefficient reached 0.993 at the one percent level of significance. All these results that both number of students in the EPSC course and the number of students at the EkF is strongly dependent on the number of children born at the turn of the 80s and 90s of the last century. The same results can be applied for proportional dependency between "Number of students of Economic Science" and "Total number of students" in comparison with "The number of live births in the years 1985-1994". There are insignificant values in both cases, but after the removal of the academic years 2008/2009 and 2009/2010, the value of Pearson´s correlation coefficient reached 0.997 at the one percent level of significance and in the second case it is 0.993 at the one percent level of significance.

	The number of live births in the years 1985-1994	Number of students who visited the course
The number of students who the course have been offered		0,979***
The number of live births in the years 1987-1992 (3rd year)		0,797*
Number of „excellent" students		-0,659
Number of EkF students	0,498	
Number of students of Economic Science	0.674	
Total number of students	0.429	

Tab. 4: Results of correlation between variables (Source: own calculation and elaboration, 2015)

Conclusion

As it was shown in the paper, the demographic changes have very different impacts not only on higher education. The aim of the paper was to determine whether the decline of students that is connected with demographic changes in society has a significant impact on the availability of the Economic Policy of Selected Countries course. The second aim is the evaluation of students´ results since the course exists. There was declared that the EPSC course struggles with a decreasing number of students as well as whole Faculty of Economic due to demographic decline caused by lower fertility rate at the turn of the 80s and 90s of the 20th century. But the most important is that all economic studies, as well as the Czech high education system, face the problem with demographic decline. The evaluation of students showed that 75% of the EPSC students were women, but the results of study reached no significant differences between men and women. The results of study also showed that while men´s results were worse at the beginning of selected period, the study results of women have worsened since 2010. Women also needed more terms than men to pass the final exam of the EPSC course. On the other hand, the number of unsuccessful men was on average twice as higher as the number of unsuccessful women. Generally during the selected period, there was a decrease in number of students but improvement of marks or decrease in number of attempts to perform exam was not. In spite of that we cannot change past demographic evolution, we have to find another ways to increase the number of students. Therefore we are going to innovate the structure of the EPSC lectures and exercises, to introduce new methods of education, new learning materials and new interactive approaches to raise the attractiveness of our course and thus

increase students´ interests in the EPSC course. As Staníčková (2013) applied, the method of Data Envelopment Analysis (DEA) will be used to evaluate the efficiency of innovation within EPSC course and its results. By using DEA method will be possible to evaluate obtained level of efficiency of non-innovated and innovated EPSC course and efficiency in students' results within EPSC course and to find out strengths and weaknesses of course and students.

Acknowledgements

This paper was created under FRVŠ project No. 32/2015 "Hospodářská politika vybraných zemí" at the Faculty of Economics, VSB-Technical University of Ostrava and Operational Programme Education for Competitiveness [Project CZ.1.07/2.3.00/20.0296].

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WHEN THE MINISTRY CLOSES A PUBLIC HEI: EXPECTED IMPACTS ON ECONOMY

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Abstract

The aim of the paper is to present the input output analysis as a useful tool for assessment of the macro-economic impacts of closedown of one hypothetical higher education institution. Although there are several papers focused on relations between regional indicators of higher education and the economic situation of the regions, results of assessment of expenses reduction using input output analysis has not been published yet. In this paper, the 5-year process of closing down of a public HEI is assumed and impacts of the first year of this process are empirically estimated in terms of impacts on gross output, gross value added and number of employees. In further research, using forthcoming regional input output tables could significantly improve the results and the estimates should be computed for individual region, also taking into account possible substitution effects.

Keywords

Gross value added, higher education institution, employment, input-output model

Introduction

Many recently published papers are focused on the issue of the number of higher education institutions (HEIs) in the Czech Republic (Fischer and Finardi, 2010), possibilities of the comparison of the quality and performance of HEIs using composite indicators (Hudrlíková, 2013) and by DEA models (Jablonský, 2011) or on growing number of students at HEIs and its demographic impact (Mazouch, 2013). In several strategic documents of the Ministry of Education, Youth and Sports of the Czech Republic (MEYS) there are stated some objectives related to number of HEIs, such as "Achieving an optimal number and structure of higher education institutions" (MEYS, 2010: 14). On the other hand, potential concentration of HEIs to the so-called centres of excellence might be in contrary to the regional policy. Indeed, according to Mazouch and Fischer (2011), share of the number of residents with the highest attained level of education equal to higher education strongly influences the regional value added and labour productivity of the region, despite the differences are lower considering the different regional price levels (Čadil et al, 2014).

Furthermore, regional input-output tables (RIOT), which can help to improve the regional economic analyses (Miller and Blair, 2009), are nowadays at the beginning of their experimental compilation for the Czech regions (Sixta et al, 2014). Computations of RIOT are at many cases made by statistical institutes or agencies (e. g. U. S. Bureau of Economic Analysis (BEA), Statistics Finland or Statistics New Zealand) and not by researchers from academia. In case of BEA, the multipliers derived from RIOT are not available for free.

When several papers are aimed at the impact of higher education on the country or

regional economics using some regression models, probably no paper is focused on the macro-economic impact of individual HEI's *closedown* using input-output modeling. However, Blackwell, Cobb and Weinberg (2002) describe some potential of using RIOT for modelling the impact of HEIs' operation on the economy. But their approach needs very detailed set of the input data (data on students, budget flows of the university and off-campus expenditures of students, parents, relatives and alumni) including some conditional data (what the students would do if they not come to the HEI) needed for estimating the incremental effects.
The aim of this paper is to introduce the input output model as a tool for this evaluation and to present some empirical estimates achieved by this model.

Materials and Methods

The symmetric input-output model represents an important analytical tool which offers many opportunities to model the impact of various economic scenarios (Zbranek and Sixta, 2013). It does not represent the core of national accounts. However, it is an extension for analytical use (Hronová et al, 2009). The input-output model could be compiled for products or industries separately. It depends on what the user wants to detect – the changes among products or among individual industries. For the purpose of the paper we use the product by product table.
The falloff in the activity of a public HEI is not a one year process. It takes approximately 5 years of gradual falloff till the last graduates finish their studies and the HEI is closed. Thus the Ministry of Education, Youth and Sports will start decreasing the amount of money transferred to the HEI. Using the information about the decreased amount, one can investigate the impact of the resource reduction to the indicators of economy, e.g. production, gross value added, compensation of employees. Moreover, the model informs about the impact into the commodity structure of the indicators mentioned. Furthermore, one can estimate not only the primary impact on the indicators but also the cons
equent impact on the decreasing final consumption expenditures.
For the modelling of the partial impact in the individual years we use the established Leontief inversion

$$\Delta\mathbf{x} = (\mathbf{I} - \mathbf{A_D})^{-1}\Delta\mathbf{y}, \qquad (1)$$

where $\Delta\mathbf{x}$ … vector of the production change,
$\mathbf{I}$ … identity matrix,
$\mathbf{A_D}$ matrix of technical coefficients which is derive from the matrix of the usage of domestic products under the intermediate consumption,
$\Delta\mathbf{y}$ vector of partial change of final consumption.
The model employs symmetric input-output tables of the year 2010 since this year is the most current one. The table is compiled according to the standard ESA 2010 methodology which was employed by the Czech Statistical Office during the year 2014 (EU, 2013). As an example of the HEI we chose the typical rather important HEI with an annual budget of one thousand million Czech crowns. The closing of the HEI will take 5 years and we assume a linear decrease of the budget send by the Ministry and a full substitution of ownership of the dormitories and the student's canteen. The last assumption reflects the location of the HEI. The hypothetical HEI is situated in Prague and there is no chance that the buildings will be left unused by another HEI. We cannot assume the same from the regional point of view as regional HEIs are located in smaller cities without an opportunity of the facilities being taken over (except Brno).

Results and Discussion

We assume a decrease in the budget received from the Ministry. As the annual budget of one typical rather big HEI reached 1 thousand million the first year of closing the HEI will receive 800 million, the second year 600 million, the third year 400 million, the fourth year 200 million and the last year of closedown 100 million as several academic and administrative staff will still be working there.

As the example of the calculation we chose the first year of closedown. Tables 1 to 3 show all steps how to estimate the influence of closedown to the economy. Table 1 shows the primary impact on the economy. One can see that the first year of closedown causes the decrease of output by 257 mil CZK. The main decrease of intermediate consumption is achieved in services where the industry Education belongs. The decrease in employment represents 325 persons in full time equivalent. The consequent impact on the decreasing final consumption expenditures (Table 2) causes the decrease of gross value added by 58 mil CZK (mainly in services and manufactured products) and decrease of output by 140 mil CZK. The decrease of employment reaches 88 persons in full time equivalent. Table 3 represents the total impact of closedown of HEI on the economy. It summarizes the primary impact (Table 1) and the consequent impact on the decreasing final consumption expenditures (Table 2). In the first year of closedown of the hypothetical HEI the decrease of output gets to 397 mil CZK and the employment of the economy decreases by 413 persons in full time equivalent.

As this paper is probably a pioneering one within this type of analysis, it is not possible to compare our empirical results to the current state-of-the-arts. On the other hand, it is suitable to discuss some critical points of our analysis. In particular, it is important in which region the HEI that is potentially being closed lies. Firstly, the impact of the economy of different regions will be different. However, for the deeper analysis the RIOT are necessary. It can be assumed that the RIOT will be at a disposal at the end of 2015 and then our computations could be both improved and particularized for individual regions. Secondly, selection of the region influences possible substitution effect – students and teacher can move from closed HEI to another one within e. g. Prague or Brno but cannot within Usti nad Labem or Jihlava, for example.

Furthermore, available RIOT are necessary, but not sufficient. The possible level of simplification of the estimates should be discussed, because above mentioned detailed data sets theoretically required by Blackwell, Cobb and Weinberg (2002) will not be at a disposal in the next years for any Czech university.

CPA		A	B	C	D	E	F	G-S	TOTAL	Final Consumption Expenditures			Gross fixed capital formation incl. valuables	Changes in inventories	Export	Final use total	Used resources total	CPA
										Households	Governments	NPISH						
									P.2	P.3			P.51+P.53	P.52	P.6			
A	Products of agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	A
B	Mining and quarrying	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	-1	B
C	Manufactured products	0	0	-1	0	0	0	-3	-5	0	0	0	0	0	0	0	-5	C
D	Electricity, gas, steam	0	0	0	-2	0	0	-6	-8	0	0	0	0	0	0	0	-8	D
E	Water supply; sewerage	0	0	0	0	0	0	-1	-1	0	0	0	0	0	0	0	-1	E
F	Constructions	0	0	0	0	0	-1	-3	-5	0	0	0	0	0	0	0	-5	F
G-S	Services	0	0	-1	-1	0	-1	-36	-38	0	-200	0	0	0	0	0	-238	G-S
P.2	Intermediate consumption (basic prices)	0	0	-2	-3	0	-2	-49	-57	0	-200	0	0	0	0	-200	-257	
D.21-D.31	Net taxes on products	0	0	-1	-2	0	-1	-10	-14	0	0	0	0	0	0	0	-14	TOTAL
	Intermediate consumption from import	0	0	0	0	0	0	-4	-4	0	0	0	0	0	0	0	-4	
P.2	Intermediate consumption (purchasers' prices)	0	0	-4	-5	-1	-3	-63	-75	0	-200	0	0	0	0	-200	-275	
D.11	Wages and salaries	0	0	-1	0	0	-1	-94	-95									
D.12	Employers social contributions	0	0	0	0	0	0	-31	-31									
D.29	Other taxes on production	0	0	0	0	0	0	0	0									
D.39	Other subsidies of production	0	0	0	0	0	0	0	1									
P.51c	Consumption of fixed capital	0	0	0	-1	0	0	-41	-43									
B.2n	Operating surplus, net	0	0	0	-2	0	0	-5	-7									
B.3n	Mixed income, net	0	0	0	0	0	-1	-4	-5									
B.1g	Gross value added	0	0	-1	-3	0	-2	-175	-182									
P.1	Output (basic prices)	0	-1	-5	-8	-1	-5	-238	-257									
P.7	Import	0	0	0	0	0	0	0	0									
	Employment (FTE)	0	0	-3	-1	-1	-4	-317	-325									

Tab. 1: Primary impact, millions CZK, current prices

CPA										TOTAL	Final Consumption Expenditures			Gross fixed capital formation incl. valuables	Changes in inventories	Export	Final use total	Used resources total	CPA
		A	B	C	D	E	F	G-S			Households	Governments	NPISH						
										P.2	P.3			P.51+P.53	P.52	P.6			
A	Products of agriculture	0	0	-4	0	0	0	-1		-5	-2	0	0	0	0	0	0	-2	-7	A
B	Mining and quarrying	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	B
C	Manufactured products	-1	0	-10	0	0	0	-4		-15	-46	0	0	0	0	0	0	-46	-61	C
D	Electricity, gas, steam	0	0	-1	-1	0	0	-1		-3	0	0	0	0	0	0	0	0	-3	D
E	Water supply; sewerage	0	0	0	0	0	0	0		-1	0	0	0	0	0	0	0	0	-1	E
F	Constructions	0	0	0	0	0	-1	-1		-2	0	0	0	0	0	0	0	0	-2	F
G-S	Services	-1	0	-9	0	0	0	-22		-32	-34	0	0	0	0	0	0	-34	-66	G-S
P.2	Intermediate consumption (basic prices)	-3	0	-24	-1	0	-1	-28		-58	-82	0	0	0	0	0	0	-82	-140		
D.21-D.31	Net taxes on products	-1	0	-17	-1	0	0	-7		-27	0	0	0	0	0	0	0	0	-27	TOTAL	
	Intermediate consumption from import	0	0	-1	0	0	0	-1		-2	0	0	0	0	0	0	0	0	-2		
P.2	Intermediate consumption (purchasers' prices)	-5	0	-42	-2	0	-1	-36		-87	-82	0	0	0	0	0	0	-82	-169		
D.11	Wages and salaries	-1	0	-6	0	0	0	-9		-17											
D.12	Employers social contributions	0	0	-2	0	0	0	-3		-5											
D.29	Other taxes on production	0	0	0	0	0	0	0		0											
D.39	Other subsidies of production	1	0	0	0	0	0	0		2											
P.51c	Consumption of fixed capital	-1	0	-4	0	0	0	-7		-12											
B.2n	Operating surplus, net	0	0	-5	-1	0	0	-6		-12											
B.3n	Mixed income, net	-1	0	-2	0	0	0	-6		-10											
B.1g	Gross value added	-2	0	-19	-1	0	-1	-30		-53											
P.1	Output (basic prices)	-7	0	-61	-3	-1	-2	-66		-140											
P.7	Import	0	0	0	0	0	0	0		0											
	Employment (FTE)	-7	0	-32	0	0	-1	-46		-88											

Tab. 2: Consequent impact on the decreasing final consumption expenditures, millions CZK, current prices

CPA			A	B	C	D	E	F	G-S	TOTAL	Final Consumption Expenditures			Gross fixed capital formation incl. valuables	Changes in inventories	Export	Final use total	Used resources total	CPA
											P.2	P.3			P.52	P.6			
												Households	Governments	NPISH	P.51+P.53				
A	Products of agriculture		0	0	-4	0	0	0	-1	-5	-2	0	0	0	0	0	-2	-7	A
B	Mining and quarrying		0	0	0	-1	0	0	0	-1	0	0	0	0	0	0	0	-1	B
C	Manufactured products		-1	0	-11	0	0	-1	-7	-20	-46	0	0	0	0	0	-46	-66	C
D	Electricity, gas, steam		0	0	-1	-2	0	0	-7	-11	0	0	0	0	0	0	0	-11	D
E	Water supply; sewerage		0	0	0	0	0	0	-1	-1	0	0	0	0	0	0	0	-1	E
F	Constructions		0	0	0	0	0	-2	-4	-7	0	0	0	0	0	0	0	-7	F
G-S	Services		-1	0	-9	-1	0	-1	-58	-70	-34	-200	0	0	0	0	-234	-304	G-S
P.2	Intermediate consumption (basic prices)		-4	0	-26	-4	-1	-3	-77	-115	-82	-200	0	0	0	0	-282	-397	
D.21-D.31	Net taxes on products		-1	0	-19	-3	0	-1	-17	-41	0	0	0	0	0	0	0	-41	TOTAL
	Intermediate consumption from import		0	0	-1	0	0	0	-5	-6	0	0	0	0	0	0	0	-6	
P.2	Intermediate consumption (purchasers' prices)		-5	0	-46	-7	-1	-4	-99	-162	-82	-200	0	0	0	0	-282	-444	
D.11	Wages and salaries		-1	0	-7	0	0	-1	-102	-112									
D.12	Employers social contributions		0	0	-2	0	0	0	-33	-36									
D.29	Other taxes on production		0	0	0	0	0	0	0	-1									
D.39	Other subsidies of production		1	0	0	0	0	0	1	2									
P.51c	Consumption of fixed capital		-1	0	-4	-1	0	0	-48	-55									
B.2n	Operating surplus, net		0	0	-5	-2	0	0	-11	-19									
B.3n	Mixed income, net		-1	0	-3	0	0	-1	-10	-15									
B.1g	Gross value added		-2	-1	-20	-4	-1	-3	-205	-235									
P.1	Output (basic prices)		-7	-1	-66	-11	-1	-7	-304	-397									
P.7	Import		0	0	0	0	0	0	0	0									
	Employment (FTE)		-7	0	-34	-1	-1	-6	-363	-413									

Tab. 3: Total impact on the economy, millions CZK, current prices

Conclusion

In this pioneering paper the possibilities of using input output analysis for assessment of impacts of potential closing of selected Prague higher education institution on the whole economy are presented. From preliminary results it can be seen that reduction in government expenses of 200 million CZK will lead to the decrease in output of the

economy of 397 million CZK, gross value added of the economy of 235 million CZK and number of employees of 413 full time equivalents. In further research, using the forthcoming regional input output tables, the preliminary estimates will be improved and particularized for individual regions of the Czech Republic. Also, substitution effects will be considered at the regional level.

Acknowledgements

This paper is prepared under the support of the project "Regional estimates of gross domestic product based on the expenditure approach" of the Czech Science Foundation, project No 13-15771S. This paper was processed with contribution of long term institutional support of research activities by Faculty of Informatics and Statistics, University of Economics, Prague.

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RESPONSIBILITY OF CZECH EMPLOYEES AND ORGANISATIONS IN RELATION TO DEVELOPMENT

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Abstract

Education, development, knowledge management, career development and talent management and its efficiency are currently often discussed themes regarding strategic management of organisations. Those concepts are strategically important. Therefore the aim of the article is to evaluate possibilities of employee education and development and identify main approaches to employee development in Czech organizations. Research outcomes identified types of employee development programmes and attitudes of organisational learning. Results describe the main types of employee behaviour during development. Based on presented results, 69.52% of respondents have an opportunity of being developed or are internally motivated for development. We may also describe possibilities of employee development in Czech organisations as following three approaches (based on results of factor analysis): Knowledge employee management, Talent employee management and Developing employee management. Employees are both self-motivated and self-managed or supported by their home organisation.

Keywords

Development, education, learning, organisations, concepts

Introduction

For an organization it is important to acquire and retain talented employees who can become and key competitive advantage. Talent may be defined as and natural ability to do something well, and Hroník (2006) staes that at present the criteria for talent are respect, productivity, and perspective – not age, as was thought previously. Each organization may have its own criteria when selecting talent according to which talent is sought and identified (Morongová, Urbancová, 2014). Talent management may be considered the proper tool for applying and retaining talented employees, one which consists of three activities, the recruitment, development, and retention of these workers, and yet it is necessary that they are motivated to work, that they consider their work stimulating and interesting, that they may have and feeling of personal success and, last but not least, that they may find in it an opportunity for personal development.

This article aims to evaluate possibilities of employee education and development and identify main approaches to employee development in Czech organizations.

The paper is composed of five sections. The first is Introduction, the second one is Theoretical Background, this followed by a presentation of the methodological approach. Subsequently, an analysis and discussion section comes before the recommendations. Finally, authors conclude the paper and summarize the contributions and limitations of the article.

Theoretical Background

Employee education, learning, and development, according to Bedrnová and Nový (2012), occupy significant and essential place in the personnel management of each organization. Its objective is to employ technically skilled employees at all levels who take initiative and are flexible with regard to managing the demands of and given position.

Kociánová (2010), Vodák and Kucharčíková, (2011) present the opinion that organizations are nowadays exposed to a range of external influences and situations that result in the necessity to adapt the capabilities of workers to changing conditions in their positions. Of course, Robbins et al. (2003) demonstrate that many employers nonetheless oppose educational and developmental activities as they assume that either academic institutions or the employees themselves should be responsible for technical/professional preparation. From the results of the study by Vnoučková (2014) it can be determined that within the Czech Republic in general, organizations support employee education and development, but the initiative should not be missed on the part of the employee. This issue is further specified by Constantine (2012), who states that while long-term development remains the responsibility of the given employee, the organization is fully responsible for professional development. According to this author employees may be accepted with a certain set of skills, knowledge, and capabilities, but at the moment the role and responsibilities of the given position change, the company has a social responsibility to invest into its human capital. Tureckiová (2004, p. 89) considers company education the main tool applied in employee development. They define this as improvement, expansion, deepening and change to the structure and content of the professional competency of the employee, which contributes to the aforementioned increased productivity of individuals and the company as a whole.

Lee and Bruvold (2003) determined that company investments in employee education and development contribute to positive employee perceptions of the organization. It can be deduced from studies by Schmidt (2007) that employees in general appreciate options for development, education, or training and consider them an essential component of their work.

Moreover, Champathes (2006), Antonacopoulou (2000), Nel et al. (2004), Lee and Bruvold (2003) see a very close link between development of employees and their productivity. With development the professional satisfaction of employees increases (Edgar and Geare, 2005; Georgellis and Lange, 2007), they are more devoted to their work and as a result their performance improves as well. This is confirmed by Dvořáková et al. (2007), who evaluate investments in people (via their development in the form of systemic improvement not merely of individual performance but also of team and company performance. An employee may therefore at present be considered a wealth of the company, an asset or human capital, whereas investments in them consist of the very opportunities for education and development (Armstrong, 2005, p. 27).

As part of issues of employee development it is important also to specify the term self-development. Folwarczná (2010) defines it as striving for continuous self-refinement, which emphasises the importance of lifelong learning. The primary responsibility for the process of learning in this case is transferred directly to the individual doing the learning. Deibl (2005) adds that self-development serves primarily for enriching the person themselves; consisting of a tendency to do everything the individual perceives as within his/her capabilities.

Materials and Methods

The data were mainly extracted from secondary sources and our analysis and discussion is linked to outcome synthesis and the evaluation of international research results and the results come from primary survey. The dataset was carried out by authors of the paper and only for purposes of the research focused on talent management. The survey was carried out using employees. The employee data set comprised 125 employees. The employees were employed full time. Most employees, 82%, have other than managerial positions. They are rank-and-file employees and 70% have no university education.

The employee respondents were structured as follows:

- employee age category: 11% – 20 to 24 years, 32% – 25 to 30 years, 35% – 31 to 40 years, 20% – 41 to 50 years and 2% over 51 years;
- employee professional experience: 10% – less than 1 year, 36% – more than 1 year and up to 5 years, 26% – more than 5 years but less than 10 years and 28% more than 10 years;
- employees work in the following industries: 1% primary sector, 18% secondary, 81% tertiary;
- employees work for organizations of size: 26% small, 29% medium, 45% large organizations;
- employees work for organizations owned by: 74% Czech organizations, 7% Czech organizations with a foreign owner, 19% multinational organizations.

The data collection instrument included questions to measure the activities of learning and development support in organisation. The questions were designed based on theories (see theoretical background) and similar researches driven by Colvin (2010), Gannon and Maher (2012), Michela (2007) and Vronský (2012).

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. All the questions were measured in a Likert type scale with verbal anchors in 1 (strongly agree) and 7 (strongly disagree) or, provided it was not possible to favour either of the sides, selected a median, neutral value (the median value was characterized by number 4). The scale permitted not only the specification of respondents' attitudes, but also their intensity.

The data were evaluated using the tools of descriptive statistics and the methods of comparison, induction, deduction, and synthesis. Descriptive statistics used to test the results included absolute and relative frequency, correlation analysis. Further analyses were based on multidimensional statistical methods – factor analysis (Varimax rotation; the Kaiser-Guttman rule was applied to select a group of significant factors. Following the recommendations of Anderson (2009), only determinants with an absolute value exceeding 0.3 were selected as significant for factor development; positive and negative dependency was further analysed in relation to its final benefits). To evaluate the data IBM SPSS Statistic Data Editor, version 22 and MS Excel was used.

Results and Discussion

Respondents in this study from the ranks of employees in organizations were asked whether they have the opportunity to develop their competencies in the organizations where they work and how they perceive their own development. How the individual employees perceive this opportunity for development was determined using the Likert scale for 12 selected assumptions (A through L, see table 1), which were based on theoretical perspectives of work.

Statement	Mark
I have enough possibilities to ongoing development	A
I use my skills and abilities on regular basis on my job position	B
My job is inspiring and interesting	C
My job gives me feeling of personal success	D
My job is beneficial and valuable	E
I take responsibility without any problem for my job tasks	F
Organisation support my development	G
Possible learning and development motivates me	H
Organisation offer possibility of awards for outstanding work outcomes	I
Development affects my work performance	J
I participate on my development regularly	K
Development and education is part of my job	L

Tab. 1: Statement of respondents

The results in table 2 present the relative frequency of answers from the individual employees in the individual tested assumption. On the basis of the results assessment it can be said that the majority of respondents (33.6%) inclined toward answering that they Somewhat Agree that they have enough opportunities for constant expansion of their skills. A total of 73.6% of respondents ranked these opportunities positively. Only 4% of those addressed stated that they have no opportunities for development. The most varying answers were to the question of whether their organization offers the option for recognizing excellent results in work or competition. A total of 49.6% respondents tended toward positive answers, 12.8% to neutral answers and 37.6% to negative answers. The results conform to the fact that a mere 43.2% of respondents inclined to agree that their organization tries to support talented employees. Detailed results for the individual tested assumptions are indicated in the table below.

Statement	1	2	3	4	5	6	7	Total
A	19.2	33.6	20.8	4.8	8.8	8.8	4	100
B	34.4	36	16	3.2	7.2	2.4	0.8	100
C	35.2	32.8	17.6	5.6	4.8	4	0	100
D	28	29.6	19.2	11.2	4.8	4	3.2	100
E	35.2	32	14.4	8	4.8	4	1.6	100
F	37.6	38.4	16.8	5.6	1.6	0	0	100
G	20.8	20	22.4	9.6	11.2	9.6	6.4	100
H	31.2	38.4	15.2	8	4	3.2	0	100
I	11.2	20	18.4	12.8	11.2	14.4	12	100
J	23.2	41.6	11.2	14.4	4	3.2	2.4	100
K	29.6	33.6	17.6	9.6	4.8	3.2	1.6	100
L	30.4	18.4	22.4	11.2	8.8	3.2	5.6	100

Tab. 2: Statements of respondents in relative frequencies

On the basis of an assessment of the data collected it can be stated that most of the respondents inclined to think that their work more or less gives a feeling of personal success, consider assuming accountability for resolving work tasks as an opportunity to gain experience, and are themselves motivated to work on themselves and to deepen their knowledge and obtain new knowledge.

Furthermore, factor analysis was made in consequence to correlation matrix which have shown relations between all variables. Regarding overall medium till strong dependences between variables, constructed for the survey for the reason of their clear use in the construct, it was expected to find statistically significant factors. As shown in Table 3 and 4, factor analysis revealed 3 statistically significant factors.

Factor	Total variance	Total % of Variance	Cumulative % of Variance
1	5.833	48.610	48.610
2	1.363	11.360	59.970
3	1.145	9.546	69.516

Tab. 3: Variance explained by factors

Such variables (statements of respondents) were chosen as significant to create resulted factor, whose value was 0.3 and higher (Anderson, 2009). Factors together explain 69.52% of behaviour of total construct.

Variable	Factor 1	Factor 2	Factor 3
A	0.400	**0.742**	-0.098
B	**0.834**	0.196	0.153
C	**0.783**	0.364	0.180
D	**0.781**	0.396	0.144
E	**0.739**	0.401	0.249
F	**0.552**	-0.246	**0.523**
G	0.378	**0.684**	0.235
H	0.264	0.087	**0.684**
I	0.088	**0.618**	0.361
J	0.225	0.253	**0.798**
K	-0.042	**0.456**	**0.714**
L	0.336	**0.686**	0.324
% of variance	**48.160**	**11.360**	**9.546**
Name of the factor	Knowledge employee	Talented employee	Developing employee

Tab. 4: Resultant factors by method Varimax

The first factor (Factor 1) describes an employee who is satisfied with its job, working in its area of interest, using gain knowledge, skills and abilities. Such employee is willing to be responsible for its work tasks and search for strategic importance of its job position. He/she sees his/her position as interesting and developing, giving the social status and personal success. Additionally, such employee thinks his/her job supports home organisation and also society. Thus we may summarize the factor describes a knowledge employee because of its current and still developing knowledge used at work process, interest in job position and organisation and willingness to work for it in the best manner. The name of the first factor therefore is Knowledge employee. Together almost half of surveyed employees (48.16%) behave in this manner and see their employer as cooperative and good place to be and work.

Factor number 2 revealed different type of employee behaviour. The second type of employees stated they have enough possibilities to be developed and to grow constantly in their organisation; their home organisation support employee development, education and learning. Additionally, home organisation offer special rewards and awards or appreciation

of superior outputs at work; employees in that organisation may compete in different competitions focused on work, projects and other concepts. Employees grouped by Factor 2 are also constantly developed and take part on development program periodically or on regular base. Employees also stated that development, learning and education is part of their job. Such description evokes talent employees who are part of talent pool or talent program. Described organisational environment is quite superior, supporting talented employees and profiting from their constant development. Total 11.36% of employees work in described environment and may be considered as talents.

The third factor (Factor 3) revealed constantly developing employee. He/she is characterized by motivation to learn and being educated and developed, he/she is constantly part of development program. Revealed type of employee also takes responsibility and is aware of self-management which is familiar for him/her. Moreover, development of an employee have straight impact on employees work. Factor 3 therefore describes constantly developing employee in the way his/her job position is being developed. Thus the name of the factor Developing employee. Almost 10% of respondents work in this kind of organisational culture.

Based on presented results of analyses we found about 70% of surveyed employees to be really developing by their organisations or at least are motivated to be developed: in the manner of knowledge employee, talent employee or developing employee. Such results seem quite positive, but still there are questions. Basically, 30% of employees do not use knowledge, talent or development techniques or are not supported in their development by their home organisation, they have no possibility to grow and there are no succession or career plans for them. Based on the results of descriptive statistics, 27 % of employees do not feel any possibility to grow and that may lead to disaffection, loss of production or even to employee turnover. Employees, who miss adequate level of development are usually key and knowledge employees; it is necessary to support their career plans and development to retain them in organisation. On the other hand, based on other similar researches, just about 20% of employees (measured in the population) are being developed (Maršíková, Šlaichová, 2014; Linhartová, 2012) or can be named as knowledge workers or talents (Linhartová, 2012). This may occur because only such employees, who are interested in development took part in the survey; the others refused to answer.

Conclusion

Based on presented outputs, we may evaluate possibilities of employee education and development. Firstly, it is employee him/herself, who sees the potential and willing to grow (Factor 1 – 48%). It is a pleasure to work with such employee in organisation. He/she wants to be developed and search for opportunities him/herself inside or outside the organisation and use his/her knowledge to upgrade his/her work outputs. Secondly, he/she is a part of talent program already running in an organisation (Factor 2 – 11%). Such employee works in line with organisational program and understand its reason. Development of employees in such organisation is smooth and both sides knows the reason and necessary steps. Finally, third type of employees (Factor 3 – 9.5%) are searching for development. They are motivated for self-development and tries to be constantly part of development program. They are responsible and thus it is easy to educate and develop this type of employee. Organisations which have any one of described type of employee may have competitive advantage in the future labour market.

Besides this study there are several promising avenues for further research. It would be

useful to know the impact on employee mobility and total outputs of an organisation. Link between employee behaviour would be interesting study for research in the future.
A theoretical benefit of this article is the summary of characteristics of talented employees in the organizations studied. A practical benefit of this article is the determination of what options for education and development are preferred by these employees. Organizations can modify their development programs according to the 3 types of employees defined and their attitudes toward development. Given the number of respondents (n=125) the study results can be generalized only to the given sample set.

Acknowledgements

This contribution is a follow-up to the project of University of Economics and Management.

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SELF-ASSESSMENT AS A SUCCESS FACTOR IN ICT COURSES

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Abstract

The paper introduces results of survey of self-assessment rating in comparison of entry and exam tests of 1st year bachelor students of Faculty of Economics and Management and Faculty of Engineering in the academic year 2014/2015. Work should analyse influence of student's self-confidence expressed by answers in entry test on actual result of that test and also on result of written part of exam test. In the second part of the paper, the way how external factors influence student's self-assessment is analysed. Data were gathered from 653 students of on-campus and combined forms of study. Entry tests were taken during first weeks of semester. Authors found that self-assessment is significant factor in the beginning of study and in test for which students are not prepared in advance. Not so for the exam test where results does not differ by groups of previously expressed assessments. Student's personal opinions and self-assessment also depend on external factors mainly as type of high school, gender and fact whether he/she previously passed any certified ICT course.

Keywords

Bachelor students, ICT skills, informatics, self-assessment, self-confidence

Introduction

The goal of the paper is to describe the influence of factors on ICT skills self-assessment and office-class software self-assessment of first year bachelor students in ICT courses at various study programmes. Those personal factors are capable to influence student's performance at school (Christoph et al, 2015). Factor of self-confidence – either legitimate or not – is important for students in many ways. It can be compared to "priming" (Nouza, Havlicek and Oudova, 2014) methods but while priming is external (or even subjective by tutor), self-confidence is internal factor. However, in both cases, students are in a certain state of mind and the question is whether the state can influence their results (Ilomaki et al, 2007).

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).

The priming effect on human performance in dealing with issues of general knowledge has been already proven (Dijksterhuis and Van Knippenberg, 1998). However, the impact on performance when solving expert issues, respectively student's performance during exams, was not clearly proved (Franěk, 2009). And even among groups in which priming was incited during solving test questions and was avoided gender stereotypes type. (Nouza, Havlicek and Oudova, 2014). However, Zarghooni (2007) showed compliance of specific personal features with one's self-presentation on social nets (self-confidence).

Discussion may be held whether higher student's self-assessment rates are just projections of his/her internal feelings or are based on real knowledge. In both cases such positive feeling may be capable to improve student's performance as evaluated in previous research.

Materials and Methods

Test group consisted of 653 students (397 men and 256 women; 61%/39%) of 1st year bachelor study programmes at Czech University of Life Sciences, Prague. Research was conducted during seminars of basic ICT courses taught at Faculty of Economics and Management and Faculty of Engineering which are mandatory for all students in 1st semester. 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 (61% of all responses; 43% men and 57% women). 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 (39% of all responses; 89% men and 11% women). Tests were created in LMS Moodle where also exam tests are written. The entry test was uniform for all groups at all faculties and study programmes. Results of the written exam test were taken into account. While some students took more than one attempt for exam test, the first attempt results were treated. Students who did not finish the course with at least one exam attempt were excluded from the survey. During the semester students had equal access to study material via LMS Moodle and lectures were made available as video-on-demand streams. According to (Benda, 2010) such approach created fair and equal environment even for student with disabilities.

During the entry test, students were asked to self-evaluate their ICT skills in general. Possible answers were "beginner", "user", "advanced user" and "expert", while detailed descriptions were provided to ensure gaining comparable results. For example "beginner" level was described as someone who is using computer mechanically without knowing what is really happening and is unable to solve any non-standard situation which may occur. The other extreme "expert" is an user who is asked by others for help and is able to creatively solve such non-standard situations.

In office-class applications skills possible levels were "basic", "middle", "advanced" and "expert" with similar descriptions. Additional questions about type of secondary school and the most used version (by individual student) of office-class software were included as well. Options included four newest versions of Microsoft Office for Windows, Libre Office and iWorks.

The analysis of values is based on data sampling from entry test and examination test in ICT courses and evaluated by descriptive statistics and hypotheses testing in SAS program. Hypotheses were tested by means of two-sided test to tell the difference between population and sample mean values (Siegel, 2011).

Results and Discussion

Influences on self-assessment

This first part of the analysis is supposed to discuss the hypothesis how student's own self-assessment is affected by external influences. Such possible externals are listed in Tab. 1 below.

ICT skills self-assessment	Office software self-assessment
H1 – Gender	H1 – Gender
H2 – Secondary school	H2 – Secondary school
H3 – Faculty	H3 – Faculty
H4 – Form of study (on-site, distant)	H4 – Form of study (on-site, distant)
H5 – Certified ICT course	H5 – Certified ICT course
H6 – Office software type	H6 – Office software type

Tab. 1: Hypothesis of influences to student's self-assessment

For all hypotheses, the null variant states that student's own self-assessment is indifferent to external factor. Hypothesis H1, H3 and H4 in dataset were tested by Wilcoxon Test (WT) due to non-normal distribution of the dataset and just two options in class variables. Thus the rest of hypothesis had to be tested using Kruskal-Wallis (Miller, 1997).

Two-Sided Pr > |Z|	ICT skills self-assessment	Office software self-assessment
H1	<.0001	0,0048
H3	<.0001	0.1401
H4	<.0001	0.0313

Tab. 2: Hypotheses H1,H3 and H4 testing, α=0.05

It is obvious that gender, faculty and form of study have some influence on student's self-assessment of general ICT skills. When study programmes vary faculty to faculty and we can expect more technically oriented students who claim themselves as more confident in ICT at Faculty of Engineering (57% of "advanced users") than at Faculty of Economics and Management (59% of "users"). The gender difference is visible as expected (Kuo et al, 2013), almost the same way as the faculty difference. Male students considered themselves as "advanced users" in 55% of cases and just 37% as "users". Women responded "users" in 66% cases and 27% called herself "advanced users". The gender/faculty influence combination cannot be confirmed, because mentioned tendency of higher self-confidence levels at FE is visible in both men and women groups. Other types of responses ("beginners" and "experts") were much less frequent in both cases. Only 1% of beginners in male group and 4% of females.

When speaking about form of study self-assessment in general ICT also depends on type of study. While 51% students of regular day-to-day programmes see themselves as "users" (and 24% as "advanced users", this ratio is almost opposite in group of combined courses students (43% of "users" and 63% of "advanced users"). In office-type knowledge such difference is less visible but still statistically significant. Over 30% of students in combined courses evaluate their office skills as "advanced" in comparison to just 19% of students in regular programmes. This can be explained by fact that student in combined courses usually work during their study and in almost companies and work positions there is more or less need for office applications usage.

The rest of hypotheses were tested using the Kruskal-Wallis (KW) test with help of Chi-square contingence tables as shown below.

Pr > Chi-Square	ICT skills self-assessment	Office software self-assessment
H2	<.0001	<.0001
H5	0.0008	<.0001
H6	0.0063	0.5321

Tab. 3: Hypotheses H2, H5 and H6 testing, α=0.05

As expected type of secondary school influences self-assessment in both categories. More than 63% of students coming from secondary technical schools consider themselves as "advanced users" in general ICT, while no more than 50% students from other types of school answered the same way. In question of office-class skills results were almost the same when most of student from general schools and "different type" schools answered "basic" when describing their level of knowledge.

Next hypotheses expected difference in self-assessment depending on the type (level) of formal ICT course passed prior entering university or no course at all. It is evident that students who completed courses are more self-confident in both branches – 69% of them answered "advanced user" od "expert" in general ICT and even 86% ranks themselves as "advanced" users at office-class software skills.

Questions about the version or the type of office suite used by students show statistical significance only in general ICT self-assessment where users of non-Microsoft products tend to answer "advanced user" or "expert" 3 times more frequently than users of Microsoft Office of all versions. Non-Microsoft products were primarily used only by 8.7% of students thus generalisation of this statistical finding may be subject to discussion. But authors – according to their personal experience during lectures and seminars – confirm these findings.

Self-assessment effects on tests

The second part of survey is focused to the effects of student's self-assessment to results of entry and examination test. These results were firstly examined by its basic statistical measures and tests for normality.

	Entry test		Exam test	
Test	Statistic	p Value	Statistic	p Value
Shapiro-Wilk	W 0.97138	Pr < W <0.0001	W 0.990271	Pr < W 0.0003

Tab 4: Normality tests for entry test and exam test

We have confirmed that neither the entry nor exam test have normal distribution. The results are consistent with expectations – exam test results should not have character of random guesses.The most interesting analysis shows whether student's expectations regarding their subjective self-confidence are comparable to their real results during the entry test. Average score differs because students characterizing themselves as "advanced users" or even "experts" gained significantly more points in tests than other groups. Such difference is plausible at the exam test but not statistically evident while office-class levels are almost at the same level of statistical conclusiveness.

	Entry test		Exam test	
Level of self-assessment	Chi - Square	Pr > Chi-Square	Chi - Square	Pr > Chi-Square
ICT general	59.9150	< 0.0001	5.8692	0.1185
Office-class applications	52.4951	< 0.0001	5.3499	0.0689

Tab 5: Influence of self-assessment on results of entry and exam test

In entry test, students on level "beginner" received average score of 30.75%, which is lower than those in "user" group (55.41%). Not mentioning "advanced users" who gained almost the same score as "experts" (65.67%, 72.83% respectively).

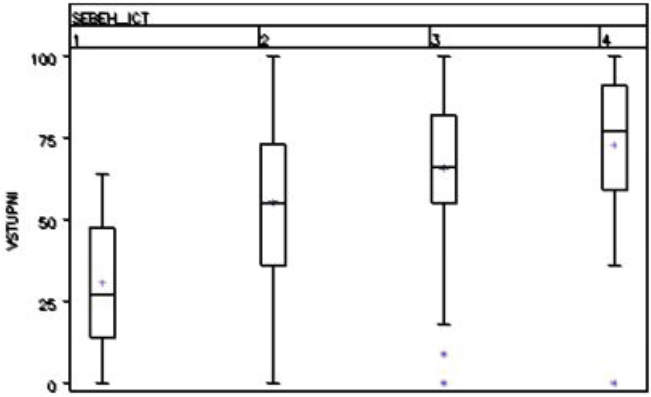

Fig 1. Distribution of entry test divided by student's self-assessment in general ICT

Also student's self-assessment in office-class software influences results of entry test where "basic" users got only 48.14% of maximum points while "middle" and "advanced" received 60.68% and 68.66%. Difference between two upper levels is not statistically significant.

The results confirm assumptions that students have realistic knowledge of their ICT skills when entering university. But after completing their course in 1st semester these differences became less important and results of exam test are comparable among all groups while still minor differences exist.

Conclusion

The paper summarizes student's personal self-assessment in ICT as general and office-class software as a success factor in their entry and exam tests. The entry test consisted of general ICT knowledge questions as well as office-class specific questions and practical issues. During examination of gained data also the effect of externalities to self-assessment itself was determined. Conclusion can be made that students are able to consider their level of knowledge at the time of entering university, which corresponds to their actual entry test results. During the course these differences become less important and student's exams results are indifferent to previously expressed self-evaluation. This may be interpreted that awareness of not so high level of ICT skills motivates the students for higher study effort. Results of entry and exam test did not vary significantly in "advanced user" and "expert" groups. It might be caused by difficulty level of tests used, while expected level of students entering school is "user" and level when finishing course should be "advanced

user". Therefore test questions that could have easily differentiated two highest levels were not included in these tests.

Research confirmed that the basic ICT course is correctly designed to improve student's level from "user" to "advanced user" and not to higher specialised levels. For the educational process, there is a recommendation to prepare voluntary exercises for students already at "expert" level because for those ones this entrance course is not motivating.

For future research, test should be constructed differently to give "expert" students chance for confirming their level of knowledge. Discussion may be taken whether include such higher difficulty questions into exam test while requirements of course syllabus don't expect them. At least at entry test such exceptionally prepared students should be identified and after exam period their results should be checked whether they used their advantage or not.

Acknowledgements

The results and knowledge included herein have been obtained owing to support from the University Internal Grant Agency of the Czech University of Life Sciences Prague, grant no. 20151007 – "Inovativní přístupy využití ICT ve vzdělávání jako prostředek snižování sociálního vyloučení" (Innovative approaches to the use of ICT in education for mitigation of social exclusion), and from the Internal Grant Agency of the Faculty of Economics and Management, CULS Prague, grant no. 20151038 – "Metody tvorby a aktualizace informačního obsahu v prostředí www" (Methods of development and update of information content in the World Wide Web environment).

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MANAGERIAL SKILLS IN EDUCATIONAL MANAGEMENT

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Abstract

Management of the educational process cannot be considered as an area in which it is possible to apply unambiguously managerial methods dedicated to the corporate sphere. Pedagogues (i.e. professionals in their area of interest, not professional managers) therefore become, in the overwhelming majority of cases, headmasters and head officers of schools. However, headmasters´ responsibilities for the successful management of education, if compared with those in the corporate sphere, are of equal value.

An extensive research survey carried out within the Czech Republic is dealing with a complex view of managerial approaches, skills, as well as consequences resulting out of them. The goal of this survey is to monitor and evaluate current situation with the usage of questionnaires. The following three research questions have been formulated in this article: what style of management is predominantly used, what roles headmasters perceive and what control mechanisms they use (in connection with their individual roles). Output of this article can be defined as results for the research questions and recommendations for improving the managerial process in the area of education.

Keywords

Responsibility of headmasters, managerial skills, management style, perceived role, supervision/control

Introduction

The aim of this article is to derive some recommendations based on these findings: what style of management is predominantly used, what roles headmasters perceive and what control mechanisms they use (in connection with their individual roles).The headmaster's position of the main school manager, which provides educational services, is, as a matter of principle, different from the managerial position in a production plant. The managerial process is very closely connected with the educational process and both of them have an intentional character and act in a formative way. The forming of pupils or students´ personality by means of education is a process far exceeding a mere "production" of qualified labour force, i.e. people capable of competition on the labour market (Liessmann, 2011). The above mentioned overlap is determining for specific requirements imposed on a headmaster: an educator, pedagogue and manager in one person (Levy, 2011). It is impossible to pass over in silence individual benefits of individual actors, subject of the object acting in the process of management. In this case one general requirement must be fulfilled – that of a sense of management, as stated for instance in Bedrnová, Nový (2009): individual interest in achievement of an individual benefit of the manager must not damage interests and benefits of school as a whole. In the opposite case management loses its sense. It is also evident that in both the management process and the educational process two dominant, though fundamentally different approaches clash: i.e. egoistic (focused on profit, benefit and well-being of an individual) and altruistic (focused on benefit, profit and well-being of a certain group).

On examples from practice it is possible to find proof that dominance of the egoistic approach in the process of company management as well as school management damages the given community, or even a state (Klimešová, 2012). This damaging of society within the framework of which the deformed management, typical for the short-term form of the rule, as was faithfully narrowed down in the early 16th century by Machiavelli (2007). Learning and training of the employees is the most important tool for improving organizational performance in the long term perspective and the need for education should be important for all industry (Urbancová, Urbanec, 2013). Thus, the managerial skills of the "school management" should be explored, analysed and developed.

Materials and methods

This contribution informs about partial research findings acquired from the questionnaire survey of regional school teachers. It deals with a sample of 176 respondents (selected on a random basic) who indicated the style of management of their headmasters, the most frequent role their headmasters have at school, control mechanisms they apply in a dominating manner. The research survey had a character of qualitative probe research, containing 33 obligatory questions, which preferred a six-stage assessment scale (0 – I strongly disagree 1 – No, I do not agree, 2 – I rather disagree, 3 – I rather agree, 4 – Yes, I agree, 5 – I strongly agree). The Spearman correlation coefficient was used in order to test statistical connections between the monitored variables. Symbol p in the tables hereinafter included in this paper and expresses probability while zero hypothesis is rejected without justification. The selected significance level was 5% (i.e. significant on the condition that $p<0.05$). Analysed and processed by SPSS software.

The research survey itself was preceded by a pilot study, the intention of which was to verify and validate questionnaires in practice. For the estimate of specific reliabilities of individual questionnaire items, the method of stability in time has been used - test and retest (questionnaire: 0.816 – 0.863).

Results and discussion

Research question 1: what style of management is predominantly used?

It is possible to perceive the ideal position of the headmaster as a position of the recognised or reputable leader. The implementation of this ideal depends predominantly on the qualities of the headmaster himself and/or headmistress herself and the whole staff of employees, in particular the teaching staff. The key difference between the manager and the leader (Levy, 2011), apart from the generally referred to aberrations is the well-noticeable on the headmaster's manifestation by means of "I want" versus "I must" (Hábl, 2012). The merger of the manager's role and that of the leader, thus represents a theoretical ideal which is characterised by the competence maturity of the headmaster (Lhotáková et al, 2007).

The respondents have also been asked to what extent they perceive their superior as a leader from the point of view of the motivation he applies to them, i.e. the applied management styles. The summary is brought by Fig. 1.

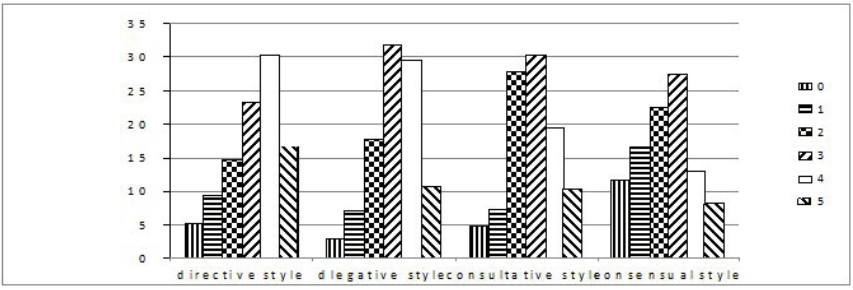

Fig. 1: Use of management styles in school practice

The applied six-degree scale enabled the researcher to specify either the inclination to or declination from the given management style. The scales 0 - 2 can be characterized, in the aggregate, as a decline from the management style, while the scales 3 – 5 as an inclination to the given style of management. At first sight, a surprising tendency to decline (weakening) with the consultative and consensual styles; the tendency of inclination (strengthening), on the contrary, is noticeable with the delegative and directive styles:

- Directive style – the head motivates employees into being obedient, deciding on his own (the aggregates of Scale 0-2 come to 30 %; the aggregates of Scale 3-5 come to 70 %),
- Delegative style –the head motivates to independence, authorizes employees (aggregates of Scale 0-2 come to 28 %; aggregates of Scale 3-5 come to 72 %),
- Consultative style – the head motivates to participation, decides after hearing the inferiors´ opinions (aggregates of Scales 0-2 come to 40 %; aggregates of Scales 3-5 come to 60 %),
- Consensual style – the head motivates employees to harmonisation, decides on the basis of his inferiors´ decisions (aggregates of Scales 0-2 come to 51 %; aggregates of Scales 3-5 come to 49 %).

The carrying out of the teacher's profession has a creative character on the one side and this profession accumulates the highest quantity of university educated employees, on the other side the research pointed at quite a significant application of the directive management style by headmasters of regional schools, which is rather characteristic for stereotype non-creative professions. On the contrary, the consultative style of management (characteristic for the interaction: you propose – I decide) and the consensual style (characterized by the interaction: we propose – we decide) has not been perceived as so frequent by teachers.

Research Question 2: What roles headmasters perceive

Manifestations of headmasters of regional schools and their influence on teacher teams have been further monitored by means of the dominating roles assigned to them by their teachers. The respondents assessed their superiors with the help of seven roles which could be completed or extended, upon their own discretion, by some other roles, such as the following ones:

A. Coordinator/the one who gets the team going (the headmaster is perceived predominantly as the one who harmonises the team, calls for action, encourages and selects individuals for solving or completing certain tasks and manages to cope with different situations);
B. Spokesman (the headmaster is perceived predominantly as the one who represents school on the outside, acquires external connections and information, provides

employees with feedback from the external environment to the internal school environment),

C. Supervisor/Checker or Controller (the headmaster is predominantly perceived as the one who observes labour discipline, supervises the meeting of tasks, requires the meeting of rules, maintains discipline),

D. Executor of Rewards and/or Repressions is predominantly perceived as the one who appreciates employees´ merits and credits, points at errors and faults and bad habits; he praises and reprehends, divides the team into "popular ones" and "unpopular" employees),

E. Decision-Maker (the headmaster is predominantly perceived as the one who is responsible for key decisions, solves all internal disputes, is capable of finding orientation in problems, has the courage to show his opinions and push their opinions forward);

F. Catalyst (the headmaster is predominantly perceived as the one who speeds up obligations and processes, acts as "transmission lever" between heterogeneous opinions, incompatible targets, inconsistent or unequal opinions),

G. Supporter (the headmaster is predominantly perceived as the one who helps or assists, challenges or encourages, shows the proper path and deals with the problems of other people – Goleman, 2011). The summary statement of respondents is plotted to Fig. 2.

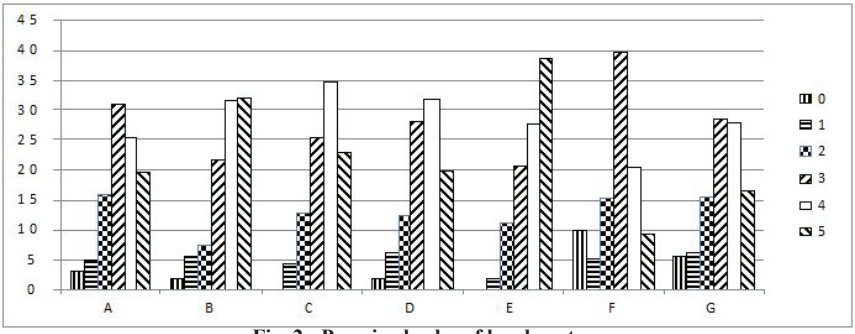

Fig. 2: Perceived roles of headmasters

From the figure it is evident that none of the roles was perceived as unambiguously dominating by our respondents. The strongest inclination of teachers was expressed towards the headmaster's role as decision-maker (E: the aggregate amounts of the 3 to 5 scale make altogether 87 %) and that of a spokesman (B: aggregates of the 3 to 5 scale come to 85 %), the strongest decline was registered with the catalyst role (F: aggregates of scale 0 to 2 comes to 30%) and that of supporter (G: aggregates of the scale 0 to 2 come to 27 %). This fact points at the dominance of functional control over professional management in the tested sample of regional schools. If the characteristics were to predominate over (outweigh) those of management, the ratios of inclination and declination would have to be of the opposite character with the monitored roles.

Research question 3: what control mechanisms headmasters use

In the milieu of regional schools we were interested in what control mechanisms are typical for headmasters and whether there is a connection between these headmasters´ control mechanisms. The results that arose from the research survey can be structured by means of the selected six-degree scale. From the point of view of dominance (aggregates

in scales 4 and 5) in the given form of supervision (control) formal control/supervision of written documents prevailed in the tested sample (67 %), followed by the check of the observed working discipline (59 %), and control by means of supervision or inspection (45 %), personal interview (44 %) and by means of observation of the teaching process (33 %). From the given structure it is evident that contactless forms of control/supervision were given preference in the practice of regional schools (i.e. supervision of written documents) with compelling outputs to numerous forms of contact forms of checks (personal interview, observation), which are characteristic for the position of a team leader.

The statistical correlation between the implemented form of control and the headmaster's role comes close to the 5% level of significance in Tables 1 - 5. In all these cases – whether with a stronger or a weaker force – the statistical connection between individual headmasters´ roles and the control mechanisms used by them was proved. In all the cases these were positive correlations (R). Within their frameworks it is possible to express the fact that the more the teacher has been controlled/checked (irrespective of a specific form/ type of control), the more was the given role of the superior strengthened in their eyes.

Headmaster's Role	Number	R	t(N-2)	p
Coordinator (A)	158	0.428488	5.923106	0.000000
Spokesman (B)	158	0.291385	3.804492	0.000204
Supervisor/Controller (C)	158	0.349506	4.659161	0.000007
Executor of Rewards/Repressions (D)	157	0.232822	2.980512	0.003342
Decision-Maker (E)	159	0.232432	2.994376	0.003196
Catalyst (F)	148	0.335329	4.300809	0.000031
Supporter (G)	157	0.364237	4.869197	0.000003

Tab. 1: The correlation between checks making use of class observations and the headmaster's roles

Headmaster's Role	Number	R	T(N-2)	p
Coordinator (A)	162	0.325653	4.35670	0.000024
Spokesman (B)	162	0.295813	3.91708	0.000132
Supervisor/Controller (C)	162	0.432273	6.06366	0.000000
Executor of Rewards/Repressions (D)	161	0.431015	6.02308	0.000000
Decision-Maker (E)	163	0.400363	5.54374	0.000000
Catalyst (F)	151	0.173377	2.14888	0.033259
Supporter (G)	162	0.268817	3.53025	0.000542

Tab. 2: The correlation between checks focused on meeting work discipline and the headmaster's roles

Headmaster's Role	Number	R	t(N-2)	p
Coordinator (A)	158	0.340842	4.528270	0.000012
Spokesman (B)	158	0.366564	4.920919	0.000002
Supervisor/Controller (C)	158	0.424179	5.850397	0.000000
Executor of Rewards/Repressions (D)	157	0.317369	4.166616	0.000051
Decision-Maker (E)	159	0.284161	3.713617	0.000283
Catalyst (F)	147	0.229867	2.844123	0.005098
Supporter (G)	157	0.281515	3.652556	0.000355

Tab. 3: The correlation between checks of documents and the headmaster's roles

Headmaster's Role	Number	R	T(N-2)	p
Coordinator (A)	158	0.412593	5.657264	0.000000
Spokesman (B)	158	0.285868	3.725977	0.000272
Supervisor/Controller (C)	158	0.382811	5.175554	0.000001
Executor of Rewards/Repressions (D)	157	0.169413	2.140114	0.033910
Decision-Maker (E)	159	0.234546	3.023179	0.002922
Catalyst (F)	147	0.376542	4.894400	0.000003
Supporter (G)	157	0.327437	4.314394	0.000028

Tab. 4: The correlation between supervision in the form of pedagogical surveillance and the headmaster's roles

Headmaster's Role	Number	R	t(N-2)	p
Coordinator (A)	159	0.404663	5.544673	0.000000
Spokesman (B)	159	0.325065	4.306957	0.000029
Supervisor (C)	159	0.262081	3.402802	0.000846
Executor of Rewards/Repressions (D)	158	0.348613	4.645607	0.000007
Decision-Maker (E)	160	0.329499	4.386715	0.000021
Catalyst (F)	148	0.364243	4.725804	0.000005
Supporter (G)	159	0.398978	5.451900	0.000000

Tab. 5: The correlation between supervision in the form of a personal interview with the headmaster's roles

As has been suggested by the calculated values, it has not been confirmed that headmasters of the schools within the framework of each perceived role preferred different forms of inspection. This fact is probably influenced even by the ill-defined /shadowy/ quality of the roles in which these headmasters had been perceived (discussed in above mentioned Fig. 2).

The implemented probe research in the tested sample did not prove the expected dominance of a consultative and consensual style of management at regional schools. This situation testifies to headmasters being perceived as "civil servants/officials", whose wishes it is necessary to meet, rather than "visionaries", to whom other employees believe and whose examples they follow. This fact confirms the domination of control over management, which is not, from the point of view of teachers´ activity, ideal at all and needs to be changed. This fact has been also confirmed by numerous findings about the roles in which headmasters are perceived as dominating persons by their subordinates. Strongest of all were headmasters perceived as Spokesmen and Decision-makers, while their roles as Catalysts and Supporters were perceived during the research as substantially weaker. Even the findings concerning the prevailing forms of surveillance or supervision carried out by headmasters fall within this framework. The greatest level of frequency has been proved by the supervision focusing on written documents and observance of work discipline checks. From the point of view of management of people, these are the simplest forms and, in terms of time, the least demanding forms of supervision, which were preferred by headmasters. The need of more sophisticated supervision should be outlined and implemented. As highly surprising it is possible to designate even a relatively weak representation of control by means of a headmaster's observation of the educational process. When testing connections between the manner of supervision and the headmaster's role, in all three variants the statistical proof of this connection has been

confirmed in all three variants (see tables 1 – 5). It was a case of positive correlation calculated on the basis of the Spearman correlation coefficient. For all forms of checks and supervision (control), it held that the more the teachers had been checked, the more they perceived the headmaster as their superior, though without a significant connection to this or that headmaster's role. Therefore, the managerial skills of headmasters should been developing continuously.

Conclusion

The carrying out of this partial survey, has called attention to the weaknesses of the manifestations of managerial skills in the practice of managing regional schools. It concerned three areas of managerial skills, i.e. the ability of motivation and work with people my means of management styles, by means of control mechanisms and by means of the role in which headmasters are predominantly perceived. The above-mentioned weaknesses/shortcomings can be seen in the context of the necessity for cooperation and team collaboration of the teaching staff, as well as a personal model and personal example towards students that are being educated. From the conclusions of the probe research, we can deduce recommendations for the practice of headmasters of regional schools: to strengthen responsibility for the school and the power of all teachers in the school in which they work (preference of the consultative state of management by the headmaster), not to give way to pressure for the simplistic approach to the supervision of teachers and to follow the path of the contact form of control (checks and supervision), which is more demanding in terms of time and competences (interviews and observation), not to stagnate or become fossilized as to the dominating role of the headmaster in the role of inspector and supervisor. Because of the creative character of the managerial process in the area of education, it is necessary to support activity, creativity, positive approaches and thought diversification of the teaching staff and not prevent them from making use of these activities. The strong managerial education is recommended.

A future probe research in this area is directed towards comparing headmaster competences before and after their acquisition of managerial education. It directs its attention to the area of the mutual interconnection between theory and practice and at the same time to the sphere of educational efficiency.

Acknowledgements

This contribution came into existence within the framework of the support provided for Project SGA 43201 15 0005 01 at the University of J. E. Purkyně in Ústí nad Labem.

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PHD STUDENT-SUPERVISOR RELATIONSHIP – IS THERE A PROBLEM?

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Abstract

This article provides an analysis of the PhD student-supervisor relationship at Czech University of Life Sciences in Prague. This analysis is built up on the responses of 184 PhD students from questionnaire disseminated in May and June 2014. The analysis focuses on the basic question if PhD students are satisfied with their supervisors. Comparison between faculties, form of studies and genders is provided. As a result, in average around 20% of PhD students are dissatisfied with their supervisors. However, the main findings do not show significant differences between either faculties, form of studies or genders. The article also discusses main reasons of satisfaction and dissatisfaction and tries to offer solutions to this problem.

Keywords

Analysis, comparison, PhD student, PhD supervisor, satisfaction, dissatisfaction

Introduction

The importance of high profile research results has risen substantially during the last decade in the Czech higher education system. Currently, approximately 18% of the Ministry of Education, Youth and Sport (MEYS) budget relates to quality and performance indicators (MEYS, 2014). Quality is, among others, influenced by Higher education institutions´ (HEIs) research results. In the Czech Republic, research results are measured based on a scheme developed by Research, Development and Innovation Council (RVVI, 2013).

Due to a MEYS (2014) budget decrease within last years a competition for state funding in the Czech higher educational system has increased. HEIs´ performance has become an issue and many comparative analyses, either within or between HEIs, have been recently published. For example, Vltavská and Fischer (2013) evaluate the labor productivity of HEIs' employees according to the teaching and research productivity. Furthermore, Flégl and Vltavská (2013) present the efficiency analysis of the Faculties of Economics using Data Envelopment Analysis and production function analysis. Dlouhý (2012) proposes a model for funding allocation among HEI´s departments based on publication productivity. Most recently, Jablonský (2014) presents a performance analysis of Czech scientists with respect to their publication activities. Jablonský also discusses the potential of bibliometric indicators as a tool for department, faculties or HEIs evaluations.

As a result of the increased competitions, many HEIs introduced internal stimulation schemes to enhance quality as well as quantity of research output of both PhD students and academic staff. One of the main causes of generally lower level of research results is related to inactivity of substantial proportion of academics. As Flegl and Vostra Vydrova (2014) pointed out a huge percentage of PhD students (in some cases more than 60%) at CULS Prague produced zero research results during the period 2007-2011. Low research performance of PhD students depends on various aspects. The influence of PhD

supervisors on research results of PhD students is very important aspect (Barnes and Austin, 2009). Pinheiro, Melkers and Youtie (2014) observe that coauthoring with the supervisor is a significant source of publications. Moreover, coauthoring and mentoring have positive impact for future research performance (Hilmer and Hilmer, 2009; Kyvik and Smeby, 1994).

Flégl, Vostrá Vydrová and Tichá (2014) published the introductory study of research engagement of PhD students at Czech University of Life Sciences Prague (CULS Prague). This introductory study covers area such as time allocation to doctoral studies, time allocation to research, involvement in research projects and satisfaction with research outputs. However, the objective of this article is to analyse the relationship between PhD students and PhD supervisors at CULS Prague. Therefore, the authors would like to discover reasons of satisfaction and dissatisfaction in this relationship among faculties. Moreover, the influence of form of studies (full-time and part-time) and genders is also analysed. Univariate and multivariate statistical analysis of categorical data is used to process the data.

Material and Methods

Data specification

Czech University of Life Sciences Prague provided in total 18 doctoral study programs in 29 PhD specializations at its faculties[1] in the year 2014 (CULS, 2014). In these study programs, in total 1093 PhD students were enrolled. In April 2014, the authors prepared online questionnaire for the evaluation of PhD studies at CULS. The questionnaire covers six main areas: *questions related to students´ introduction, questions related to doctoral study, questions related to PhD supervisor, questions related to doctoral scholarship, questions related to research publications*, and *questions related to satisfaction with the doctoral study*. This article, however, focuses only on questions related to relationship with PhD supervisors. As several PhD study programs are taught in foreign language (mainly English) the questionnaire was prepared in both Czech and English version. The questionnaire contains of open-ended and closed questions, as well as a combination of both types. The main purpose of the questionnaire is to find out reasons of satisfactions and dissatisfactions with current doctoral studies at CULS Prague.

The questionnaire was disseminated among all PhD students in May and June 2014. The dissemination was supported by an official email sent to all PhD students. The authors also sent a reminder to this survey 2 weeks after the first dissemination. In total, 187 PhD students (representing 17.11%) have expressed their opinions about PhD studies at CULS Prague. Out of those 187 responses, 72 PhD students were males and 115 were females (Table 1). In addition, the respondents can be divided into two basic groups according to their residency, i.e. Czech & Slovak residents and foreigners. Due to only 3 responses from foreign PhD students, we decided to exclude these responses from the further analysis.

Table 2 summarizes the distribution of the respondents regarding their age. The majority of the PhD students are in the group 26-30 years old (72.28%). Considering that the majority of master students in the Czech Republic graduate around the age 26 and the length of doctoral studies at CULS Prague are 3 years in general, then this age distribution reflects well the conditions.

[1] 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).

Residency	Gender		
	Male	Female	Total
Czech & Slovak residents	71	113	184
Foreign residents	1	2	3
Total	72	115	187
Share	38.50%	61.50%	

Table 1: Number of responses from PhD students by gender and residency (source: own calculation)

Age groups	Czech & Slovak residents	Share
0-25	14	7.61%
26-30	133	72.28%
31-35	20	10.87%
36-40	7	3.80%
41 and over	10	5.43%
Total	184	100.00%

Table 2: Age distribution of PhD students (source: own calculation)

Most of the respondents (88.59%) study in full-time programs contrary to only 11.41% of respondents enrolled in part-time programs (Table 3). Table 4 shows the distribution of received responses sorted by faculties at CULS Prague. The distribution corresponds with the size of the faculties, as the most responses are from FAFNR (28.80%), FES (23.37%) and FEM (19.57%). Whereas the smallest faculty FTAS represents only 8.15%.

Residency	Form of the study		
	Full-time	Part-time	Total
Czech & Slovak residents	163	21	184
Share	88.59%	11.41%	100.00%

Table 3: Form of the doctoral studies (source: own calculation)

	Number of responses	Share
FAFNR	53	28.80%
FFWS	22	11.96%
FTAS	15	8.15%
FES	43	23.37%
FEM	36	19.57%
FE	15	8.15%
Total	184	100.00%

Table 4: Number of responses from PhD students according to faculty (source: own calculation)

Statistics

We use tools of univariate and multivariate statistical analysis of categorical data. The analysis of individual variable values is based on a frequency distribution and calculation of descriptive characteristics. The principles of dependencies of two variables are

described on the basis of a contingency table. Chi-square test is chosen to test hypotheses about the independence of two variables. In case of a failure to comply with the basic test requirements, which is linked to the expected frequencies, we logically merge selected answers. As a result, 80% of observations in each category should be higher than 5. Although we do not stick with this requirement in all cases, additional merge of categories is not possible due to the nature of categories. We can then refer to a sparse contingency table (Burman, 2004). Using the chi-square test we test the compliance of observed and expected frequencies. To calculate the test criterion we can use Person´s chi-square statistics (Chambers and Skinner, 2003). In addition Cramer´s V is applied to measure the strength of the proven dependencies.

The significance level $\alpha = 0.05$ is set for testing statistical hypotheses. Statistical software SPSS 2.2 is used for a practical application of statistical tools.

Results and Discussion

Following section is related to the detailed description of achieved results. The authors analyze the satisfaction and dissatisfaction of PhD students with their supervisors. Moreover, the reasons of satisfactions and dissatisfactions are also analyzed.

Are PhD students satisfied with their supervisors?

The questionnaire contained of following possible answers; *definitely not*, *not very*, *I do not know*, *quite satisfied*, and *completely satisfied*. The authors decided to merge categories (to *satisfied*, *dissatisfied*, and *I do not know*) due to fewer number of responses. Regarding to the achieved responses the average satisfaction at CULS Prague reaches a level of 77.32%. Approximately 8 out of 10 PhD students are satisfied with their supervisors. However, it is important to analyze dependences influencing this level of satisfaction, i.e. find out whether faculty, gender or form of study have an impact on the satisfaction. Therefore, we first test following hypothesis:

H_0: There is no statistically significant dependence between satisfaction of PhD students with their supervisors and the faculty.

Table 5 summarizes calculated statistical characteristics. As a result, H_0 is not rejected ($p = 0.903$), thus there is no statistically significant dependence between satisfaction with supervisor and faculties. Most of the PhD students across the faculties are satisfied with their supervisors. The highest satisfaction with supervisors is at FFWS (81.82%). On the other hand, we can observe the lowest satisfaction at FEM (69.44%), i.e. approximately 3 PhD students out of 10 are dissatisfied with their supervisors.

Faculty	Satisfied	Dissatisfied	Do not know	Statistics	
FAFNR	39	10	4	Pearson´s test	4.813
FFWS	18	2	2	p-value	0.903
FTAS	12	2	1	Cramer´s V	0.114
FES	34	8	1		
FEM	25	8	3		
FE	12	3	0		
Total	140	33	11		

Table 5: Satisfaction of PhD students with their supervisors according to faculty (source: own calculation)

As the next step we test similar hypothesis, but now regarding the form of study:

H_0: There is no statistically significant dependence between PhD students of the full-time and part-time form of study according to satisfaction with their supervisors.

Faculty	Satisfied	Dissatisfied	Do not know	Statistics	
Full-time	123	32	8	Pearson´s test	5.104
Part-time	17	1	3	p-value	0.078
Total	140	33	11	Cramer´s V	0.167

Table 6: Satisfaction of PhD students with their supervisors according to form of study (source: own calculation)

In this case, H_0 is again not rejected ($p = 0.078$), so there is no statistically significant dependence between satisfaction with supervisor and form of study (Table 6). However, the result is very close to statistical significance. We can only observe slight difference between full-time and part-time PhD students. Satisfaction of full-time PhD students is 75.46%, while satisfaction of part-time PhD students goes over 80% (80.95%). In both cases the results correspond with the average satisfaction with supervisors between faculties at CULS Prague.

Moreover, we can analyze whether there is a difference between genders in term of satisfaction. Following hypothesis is examined:

H_0: There is no statistically significant dependence between male and female PhD students according to satisfaction with their supervisors.

Considering genders (Table 7), H_0 is again not rejected ($p = 0.524$), so the different gender does not have a direct impact on the relationship with supervisor. Similarly to the previous analyzes the average satisfaction is 76.6% (as 78.87% for male PhD students and 74.34% for female PhD students). We can observe slightly more dissatisfied female PhD students (approximately each fourth female PhD student compare to each fifth male PhD student).

Faculty	Satisfied	Dissatisfied	Do not know	Statistics	
Males	56	10	5	Pearson´s test	1.293
Females	84	23	6	p-value	0.524
Total	140	33	11	Cramer´s V	0.084

Table 7: Satisfaction of PhD students with their supervisors according to gender (source: own calculation)

The initial look does not indicate any problems. The average satisfaction with supervisors reaches 77% at CULS Prague without any significant differences among faculties, genders or form of study. On the other hand, with a closer look approximately two out of 10 PhD students are dissatisfied (female PhD students are slightly more dissatisfied then male PhD students). Obviously, generally accepted level of satisfaction does not exist. However, from our point of view, this closer look points out on a problem. Therefore, a question arises: what are the causes of satisfaction and dissatisfaction?

Table 8 summarizes main reasons of satisfaction expressed by PhD students in the questionnaire. All PhD students could mark more than one option; therefore, the total number of responses is higher than the number of respondents. PhD students appreciate the most a good communication with supervisors (25.11%) and supervisors´ knowledge and experiences (23.14%). Besides the responses stated in Table 8, PhD students could express other reasons. From all those responses, we can sum up two main categories: 1)

supervisors´ personal interest in supervising, i.e. consultancy approach, and 2) sharing professional contacts.

	# of responses	Share
Good communication with supervisor	115	25.11%
Supervisor devotes some time for me	78	17.03%
Supervisor is opened to new ideas	88	19.21%
I can solve study-related problems with supervisor on a daily basis	71	15.50%
Supervisor has knowledge and experiences that help in my doctoral study	106	23.14%
Total	458	100.00%

Table 8: Main reasons of satisfaction of PhD students with their supervisors (source: own calculation)

Contrary to Table 8, Table 9 summarizes main reasons of dissatisfaction. PhD students could again mark more than one option. The main reason of dissatisfaction is related to the time supervisors devote to their PhD students (32.53%). Moreover, problems with communication (24.1%) and impossibility of solving study-related problems with supervisors (21.69%) are other important reasons of dissatisfaction. The last two problems are tightly connected to each other. Besides the responses mentioned in Table 9, PhD students could express more reasons of dissatisfaction. First of all, PhD students pointed out that supervisors, in some cases, work outside CULS Prague. Therefore, PhD students are not able to cooperate with their supervisors. Second of all, the pressure for research outputs is also stressed as a problem. PhD students are not able to cope with this pressure without a help from their supervisors.

	# of responses	Share
Bad communication with supervisor	20	24.10%
Supervisor does not have time for me	27	32.53%
Supervisor is not opened to new ideas	4	4.82%
I cannot solve study-related problems with supervisor	18	21.69%
Supervisor does not have knowledge and experiences that could help in my doctoral study	14	16.87%
Total	83	100.00%

Table 9: Main reasons of dissatisfaction of PhD students with their supervisors (source: own calculation)

As a conclusion, closer connection between supervisor and PhD student should minimize reasons of dissatisfactions. As Barnes and Austin (2009) point out, the influence of PhD supervisors plays important role in research results of PhD students. Similarly, Pinheiro, Melkers and Youtie (2014) observed that co-authoring with a supervisor is a significant source of publications that can avoid problems with research outputs at CULS Prague referred by Flegl and Vostra Vydrova (2014). Therefore, co-authoring and mentoring (supervising) could improve research outputs. Furthermore, proper supervising could, among others, diminish problems with bad communication between PhD students and supervisors.

On the other hand, independence, initiative and diligence are required from PhD students. Supervisors cannot solve all problems when PhD students are not able to reach these requirements. In addition, PhD students should be mainly the ones, who contact their

supervisors. However, cooperation on study- and research-related tasks should be secured from both sides of the relationship.

Conclusion

This analysis focuses on a basic question related to satisfaction or dissatisfaction of PhD students with their supervisors at CULS Prague. For this purpose, the authors disseminated online questionnaire at Czech University of Life Sciences in Prague in May and June 2014. In total, responses of 184 PhD students through all faculties are used for this analysis. The results show that approximately 20% of PhD students are dissatisfied with their supervisors. This dissatisfaction is mainly related to insufficient time supervisors devote to their PhD students. Consequently, bad communication between PhD students and supervisors arise as another main problem. The results do not show significant differences in responses neither between faculties nor between full-time and part-time PhD students. According to the results, female PhD students tend to be slightly more dissatisfied. The future research will lead to an analysis of supervisors´ opinions related to PhD student-supervisor relationship. As their opinions can either confirm results in this article or bring different view into this problem.

Acknowledgements

This work was supported by the grant project of the CULS Prague Grant Agency, no. 20141028.

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HOW TO STAY IN TOUCH - COLLABORATION BETWEEN ALUMNI AND THEIR ALMA MATER

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Abstract

This paper is focused on the cooperation between an Institute of Education and Communication (IEC) and its alumni. The research arose from a more general interest of IEC to start a systematic and regular monitoring the information about with its graduates. We are especially interested in finding out how much the former students tend to collaborate with their alma mater and what their expectations of this participation are. In the research, we asked ourselves the following questions: Which graduates are interested in cooperating with IEC? How can the graduates contribute? The findings and proposals are based on a questionnaire survey (N = 98) that was disseminated among graduates of the programme ´Teaching of vocational subjects´ and the programme ´Teaching of practical training´ that are offered at IEC. At the end of the paper, the possibilities and the strategy of developing future cooperation between IEC and its graduates are offered.

Keywords

University alumni, co-operation between university and graduates, alumni associations, career counselling, vocational education

Introduction

The existence of generations of graduates represents many opportunities and a considerable potential to further development of universities. It is clear that the contact with graduates is realized in various ways and at different levels of formality. There is a lot of research that monitors for example the employability of graduates at the job market, their view of teaching quality or their requirements of further education. One of the ways to activate former students is establishing the graduates associations. These institutes have had their long tradition mainly in the English-speaking countries, whereas in our native area they did not begin to develop significantly until 1989. It could be presupposed that a group of graduates committed in this way have a more important position characterized by the sense of fellowship with the institution as well as by emotional and motivational elements that manifest themselves by a more intense interest in the course of events at their alma mater. Possibly, it can manifest itself by the effort to support or even take part on its further development.

The frequency of researching the graduates´ associations is lower compared to the total number of published materials referring to the tertiary education graduates. Seeking the bibliography is also complicated by the fact that the issues overlap and mingle. Typically, this is represented by the research of the USA universities. For example, a large-scale report of Lombardi (1975) brings a detailed analysis of the opinions of Massachusetts Institute of Technology (M.I.T.) graduates. The aim was to collect data from graduates and thus get feedback in the area of teaching quality (experience with the studies), their point of view of the current M.I.T. (i.e. prestige, evaluation of the present school development,

opinions of the financial situation of the institute) and namely in the area of the rate and potential of graduates´ participation. The authors state that 60% of graduates visited the school at least once in the last 5 years and the reasons to do so were divided into the following categories:

a) Headhunting for new employees for their own companies, participation on professional events or departments´ meetings, cooperation in research, visiting individual academic employees, participation on lectures or seminars, making use of the library (22%);

b) participation on the graduates´ meeting(s) of the same study year, participation on the events of graduates´ association, a share on other activities (consultancy, membership in management board and committees) (7%);

c) visiting friends at the university, campus sightseeing, visiting M.I.T. with family members (23%);

d) participation on cultural events or making use of recreation capacity, administration acts (8%).

The graduates´ associations have a fundamental importance for a number of Western universities with regard to financing, therefore it is understandable that they try to involve as many former students in the association as possible and it is often the case (not necessarily) that the membership is determined by a financial contribution. The membership in the graduates´ association can have many reasons. Newman and Petrosko (2011) found out that the membership in the association is more probable with graduates that a) contribute to the school financially, b) provided their contact information (telephone, address) to the university, c) were relatively older than the non-participating respondents, d) positively perceive themselves as graduates of the given university, e) perceive the graduates´ association positively, f) have more frequent contact with their alma mater, g) know other members of the graduates´ association.

What is evident is the motivation based on personal identity and responsibility (who sends money is more interested and involved) as well as the social level where the membership in a particular social group (an association) and meeting other members play its role. McDearmon (2013) also researched into the participation on graduates´ associations; he focused on the way the active member identity is formed. He identified three elements of identity – the importance that a respondent personally gives to the association (the issue of "I often thought about joining the graduates´ association"), social expectation ("the others thought I could join the graduates´ association") and the expectation following the member´s role (i.e. "As the association member, I feel my duty is to support my alma mater financially).

If we ignore the potential material contribution of the cooperation with graduates, which is not very common at teaching colleges, former graduates can pass on their professional experience and competence to current students. On the other hand, universities help their graduates keep, deepen or broaden their education for example in the form of workshops or follow-up studies of teaching staff. This trend corresponds with EU policy; see for example the recommendation of European Parliament and Board from 2006 requiring a life-long development of key competences.

Teaching competences have been studied and dealt with for the last two decades in a number of major papers, for example Eraut (1994) and Korthagen (2004).The authors agree, apart from other things, that competences must be developable / transferable and bound to professional situations. University as a sphere of the starting professional preparation represents just a part of professional development. Further development of competences takes place at work and in contact with professional reality.

Then, why is it essential for a university to know the competences that it furnishes its students with? If the graduates are able to make use of the gained competences in their practice and are - thanks to them - more employable and successful at the job market, it will also be a feedback to the university regarding the teaching quality that it provides to its students. Moreover, students of teaching are potential teacher trainers at schools for future students of teaching. And the aim of the university that prepares future teachers should be a graduate who will be equipped with fundamental professional competences, who will be willing to carry on learning, co-operate with colleagues and who will address the university when needing help, co-operation as well as the development of his/her professional competences.

The goal of this article is to present research results based on systematic and regular monitoring of IEC graduates. We are especially interested in finding out how much the former students tend to collaborate with their alma mater and what their expectations of this participation are.

Materials and methods

The overall intention of the research was to deepen understanding of how collaboration with alumni could function and what could be the future benefit for institution we represent. In the front line of the branchy topic we decided to concentrate on following research questions: Which graduates are interested in cooperating with IEC? How can the graduates contribute? What are relations between the willingness to cooperate and the motivation to study? What is relation between graduates´ competences and their willingness to cooperate?

The method of a questionnaire was used for the data collection. The target population of the research theoretically included all graduates of two study fields of teaching since 2008 when the first year of newly accredited bachelor programmes finished their studies. The total number was 482 respondents. First, the last three years of graduates were addressed, and also the respondents from previous years whose electronic address is existent in the information system of the university. Thus, the sending out of the questionnaires did not exceed the total costs. Moreover, graduates who visited IEC on the occasion of a yearly graduates´ reunion during the data collection period were also addressed. 268 individuals (55% of all graduates) were asked to fill in the questionnaire.

The research team prepared two identical forms of the questionnaire (with regard to contents): an electronic document. The total rate of return was 37%, which can be considered a sufficient number with respect to similar research; the total number of returned questionnaires was 99, out of which one was excluded due to lacking information. The selected collection was compared with the total population in the parameters of age, sex, average school results during the whole studies. In view of minimal differences between the sample and the population composition, it can be anticipated that the sample is representative enough, although the willingness to fill in the questionnaire itself indicates possible differences in the attitudes and characteristics of the whole.

The concept of the questionnaire reflected several research areas. The researchers examined besides the basic personal identification data for example the motivation to study at IEC, professional development of the respondent, mainly with regard to the correlation of his/her work activity with a gained teaching qualification, the evaluation of the study benefits for the development of professional and key competences as well as self-evaluation of these competences, and finally the willingness of the addressed to co-operate with IEC in future, and in what way. The topic of this paper narrows the data presentation to chosen issues only whose wording is always given at the appropriate place of the text.

Results and Discussion

The first task was to determine to what extent the IEC graduates are interested in future co-operation. In the questionnaire, the respondents were given a list of 8 different areas of potential co-operation. The offer included three items that are mainly beneficial for graduates (participating on seminars, membership in the graduates´ association, participating on the labour exchange). In this first case, the co-operation would mainly presuppose the activities of IEC towards the graduates. Five following items mapped the willingness of the graduates to co-operate actively, for example when consulting the bachelor theses of IEC students or directly in classes (so called active element of co-operation). The total interest in the graduates´ activity can be expressed by a relationship:

$$CZ = PZ + AZ$$

CZ stands for total interest, PZ stands for "passive" interest (three items) and AZ stands for active interest (five items).

On the whole, there was a generally high willingness of the respondents to co-operate: 67% of them chose at least one of the 8 offered areas of co-operation. It is understandable that the interest is related in this case to the fact that the questionnaire was filled in and sent back by active people who have a positive relationship to IEC. The choice of activities organized by IEC for graduates prevails, but the difference is not remarkable (60% of the respondents prefer "passive" forms (PZ), 40% would like to co-operate actively (AZ)). The preferred activities are dominated by the membership in graduates´ association, participation on conferences and seminars, and arranging the teacher training of IEC students at secondary schools.

Type of activity	Number of answers	%
Participation in IEC graduates´ association	38	38.8
Participation on IEC conferences and seminars	24	24.5
Arranging the teacher training	20	20.4
Cooperation on study trips for IEC students	17	17.3
Participation on teaching within IEC programmes	14	14.3
Examining bachelor theses	9	9.2
Participation on labour exchange	8	8.2
Solving and consulting bachelor theses	8	8.2

Tab. 1: Types of interests

These results are in accordance with findings of Weerts (2010), who argues that alumni activities consist of more forms, including participating on special events or helping with mentoring. In case of IEC graduates the respondents prefer activities which they have already done or known from past, mainly from their own studies (i.e. seminars, teacher training). The interest in graduates´ association can be also related to a deeper motivation and more complex elements of personality, mainly with the student´s identification with IEC (being proud of one´s own university, positive emotions related to the study place and people), also with social needs (meeting former classmates) as well as with the need to stay in touch with the current development of teaching fields.

The questionnaire also examined the reasons why the respondents decided to study at IEC. The combination of the items of reason to study and interest in co-operation may imply that graduates willing to co-operate are mainly those who had chosen to study at IEC on the grounds of internal motivation, be it professional, or personal. At the same time, they are individuals who respect authority, fulfil given duties (they were told to

study) and who can be more conservative. In contrast, those who are not interested in co-operating often mention getting the diploma as the reason to study (external motivation).

	CZ < = 1	CZ > 1
Why did I decide to study at IEC?	(in % of all respondents)	
To do my job better	29%	39%
To get knowledge and skills useful for my everyday life	39%	32%
It was a duty	13%	23%
To get a diploma	42%	23%

Tab. 2: The reasons to study at IEC and the willingness of graduates to co-operate

The second area of interest was to find out what graduates are interested in co-operating. We took into account mainly the respondents´ age and their study results during the whole pre-graduate preparation at IEC. We investigated the rate of correlation between the input variables (age, study results at the scale 1=the best, 4=the worst) and the output variable of general interest (CZ). It ranged from figure 0 (the respondent did not tick any of the offered activities) to figure 8 (the respondent showed interest in all the offered activities). The statistical dependency between the age and the willingness to co-operate was very variable in our sample: the group of motivated graduates consists of representatives of practically all age categories, the differences can be seen only at particular activity offers. It is a positive finding that people with higher age average and enough experience are interested in training IEC students. On the other hand, younger respondents who might benefit more significantly from the information related to their career would attend the labour exchange more often. The graduates´ association attracts mainly older graduates, which might be due to their current life stage; some of them may be looking for new life tasks and challenges after they have fulfilled their parental and professional roles.
In the case of study results and interest, we have found out a statistically significant negative correlation (r = - 0.206): students with better marks have ticked in the questionnaire more areas which they would like to be involved in. The correlation is higher at the active form of co-operation. The group of graduates motivated to an active co-operation (teacher training, consulting the bachelor theses, participation on teaching at IEC) is getting narrower with a higher number of interest activities, as shown in the following table.

		Study results (mean)		
		Mean	Count	%
No. of activities (AS)	4	1.20	2	2,0%
	3	1.50	7	7,1%
	2	1.53	9	9,2%
	1	1.49	21	21,4%
	No	1.60	59	60,2%
	Total	1.55	98	100,0%

Table 3: The rate of active co-operation (the number of activities) and the study results

Thirdly, we wanted to find out what can IEC graduates bring into the co-operation on the basis of their competence profile. A part of the questionnaire consisted of two sets of questions in which the respondents evaluated their competences. The first set researched into the transferable competences (i.e. communication in mother tongue and in a foreign language, mathematical abilities, learning abilities) and teaching competences. We assumed that it would be good mainly for the active forms of co-operation that the

graduates are above average in these areas and thus can pass on their experience to others. To be specific, we chose these competences for the next analysis: the ability to learn, expertise, teaching methods, teaching style, team work, and reflection. The results did not bring bigger differences in comparison with the assumptions, which can be caused by many things. Self-evaluation is not a reliable enough method for competence evaluation, the respondents tend to overestimate or on the contrary underestimate themselves. It is generally true that the more willingness there is to co-operate, the more some competences increase; the self-evaluation of teamwork competence grows with stronger willingness to active forms of co-operation.

	Active collaboration AZ > 0	No active collaboration AZ = 0	Difference in the average evaluation
Teaching style	1.81	1.98	0.17
Ability to learn	1.87	2.04	0.17
Expertise	1.94	2.24	0.3
Reflection	2.14	2.19	0.05
Teaching methods	1.83	1.9	0.07
Team teaching	1.86	1.92	0.06

Tab. 4: The rate of active co-operation (the number of activities) and the level of a competence

Conclusion

Today´s key question is no more whether a university should communicate with its graduates, but rather, in what way it should communicate and what brings this communication to both parties. This interconnection brings the improvement in the quality of study programmes on the university´s part, enables the graduates to stay in touch with their co-students and supports the development and strengthening of their professional competences up to now. For example, IEC keeps in touch with many of its graduates by means of teacher teaching practices for the current students of teaching because some of the graduates have become so called teacher trainers at the secondary vocational schools. Our results go well with findings of McDearmon (2013), who argues that the role of alumni and their readiness to do more for their alma mater stems from their inner identity – in case of IEC those, who are more aware of the importance of the own teaching profession will be, as we expect, more eager supporters of their former school.

The focus on the co-operation with graduates and monitoring their employability at the job market after the finish of their studies is a highly up-to-date issue; one can even say a necessity. The employability of graduates in the practice is a quality benchmark of a given university and also in a way a PR method. Schools that realize it begin to monitor their graduates and try to keep in touch with them even after the studies have finished. Some of the forms it may take are: graduates´ association, reunions after several years, co-operation when consulting bachelor and diploma theses as well as participation on teaching or arranging the teacher training for the current students.

It follows from our research that 40% of IEC graduates of vocational subject teaching and practical teaching are interested in “active” co-operation with its ´alma mater´, which is by all means a very positive findings and also a space to look for various ways how to fulfil this activity. Further considerations will include if the communication will take form of an annual reunions of graduates, a closer co-operation when arranging the teacher training of current students, an interconnection of initiatives for research in the area of

applied research, or creating seminars supporting the development of chosen teaching competences. The research has shown new ways and directions of communication and co-operation between IEC and its graduates, for the realization of which it is necessary to update contacts and make the starting initiative from the university´s part to involve the graduates into the university life even after finishing their studies.

On the basis of the research up to now, we have set these possible strategies of co-operation between IEC and its graduates:

- starting the co-operation already during their studies, for example by a more intense engagement of students into teaching;
- looking up the gifted students continuously and work with them further;
- establishing the IEC Graduates´ Association and creating an attractive offer of its activities
- informing the graduates about the current events at IEC, holding graduates´ reunions on a regular basis;
- inviting graduates to IEC events.

We believe that the stated proposals may help keep the communication and co-operation with our graduates and that their feedback to the study programme will enable its improvement of quality and will increase the employability of our graduates in the practice.

Acknowledgements

The research was carried out as a part of a project which was dedicated to the reinforcement of pedagogical practice and supported by the Education Fund of the Czech Ministry of Education. The authors also discuss the advantages and disadvantages related to different forms of co-operation and which of them seem to be the most effective.

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WHAT COMPETENCES ARE EXPECTED TO BE GAINED AT SCHOOLS?

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Abstract

New times require new skills in new areas. This is the reason why the structure and syllabus are becoming obsolete. Many teams of teachers study new content of teaching materials and new ways of teaching. These efforts are supported by different organizations, beginning with the leadership of schools across the state authorities to the bodies of the European Union. In our study, we examined the students' point of view, both potential and current, as well as the former. We focused on the research skills which "ordinary people", according to their opinion, need for their personal and professional life. We sought to determine the knowledge and skills that should be part of the studies according to these people, and on the other hand, to point out things which they would gladly give up. We researched among schools at all levels, although our priorities were primarily the college level studies. Our assumptions were confirmed in many ways. However, many of the requirements were inconsistent with the actual state of education. The knowledge gained in our research could help in creating track objects as well as their content and the form of teaching.

Keywords

Professional competence, undergraduate students, exploration, tests of hypothesis, decision trees

Introduction

Experts from many countries deal with the problem of improving the necessary skills in teaching at various levels of schools. We can mention, for example, surveys in Russia, Belgium, Spain, USA, Iran, the Netherlands and Cyprus. The article (Cerny, 2013) deals with the methodology of appropriate professional skills. The authors based their recommendations on a thorough statistical processing of detailed quantitative study results. Another article (Aesaert et al, 2015) focuses on competence in the field of ICT. The authors present several conceptual frameworks of the development of professional competencies, which are based on their own empirical research. Another paper (Martínez, Vidal and Cervera, 2015) brings the criticism of changes in curriculum concepts and approach to pupils when speaking about teaching foreign languages. The authors did a survey among the students and concluded that the changes in curriculum concepts did not produce expected improvements, especially in the area of communication skills. In their opinion, schools are erroneously focused primarily on improving the grammar. Finally, the authors point out the need to improve communication skills in the first place. The authors of the article (Ockey et al, 2015) analyze and evaluate indicators, which lead to assessing the level of acquiring the necessary skills in the field of language teaching. They formulated their conclusions based on a survey among Japanese students at American universities. Problems proved to be mainly in the field of communication and interaction as well as presentation skills competencies. Consequences of the development of

opportunities related to identification skills and entrepreneurship education are presented in another article (Karimi et al, 2014). Skills related with business are also discussed in (Beranek, 2013) or (Chlpekova and Koltnerova, 2013). The authors of the article (Ishmuradova et al, 2014) emphasize strengthening the role of experience and practical knowledge when learning foreign languages. The emphasis on communication skills is highlighted in the article. The authors of the essay (Nicolaou and Constantinou, 2014) discuss the problematic of surveys of competencies. Their work brings an objective judgment and more theoretical point of view. They compare more than 800 works cited and try to find models of conception. They use mainly the principles of paper (Greca and Moreira, 2000). The article (Fahrutdinova, Yarmakeev and Fakhrutdinov, 2014) deals with finding new approaches and methods of creation foreign language communicative competence of future university teachers of foreign languages. In this article, the communicative competence is defined as an important part of key competencies. It is true that most of the articles deal with language competence and knowledge in the field of ICT. However, there are also articles that are interested in the other areas of knowledge and skills. The authors of articles (Lopes and Costa, 2007) or (Putter-Smits et al., 2012) look into competencies in the natural sciences.

Material and Methods

Research objective

The survey was carried out repeatedly in the years 2012 - 2014 in the context of student activities at the Faculty of Social and Economic Studies J.E. Purkyne in Usti nad Labem. It followed an opinion on the level of information obtained at school via questionnaire. The emphasis was placed on the contradiction between wishes and reality. The survey's aim was both to analyze the subjective respondents view on competences given to them at school. The survey focuses primarily on the structure of these competencies and their level. The real results were compared with desired ideas. Another objective was to determine the difference between expectations and reality and to suggest possible modifications to the curriculum, especially at universities. These modifications should be based on the results originating in the survey. Dissatisfaction with education, ineffective teaching and poor quality of teaching, especially in the field of foreign languages and IT, were our main hypothesis.

Data

954 respondents, aged 15 and over, responded to the questionnaire. 181 of them participated in the research in 2012, 284 in 2013, and 489 in 2014. The average age of respondents was 33 years. The educational structure of respondents is evident in Figure 1. It is obvious that high school students are prevailing in the survey. The structure of the respondents in terms of the number of their jobs passed so far, is evident from Figure 2. The structure of education is evident from the Figure 3. It is obvious that in the survey graduates of business schools dominated. The second most frequent specialty is technical education. From the Figure 4, it is obvious that employees prevailed in the survey in terms of current position. Half of all surveyed employees were employees in administration. Students accounted for almost a quarter of all respondents.

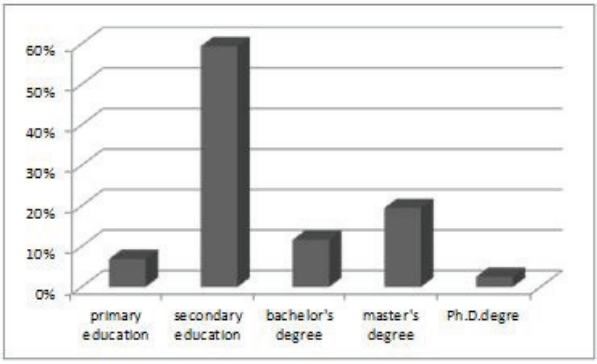

Fig. 1: Structure of the respondents in terms of education attained

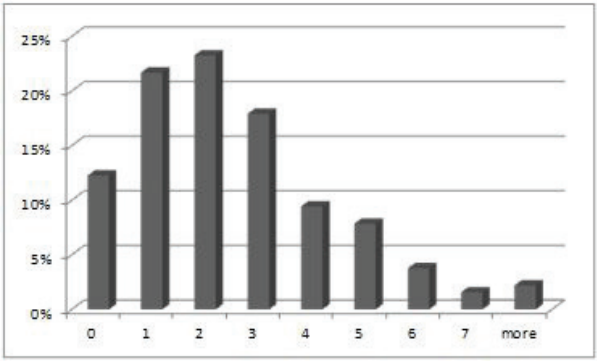

Fig. 2: Structure of the respondents in terms of number of previous jobs

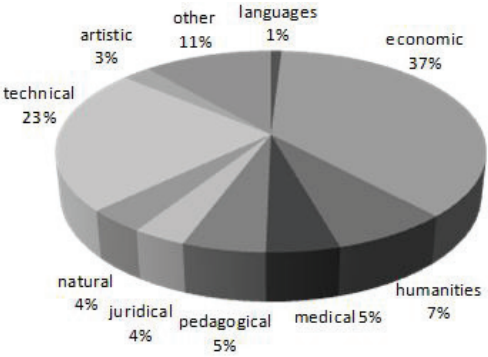

Fig. 3: Structure of the respondents in terms of study focus

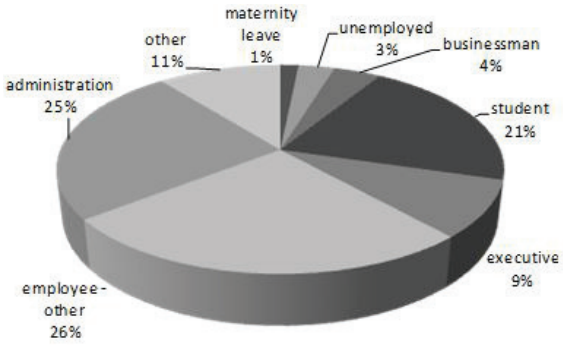

Fig. 4: Structure of the respondents in terms of current job focus

We observed following information in the questionnaire:

- satisfaction with the field (74 %),
- whether the respondent is currently studying at a university (35 %),
- whether the respondent is planning gain further education (38 %),
- as the respondent is currently studying a university, then which field?

Methods

Most of the questions were closed, it means that respondents could choose from a menu of responses (five-point answers were most common). Open questions were asked only exceptionally. These were designed to clarify answers from previous closed questions. The work uses the method of the questionnaire-based surveys and data processing with the use of relevant survey methods described, for example, by (Zambochova 2012).

The following tests were carried out during the processing. We investigated whether all four files vary significantly. As the next step, we examined whether different types of respondents have different opinions on particular issues.

We used c2 test of independence in the case of categorical non-scale variables. For ordinal variables (in the case of scale questions) we used the Friedman test for evaluating the level of response in different groups. In the case of continuous variables, we used a pair of tests, and an F-test for comparison of variances, and subsequently the t-test for comparison of mean values (by the F-test result it was decided about t-test with comparable variances and the t-test with unmatched variances). For the application description, see (Rezankova, 2010).

We worked at the 5% significance level for all tests. The null hypothesis was the equality of monitored values (the range, mean values, frequencies) of individual files.

In the next stage of processing, the classification was performed, using the cluster analysis and subsequently decision trees. The aim was to find a group of respondents with similar views in areas of competence. The Two Step Method was used for clustering, because of primarily nominal variables processing. Decision trees were always created by using three algorithms, namely CHAID, CRT and QUEST. The generated three trees were then compared and used to interpret the resulting clusters using the cluster analysis. All the methods are implemented in the SPSS statistical system.

Results and Discussion

Statistically significant differences between individual files were not proved in most cases of the comparison (the resulting p-values were significantly greater than 5 %, they ranged

from 0.26 to 0.74). Therefore, we could continue to work with all files collectively. The only exception was the issue of colleges studied at present. A wide range of responses occurred in this matter and the composition of respondents in each year was very different. For this reason, we did not include this question in the main processing. Several tests are performed only marginally, for the year 2014.

We examined the first view of the entire population on the overall level of satisfaction with training at various levels of schools. Tests showed, that opinions on individual school levels are different. Vocational schools received the highest satisfaction with the quality of training. Almost 50 % of respondents agreed with the fact**,** that graduates of these schools are well prepared for their work (more precisely, 5 % were totally satisfied, almost 45 % were more or less satisfied). The proportion of satisfied and dissatisfied respondents was comparable in the case of secondary schools, with no statistically significant difference. In the case of universities, a large number of respondents did not comment specifically**,** because they had no idea. We found on closer investigation, that people with complete secondary education are the most critical, and they are also the most dissatisfied when speaking about the readiness of graduates. Conversely, people with the basic education emerged as the most satisfied group of respondents. These people mostly did not express their opinions about the issue of colleges.

We figured out the following findings in the survey, which dealt with the types of school subjects considered to be necessary at all levels of schools. The learning of a foreign language was regarded as the most necessary school subject as it got separated from other subjects during the data processing the most significantly. Almost 90 % of people would rank it at all levels of schools, irrespective of their education (not even the field of education). Teaching ICT, Czech language and general knowledge is the second statistically different group. Approximately 70 % of people would rank these subjects in the curriculum at all levels of schools. A fact worth mentioning is the finding that statistically significant differences were not revealed, as regarded those opinions relative to the level of educational attainment. However, tests showed, that according to artistically focused people the general overview is not that important and they would also removed teaching Czech language in higher forms of education. Conversely, people with specialization in humanities would gladly accepted teaching Czech language at all levels of schools. Teaching math and financial literacy are another statistically distinctly differentiated group. Approximately 60 % of people would rank these subjects in the curriculum at all levels of schools. Tests showed weaker dependence of views on these subjects within groups of people with different education levels. To our surprise, people with secondary education support these subjects the least. A very strong dependency was shown in testing views on these subjects from the perspective of people with different educational fields. It was not a surprise that mathematics is not considered to be that important and is discouraged by people of artistic, humanities-based, medical and pedagogical nature. However, not supporting financial literacy is slightly surprising. As it was assumed, mathematics was supported the most by people of technical and economic orientation. These two types of respondents, but also people dealing with science or working in the field of law, support the financial literacy. All the other proposed subjects were always promoted just by people related to them (psychology, law, science, etc.).

Great support for the teaching of foreign languages and ICT were one of our main hypotheses. Therefore, we focused in detail on these subjects in further survey. After carrying out the statistical evaluation we came to the conclusion that the vast majority of people (almost 95 %) would suggest improving capabilities in these two areas also outside

the school curriculum – as an extracurricular education. Tests have shown that this view is shared by all groups of respondents. Only a group of unemployed is slightly different (p-value 0.12). This category of people prefers the extracurricular education even at 98 %. Another part of the questions in the questionnaire focused on improving the competencies that do not belong directly to particular subjects. Ability to learn, logic, stress resistance, reliability, adaptation to conditions, working with people, self-presentation are examples of these competencies. The logic emerged to be surprisingly statically different the most. 85 % of the entire population would support its improvement, all across levels and fields of study. The next significant group of competences are working with people, reliability, ability to learn and adaptation to conditions and self-presentation. All these competencies are supported approximately by 60 % of the respondents. Tests revealed differences within each group of respondents in some of these competencies. The ability to adapt is strongly supported by people without secondary education. The ability to work with people is strongly supported by employees in administration. The ability of self-representation is desired to be developed by people who work on field of art or law.

Last questionnaire examined things which the respondents were satisfied with during the studies and things they lacked the most. In this section, there were also open questions. Mainly on the basis of these open questions, it is possible to bring conclusions**,** that most of the people lacked the connection with real practice, good quality teachers, foreign language teaching and learning ICT. The good information is the fact that 23 % of respondents think that they did not lack anything substantial in their education. Tests proved once again that the responses were comparable across the different groups of respondents. The only group that is statistically significantly different, were entrepreneurs. Relative satisfaction greatly exceeded in this group. However, upon closer examination of the questions placed at the end of the questionnaire revealed**,** that these respondents did not rely on schools, but on themselves and that they actively gained the necessary knowledge themselves.

In the next processing step, we focused on the classification of respondents. First, we performed a cluster analysis, which divided the respondents into groups similar to each other in terms of preferences of individual information sources. Then we created a new variable representing membership in the clusters created in the previous step. We received excellent quality of clustering in the application of the two-step method, which created two clusters. We also constructed decision trees using the three selected methods (CART, CHAID QUEST). We chose belonging to the cluster as the response variable and we chose answers to particular questions about respondents' opinions as explanatory variables. Risk estimate is ranged from 0.142 to 0.235 for all the created trees. This means that the success rate of classification of objects ranged from 85.8 % to 76.5 %. The quality of models was adequate. Next, we created a second trio of decision trees. Again, we chose belonging to the cluster as the response variable. However, unlike the previous one, we chose answers to questions about the respondent's type as explanatory variables. Risk estimate is ranged from 0.348 to 0.483 for all the created trees. This means that the success rate of classification of objects ranged from 65.2 % to 51.7 %. Therefore, the quality of models was not very high. However, this quality can be considered as sufficient. The following observations are the result of the classification. Respondents older than 35 years, with economic or technical specialization, are the happiest. Education in foreign languages and ICT is insufficient according to most of the respondents. People with pedagogical orientation are less satisfied, but without specific wishes. Secondary education in economics people who work in administration**,** aged between 23 and 35 years, are the least satisfied. They mostly lack better quality teachers and linking schools with more

real experience. They would welcome more particularly the teaching of entrepreneurial competencies, logic, but also psychology and general knowledge in addition to foreign languages and ICT. They would welcome teaching more through discussions and help in improving the skills of self-presentation. Young artistically-oriented respondents have no fundamental objections to the level of education. They would welcome more creativity. The creativity would be also welcomed by students of medical schools. In addition, they would appreciate more connection with practice and improvement in working with people.

Conclusion

From the above investigation it is obvious that satisfaction with the level of education in the Czech Republic is more or less satisfactory despite the unofficial speech. People with secondary education in economic field, who are working in administration, consider this issue to be the most critical. According to respondents, the biggest problem of the Czech education is in connecting school education with real practice. Dissatisfaction is also in the area of teachers' competence. The demand for intensive teaching of foreign languages and ICT is echoed across all groups of respondents. In this area, it is also the greatest dissatisfaction with the level of teachers. The view of the other focus of teaching is, however**,** more differentiated by groups of respondents. Technically focused respondents think that the Czech education has an insufficient level of teaching mathematics. Humanities and economic based respondents would like to have more psychology, logic, teaching business and general knowledge included in their studies. Artistically and medically focused respondents called for promoting greater creativity. Respondents of both last mentioned groups would welcome education concerning working with people. It is obvious, that there is a need for greater differentiation of subjects in various fields of education, preferably in the form of a variety of optional courses.

Our findings are broadly consistent also with inquiries from other countries that we mentioned at the outset. Our research showed the lack of emphasis on students' communication skills in foreign language teaching, as well as in articles (Ockey et al, 2015) or (Martínez, Vidal and Cervera, 2015). We could take suggestions for improvement in teaching IT, for example, from (Aesaert et al, 2015). Our findings show to the importance of connecting schools with real practice is highlighted in (Kamalova, 2015), as well as in our survey. It is obvious that the problem of the Czech education is not only a national issue, but has a transnational character.

Acknowledgements

The search is financed by the internal grant agency of the J.E. Purkyne University in Usti nad Labem, the Czech Republic.

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Proceedings of the 12th International Conference Efficiency and Responsibility in Education 2015

Cover:	**Roman Kvasnička**
Technical editors:	**Jiří Fejfar, Roman Kvasnička**
Published by:	**Czech University of Life Sciences Prague** **Kamýcká 129, Prague 6, Czech Republic**
Printed by:	**Powerprint, s. r. o.** **Kamýcká 1219, Prague 6, Czech Republic**

ISBN 978-80-213-2560-9
ISSN 2336-744X