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ASSESSMENT TOOLS FOR EVALUATING KNOWLEDGE OF ONLINE STUDENTS

[1]✉Akerke Akanova, [2]Nazira Ospanova, [3]Gulmira Abildinova, [4]Milos Ulman

[1]Department of Computer Engineering and Software, Information Technology Faculty, Eurasian National University named by L.N. Gumilyov, Satpaev Street 2, Astana, 010000, Kazakstan, +7 7172 709 500, akerkegansaj@mail.ru

[2]Department of Computer Science and Mathematics, Physics and Informatics Faculty, S. Toraigyrov Pavlodar State University, Kazakstan

[3]Computer Science Department, Information Technology Faculty, L.N. Gumilyov Eurasian National University, Kazakstan

[4]Department of Information Technology, Faculty of Economics and Management, Czech University of Life Sciences Prague, Czech Republic

Abstract

The paper deals with online course delivery in higher education courses in Kazakhstan. The aim of the paper is to verify whether or not the assessment of students' responses to questions during online lessons may lead to improvement of quality of students' knowledge and higher participation in online lessons. Survey among 165 students from 10 specialties at Pavlodar State University named after S.Toraigyrov was conducted in academic year 2014/2015. By examining basic characteristics of dispersion, the online courses with immediate evaluation attracted more students than courses without evaluation. Additionally, the evaluation has significantly and positively affected participation of students in online courses.

Keywords

Assessment tool, distance learning, education, e-journal, LMS, offline, online

Introduction

With the introduction of information network technologies in the theory and practice of traditional education of high school in Kazakhstan, distance learning technology is being gradually introduced. One of the tasks of Kazakhstan in the field of education, 10 years ago, was entering into the worldwide educational area. In this regard, Kazakhstan began to intensively introduce new technologies in education. Ministry of Education and Science in Republic of Kazakhstan (2006) issued an order "The rules of the organization of distance learning in institutions giving higher professional education, additional vocational education of the Republic of Kazakhstan" about approving the Rules of the organization of distance education in the institutions giving higher professional education, additional vocational education of the Republic of Kazakhstan. This document discloses the concept of distance learning forms such as video lectures, television lectures; radio lectures; multimedia lectures; video conferencing; teleconference; independent work of students on electronic textbooks (e-books, multimedia tutorials, trainers, information and referral system), virtual laboratory workshops (simulations); computer testing systems; consultations through forums, chat rooms and e-mail.

Having some difficulties in the organization of distance learning such as a separate form of

education in 2009, the Ministry of Education and Science of the Republic of Kazakhstan (2009) is developing State Educational Standard of the Republic of Kazakhstan 5.03.004-2009 "Organization of learning for distance educational technologies", here distance learning is applied in all forms of education (full-time and part-time), as a new learning technology.

On March 11, 2010 Kazakhstan became a member of the Bologna process and a full member of the European Higher Education Area. Regarding the requirements of the Bologna process some additional changes are being made in distance education technology, and in 2012 the Ministry of Education and Science developed new rules of organization of educational process on distance educational technologies. This document amplified requirements for the application of distant learning technologies in higher education.

The joining of Kazakhstan to the Bologna process allowed Kazakhstan to adhere to educational programs, curricula, academic mobility of students and teachers, to maintain convertibility of national diplomas in the European region and to enable the right of the graduates to work in any country. An important role in this is distance learning in connection with the employment of students, as well as taking into account large area of the country, applicants to the university have the opportunity to reduce material, travel and time (Nurmukhametov et al, 2015). According to the Regulations of educational process organization by distant educational technology by the Ministry of Education and Science of Republic of Kazakhstan (2015) the categories of students used distance education technologies including students with a college diploma, students enrolled in the academic mobility and those who serve in the army and people with disabilities, respectively, there is no age limit for distance learning.

Online Distance Learning is a broad and interdisciplinary field of research (Zawacki-Richter and Anderson, 2014) that includes online learning, distance learning and e-learning (Moore et al, 2011). Based on the international Delphi study, three broad categories of research were described (Zawacki-Richter et al, 2009): macro-level (distance education systems and theories), meso-level (management, organization, and technology), micro-level (teaching and learning in distance education). This paper deals rather with micro-level aspects of the online distance learning in higher education in Kazakhstan.

One of the type of exercises used in distance learning classes are online sessions; it can be a lecture or consultation on the covered subjects. Online activity should not differ from usual lesson, that is, the sequence of presenting material by teacher, presentations of participants, surveys of teacher, questions and answers should be the same. Virtual classrooms replace the usual classroom of high school, but with the difference that students and teachers are distant from each other. Using special web technology helps them to communicate in real time. Accordingly, the communication is in the synchronous mode of a live broadcast.

Like in any other traditional lesson, an online lesson includes monitoring of students' knowledge (Milevich, 2009). They differ in purpose, the time of implementation, applied tools and techniques. Types of control are of not equal value in terms of objectivity, checking the depth of mastering the studies, and the psychological and educational significance.

Every teacher can choose any methods of assessment at online lessons. There are many methods of assessment as at traditional lessons and at online lessons methods such as observation of a student`s learning process, oral and writing quiz, assessments, essays, tests, self-control, mutual control, portfolio which are applicable for online lessons Robles & Braathen (2002). However, assessment in the form of grading and certification is no

longer sufficient. Assessment should be linked with learning and skill development of the students (Chaudhary, 2013).

In accordance with terms of Bologna Declaration in Kazakhstan, all educational institutions for evaluation of knowledge use the module-rating system of assessment, which implies 100-point scale grading. Maximum number of points that student can receive for academic achievements in the process of modules' content learning is 100 points. At the same time the student's knowledge of a module content is valued based on scores obtained for all kinds of activities carried out, taking into the account respective coefficients. For example, it takes into account the scores in the tests, performance in writing essays or control works, in laboratory work, case studies, etc. Intensive modernization of traditional education came with the introduction of distance learning technologies in training.

Despite the implementation of online distant learning and its growth in Kazakhstan, certain challenges and issues has not been fully examined yet. Further studies show that motivation of distant online learners is rather a weak point of distant online learning performance. Some studies have shown that it is not just internal motivation, but a complex of conditions that drive students to learn in online distance learning courses (Hartnett et al, 2011). Procrastination (Michinov, 2011) and retention of online students is another issue that affects online course delivery and results. Using appropriate technologies, providing feedback and knowing the online learner are success factors to high retention and relevant outcomes (Mitchell, 2015). Nowadays, students positively receive online communication in online distance learning (Aydin, 2012).

The aim of the paper is to verify whether or not the assessment of students' responses to questions during online lessons may lead to improvement of quality of students' knowledge and higher participation in online lessons.

Materials and Methods

One of the requirements of Regulations of the learning process organization in distance educational technologies in Kazakhstan is the availability of the network management system of education (Nurmukhametov et al, 2015). Baizyldayeva et al (2013) provided overview of widespread network technologies used in distant education in Kazakhstan.

Every high education institution which applies distance learning technologies in education has its own educational portal. On the basis of this portal they have formed subsystems for the application of distance technologies identifying a student who has full educational content in online and offline regime, testing a program and feedback with a student.

At Pavlodar State University (PSU) named after S.Toraigyrov, its own system of distance learning was developed and implemented on the basis of university portal (Akanova, 2013). In the the system, modules for both offline and online lessons are used. In offline classes, all kinds of knowledge evaluation are used in accordance with the type of work (for example, grades for the tests, for the performance of writing essay or control work, for the performance of laboratory work, and case studies are taken into account, etc.) In this case, we used all of the five categories proposed by Kearns (2012) such as written assignments; online discussions; field; quizzes and exams. Presentation but online lessons were taught in the form of consultations and were not evaluated. In the online lessons, students discuss with the teacher covered subjects.

During that time the system of distance learning at PSU had not introduced the assessment of online courses, which led to the decrease in students' attendance in online sessions and deterioration of quality of students' knowledge. Hence it brought the issue of assessment of students' knowledge in online courses and the development of electronic register to put

down students' mark in real time and automatically transfer them to the teacher's register. Technical implementation of distance learning technologies is a rather complex software and hardware system, and basically it is built on the basis of the portal scheme (Figure 1).

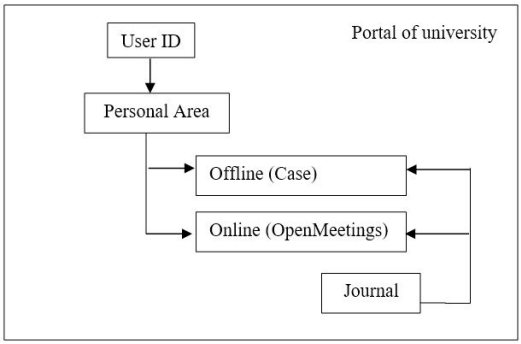

Figure 1: Arrangement of the journal on portal (self-authored)

Organization of educational process for distance educational technologies at PSU is based on the educational portal of the university (www.psu.kz). On the basis of the educational portal "Automated system of university management", distance learning management system (LMS) has been developed, including online and offline modes of interaction between students and teacher. The educational portal was formed by group of university programmers and the head of Department academic questions, subsystem for distant education was formed by group of programmers and the head of department of distant education and IT promotion (Akanova et al, 2013).

A planning schedule was designed according to the working curriculum, which distributes the time for online training groups that use distance educational technologies. Offline and online lessons are organized by using modules of distance educational technologies application in the educational process: online lessons, electronic methodical complex of disciplines (cases), file sharing, chat, etc. To implement online training, free access program Apache OpenMeetings was applied. The module of register for students' assessments is located in the teacher's dashboard, which is interconnected with the register for online courses. Electronic register for online courses works only in real time mode, which lets marks being automatically transfered to the electronic register of teacher in the dashboard. Considering the aim of the study we have electronic register in real time mode and students' knowledge assessment.

Thus an e-journal was developed so that the teacher would not use the paper journal during the online sessions, and it can be easily integrated into any available webinar. Indeed, it is easier to take notes without taking the fingers off the keyboard during the online seminar at the computer. Teacher can grade each issue separately. Then, the program itself calculates the average score as a percentage. The application takes off the burden of unnecessary calculations from teachers.

The functions that the program performs are such as:

1. The program is connected with the university's journal of distance learning system through which students are identified and therefore in the list of students appear only those who are in the online class.
2. In the opposite side of each student's column there is the column for grades.
3. The program finds the correct answers and displays average rating percentage.

4. The program may be placed on the desktop of the teacher, which can be seen by students in the program Apache OpenMeetings.
5. In the module Journal (see Figure 2), the teacher can also choose the number of questions that will be used during the lesson.

Учитель: Аканова Акерке Сапаровна | Количество вопросов: 6 5 4 3

№	ФИО студента	1	2	3	4	5	Итог
1	Абзамова Жансая	✗	✓	✓	✓	✓	80
2	Адильхан Абай	✓	✓	✗	✓	✗	60
3	Болатов Бакытжан	✓	✗	✓	✓	✓	80
4	Джайыкбаев Берик	✓	✓	✓	✗	✗	60
5	Жанболатов Думан	✓	✓	✗	✓	✓	80
6	Жумабаев Магжан	✗	✗	✓	✓	✓	60
7	Имамадин Ержан	✓	✓	✗	✓	✓	80
8	Каким Мерей	✓	✗	✓	✓	✓	80
9	Кенесбек Олжас	✓	✓	✓	✓	✓	100
10	Калидолла Ерболат	✓	✗	✓	✓	✗	60
11	Нурсултанов Якуден	✗	✓	✓	✓	✓	80
12	Сейткан Бекзат	✓	✓	✗	✓	✗	60
13	Советханова Маржан	✓	✗	✓	✓	✓	80
14	Талапов Есбол	✓	✓	✓	✓	✓	100

Figure 2: The module Journal for grading students' knowledge

Hence, to achieve the aim there are questions occurred: Is the students' knowledge assessment needed? Is the electronic register in real time needed? The purpose of these questions was to identify differences in the quality of knowledge on online courses with and without evaluation. For the beginning the survey with a sample of students was held, which included questions such as: Would you attend to online lessons? Would you like to get marks for each question asked? Would you like to get the mark on online courses? Considering the results of the survey, an observation of online lessons with and without evaluation was made afterwards. This methodology should help to verify the hypothesis that the assessment of online lessons provides improvement of quality of students' knowledge and participation.

Results

The research was held in 2014-2015 academic year. 225 students from 9 specialties participated in the experiment. In the first semester 125 students from specialties Special Information Systems, Computer Science, Electric Power Industry, Rights, Accounting and Auditing participated in the experiment. Such courses as Database system, Operating Systems, Criminal Law, Theory of Electrical Engineering, work in the sphere of 1 C were taken for observation. In the second semester 125 students majoring in Computer Science, Law, Accounting and Audit participated in the experiment, and for observation were taken following courses: Object-oriented programming with programming in C #, Programming Technology, Civil Law, Physics 1, Microeconomics. The complexity of the disciplines in this experiment and features of specialties has not played the main role.

Each participant group contained 25 students. During the observation of first semester, where online classes were conducted without evaluation, average attendance to all courses amounted 32% (Survey), 36% (Discussion), 32% (Report) from general quantity of students of the group. For example, general quantity of students is 25, 8 students out

of 25 attended the lessons (Table 1). From Table 1 occurs a question: Why the practical and individual works were done by 64-68% of students? By the results of research of first semester 66.5% out of 25 students attended 15 lessons (each three credit course has 15 lessons) more than once and could accomplish the tasks (Table 1). By the results of observation of second semester, where online lessons were conducted with evaluation, the attendance of students increased to 76% (Survey), 80% (Discussion), 88% (Report). The grades of the students were put into electronic register, respectively, we could observe students actively participating during the online lessons, it raised the attendance and small part of them not only took part in it, e.g. out of 19 attendants 16 were evaluated, therefore only 3 students were passive. Among the evaluated students we choose the students with grades 'excellent' and 'good' for evaluating the quality of training. They are 15 out of 16 students (Survey), 16 out of 18 students (Discussion), 17 out of 19 students (Report). On average the percentage of the quality of knowledge during the use of online lessons evaluation was equal to 92.25%, and respectively practical and individual works were done up to 92.11%. It shows the increasing of knowledge quality comparing to the first semester's 28.5% (92,11 - 63,61) (Table 1).

Types of classes		Online			Offline	
		Survey	Discussion	Report	Task for practical work	Task for individual work
1st semester Discipline №1	Quantity of participants	8 /32%	9/36%	8/32%	16/64%	17/68%
	Evaluation	-	-	-	16/10	17/11
Knowledge quality		-	-	-	62,5%	64,71
2nd semester Discipline №1	Quantity of participants	19/76%	20/80%	20/80%	22/88%	23/92%
	Evaluation	16/15	18/16	17/16	19/17	19/18
Knowledge quality		93,75%	88,89%	94,12%	89,47%	94,74%

Table 1: Database of evaluation, 2015 (own calculation)

Studies have shown that students, who are motivated by assessment, attend online lessons more frequently than they used to attend before. Thus, visiting the online class, they get theoretical knowledge, discuss the topic and get the teacher advice. The knowledge they can use during the execution of practical and independent work that contributes to the proper performance of tasks in the offline training.

Applying the method of observation, we investigated and found that the use of online lesson evaluation and use of electronic register have a significant impact on improving the quality of students' knowledge (Table 1).

As the result of the observations, students are well-trained and active in the graded online lessons with provided questions and tasks for studying the subject; otherwise, they have passive attendance, poor preparation for the online lessons. To obtain empirical data, students of all courses was involved.

In the result of ANOVA analysis we get significant difference between the groups, i.e. by ANOVA calculating we obtained the difference in 0.5, which proves that hypothesis about evaluating online lessons has essential impact and leads to positive results (Table 2).

Criteria	Quantity of observations	Quantity of participants	Average of attendants	ANOVA
Online lessons with evaluation	15 lessons	125	18	0,70
Online lessons without evaluation	15 lessons	125	8,73	1,20

Table 2: ANOVA, 2015 (own calculation)

This experiment proves that the use of evaluation of students' knowledge and application of the electronic register contribute to the quality of students' knowledge.
The problem of distance learning is that distance learning offers different modules for use in offline sessions, but do not offer online training modules (most online lessons use a link to webinars). This raises the question of research and development of distance learning system with the inclusion of different types of training: online with the register, online without register, offline with the register and online without register.

Discussion

Similar study was done among 351 higher education students in Croatia and showed that students' learning strategies can be positively influenced by announcement of online assessment can positively impact both formal and perceived levels of success in achieving the desired learning goals (Zlatović et al, 2015). Online communication was also positively perceived by majority of higher education students in Turkey (Aydin, 2012). Despite providing just a minimalistic form of interactivity (Open Meeting) and feedback (instantaneous evaluation of answers), students experienced higher satisfaction with courses delivery. Courses and programs that are more interactive and incorporate the use of multimedia are perceived as more helpful by students (Boling et al, 2012).
Unlike other applications and systems, the program considered in this paper enables students and teachers work in both online and the offline modes, which is not provided by many other programs such as Moodle or Blackboard (Nozawa, 2011). It can also be used for online training as well as grading students' knowledge in all areas of IT specialties while it promptly issues the results of works for students and teachers.
The program Moodle is designed to deliver content unlike the distance learning system that is used at PSU. On the contrary, Moodle has limited possibilities of assessment (Kumar et al, 2011). There is evaluation of student only within a course, while the proposed program that is able to build a final assessment. Moodle is a system focused on the Western model of education (Loginova, 2015) having one course with several groups of students, while the distance learning management systems used in Kazakhstan should be more focused on the priority use in study groups.
In general, online education is nowadays being considered and implemented in all higher education institutions in Kazakhstan (Kenzhebayev and Dalayeva, 2014). The software examined in this paper provides the capability for student's knowledge assessment. The methods and types of the assessment are presented in Robles and Braathen (2002) were implemented at PSU online portal and proved to have a positive impact on students' attendance and knowledge assessment.

Conclusion

Based on the research following conclusions can be made. The choice of an appropriate knowledge quality assessment system is a complex and painstaking task. The main purpose of the system is detection of knowledge level of covered subjects and knowledge gaps, obtaining information for correcting the work of teachers. Positive grades encourage

students for further studies, provided feedback and fair criticism triggers their desire to catch up and continue.

The Journal module which is used in online lessons at PSU makes it possible to objectively evaluate students' knowledge and promptly publish the assessments. Thus, Journal module improves the organization of grading in the classroom of online mode, and enables teachers to inform the students about the grades quickly.

The questions of interactivity during online lessons are left to be explored scantily. Further research should be focused on examination of online distant learning outcomes across various higher education institutions in Kazakhstan. As another relevant topic seems to be to make a comparison of results with other countries in Asia and Europe that face similar conditions in terms of geographical distance, number of population and undergoing reforms in higher education system.

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REQUIREMENTS AND EXPECTATIONS FOR MBA PROGRAMMES IN THE CZECH REPUBLIC: PERCEPTIONS OF EMPLOYERS

[1]✉Tereza Balcarova, [2]Ladislav Pilar, [3]Katerina Venclova, [4]Karolina Tuckova

[1]Department of Management, Faculty of Economics and Management Prague, Czech University of Life Sciences Prague, Kamýcká 129, Prague, 165 21, Czech Republic, balcarova@pef.czu.cz

[2]Department of Management, Faculty of Economics and Management Prague, Czech University of Life Sciences Prague, Czech Republic

[3]Department of Management, Faculty of Economics and Management Prague, Czech University of Life Sciences Prague, Czech Republic

[4]Department of Management, Faculty of Economics and Management Prague, Czech University of Life Sciences Prague, Czech Republic

Abstract

This research is the first phase in a scientific study focused on evaluation of the value of MBA programmes in the Czech Republic. The aim of this preliminary research is to identify the requirements of MBA programmes from the employers' perspectives as regards confidence in the quality, financial contribution, acquired competencies and the personal development of their employees. In this study the results of a quantitative survey (n = 127) are evaluated. The results of this survey indicated a positive moderation effect between confidence in the quality of MBA programs and the financial contribution of the organization as regards the MBA fee and the size of the organization. The most important factor is identified as the acquisition of expert knowledge for micro, small and medium sized organizations. It was found that for large organizations an important factor is the development of soft skills, especially leadership, according to Czech HR managers.

Keywords

Business studies, employers, higher education, Masters of Business Administration, soft skills, leadership

Introduction

Human resources can be considered as the main engine for any organization. The development of knowledge and skills in employees enhances their effectiveness, for fulfilling the requirements placed on the organization. In a time of constant change that occur in the external and internal environment of every organization, companies should be able to respond to these changes and adapt to new requirements. The question arises as to whether the Master of Business Administration (MBA) programmes support the organization in its business activities. Employers in the Czech Republic need to know what additional value and benefits can be provided by an MBA program. The issue arises as to whether employers want to support their employees and provide them with the opportunity to study for an MBA. If the answer is positive, are they willing to pay and do they have confidence in Czech providers of MBA programmes?

MBA studies were established in the USA in the 1960s and were widely adopted in Europe

(Baruch and Leeming, 2001). Gupta and Bennett (2014) conclude that the numbers of MBA programs are growing throughout the world, with more and more colleges offering graduate education in business. In the Czech Republic there is an extensive system of formal education, from elementary schools to high schools, colleges and universities (Plamínek, 2014). Folwarczná (2010) states that MBA programmes are considered in the Czech Republic as a means for developing managers. Malach (2005) noted that the MBA represents the acquisition of managerial skills or qualifications, and should create a better chance for graduates to gain a managerial position, primarily in international companies. According to Vnoučková, Urbancová and Smolová (2015) Czech organizations support their employees in their development, and responsible employees are self-motivated for their personal development. What is the situation with MBA programs? Various studies analyse the value of MBA programs abroad. Baruch and Leeming (2001) examined the efficiency of MBA programs in adding value to the graduates, so that they become better managers. Gupta and Bennett (2014) analysed the effect of MBA programs on organizational success, stating that employees with an MBA were more productive in organizations because of skills acquired in four major areas: social, administrative, ingenious and logical resources. Baruch (2009) examined the value of the MBA for graduates and for their employers at three levels - the individual, the organization and wider society. They also pointed out the benefits and potential pitfalls of the MBA for each constituency.

Employers plays an important role in the process of providing higher education through the MBA courses. The employers are interested in the quality and value of the MBA degree (Minh Ly et al, 2015). As sponsors (Smith, 1993) they expect a certain level of education and benefit from the training in addition to the diploma award itself, leading to their promotion. But they do not expect that it will produce a solution for developing their organization or its management (Smith, 1993). One of the aims of this research is to evaluate the employers'confidence in MBA programmes and their willingness to pay – taking into account the quality and level of the training provided by higher education institutions. Employers stated that they are willing to contribute financially to the education of workers to develop the talent and skills of their human resources, in order to raise the standards of their employees and exploit their newly acquired new skills (Shimizu and Higuchi, 2009; Gupta and Bennett, 2014). On the other hand previous studies suggest that the MBA has less importance for HR than before (Cruz and Wood 2015; Varela et al, 2013; Blass and Weight, 2005). Critics of MBA programs have stated that these programs are now considered as a tool for the first insight into management, rather than as a tool for advancement to senior positions or promotion in management (Blass and Weight, 2005; Mintzberg, 2004). It is also reported in previous studies that HR sees no advantage in the title itself, if it does not reflect the greater knowledge of employees (Blass and Weight, 2005).

Prince et al (2015) said that companies see the value of MBA programs for employers. They noted that a successful MBA results are seen in more effective delivery in management positions (Prince et al, 2015). The value of an MBA has been identified as managerial and soft skills that include such generic competencies as teamwork, oral and written skills, leadership skills, adaptability, dependability, innovativeness and resourcefulness (Prince et al, 2015; Baruch, 2009; Malach, 2005). Research on the perspectives of alumni and graduates showed that the value is perceived not only in terms of acquired skills and knowledge (new soft skills, general experience, complex business understanding), but

also in getting new experience, job satisfaction and personal development (Bledsoe and Oatsvall, 2009; Baruch and Leeming, 2001).

An important aspect is the level of confidence in the MBA program itself and in the institutions offering MBA programmes in the Czech Republic and abroad. Previous studies point to some degree of skepticism expressed by HR specialists regarding the value of MBA programs. Criticism is aimed at the discrepancy between the content of programs and the lack of development of managerial soft skills (Bledsoe and Oatsvall, 2009; Bennis and O'Toole, 2005; Ghoshal, 2005; Mintzberg, 2004) - with little effect on the career prospects of graduates (Bledsoe and Oatsvall, 2009; Bennis and O'Toole, 2005; Pfeffer and Fong, 2002)**.**

According to these findings the research questions are: RQ1 Is there a difference between perceptions of the MBA studies by certain size of the company? RQ2 Is there an effect of the size of the company and the level of confidence in the quality of MBA programmes on the willingness of employers to share the costs of MBA courses?

Materials and methods

A quantitative survey was conducted from December 2015 to January 2016 in the Czech Republic, to identify the value of the MBA as perceived by the employer. It was carried out on the basis of a questionnaire survey comprising of 23 questions, two of which were qualitative in nature. 15 questions were based on the degree of agreement about the added value as perceived by employers. This was measured using a Likert scale from 1 (not at all) to 5 (complete agreement). The sample group consisted of 341 HR managers. The questionnaire return rate was 37.2%, of which micro organizations (with up to 10 employees) amounted to 25%, small organizations (from 10 to 50 employees) amounted to 16.7%, medium-sized organizations (from 51 to 249 employees) accounted for 20.8% and large organizations (over 250 employees) represented 37.5% of the sample. The classification of organizational size was taken from the Office for Official Publications of the European Communities (2006). In terms of their legal basis, the most frequent types of organization were limited liability companies (62.5%), followed by joint-stock companies (25%). 22.5% were cooperatives, while 22.5% were self-employed. For vertical analysis the method of arithmetic mean and mode was used. To analyse the effect of the size of an organization on confidence in the quality of MBA programs and the employer´s financial contribution for MBA courses, the moderation effect method was used. Moderation occurs when the relationship between two variables (in this case: confidence in the quality of MBA programs, and the employer´s financial contribution for MBA courses) depends on a third variable (in this case: the size of enterprise). The moderation effect was measured using the statistical worksheet plots of two-way interaction effects for non-standardized variables (Dawson, Richter, 2006). Input information for analysis was modelled in the IBM SPSS AMOS (Version 22, 2016) program. For the Moderation the following equation (1) was used. Where β1 is the coefficient relating the independent variable, X, to the outcome, Y, when Z = 0, β2 is the coefficient relating the moderator variable, Z, to the outcome when X = 0, i5 the intercept in the equation, and e5 is the residual in the equation. The regression coefficient for the interaction term, β3, provides an estimate of the moderation effect. If β3 is statistically different from zero, there is significant moderation of the X-Y relation in the data. (Fairchild and MacKinnon, 2009)

$$Y=i5+\beta 1X+\beta 2Z+\beta 3XZ+e5 \quad (1)$$

Results

The results of this research (Table 1) demonstrate the differences in perception of MBA programmes by employers. As regards the employer´s financial contribution for MBA courses, 45.8% of organizations are not willing to pay for their employees on an MBA course. The remaining companies (54.2%) are willing to contribute. 8.3% of the companies responding would pay up to 25% of the MBA course costs, 25% of companies are willing to pay up to 50% of the MBA course costs, 12.5% of companies are willing to pay a maximum of 75% of the MBA course costs; only 8.3% of companies are willing to pay up to 100% of the costs for an MBA course.

	Micro		Small		Medium		Large	
	AM	M	AM	M	AM	M	AM	M
I would expect improvement of employee's complex business understanding.	1,79	2	1,78	2	2,26	2	1,45	1
I would expect the employee to develop new hard skills.	1,56	2	1,52	2	1,67	2	2,17	1
I would expect the employee to develop existing hard skills.	1,85	2	1,61	2	1,54	2	1,89	1
I would expect the employee to obtain new leadership skills.	2,72	3	2,69	3	1,48	1	1,74	2
I would expect the employee to develop existing leadership skills.	2,89	3	2,76	3	1,46	1	2,19	1
I would expect the employee to gain general experience.	2,54	3	2,62	3	2	1	1,74	2
I would expect the MBA programme to contribute to the personal development of the employee.	2,15	2	2,53	2	1,67	2	1,15	1
I would expect that I would promote the employee.	2,95	3	2	2	2,33	3	2,4	2
I would expect the employee to change the focus of their career.	3,32	4	2,5	3	3	3	2,81	4
I would expect that the employee would require an increase in salary.	2,63	3	2,5	3	2,32	2	2,13	3
I would expect the employee to obtain new contacts that are useful for work purposes.	2,32	2	2,36	2	2,33	1	2,43	3
I would expect the employee to be awarded the MBA title.	3,22	3	3,11	3	2	1	1,15	1

AM - Arithmetic mean, M – Mode

Table 1: Vertical analysis of employers´ expectations and requirements according to organization size, 2016

This vertical analysis suggests that micro-organizations have the greatest expectations for the acquisition and development of hard skills by their employees. It also shows that their lowest expectations are for a change in focus in the careers of their employees and also for

the expectations of promotion by their employees on the basis of the MBA award. Micro- and small organizations have high expectations for the acquisition of new hard skills and for the further development of existing skills. No significant demands were identified for new leadership skills or for their development. Also, micro- and small organizations are not interested in the personal development of their employees, nor do they expect requirements for promotion, or demands for an increased salary. But they do expect the acquisition of new contacts through their employees studying on an MBA program.

Medium sized organizations mostly expect the development of new and existing hard skills. By comparison with micro- and small organizations, their expectations regarding complex business understanding are lower. By contrast, there is a high expectation of competency in leadership. Furthermore, medium organizations have greater expectations for the personal development of their staff, than is the case for micro- and small organizations. Medium sized organizations also expect requests for an increase in salary.

Large organizations have minimal expectations for complex business understanding. However, they do have the highest expectations of leadership competency, coupled with expectations of future demands by their employees for promotion and salary increases.

The moderating effect of company size was examined with reference to the impact of confidence in the quality of MBA programs and the financial contribution for MBA courses. The size of a company was shown to have a negative moderating effect, as illustrated in Figure 1. In other words: the size of an organization has a positive relationship as regards confidence in MBA programs in the Czech Republic and the percentage contributed by employers paying for MBA programmes for their employees. This result can be interpreted as follows: The bigger the company, the smaller is the effect of confidence in the quality of MBA programmes as regards the percentage that the company is willing to pay. In other words, it can be also said that small organizations are willing to pay a greater share of the cost for an MBA course, but only if they have confidence in the MBA programme.

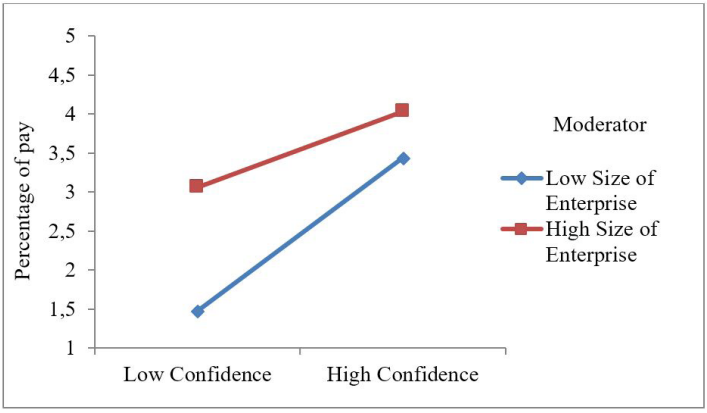

Figure 1: Moderation effect of company's size on the relationship of confidence in the quality of MBA programmes and the employer´s share of the costs for MBA courses, 2016

Discussion

In terms of the value of MBA programmes for employers, this study has identified the requirements and expectations of HR managers. As suggested earlier, these results form part of a long-term research programme aimed at evaluating the level and quality of MBA

programmes provided in the Czech Republic, and their practical impact on business development. Extensive studies of MBA programs have been conducted in recent years. Researchers have identified the benefits of MBA programmes for businesses and their development. The results of the present study support reports by Gupta and Bennett (2014), Baruch (2009) and Smith (1993). However, the present results show that there are differences in employers' perceptions and requirements with reference to different types of enterprise and especially their size.

Various researchers (Cruz and Wood, 2015; Varela et al, 2011; Bennis and O'Toole, 2005; Mintzberg, 2004) have stated that there have long been discussions regarding the development of comprehensive management skills, including leadership. They have stated that partial specific skills (such as setting goals) are often developed (Varela et al, 2011). Some studies conducted so far even evaluate MBA programs as being inadequate (Varela et al, 2011) and that there is a lack of development of managerial skills. The Authors' results have shown that large companies strongly require the development of managerial skills, especially leadership skills. This research has shown that large companies require leadership skills to be developed as an outcome of MBA programmes.

When for example hiring "strategic" Chief Financial Officer after completing their MBA programmes, some company managers expect the candidates to have broader leadership skills, together with other skills (Datta, 2014; Costigan, 2015). Nevertheless, this research confirms that small businesses in particular, require the development of hard skills rather than leadership skills. This reflects the criticisms that have already been published, indicating that the emphasis on hard skills over soft skills is considered to be a disadvantage of current MBA degree programs (Cruz and Wood, 2015; Mintzberg, 2004). Interestingly, however, the respondents oppose the notion that the title does not constitute an advantage in itself, but consider that the acquired knowledge is in itself important (Blass and Weight, 2005). However, respondents, especially those from large organizations, stated that if they contribute to the cost of the MBA programme, the MBA title is one of the features they most appreciate, even more than the content itself. These respondents also expected that the formal MBA title would lead to employees' expectations for promotion, as suggested in previous studies (Shimizu and Higuchi, 2009; Gupta and Bennett, 2014). These expectations are, however, much lower in micro- and small organizations.

Differences are also evident in the attitudes to the personal development of employees. There is a noticeable difference in medium and large organizations who are interested in personal development for motivating their employees, as claimed by Vnoučková, Urbancová and Smolová (2015). But employers in micro- and small organizations have very low expectations for the personal development of their employees. There is also a need for research and evaluation of the impact of the MBA on the development of HR and the overall development of a company, as noted by Smith (1993) commenting on the expectations of HR managers.

Conclusion

This study suggests that differences in the size of organizations are reflected in different requirements and expectations by the employer as regards the value of the MBA degree. These findings underpin any evaluation of the benefits for employees of MBA programmes. They are also important when considering whether the benefits conferred meet the expectations of employers in organisations of different size.

These results have practical implications, particularly for the development of the structure

and content of the MBA programs. They also have relevance when promoting and developing publicity for MBA programmes, which should be modified according to the size of the target organization. The results of the study answered our research questions. The answer of RQ1 whether there are any differences in the perception of MBA study programmes by certain sizes of companies served specific distinctions by each of above discussed variables. The micro- and small organizations have high expectations in the field of hard skills rather than leadership skills. On the other hand large organizations are more focused on the leadership competency. As for the answer of the RQ2, Small and micro-organizations are generally more sensitive to the issue of confidence in the provider and the need to deliver added value. They give highest importance to the acquisition of hard skills. They also monitor the value for the company and its further development. However for large enterprises the development and acquisition of new leadership skills are an important requirement for the MBA.

These preliminary results highlight a number of issues regarding the value of the MBA as perceived by employers. It is suggested that they became a focus for improving and developing the content of MBA programmes and for promoting the MBA qualification itself.

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COMMONALITIES IN EDUCATION AND RESEARCH OF THE POST-SOVIET COUNTRIES

[1]✉Irena Benesova, [2]Zuzana Novotna, [3]Petra Sanova, [4]Adriana Laputkova

[1]Department of Economics, Faculty of Economics and management, CULS Prague, Kamycka 129, Prague, 165 21, Czech Republic, +420 224 382 075, benesova@pef.czu.cz

[2]Department of Statistics, Faculty of Economics and Management, CULS Prague, Czech Republic

[3]Department of Finance and Trade, Faculty of Economics and Management, CULS Prague, Czech Republic

[4]Department of Languages, Faculty of Economics and Management, CULS Prague, Czech Republic

Abstract

Education is a necessary precondition for economic growth and development even in the post-Soviet countries. These countries witnessed a similar educational pattern in the past which can influence their current situation. The results illustrate significant differences between these countries. Applying the cluster analysis, the countries were divided into five groups. The first group includes Belarus, Ukraine, the Russian Federation and the Republic of Moldova, the second Uzbekistan and Kazakhstan. The third cluster contains Kyrgyzstan and Tajikistan, and the fourth one Azerbaijan and Georgia. As an extra (fifth) group can be considered Armenia. The variance between these four groups is considerable and will be a part of further research.

Keywords

Education, public expenditure, post-Soviet countries, cluster analysis, Russia

Introduction

The post-Soviet countries still play an important role in the global economy, the Russian Federation being the most important of them (Svatoš, Smutka and Ishchukova, 2014). Provided that these countries are able to cooperate, they can increase their influence and position. One of the possibilities is regional integration that should bring them back to the global power (Lukin, 2012). It is a widely accepted fact that the countries abundant in natural resources reach lower growth rates, have a higher tendency to corruption, achieve a lower level of education and of home and foreign investments (Gylfason, 2001; Torvik, 2002; Sachs and Warner, 2001); however, Mehlun, Moene and Torvik (2006) add that institutional provision also matters.

Utilizing comparative advantages of all participating countries is the key to successful cooperation (Fathipour and Ghahremanlou, 2014), which will enable their presentation at a global level as a whole, and this way defend their common interests. At the same time, functional regional integration encourages the influx of capital and improves productivity (Kumar, 2015). It could be stated that without functional regional integration, paradigm of globalisation is unable to function (Dutta, 2002).

After the dissolution of the Soviet Union, the former union republics gained independence and the first integration tendencies started appearing. The Baltic States (which never really distinguished themselves for their strong connection with Russia) signed association agreements with the European Union. The remaining countries created the Commonwealth

of Independent States – CIS. From the beginning of these countries' independence, this form of cooperation was the target of a considerable number of economists and politicians (Hartwell, 2013), predominantly in Russia and Central Asia (Azizian and Bainazarova, 2012).

Education is considered a crucial component of economic development. The very first idea appeared as early as in 1967 when Denison mentioned connection between economic growth (and its subsequent economic development) and investments in education of nine industrialized countries (Denison, 1967). Islam, Wadud and Tariq Islam (2007) mention a relationship between income and education in Bangladesh where income and education are closely related and allow each other to grow.

Some authors (Devicienti, Gualtieri and Rossi, 2014; Bitler and Karoly, 2015) emphasize that education is one of the most crucial preconditions for tackling poverty. Through education, people can acquire better professions and earnings. Education is also closely related to inequality (Pignataro, 2012; Sauer and Zagler, 2012, 2014). However, the remaining problem is the connection/relationship between educational services and labour market (Rymesova, 2012).

Based on the above facts, we consider research and education one of key factors that can improve the economic situation of the post-Soviet countries. The main aim of this paper is to find commonalities and differences in this area between the post-Soviet countries and based on these to classify these countries into different groups.

Materials and Methods

This is a comparative study which compares education in the post-Soviet countries. Estonia, Latvia and Lithuania are excluded from this study, as they are already members of the European Union (EU). The following countries were analysed: Armenia, Azerbaijan, Georgia, Belarus, Kazakhstan, Kyrgyzstan, Moldova, the Russian Federation, Tajikistan, Turkmenistan, Uzbekistan and Ukraine. Not all the data are available for all of the countries. Whenever the data are unavailable, this fact will be mentioned in the paper. The analysis has been conducted for years 2001 – 2012. We are aware of the fact that the time period may be inadequate, especially its end. Unfortunately, the latest data in the field of education which can be compared for the majority of the countries have been unavailable after 2012. Whenever they are available, we will use the newest data.

At the beginning, descriptive and comparative statistics and data visualization are used for comparison.

The indicators are calculated according to international methodologies and the data compared are fully representative. SAS 9.4 statistical program was used for all the calculations.

Cluster analysis (CA) was used to calculate comprehensive assessment of selected indicators. Initially, 43 indicators were available for these countries. The purpose of this method is to investigate the details of multidimensional objects and their classification into categories (clusters).

Before the CA itself was calculated, the input data were standardized using the norming Z-function. Each attribute was normalized into its Z-score by deducting the average and by dividing the standard deviation. Using this transformation, scale differences and attributes often differing in order of magnitude were eliminated (Meloun and Militky, 2004).

The original data set (all the variables are mentioned below) was reduced using correlation analysis and variation coefficients to exclude redundancies between variables and their interconnectivity. Finally, sixteen variables were selected.

After the transformation, the data were clustered using hierarchical clustering. This type of clustering is based on hierarchical organization of objects and their clusters. These clusters can be visualized using dendrogram (Hebak, 2005). Ward's method of clustering was used in this study, the principle of which lies in minimizing cluster heterogeneity according to the criterion of minimum growth of the intra-class sum of squared deviations of objects from the cluster centre. In each step, the increase in the sum of squared deviations is calculated for each pair of deviations occurring due to their clustering. Subsequently, the clusters merge, which the minimum value of the increase corresponds with exactly (Meloun and Militky, 2004). According to Bock (1985) and Hartigan (1985) there is no standardized method to select the number of cases in clusters.

The data are derived from several sources, especially from the UN – UNESCO database and the national statistics of the analysed countries. This is necessary as this paper is a part of research which compares this phenomenon at a regional level. However, there is a substantial difference between different data sources (even though the description of the dataset is the same).

The original variables entering the analysis are as follows: a cumulative drop-out rate to the last grade of lower general secondary education, duration of compulsory education, enrolment in lower secondary education, both genders, enrolment in pre-primary education, enrolment in primary education, enrolment in secondary education, enrolment in tertiary education (all programmes), enrolment in tertiary education (ISCED 5), enrolment in tertiary education (ISCED 8), enrolment in tertiary education per 100,000 inhabitants, enrolment in tertiary education per 100,000 inhabitants (female), enrolment in upper secondary education, fertility rate, GDP (current US$), GDP growth, GDP per capita PPP, GNI per capita, the Atlas method, GNI per capita PPP, gross enrolment ratio (primary), gross enrolment ratio (pre-primary), gross enrolment ratio (pre-primary, gender parity index), gross enrolment ratio (tertiary), gross intake ratio to Grade 1 of lower general secondary education, gross intake ratio to Grade 1 of primary education, inbound mobility rate, infant mortality rate, life expectancy at birth, net flow ratio of internationally mobile students, official entrance age to primary education, rate of out-of-school adolescents at lower secondary school age, out-of-school children at primary school age (percentage female), population growth (annual %), pupil-teacher ratio in pre-primary education, pupil-teacher ratio in primary education, pupil-teacher ratio in tertiary education, rate of out-of-school children at primary school age, rural population, school life expectancy, primary, school life expectancy, secondary, teachers in primary education, total net enrolment rate (lower secondary), total net enrolment rate (primary).

Whenever necessary, the data entering the analysis were extrapolated to the population, which enabled to reduce the influence of substantial differences given by different sizes of the states.

Results and Discussion

Expenditures on education and research

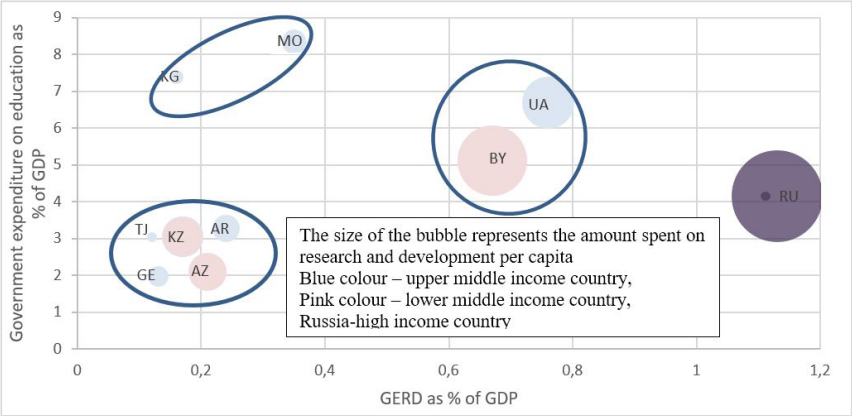
Government expenditures on education play a very important role in economic development. However, the countries' attitudes to spending on education differ across continents and regions.

The government expenditure on education as % of GDP varies between the analysed countries and years. The highest percentage of GDP on education is spent by the Republic of Moldova. In 2009, it was 9.5%. Long-term, it is Moldova that has invested the highest

amount of money into education, contrary to for example Georgia, Kazakhstan, Azerbaijan or Armenia. Expenditures on education in these countries are lower than 3%, which is their long term average. The percentage of GDP in education fluctuates; however, there is a growing tendency from the long-term perspective.

Regarding the expenditure on education and research and development (GERD), we can divide the post-Soviet countries into three groups, plus Russia (Fig.1). Azerbaijan, Armenia, Georgia, Kazakhstan and Tajikistan are in one group. These countries' expenditure on education is lower than 4%, and GERD is lower than 0.3%. In relation to the World Bank classification of countries according to income, this group of countries consists of lower-middle income and higher-middle income countries (Kazakhstan and Azerbaijan). These two countries also spent higher GERD per capita compared to the rest of the countries.

The second group consists of Moldova and Kyrgyzstan that spend more than 7% of their government expenditure on education. Both are lower-middle income countries. The last group includes Belarus and Ukraine. Expenditures on research and development in these two countries are higher than 0.6% of the government expenditure on GDP, and their expenditure on education is higher than 4%. Their GERD per capita is 57 USD in case of Ukraine and 102 USD in Belarus. Currently, they do not belong to the same group of income countries (World Bank classification), given by the fact that there has been a long-continuing conflict in Ukraine. There is a decline in case of Ukraine compared to growth in Belarus.



Note: Data for Turkmenistan and Uzbekistan are not available
Source: own calculation, UNESCO

Fig. 1: Differences in education, research and development expenditures in 2012

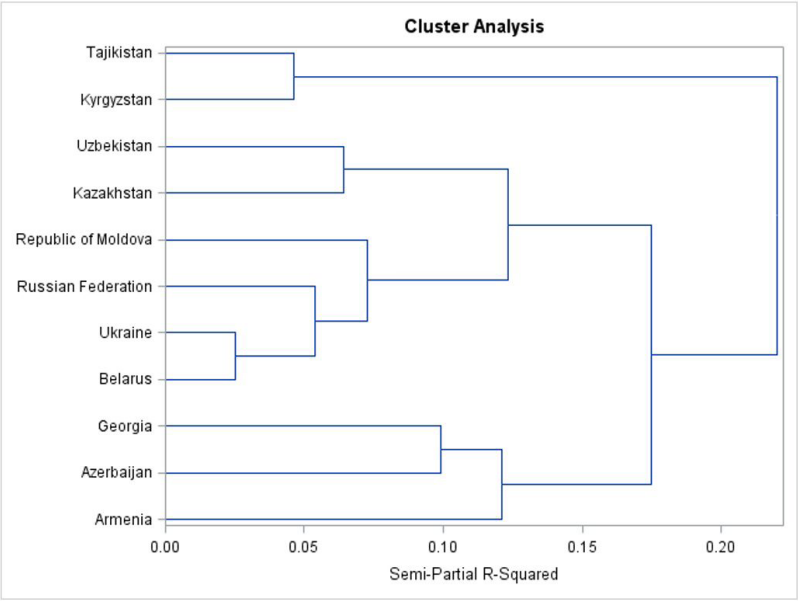
The position of Russia is very specific and in some way reflects the situation in the former Soviet Union (USSR). After the disintegration of the USSR, a number of laboratories and research centres have decreased; however, they have been able to maintain most of these despite a significant decline in the employment rate. The educational and research infrastructure from the USSR decades shapes the base for human capital development in high-tech sectors of current Russia. This could be perceived as their inheritance from the former extensive system of education in technical disciplines and research. According to the PISA scores, their situation is improving in mathematics and sciences.

Commonalities between the states

Education in the former Soviet Union was considered as an important factor of promotion of equal chances and opportunities. However, there were considerable differences between different states and even between, for example, urban and rural areas. The same was true for various types of education. On the one hand, for example, Lomonosov State University in Moscow established as early as in 1755 can be mentioned, and on the other hand some local universities. These differences remain even 23 years after the disintegration of the USSR and are even more evident. Each of the post-Soviet countries has tried to distinguish its educational system from the "old Soviet system" represented by the state given curricula. However, in many cases it was a mere proclamation of the principles of the new systems together with stating new values without real application. This problem is stressed by the fact that the system in most of these countries is under-financed.

The post-Soviet countries can be divided into five main groups. The first consists of Belarus, Ukraine, the Russian Federation and the Republic of Moldova, the first of which are the most similar This group could be referred to as "European", and is characterized by their strong economies with relatively high government expenditure on education. However, economic growth of these countries is relatively weak compared to the rest of the analysed countries. These countries also have negative population growth that negatively influences the overall situation. On the other hand, they have strong pre-primary education. The tertiary education of these countries is characterized by joining the Bologna process. The very first to join this process was Russia, followed by Moldova, Ukraine and finally Belarus. However, joining the process does not mean that all the principles have been adopted already. It rather concerns joining a group of countries that are members of the European Higher Education Area and choosing only some of the principles. However, it emphasizes the difference between these countries and the rest of the region, especially central Asian states. The problem of these countries is also connected with their inefficient structure of higher education which does not copy the needs of the labour market.

Kyrgyzstan and Tajikistan are in the second group of countries. Both are located in central Asia. These countries belong to the lower-middle income countries with the highest share of rural population with a very high percentage of people living under the poverty line (around 24%). Compared to the rest of the countries, they reach the lowest level of income and the highest population growth. Both countries profess Islam as their main religion and all these factors influence their educational situation.



Note: Data for Turkmenistan are not available
Source: own calculation, UNESCO

Fig. 2: Cluster analysis of the post-Soviet countries

A pupil – teacher ratio in pre-primary, primary and tertiary education is the highest of all analysed countries. These countries witness a high rate of females out of primary school. In general, the gross enrolment ratio in primary education is low, with Tajikistan in an even worse situation than Kyrgyzstan. If the net flow ratio of internationally mobile students is taken into consideration, it is surprising that compared to the rest of the countries the net flow is positive which means that more students are incoming that outgoing.

This trend in low pre-primary enrolment (the gross enrolment ratio for pre-primary education reaches mere 12%) has its base in the decline of expenditure on education during the 1990s, and these countries have never recovered from these budgetary cuts.

The third group consists of Kazakhstan and Uzbekistan. Their school life expectancy is high with over ten years of compulsory education.

The members of the four group are: Azerbaijan and Georgia. As an extra (fifth) group can be considered Armenia. All these countries are located in the Caucasus and even if they are different according to for example religion, they share some common characteristics. According to the dendrogram it can be said that Azerbaijan and Georgia create is the most heterogeneous group. However, there is some common characteristics of these two groups. All the countries have the highest life expectancy. They all have very strong GDP growth. As in the case of the first group, all these countries have also joined the European Higher Education Area through the Bologna process. Azerbaijan and Georgia have the lowest pupil-teacher ratio not only in primary education but also tertiary that is in contrast with a relatively high negative net flow ratio of internationally mobile students. If the rate of out-of-school children at a primary school age is taken into consideration, Azerbaijan and Georgia have very high rate compare for example to Kazakhstan and Uzbekistan.

This is influence by very high percentage woman out of primary school – more than 50%. Azerbaijan and Georgia also have relatively low government expenditure on education and research. These countries have lower enrolment in tertiary education in all ISCED programmes compare to Armenia. Compare to Azerbaijan and Georgia Armenia has even more equal enrolment for higher education for females. Armenia has also the highest duration of the compulsory education – nearly 11 years. Gross enrolment ratio for primary education is higher in Azerbaijan and Georgia – more than 100%, which means that over-aged students are accepted to the schools. This is given by lower age (6 years) to start primary education.

As it is evident, there are different results if different indicators are taken into consideration. One of the indicators is expenditure on education as it was already mentioned by Musil and Fisher (2015). However, all of the findings show substantial differences between the post-Soviet countries. This is not true only regarding education but also in other areas, as Breen and Jonsson (2005) also mention. Way and Levitsky (2007) have already discussed the differences between autocratic Russia and the remaining states. These differences are more evident in case of expenditure on education. Not all the children have access to school. This is given by under-financing in some of the countries. This problem has also been highlighted by Habibov and Cheung (2016) who connect it with corruption. Unfortunately, there are no available data about corruption in the educational system in the post-Soviet countries that could be included in the analysis. Most studies Osipian (2012), Osipian (2009) and Habibov and Cheung (2016) confirm the wide spread "corruption" in the educational systems of the post-Soviet countries. This factor negatively contributes to efficiency of education in most of the post-Soviet countries. On the other hand, Johnson (2015) considers the system of education an importing factor for literate societies in the post-Soviet countries. The similarity between the central Asian states, especially Uzbekistan, Tajikistan and Kyrgyzstan, is also mentioned by Nessipbayeva and Dalayeva (2013).

Conclusion

The post-Soviet countries are featured according to differences in education and science. Some countries show more signs of similarity than others. According to the results of the cluster analysis of educational variables, it can be concluded that there are similarities between the Caucasus republics (Armenia, Azerbaijan and Georgia), European states (Belarus, Moldova, Russia and Ukraine) and the central Asian countries. These variations are given by their different economic situation and the way of funding. Some cultural aspects also play a role. The disparity is visible for example between the pupil-teacher ratio, the number of out-of-school children, gross and net enrolment.

Acknowledgements

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PREDICTION OF UNSUCCESSFUL STUDENTS BASED ON THEIR ACTIVITIES IN THE LMS MOODLE

[1]✉Ladislav Beranek, [2]Radim Remes

[1]Department of Applied Mathematics and Informatics, Faculty of Economics, University of South Bohemia, Studentska 13, 370 04 Ceske Budejovice, +420 387 772 511, beranek@ef.jcu.cz

[2]Department of Applied Mathematics and Informatics, Faculty of Economics, University of South Bohemia, Czech Republic

Abstract

Online electronic learning systems (Learning Management System - LMS) are currently important tools for teaching at various schools and universities. These systems contain a lot of information about students' learning process, about students' studying activities and other. In this paper, we try to predict the success of students in this course based on the pieces of information which are mainly captured from students' discussions on Moodle online forum. It turned out, however, that the information from online forum is sufficient for prediction, and we had to supplement information from online forum with some other data from LMS Moodle, such as for example how students handled their home assignments. Our work aims especially on identification of students who are unlikely to be successful and who need some special attention of teacher. The results show that it is possible to perform such identification with an acceptable degree of inaccuracy.

Keywords

Performance prediction, online forum, data mining, LMS Moodle

Introduction

The use of e-learning systems (LMS) has become an integral part of educational processes, especially on universities. These systems provide a variety of options. They also support collaboration activities and active learning of student which are prerequisites for effective learning, see, for example Renkl et al (2002), Williams et al (2006), McKeachie and Svinicki (2006), Nerguizian et al (2011). Based on these facts, we included in the past into our course E-business wiki technologies (Beranek and Remes, 2012a; Beranek and Remes, 2013) and from the last year also online discussion forum. Web technologies are constantly evolving and it is difficult to cover all possible technological changes as a result of this development (Beranek and Knizek, 2012b). This means that teachers must be able to show to students how they can find relevant information and how they can work with that information. But it also means that students can contribute with their knowledge and experience to the course content as well. They may have different opinions on the discussed topics related to various processes and technologies in E-business domain. Online forums are tools that allow to share ideas, exchange information and knowledge, comments on posts by other students and getting feedback (Raghavan et al., 2010; Zafra et al., 2011). Online forums allow to communicate and interact in another way than normal social interaction in a traditional classroom. This may be also useful for students who may feel ashamed at seminars to express their opinions or ask questions (Cheng et al., 2011).
Practical experience showed us that the use of online forums promoted activity of students and their involvement in the course E-business. Positive attributes typically associated with using online forums or by other similar online tools are also reported by other authors.

It is a collaboration, organization, operation and cognition (Biasutti, 2011; Cole, 2009; Guth, 2007; Kleinman, 2005). These online tools support also debates in the learning process, support the right structure of communication. They also contribute to the shaping and the thinking of students. On online forums, students have to think by a certain way, they have to discuss and organize their thoughts (Zafra et al. 2011; Schwartz et al., 2004). In this way, online forums promote a higher level of cognitive perception (Kanuka et al., 2007), critical thinking (Richardson et al., 2010) and collaborative learning (Beranek and Remes, 2013).

Online forums are now a standard tool, which is part of the most educational e-learning systems. These systems also allow you to keep in its databases various educational data including records from online forums. This fact has led to efforts to process this information, e.g., Lopez et al. (2012) describe the use of data from online forums for analysing student participation in online forums, including the assessment of their performance. Usually these analyses relate to the examination of a transcript or of a printed version of the dialogue that students create during their communication on online forum and which is saved in online forum database. However, such an evaluation is not simple, the majority of existing e-learning educational environments provide just a text output from online forums. They do not provide some indicators or other information about the structure of interaction between students (Dringus and Ellis, 2005).

The predicting the students' performance is a difficult problem due to the large number of factors or characteristics that influence the performance of students. These factors can be psychological, demographic, cultural, social or family factors. Students' performance may affect previous education, interaction between students and teachers and more (Araque et al., 2009). Also, various data mining methods can be used for prediction, e.g., methods of classification or regression analysis or other. For example, Khan et al. (2012) use attributes such as frequency of access of online forum, duration of sessions on online forum and the other for the classification of students in terms of their success. Cobo et al. (2011) used as agglomerative hierarchical clustering method for modelling activities of students on online forum. Their approach is based on a number of messages that students write but also to read and respond to (Lopez et al., 2012; Romero et al., 2013).

The aim of our paper was to answer the following research questions:

1. What attributes, from those which are available on online discussion forums within the course, are the best for the prediction of students' performances? Should we seek other additional attributes, for example grade in another subject, for more accurate prediction?
2. In what time after the beginning of the course is it possible to perform a valid prediction of students' performances?

Research question number two deals with the issue of students whose study performances are not good from a variety of reasons. It would be convenient to reveal problematic students as soon as possible. It would then be possible to work with those students more intensively.

The paper is organized as follows. First, the review of relevant literature is briefly described. The proposed approach is presented together with the materials and methods used after literature review section. Then, the experimental results and discussion are described and finally, conclusions and future work are addressed.

Materials and method

For predicting the performance of students, we focused on the use of data particularly data from discussions on online forum which was a part of learning process within the course

E-business. This course is organized for the second year undergraduates of our faculty. The number of participants in the course was 38 students. Student age was in the range 20 to 24 years, with a mean value of 20.8 years. Percentage of female students was 73.7 percent. Students were acquainted with the use of Moodle online forum at the beginning of semester in October 2015. One seminar was devoted to the explanation how to handle Moodle online forum, what students can expect from online forum, what it is for.

The inclusion of online forum into the course E-commerce also needed some pedagogical changes before the start of the course. Discussions during lectures and seminars were encouraged. Students were asked to continue discussions on online forums in Moodle LMS and to publish and to comment new material or links on online forum. We also announced that the active use of online forum will be evaluated and will affect the final grade in the subject of E-business. In January 2016, we performed final interviews.

We used the following types of data from online discussion forums, in particular:

- The number of contributions that students have created,
- How often they entered the online forum,
- The time when they entered into an online forum, in which period,
- What was the length of contributions (the number of words in a contribution),
- What was the quality of contributions.

Furthermore, we have used additional data from the LMS Moodle, in particular:

- The quality of home assignments (students had to handle in each week of the course an assignment according to a task. Processed assignments were evaluated by teacher quantitatively according to specified criteria using the scale of 1 to 5, where 1 was a sign of excellent grade and 5 was very bad). We have calculated the weighted average quality of home assignments from all submitted home assignment.
- The number of times a student visited the LMS Moodle in order to download learning materials, viewing them, etc.

Furthermore, we have assigned each student a mark (a label) success or failure depending of the results achieved at exam. As already stated, our goal was to predict if a student would be successful in our course.

We had to evaluate the quality of students' contributions on online forum by teacher. Contributions were evaluated using a range of 1 to 5, like at school. 5 points for contributions that were irrelevant to the course content, namely rather formal without quality content, or content was simply copied from other internet sources. The goal of these contribution was to fulfil the requirement of teacher to write something on online forum. Contributions were assigned with points 1 when they provided a full or accurate information about some difficult topics. These reports showed that the student had excellent knowledge of the issue and his messages contributed to the development of the subject among students. Contributions that provided adequate information on important topics were marked with 2 points. These reports showed that the student had a good knowledge of the issue. Posts that provided limited or basic information about the topics in the course in which students showed an acceptable level of knowledge of the issue obtained 3 points. Messages with at least minimum level of independent student work got 4 points.

In conclusion, we also asked students about their evaluation of the use of online forums in the course, whether it was useful for them.

Originally, we intended to use only the attributes of the Moodle online forum like this problem is described by Romero et al. (2013). These authors also used attributes from the analysis of social networks, which was created around an online forum. We were not able to repeat their procedures both in terms of attributes which they got from online

forums, and even as regards the analysis of social networks modelled on the background of communicating on-line forum. We used the procedure developed in our previous work (Drlik and Beranek, 2015) for social network analysis.
Data from online forums and from other Moodle modules were processed in the program RapidMiner (https://rapidminer.com/). This program offers a variety of methods for data processing, including for example word processing and sentiment analysis. The software has also a range of methods for data pre-processing, selection of attributes, discretization, filtration and other operations. This allows, for example, very effective way in the finding of attributes that contribute to correct classification and other.
We had labelled data however we used the unsupervised learning methods of data mining. Here the aim was simply to extract the most available information from the data. Clustering algorithms k-means is an example of these methods. It examines data to find groups of items that are similar. It is an exclusive clustering algorithm. Each object is assigned to precisely one of a set of clusters.
In our case, the class labels are not used during clustering, but they are used for evaluation of the obtained cluster. The advantage of using classification through clustering is the ability to get a general but assessable view of two groups or clusters that are generated: the students that pass, and students who fail.

Results

As it was already mentioned, data from discussions on online forum were our primary source of information. The number of students was 38 students. Students were asked to use online forum for posting their opinions, for discussion of various topics, questions and answers. We collected and analysed data from discussions on online forum from LMS Moodle roughly at two-thirds of the duration of the course (in week 9 of 13) and then in the last week of the course.
We used the attributes described above for prediction, for cluster analysis and classification. We used clustering algorithms to generate two clusters, to predict two classes (pass/fail) correctly on the basis of clusters. We employed standard clustering and classification algorithms, which the data mining software RapidMiner offers. We then evaluated the accuracy and F-measure of these used algorithms (see Table 1).
Based on the results, we can respond to two initial research questions raised by this document:
1. What attributes to choose from those available, or to suggest other for more accurate prediction.

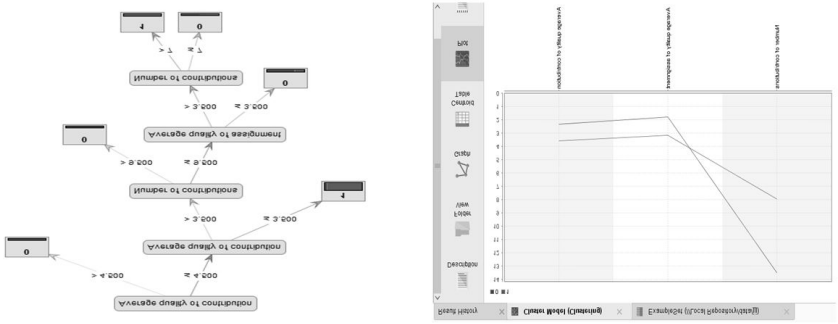
Algorithms		Measure	Results (data from the middle of the course)	Results (data from the last week of the course)
Chosen clustering algorithms	SimpleKMeans	Accuracy	0.462	0.681
		F-measure	0.481	0.645
	HierarchicalClusterer	Accuracy	0.385	0.598
		F-measure	0.397	0.573
Chosen classification algorithms	DT	Accuracy	0.59	0.789
		F-measure	0.577	0.777
	ADTree	Accuracy	0.501	0.745
		F-measure	0.514	0.732
	J48	Accuracy	0.535	0.787
		F-measure	0.514	0.741

Table 1. Accuracy and F-measure of the used clustering and classification (decision tree) algorithms (part of the table) (source: own calculation)

In the process of cluster analysis, we tested all the attributes outlined in previous chapter for predicting student performance. It turned out that attributes "*Number of times the student visited the LMS Moodle in order to download learning materials, viewing*" and "*Time when student entered an online forum, in which period*" do not contribute to the prediction. The attribute "*How often student did enter into online forums*" correlates with the attribute "*The number of messages that students created*".

We performed predictions with various sets of attributes to answer to the research question "What attributes are the best predictors"? On the basis of Accuracy and F-measure values, it was obvious that the best predictors are following attributes: "The quality of the contributions on online forums", "Number of contributions on online forum" and "Quality of home assignments".

2. In what time after the beginning of classes, it is possible to make a forecast about student performance? It turned out that the prediction accuracy using decision tree (DT) in mid-course is relatively low (59%). The accuracy was higher at the end of the course, it reached 79% (see Table 1).



a) **b)**

Figure 1. Example of data analysis: a) classification tree, cluster analysis b)

We present here only part of our results considering the scope of this paper. Figure 1 serves for an illustration of the classification and cluster analysis. In the classification and also in

the cluster analysis, cluster centroid described the typical student for each of two groups (passed and fail). In fact, students who have demonstrated a high degree of participation in the forum with a good average evaluation of their contributions (with a high number of them) as well as assignment are grouped into in the cluster 1 (students who passed the course). Similarly, students who have demonstrated a very low participation rate and also their assignment were evaluated poorly were classified as students fail (cluster 0).

Discussion

We have analyzed the obtained results in detail. It appears for example that, unlike the work the work Romero et al. (2013) we could not get the prediction based on attributes from the analysis of social networks caused by relationships within online forum. Average number of contributions per student in our research (about 10 posts per student) did not differ much from the Romero's et al. (2013) (about 11 posts per student). However, on online forums, which were analyzed by Romero et al. (2013), more students responded to the comments of others. In our examined course, the students did not react too much to the contributions of others. This was the reason that we were not able to construct a reasonable social network on the basis of online forums in our course. We could not use therefore the attributes related to social networks. We had to complete attributes obtained from online forums by other attributes to get the prediction with sufficient accuracy. We chose attributes from the LMS system, namely the attribute "Quality of home assignments".
Performed analyses have shown the basic fact: most of students, who actively participated in the online forum (they had a least fourteen number of contribution on online forum with a good quality in average), completed the course successfully. They created the good posts both in quantity and quality and also worked out good home assignments.

Conclusion

This paper deals with the application of data mining techniques to data that occur in the LMS systems. The aim was to predict that students will have difficulty completing the course. In this document we have used data from discussions on online forum.
The results show in principle that it is possible to predict on the basis of student activities on the online forum student performance. However, additional research is needed. There are more factors or aspects that may affect student participation in online discussion forums such as the structure of the course, the number of students in the classroom, feedback, prior knowledge of the topic, interface properties, expertise in content, students' role and educational tasks, differences in demographic and abilities of students, etc. Hence in further research, we want to conduct research in more subjects who use online forums and with larger group of students.

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THE EFFICIENCY OF THE USE OF COMPUTER-AIDED ASSESSMENT SYSTEM IN MATHEMATICS

Andrea Berkova

Department of Informatics in Transport, Jan Perner Transport Faculty, University of Pardubice, Studentská 95, Pardubice, 532 10, Czech Republic, +420 466 036 647, Andrea.Berkova@upce.cz

Abstract

In the recent years there has been a great increase of using Computer-Aided Assessment systems in many areas of education. In the area of mathematics education platforms like Maple T. A. (Testing and Assessment), which are specialized for assessment in mathematics or natural sciences, were developed. The pedagogical experiment focused on the efficiency of the use of the Maple T. A. platform to students' performance in calculus classes was evaluated taking into consideration students' approaches to learning and studying. The paper presents results of this research conducted on the first and later second year undergraduate students of teaching mathematics.

Keywords

Approaches to learning and studying, Maple T. A., Computer-aided assessment, CAA

Introduction

In connection with the development of information technology, the CAA (Computer-Aided Assessment/Computer Assisted Assessment) systems are increasingly used for both formative and summative assessment of students in many areas of education. Good CAA platforms can help to consolidate student understanding, to support self-directed learning and to make it easier for instructors to manage growing class sizes (Technical Whitepaper, 2015). Contrary to the common assessment platforms, the systems suitable for mathematics must have special functions used for testing mathematical knowledge. The specificity of assessment of students in mathematics involves use of mathematical symbols, equalities, numerical series or graphs. An example of such system is the platform Maple T. A. (Testing and Assessment), which was established by integrating computational capabilities of computer algebra system Maple to CAA system.

The effects of CAA systems have been the subject of several studies with diverse results. The CAA systems are used here mainly for student´s homework and final exams. To name a few Hauk, Powers and Segalla (2015) as well as Allain and Williams (2006) did not find any statistically significant differences between final results of the students using CAA and students using paper and pencil for their homework. The differences were not discovered even by Demirci (2006). However, contrary to the previous studies there was a slight difference in favour of those students who were using the traditional pencil and paper for their homework assignments. On the other hand Love, Keinert and Shelley (2006) and also Burch and Kuo (2010) claim that the means of results of students who utilize online homework were higher than the means of students who used paper and pencil for their assigned homework.

Based on the review and the fact that the utilization of such systems in the Czech Republic is not widespread (according to survey in Berkova, 2014) the author has decided to implement the CAA platform Maple T. A. at the University of Hradec Kralove and observe the results of the utilization of this platform on the process of teaching Calculus

in the Czech educational environment. The area of interest included how the software will suit different types of students. Because of this, in the first part of the research the students were divided into characteristic groups based upon a questionnaire survey that was focused on the students' approaches to learning and studying. Students' approaches to learning and studying describe what students do when they go about learning and why they do it. The basic distinction is between a deep approach to learning, where students are aiming to understanding, and a surface approach to learning, where they are aiming to reproduce material in a test or exam rather than actually understand it (Entwistle, 1988; Ramsden, 1992). For its quality, the ETL (Enhancing Teaching-Learning Environments in Undergraduate Courses) project's questionnaires were chosen to be modified and used in this research (Entwistle, 2005). The author managed to get approval from author professor Entwistle to use these instruments from the ETL project.

Let us summarize that the research dealing with the utilization of the Maple T. A. platform was conducted at the University of Hradec Kralove. The first year undergraduate students of teaching mathematics were divided into characteristic groups based upon their approaches to learning and studying. The students that were divided into these characteristic groups then underwent a pedagogical experiment. The research questions are thus:

(RQ1) Do the achieved students' results differ in context to the form of teaching (with or without the aid of CAA)?

(RQ2) Is there a relationship between the students' approaches to studying and their achieved results?

(RQ3) Is the efficiency of the forms of teaching (with or without the aid of CAA) the same for students with different approaches to studying?

Materials and Methods

The research sample was composed of first (2013/2014) and later second (2014/2015) year undergraduate students at the University of Hradec Kralove which were attending the classes of calculus (Mathematical analysis 1, 2, 3). A total of 22 students between the ages of 18 and 20 participated in the study. To maintain anonymity, each student was given a number (Student 1, Student 2, etc.).

In 2013, the questionnaire Q1 focused on students' approaches to learning and studying was created based on instruments from ETL project. The Q1 questionnaire consists of three main parts (see Figure 1a). The first one named Learning orientations is focused on the students' expectations and their goals in their university studies. It contains a total of seven questions. The second part is dedicated to the students' approaches to learning and studying. It has 17 questions. The final, third, part focused on students' preferences for different types of course and teaching has 8 questions. The second and the third part contain the added questions (6 questions) focused on the using of information and communication technology (ICT) or traditional techniques in education. Students answered by checking the answers on a scale 1-5 in all of the items. The Q1 questionnaire survey (Cronbach's Alpha 0.797966) was conducted in fall 2013/2014 in the subject Mathematical analysis 1. The results of the survey were evaluated using cluster analysis (division of students into characteristic groups).

a) Scales and items of Q1 questionnaire

1. Learning orientations
(What do you expect to get from the experience of higher education?)
- Intrinsic orientation (3 item scale)
- Social and personal reasons (2 items)
- Career reasons (1 item)
- Lack of purpose (1 item)

2. Approaches to learning and studying
- Deep approach (9 item scale)
- Surface approach (4 items)
- Organised effort (4 items)

3. Preferences for different types of course and teaching
- Supporting understanding (4 items)
- Transmitting information (4 items)
- Using ICT (3 items)
- Traditional class (3 items)

b) Scales and items of didactic tests T1 and T2

1. Knowledge gained in the semester
- Each thematic area 2 items (8 items in total)

2. Mathematical apparatus and insight into the studied problem
- Inequalities (2 items)
- Limits (2 items)
- Basic arithmetic and geometric sequences and series (2 items)
- Understanding/application of new mathematical theorems (2 items)

Figure 1: Scales and items of used research instruments

For the detection of the efficiency of the CAA platform the experiment with repeated measurements has been selected, since the study group of 22 students was too small to conduct a classic experiment utilizing the parallel groups' technique. During the first semester of the experiment, the subject Mathematical analysis 2 (spring 2013/2014) was taught using the traditional teaching form utilized classical, in regards to homework mainly paper and pencil aids. The following subject Mathematical analysis 3 (fall 2014/2015) was taught with the aid of the new CAA mathematical platform Maple T. A. (experimental teaching). Lessons of the semester were always divided into four thematic areas. The students were in the end of both semesters given objectively scored cognitive didactics tests (T1 and T2) which were created in the Maple T. A. system. The T1 (Cronbach's Alpha 0.825213) and T2 (Cronbach's Alpha 0.853111) tests assessed the level of the students' knowledge in given thematic areas (8 questions) and mathematical apparatus and insight into the studied problems (8 questions). The items called mathematical apparatus and insight into the studied problems are focused on key knowledge from the students' previous studies which the students are not in proper semester primarily studying, but are essential for the study of mathematics itself (inequalities, limits etc.) and application of new mathematical theorems (see Figure 1b). The experiment was evaluated using analysis of variance with repeated measures taking into consideration form of teaching and characteristic groups of students.

Results and Discussion

Cluster analysis

Clustering or cluster analysis is the process of grouping individuals with similar variable measurements (in our case with similar responses in Q1 questionnaire). Figure 2 shows the results of this cluster analysis that gave rise to characteristic groups of students based on their responses in Q1 questionnaire according to their approaches to learning and studying. The results were analyzed in the NCSS statistical software.

Firstly observe the part with the Three Clusters. Cluster3 is composed of only one student (Student 16). From the graph (Fig. 3a) it is evident that this particular student is someone with lack of motivation (highest score in the Lack of purpose item). An interesting fact is that Student 16 dropped out the university during the time of this research. Cluster1 is comprised of 11 students who have conclusively the highest score in the Career reasons in the Learning orientations section. In the area of the Approaches to learning and studying these students are ambivalent with the best score in the Organized effort subscale. Nonetheless, they are most clear in the area of Preferred course and teaching types – they conclusively prefer teachers who are simply Transmitting information to teachers who

Support understanding of the studied material. On the other hand, Cluster2 is apparently composed out of highly motivated students (high score in the Learning orientation section with a drop in the Lack of purpose item). These 10 students with high score in a Deep approach and low scores in Surface approach are evidently interested in more in-depth studying. Conversely, the students from Cluster2 do not have significant preferences in regard to the type of course and teaching and go down well with various types of being taught.

Cluster Means	Three Clusters			Four Clusters			
Variables	**Cluster1**	**Cluster2**	**Cluster3**	**Cluster1**	**Cluster2.1**	**Cluster2.2**	**Cluster3**
Intrinsic	3,515152	4,266667	3	3,515152	4,444445	4,190476	3
social_and_personal_reasons	3,181818	3,55	2	3,181818	4,166667	3,285714	2
career_reasons	4,818182	4,2	2	4,818182	5	3,857143	2
lack_of_purpose	2,818182	2,3	4	2,818182	3	2	4
deep_approach	3,131313	4	2,222222	3,131313	3,851852	4,111111	2,222222
surface_approach	3,136364	2,175	2	3,136364	2,833333	1,892857	2
organised_effort	3,454545	3,675	2,5	3,454545	3,666667	3,678571	2,5
supporting_understanding	2,613636	3,825	2	2,613636	4,083333	3,714286	2
transmiting_information	4,363636	3,85	2	4,363636	4,5	3,571429	2
using_ict	4,060606	3,966667	2,666667	4,060606	3,777778	4,047619	2,666667
traditional_class	3,454545	3,666667	2,666667	3,454545	4,444445	3,333333	2,666667
Count	11	10	1	11	3	7	1

Figure 2: K-Means Cluster Analysis Report (NCSS)

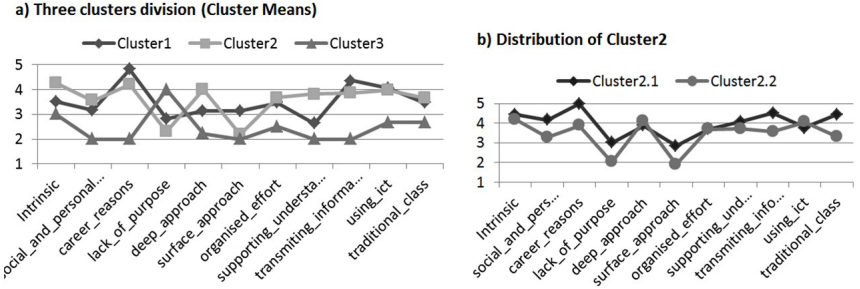

Figure 3: Graphical interpretation of cluster analysis

Because Student 16 from Cluster3 has dropped out after the spring semester 2013/2014, only two clusters remained for further evaluations. Because of this, it was decided to divide the students again using cluster analysis into four clusters (see the part with Four Clusters in Figure 2). The results were interesting. Student 16 formed again his own single member cluster which was for the sake of clarity named again Cluster3. Students from the first cluster again formed Cluster1. Cluster2 has split into two groups (for the sake of clarity named Cluster2.1 and Cluster2.2). Cluster2.2 consists of 7 students, Cluster2.1 then consists of the 3 remaining students. Because Cluster2.1 only has 3 students, it has been decided to use the previous cluster division for further analysis, taking into account this finer division if it was necessary. As it can be seen in Fig. 3b the students in Cluster2.2 are more pronounced in regards to their Approaches to studying. Cluster2.1 is strongly motivated by career and furthermore slightly higher scores can be seen in the Transmitting information subscale. In regards to their Preferences for types of course and teaching, students from Cluster2.1 also prefer traditional, paper and pencil, educational methods over using information technologies. On the other hand, Cluster2.2 does prefer information technologies.

Repeated measures ANOVA

Analysis of variance (ANOVA) is statistical method used to determine the effect of independent variables on the dependent variable by analysing the differences among group means. Repeated measures ANOVA is used when the comparative measurements are conducted on the same individuals. From the pedagogical experiment with such repeated measurements, data were gathered with the help of didactics test T1 (traditional teaching) and test T2 (experimental teaching). The independent variables are represented here as the teaching form (traditional/experimental) and the belonging to characteristic group (clusters according to student´s approaches to studying). The dependent variable in the experiment was students' results in the didactic tests.

In the two-way ANOVA approach, firstly the last third research question *(RQ3)* about the interaction of two independent variables is examined and if the interaction is not proven, then it is possible to continue with the testing of the main effects of these two independent variables – the effect of teaching form *(RQ1)* and the effect of approaches to studying *(RQ2)*. Let us now look at the two-way repeated measures ANOVA of the tests results (Figure 4) for distribution of characteristic groups on the two clusters (Cluster1, Cluster2) and finer division into three clusters (Cluster1, Cluster2.1, Cluster2.2). Student 16 (Cluster3) could not be included in the report due to abandoning studies during the experiment. The figure 4 shows the Probability Levels (the lowest possible levels of significance) for the main items of didactic tests. If the Prob. Level is less than the selected level of significance α, then the effect of variable(s) is confirmed (as marked in the figure 4), otherwise it is not confirmed. The report was obtained again from NCSS statistical software.

Prob. Levels of ANOVA for division into 2 Clusters (Cluster1 and Cluster2)

Source Term	TOTAL	Knowledge	New theorems	Inequalities	Limits	Sequences and series
A: Char_group	0,504951	0,847457	0,039644*	0,567277	0,690005	0,098916
B(A): student_number						
C: Teaching_form	0,000000*	0,000003*	0,000380*	0,031573*	0,219917	0,024607*
AC	0,858300	0,791520	0,306041	0,567277	0,375957	0,913766

Prob. Levels of ANOVA for 3 Clusters (Cluster1, Cluster 2.1, Cluster 2.2)

Source Term	TOTAL	Knowledge	New theorems	Inequalities	Limits	Sequences and series
A: Char_group	0,098016	0,424697	0,001688*	0,849844	0,037685*	0,203744
B(A): student_number						
C: Teaching_form	0,000001*	0,000032*	0,000296*	0,132953	0,450212	0,058912
AC	0,795602	0,760237	0,366037	0,622538	0,674421	0,941662

* Term significant at alpha = 0,05

Figure 4: Repeated Measures ANOVA Report (NCSS)

At the significance level of 0.05, the interaction between independent variables (Prob. Level 0.858300 or 0.795602 in AC line) has not been proven with the TOTAL results. Equally no differences were found between TOTAL results of the characteristic groups of students. Although, when taking into consideration the finer division of characteristic groups (three clusters), the influence of belonging to this characteristic groups on the TOTAL test results has been disapproved but by a slight margin (Prob. Level 0.098016). On the other hand, the influence of the teaching forms has been shown as statistically significant in TOTAL results. Additionally, subsequently performed paired test confirmed

these statistically significant differences for teaching forms in favour of the experimental group.

When looking on the subscales (Knowledge in thematic areas, New theorems, Inequalities, Limits and simple Sequences and series), more diverse results can be found. In the Knowledge subscale the results were the same as above, however in the New theorems subscale the influence of the belonging to characteristic group on the didactic tests results has been proven (Prob. Level 0.039644 for two clusters and 0.001688 for three clusters division). It is obvious that when talking about the TOTAL results, the students' approaches to studying are not showing themselves strongly. However, in regards to understanding of new mathematical theorems, the students from the Cluster2 are doing much better than from Cluster1. An interesting fact about the subscale labelled Inequalities is that if the students are divided into three clusters, there is not difference on the 5% significance level between experimental and traditional teaching form. Similarly, in the Limit subscale there has not been proven influence of teaching form on any of the students cluster divisions. Conversely, when taking into consideration the finer division (three clusters), the belonging to a characteristic group has expressed itself on the students' results in the Limit subscale (Prob. Level 0.037685). Finally, among the simple Sequences and series the influence of the forms of teaching has been proven only with the two cluster division (Prob. Level 0.024607).

Let us now summarize the obtained results. It should be noted that the students' approaches to learning and studying do not have much influence on the final results and the knowledge the students' gained in a given semester. On the other hand, when talking about the understanding/application of new mathematical theorems, students interested in a deep understanding of the curriculum have better results. Further, the results of the students after completing the classes taught with the aid of CAA were significantly higher than the result of the students after the classes taught using the traditional approach. Finally, the efficiency of the forms of teaching was not different for students with different approaches to studying (no interaction was shown). The better results of experimental group were seen in all characteristic groups of students.

Conclusion

This paper informs about the research focused on the utilization of CAA when teaching Calculus at the University of Hradec Kralove (Czech Republic). The undergraduate students of teaching mathematics have undertaken a pedagogical experiment. Repeated measurements were carried out in two successive semesters to minimize the influence of the natural development of students as much as possible. Due to this repeated measures approach contrariwise, the problem with imbalance of parallel groups was eliminated in contrast with other studies. In order to take into account the students' approaches to learning and studying, the students were divided into characteristic groups and when evaluating the results not only the teaching forms but also the characteristic groups of students, using two-way repeated measures ANOVA, were taken into consideration. In response to previous studies mentioned in introduction, which, however, differ in their conclusions and in which students' approaches to learning are not discussed, the positive effect of the use of CAA to student´s performance was clearly shown in this study. Although the significant effect of approaches to learning was not appeared in this paper, this issue should be investigated further.

Even though the research is limited by the small number of participating students and the fact that both traditional and experimental teaching forms were conducted by the

author of the research, we believe that the conclusion of this paper can help lecturers when considering adding CAA system into teaching mathematics. The use of systems CAA should be taken into account also in connection with the downward trend in the field of mathematical knowledge of the first year undergraduate Czech students (as discussed in Kourilova and Bebcakova, 2015). Future upcoming research will focus mainly on the opinions and experience of Czech students/teachers with CAA platform. Because the use of the CAA systems in the Czech Republic is in infant stages (Berkova, 2014; Berkova and Kulicka, 2015), the author set up to use research results to formulate in dissertation thesis recommendations for the usage of CAA in the specific Czech environment and thus pave the way for the usage of CAA at other Czech universities and institutions.

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THE FACTORS AFFECTING THE LEVEL OF EARNINGS IN THE FIRST JOB AFTER GRADUATION

[1]✉Michaela Brazdilova, [2]Marek Krajca

[1]Department of Economic Statistics, Faculty of Informatics and Statistics, University of Economics Prague, W. Churchill Sq. 4, Prague 3, 130 67, Czech Republic, michaela.brazdilova@vse.cz

[2]Department of Economic Statistics, Faculty of Informatics and Statistics, University of Economics Prague, Czech Republic

Abstract

By finding a job after graduation, the level of earnings is certainly one of the factors, which is taken into the consideration. It is possible to find some typical characteristics, which appear by students with above-average earnings in the first job after graduation. This paper focuses on the graduates from the University of Economics, Prague, who are classified into different groups according to their answers in the REFLEX 2013. This analysis investigates the relationship between the attitude of respondents to their secondary education and higher education and their gross monthly earnings in the first job after graduation. The appropriate statistical methods for evaluation of dependence between these variables are the discriminant function analysis and logistic regression. By using these multivariate methods it is possible to determine which factors discriminate between graduates below average and above average gross monthly earnings.

Keywords

Factors of above average salary, First job earnings, REFLEX survey, logistic regression, education

Introduction

The choice of further educational direction is very often affected by the job opportunities and the level of earnings, which is possible to get. According to Xia and Liitiäinen (2014): "The theory of human capital implies that investment in education increases labour productivity and that employers value this productivity through wages." A lot of universities make for their potential students themselves more attractive with statement about about higher probability of above average wage already after graduation. After graduation the most important step is to find some job, but the salary is one of the factors, which is taken in consideration every time by finding a job. Regarding to article McGuinness and Byrne (2014) the mismatch between wage and job satisfaction will always occur, but a lot of problems with low job satisfaction are solved by compensating wages. The salary is important criterion by choosing job and some students have this fact in their mind already by choosing the further tertiary educational institution. The hypothesis, that young over-educated workers earn more than those who have just the required education for the job, is proved by Kapelmann and Rycx (2012). He states, it is because they are more productive than the latter. The young people want to study the university, faculty and study field, which ensure them the satisfying level of earnings in the job after graduation. In the article written by Bills (2003) the author states, that next to the occupational status also the earnings are useful ways to distinguish better jobs from less desirable ones.

Higher education should be a tool in combating difficulties in finding jobs according to interests Xia and Liitiäinen (2014). Nevertheless the university degree is not the only one criterion, that can influence the salary, but the level of earnings can be affected by a lot of other factors. According to Fischer and Musil (2015) the outcomes of education institutions are skills and knowledge that students get, which can be very different among graduates. This statement was also proved in the research by Kucel and al. (2016), which declares that investment in entrepreneurial skills through entrepreneurial education helps individuals to find matching jobs. In addition many other aspects enter into the ability of the graduates to find a suitable job with a satisfactory earning.

The aim of this paper is to find some of key factors, which are necessary to take into account by decision of further education direction in connection to following earnings possibilities. Everyone has different input parameters, such as personal and demographic characteristics, human skills or talent and social conditions, therefore every person has own specific opportunities to get a good job. Some of these factors it is possible to influence, so we can determine our conditions for finding a job and probably for above average earnings. This is reason, why it is necessary to find most of these factors and observe their weight by assuring of salary in the job. On the other hand it is obvious, that some earnings' inconsistencies will be still present in whole society and especially between graduates. The findings in working paper Sánchez and McGuinness (2011) suggest that graduate mismatch can only be alleviated by increasing general levels of job quality within economies. This is a challenge for policies and legislators, which can influence earnings in general, but this paper aims to give some recommendation for students, who wants achieve above-average earnings.

According to General Results of the REFLEX Project prepared by Allen and Velden (2007) the Czech graduates earn generally least among of other European countries. That is an international survey among higher education graduates, which collects information within the period 2008-2012 and creates a huge database with a lot of variables. This paper focuses just on differences between graduates in the Czech Republic, specifically on students from the University of Economics, Prague. The data show that 48 % of these graduates have above-average earnings in the first job after graduation. The commonly appearing characteristics of these students were observed among all variables in the database. The variables, which can explain a high percentage of total variance, it is possible to use for the logistic regression. For this analysis will be focused especially on variables about type of education or profession, some work experience and also mostly predetermined characteristics as region or gender.

Methodology and data

In this chapter the statistical methods used for this analysis and the tests to evaluating goodness of fit of calculated model are introduced. After that here is explanation of the whole statistical survey with its huge dataset and all input variables used by processing this paper. The analysis of results was provided in SPSS software, so all outputs in tables below were calculated in it. The case processing summary tells that 1208 cases were included in this analysis and 496 cases are missing data on one of chosen variables. To sum up, 29.1 % of all cases were not included in this analysis because of missing data, primarily due to lack of answers in some explanatory variables.

Binary logistic regression

Binary logistic regression, as opposed to linear regression, deals with finding a function

that relates outcome variable *y* with only two possible categories, dichotomous dependent variable y (Hebák, et al., 2005). Independent variables **x** (explanatory variables, also called predictors) may be of any type: continuous, categorical, dichotomous etc. Categorical explanatory variables are binomial distributed with parameters π_j and n_j. Problem is that the relationship is non-linear because the probabilities are in the range between 0 and 1. Therefore the probability is transformed to remove the range restriction. If the probability π_i is moved to the *odds* and then is taken the logarithm that calculates the logit, the result is (ReStore, 2015):

$$\frac{\ln \pi}{1-\pi} = x^T \beta \,. \tag{1}$$

Solving for π, this gives:

$$\pi = \frac{\exp(x^T \beta)}{1+\exp(x^T \beta)} \,. \tag{2}$$

Logit is already linear in ***x*** and in parameters **β.** The general logistic distribution function is:

$$F(x) = \frac{e^{(x-a)/b}}{1+e^{(x-a)/b}} \,. \tag{3}$$

For estimating the logit model the maximum likelihood method was used. Maximum likelihood estimator is consistent, asymptotic normally distributed and efficient (Hebák, et al., 2005). Because of the non-linearity in parameters system of equations, the iterative Newton-Raphson method for nonlinear systems of equations was used. After fitting the model the goodness of fit with these tests and statistics should be used (Hebák, et al., 2005):

- **Hosmer-Lemeshow test** assesses how well the data fits the model. It tests the null hypothesis that the model is a good enough fit for the data.
- **"Pseudo" R-square** is similar to R-square in linear regression. It is possible to observe the Cox - Snell R-square and Nagelkerge R-square. First named index has the maximum value equal to 0.75, whereas Nagelkerge R-square provides the corrections and its value is on the range between null and one (ReStore, 2015).
- **Wald test** assesses the significance of each parameter in the model. It rejects the null hypothesis of the corresponding coefficient being zero (ReStore, 2015).

Dataset

Data for providing this analysis was taken from the database of the REFLEX project (Research into Employment and professional FLEXibility). This belongs to a large-scale European survey among higher education graduates. Fifteen countries are participating in this project (REFLEX, 2015) (Austria, Finland, France, Germany, Italy, the Netherlands, Norway, Spain and the UK plus Belgium-Flanders, Czech Republic, Portugal, Switzerland, Japan and Estonia that have received funding from national sources). Analyzed data from the University of Economics, Prague contain answers from 1704 respondents who graduated between the years 2008-2012. Data was weighted according to actually distribution of graduates in population by the proportion of gender, economical status, faculties, type of study and year of graduating as mentioned by Dlouhá and Dlouhý (2014).

Original data matrix consists of 418 variables, whose significance in model were tested

and based on this the 11 of them were included in this analysis as explanatory variables. The explored variable was set "gross monthly earnings in the first job after graduation". This original categorical variable had to be recoded to dichotomous variable, where the value 0 means gross monthly earnings lower than 240 00 CZK and the value 1 is gross monthly earnings higher than 240 00 CZ. Such a threshold was determined because of average gross monthly wage in the Czech Republic in the year 2010 according to Czech Statistical office was on level of 238 64 CZK per month.

Following tables show descriptive statistic of explanatory variables. Table 1 contains the continuous variable and in the second one (Table 2) can be found the rest variables (nominal) and frequencies of their categories.

Variable name	N	Mean	Std. Dev.
Work experience measured in hours/week during education	1697	19.68	14.397

Table 1 - descriptive statistics – continuous variables (Own Source: SPSS output)

Categorical Variables Codings		Percentage (%)
Region during first job	Prague	76.4%
	Central Bohemia	9.4%
	Southwest	4.1%
	Northwest	1.8%
	Northeast	3.3%
	Southeast	3.4%
	Central Moravia	1.6%
Faculty	FFA	17.2%
	FIR	27.8%
	FBA	19.3%
	FIS	16.5%
	FE	11.9%
	FM	7.3%
Type of profession of the first job	Legislators and executives	9.1%
	Specialists, researchers and academics	39.2%
	Technical and professional workers	18.6%
	Officials	24.8%
	Workers in services and sales	8.3%
Way to successfully find a job	yourself	59.7%
	contacts	1.3%
	authorities	24.2%
	predetermined	14.8%

Highest attained education degree	Bachelor	25.2%
	Master	72.4%
	Doctoral	2.5%
Gender	Female	61.8%
	Male	38.2%
High school type	Other type	27.0%
	Grammar school	73.0%
Czech nationality	Czech	91.6%
	other	8.4%
Stay abroad during education	No	59.0%
	Yes	41.0%
Work experience during education	No	28.6%
	Yes	71.4%

Table 2 - frequencies – nominal variables (Own Source: SPSS output)

Results

The resulted regression model can explain more than 28.6 % of total variability of earnings in the first job after graduation by using 11 different variables, which affect the level of salary in the job. Some of them describe differences between earnings better than others, but all factors together give overall appropriate information about earnings assessment. Among these belong "Work experience during education", "Stay abroad during education", and the other changeable factors as Highest attained education degree, Faculty or Type of profession. Other significant factors include these, which is not possible to change, e.g.: Gender, Region. The rest of variables contribute to explanation of total variability less than these over mentioned, but they give additional information to earnings differences. These are High school type, Nationality, Work experiences measured by hours per week during education and also Way to successfully find the first job after graduation. The model shows, that according to these variables the people from other than grammar schools and also people, who continue working in their first job after graduation thanks to predetermined agreement in contrast to them, who found their job yourself or by official authorities, reported higher earnings.

By providing correlation analysis to find some relationship between chosen variables, no significant dependence was observed. Pearson correlation coefficient did not exceed the value of 0.2 in any case, so it means that all variables are independent. Omnibus tests of model coefficient confirm that the model including explanatory variables is an improvement over the baseline model. Chi-square test indicates that the new model explains more of the variance in the outcome than the model without any explanatory variables. Statistic used in Table 3 was already mentioned in the methodology. The Pseudo R-square – Nagelkerke R square says that the model explains more than 28.5 % of the variation in the output.

Model Summary			
Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	1414.177[a]	0.214	0.285

a. Estimation terminated at iteration number 5 because parameter estimates changed by less than,001.

Table 3 – Model summary (Own Source: SPSS output)

The Table 4 shows all important results of this whole analysis. It provides information about regression coefficient, Wald statistic and Odds ratio. The P-value 0.193 in Hosmer and Lemeshow test (Table 5) indicates that the null hypothesis was not rejected, so the model is a good enough fit for the data.

Variables in the Equation									
		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	Work_experience- yes	.499	.153	10.576	1	.001	**1.646**	1.219	2.224
	Work_experience_hours	.026	.005	25.941	1	.000	**1.026**	1.016	1.036
	Faculty- FM			17.214	5	.004			
	Faculty- FFA	.826	.338	5.959	1	.015	**2.284**	1.177	4.434
	Faculty- FIR	1.088	.331	10.828	1	.001	**2.969**	1.553	5.676
	Faculty- FBA	.858	.336	6.543	1	.011	**2.359**	1.222	4.554
	Faculty- FIS	1.049	.351	8.952	1	.003	**2.854**	1.436	5.673
	Faculty- FE	.459	.345	1.776	1	.183	**1.583**	.806	3.112
	Gender- Male	.813	.146	31.161	1	.000	**2.255**	1.695	3.001
	High_school- Grammer	-.189	.160	1.393	1	.238	**.828**	.605	1.133
	Nationality- Other than Czech	.020	.250	.006	1	.936	**1.020**	.625	1.665
	Finding_job- yourself			.936	3	.817			
	Finding_job- contacts	-.151	.609	.062	1	.804	**.859**	.260	2.837
	Finding_job- authorities	.072	.163	.196	1	.658	**1.075**	.781	1.480
	Finding_job- predetermined	.166	.188	.777	1	.378	**1.181**	.816	1.708
	Stay_abroad- yes	.441	.142	9.669	1	.002	**1.554**	1.177	2.051
	Region- Prague			25.023	6	.000			
	Region- Central Bohemia	-.190	.228	.689	1	.407	**.827**	.529	1.294
	Region- Southwest	-.004	.339	.000	1	.990	**.996**	.513	1.933
	Region- Northwest	-.758	.506	2.242	1	.134	**.469**	.174	1.264
	Region- Northeast	-1.336	.359	13.895	1	.000	**.263**	.130	.531
	Region- Southeast	-.891	.437	4.148	1	.042	**.410**	.174	.967
	Region- Central Moravia	-1.827	.723	6.387	1	.011	**.161**	.039	.664
	Type of profession- Legislators and executives			52.683	4	.000			
	Specialists and researchers	-.362	.237	2.331	1	.127	**.696**	.437	1.108
	Technicals and professionals	-.427	.264	2.607	1	.106	**.652**	.389	1.096
	Officials	-1.496	.264	32.014	1	.000	**.224**	.134	.376
	Workers in services and sales	-1.092	.337	10.526	1	.001	**.336**	.173	.649
	Education_degree- Bachelor			37.958	2	.000			
	Education_degree- Master	1.376	.258	28.421	1	.000	**3.958**	2.387	6.563
	Education_degree- Doctoral	.245	.406	.362	1	.547	**1.277**	.576	2.833
	Constant	-2.703	.495	29.772	1	.000	**.067**		

a. Variable(s) entered on step 1: Work_exp. Work_exp_hours. Faculty. Gender. High_school. Nationality. Finding_work. Stay_abroad. Region. Type_of_profession. Education_degree.

Table 4 - Variables in the Equation summary (Own Source: SPSS output)

Hosmer and Lemeshow Test			
Step	Chi-square	df	Sig.
1	11.151	8	0.193

Table 5 - Hosmer and Lemeshow Test summary (Own Source: SPSS output)

According to characteristics, which we cannot influenced, it is clear, that men get 2.3 times more likely above average earnings than women. In General Results of the REFLEX Project prepared by Allen and Velden (2007) is mentioned, that females more often earn lower. The Region, where we are looking for a job, affects also total earnings. Compared to Prague workers in every other Region is lower probability to gain the over-average salary.

Especially in Central Moravia and Northeast is the likelihood on above-average earnings only about one fourth of this probability in Prague. The situation in Southwest and Central Bohemia is better, because there is the likelihood in level higher than 0.8 compared to Prague workers. Other important factors are easier to influence. Some of them we can change ourselves already by choosing the university. In general the people with master degree have 4.0 times more likely above-average earning compared to bachelors. By the people with Ph.D. degree it is just 1.3 times more. It could be because of part-time job, which is their first after graduation of the master degree, while they make their living by stipendiums or using grants. After that the chosen faculty predetermined the probability of level of earnings.

Our paper is focused on students from University of Economics Prague, which has six faculties. All five faculties in Prague show higher likelihood on above-average earnings in comparison to FM. Students of Faculty of International Relations even 3.0 times more likely the above-average earnings and students of Faculty of Informatics and Statistics have 2.9 times more likely. According to Vltavská and Fischer (2013) the highest difference by the comparison of teaching productivity and labour costs was achieved in this faculty FIS.

Finally the type of profession, is necessary condition for assessment of the salary. People, who are working as Legislators and executives have the highest likelihood on above-average earnings compared to other type of professions. Specialists, researchers and academics show this likelihood about 30 % lower and Technical and professional workers about even 35 % lower in comparison to the first group. Workers in services and sales have this chance even much lower, but more surprisingly is one fourth of this likelihood for all Officials.

Finally there are two factors, which it is possible to influence during the studying regardless to study field and these can ensure higher probability of above-average earning in the first job after graduation. Both of them are some new experiences during studying. First of them is previous work experience, that according this model increases the likelihood on above-average earnings almost 1.6 times. Students, who are during their education staying abroad can 1.6 times more likely achieve the above-average salary. It does not matter, how long we are working or staying abroad, but any of these new experiences can assure higher likelihood on higher level of earnings. According to General Results of the REFLEX Project prepared by Allen and Velden (2007): “Experience abroad has a positive effect on the earnings.“

Discussion

For further analysis of earnigs after graduation it would be appropriate to provide the

comparison between the similar study fields on all universities in Czech Republic. Furthermore we can consider the disparity between countries based on finding of Støren and Aamodt (2010), that relatively large country differences were found concerning the graduates' assessments of the usefulness of the study programme. The comparative study between European contries was provided also by Triventi (2013).

Conclusion

This paper presents some characteristics of students, who state above-average earnings in their first job after graduation. According to these variables, which can explain a lot of variability, it is possible to determine the probability of above-average earnings. The dataset of survey REFLEX 2013 shows that 48 % of graduates of the University of Economics, Prague have above-average earnings in the Czech Republic in the first job after graduation. To main factors that affect salary belong especially the previous work experience (which increase about 1.6 times likelihood to achieve higher salary) and stay abroad during education (graduates with this experience has 1.6 times more likely above-average earnings). The education degree (master graduates has even 4.0 higher likelihood on higher salary) and also choice of studied faculty (graduates of Faculty of Informatics and Statistics or Faculty of International Relations have the highest probability to get above-average income) can increase the probability of above-average earning.

Some of demographic factors of people can also determine the salary, gender and region of first job after graduation are typical variables. Males can 2.3 times more likely achieve above-average earnings than the females and people working in Prague have this likelihood much higher (the more the Region is situated on the east, the lower probability on above-average earning exists). Finally the type of profession is important factor that affect the earnings (the legislators and executives more likely achieve the above-average earnings than the officials or the workers in services and sales). To sum up, the graduates of University of Economics, Prague who are males, attended master degree of Faculty of Informatics and Statistics, stayed abroad during education, have previous working experience and find their first job after graduation in Prague, can achieve more likely above-average earnings in this job than others.

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FROM CLASSIC TO SMART TECHNOLOGY

[1]✉Maria Burianova, [2]Milan Turcani, [3]Zoltan Balogh

[1]Department of Informatics, Faculty of Natural Sciences, Constantine the Philosopher University in Nitra, Tr. A. Hlinku 1, Nitra, 949 74, Slovensko, +421 376 408 676, mburianova@ukf.sk

[2]Department of Informatics, Faculty of Natural Sciences, Constantine the Philosopher University in Nitra, Slovensko

[3]Department of Informatics, Faculty of Natural Sciences, Constantine the Philosopher University in Nitra, Slovensko

Abstract

The report is dealing with mobile technologies and their possibilities of setting them into education. There is a list of tools which help to redesign the e-learning educational content to get m-learning contents. Specifically, they can be found in educational environment LMS Moodle which is accessible to all students of the Department of Informatics, Faculty of Natural Sciences, Constantine the Philosopher University in Nitra. To gain information about the use state of mobile technologies a research through a questionnaire has been carried out by the writers of the report. The aim of the research which took part in 2016 was to find out the students´ opinions about mobile technologies, social networks and cloud services. The results are shown in graphs which provide relevance of the current results. The next part of the report is dealing with the preparation or redesign of teaching materials from e-learning to m-learning.

Keywords

E-learning, m-learning, mobile devices, mobile technologies, redesign

Introduction

Connecting the world of technology, business, economics and also education would strengthen as it is introduced by many domestic and foreign sources. Today´s world experiences a revolution with a content which can be compared to any other previous industrial revolution. The historically first one was powered by steam. The second one was built on mass production. Now, there is the third one – the digital revolution which has a global nature; although a few years ago it seemed that it has not reached any effect. But now the real change is obvious (Garth, 2015). The sources (Pcrevue.sk, 2016; Elucidate, 2016; and other) state that considering the declining cost to produce sensors and increasing computing power the Internet connection will have billion sensors. Other accessible devices would connect to Internet and communication channels until 2022. In 2018 unlimited data storage should be available to the majority of the world´s population. Cloud services would increase from 2013 until 2018 twelve times, annual growth rate is assumed to 64 %. Global mobile data operation has increased by 81 % in 2013. In that year there were 526 million mobile devices connected. The speed of mobile network connection would increase twice until 2018. The world of mobile technologies is on its increase. We are in a post-PC era now. The sale of personal computers is decreasing against tablets and intelligent phones. Over one milliard smartphones have been sold. The global sales of mobile devices have increased by 68 % in 2013. Simultaneously, PC sale has recorded the biggest decrease by 9.8 %. It results from an essay realized by International Data Group (Elucidate, 2016).

According to a research, among other things the authors (Rohlíková et. al, 2015) have pointed out important facts. As they claim, the significant majority of university students is convinced that using ICT in education leads to better results in learning. Although, the time students spend on the Internet has rarely scholarly content. Mostly, technologies help students in organizational aspects. They specify terms and deadlines, exchange study materials, support each other in preparations for exams, etc.

Materials and Methods

The ownership of mobile devices among the students is high. The aim of our research was to determine the readiness of students to take mobile devices into the mainstream education. The research was conducted in the period November 2015 - February 2016 and was carried out by a questionnaire. 112 students have taken part in the research, 37 fourth year students and 75 first year students of the Department of Informatics, Faculty of Natural Sciences, Constantine the Philosopher University in Nitra. For the reason of late evaluation of results, were created two groups of students of study specialization Applied informatics. The questionnaire included 13 items. In this paper we present the results of four items. There are various statistical methods to evaluate questionnaires as it is presented in the following publications (Cápay et al., 2011; Balogh et al., 2013; Horáková et al., 2014; Klocoková and Munk, 2011). We used a simple descriptive statistics by using the MS Excel.

State which technology do you use the most for studying?

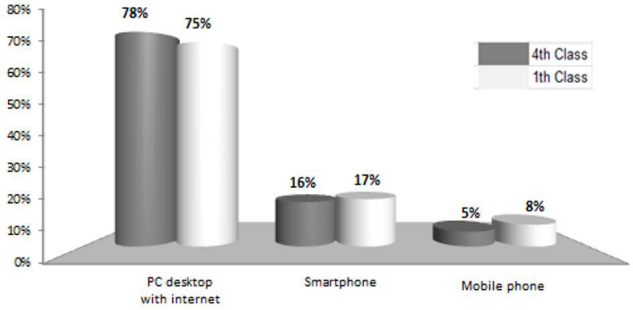

Fig. 1: Use of technology in education

Social networks have become another phenomenon. At the beginning they entrenched amongst the younger generation. Nowadays, the interactive communication has massively spread. Particular interest groups of users have been created. For example within educational activities, a company named Atos has developed blueKiwi on a platform of social networks as a tool which freed people from dozens of useless e-mails, improved cooperation in groups, dulcified the work environment and helped good ideas to be put into practice. Today, it is used in the whole world and it entrenched in the conditions of the Slovak education. Thanks to it, teachers can efficiently cooperate and exchange their experience regardless the physical distance (Ucn.sk, 2015). Figure 2 shows which activities are students using on the mobile devices.

What are the five most common activities you are using on mobile devices?

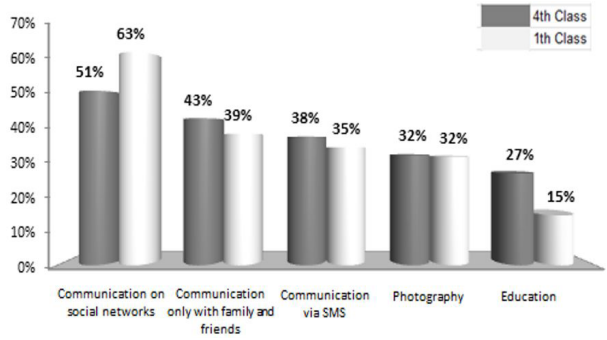

Fig. 2: The most common activities on mobile devices

Another aspect of the research was whether students would be able to study ***only*** through mobile devices. In Figure 3 there is the result of the research.

Would you be able to study through a mobile device?
State how many subjects and in what time.

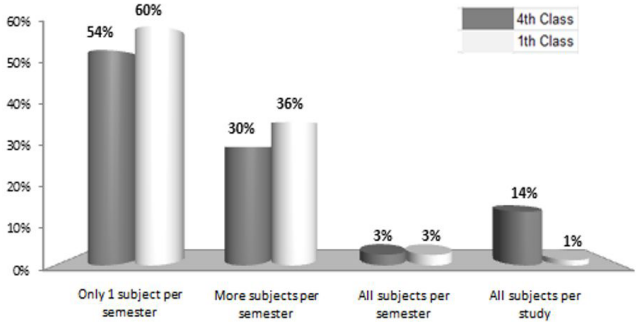

Fig. 3: Education only through mobile device

E-learning module redesign into m-learning application

The development of mobile devices and broadband network leads to concept transformation from electronic education – e-learning – into a concept of mobile education – m-learning. M-learning is becoming gradually a natural expansion of traditional ways of learning as one of the forms of e-learning. It can help the students to search for knowledge, to gain it, create their own knowledge, share and handle it. In accordance with this objective the principles of m-learning system design are as follows:

Simple: e-learning system should be simple and work smoothly.

Adaptive: since the mobile devices are independent of time and place, the system should be easy to use.

Individually: considering that the mobile devices are personal tools, the teaching activities should meaningful and should fit for each student.

Communicative: a compact device eases the communication with the digital content

or other persons. That is why the system should provide adaptive, communicative and collaborative functions (Liaw et al., 2010).

To adapt the existing e-learning content to m-learning, there is a few ways. Small edits help just partially, the most appropriate way is to remake the e-learning module or course. Redesign is always the best choice. To accept new mobile application in the shortest time, it is important to pay attention to intuitive user experience of students. The student should feel comfortable when using the new application. Each order should be in a place where the student expects to find.

There are tools needed for redesign which are freely accessible for teachers on the Internet. To edit texts and static graphics, the application *Tuul* is really appropriate. All teachers would appreciate it through digital materials. The application enables not only creation of own texts and graphic parts but also linking the materials with all accessible online sources.

To play animations and videos in mobile devices which can be found in e-learning mostly in Flash format, there is a need of conversion because they cannot be shown on some devices such as iPhone. Although, there are tools which can convert source files Flash into HTML5 or record the Flash content as MP4. Creation of more sequences of images with texts can be another edit alternative, added by podcasting.

Knowledge testing of students are enabled by various applications. *Socrative* is one of the most spread amongst teachers. It is an intelligent system which enables the teacher to involve the students into a series of educational activities (tests, exercises, games) through his classroom. Socrative helps to provide education engagingly and interactively. It works on a standard web interface and it can run on any device with connection to the Internet. Tools for creation of educational activities are simple the teacher can visualize the results at once.

The application *Kahoot!* is one of the possibilities of playful form of education. Such as the previous application it also works on fixed and mobile devices. The application provides widespread possibilities of education through educational games and supports better understanding of contents by playing them. It is essential to provide questions and answers.

Clarisketch is an application that helps the teacher to explain everything in a simple way. It is enough to use scheme drawing up, pictures, screens, maps, diagrams or photographs and comment them with voice (Iklarity.com, 2015).

Another useful mobile application for secondary school students (for their maturity exams) is an application *Zmaturuj.sk.* It contains 22 fields, 620 topics and more than 160 thousand words. It has a simple design and required information making a minimal size.

An important attribute of the graphics is the orientation of the viewing area. In e-learning the graphics are oriented on width considering the standardly set desktop. But probably, the user would hold the device oriented on its height. The creator of the application has to bear in mind this important fact. He has to avoid the constructions of educational contents that oblige the user to turn the display. Using both hands is evaluated as design flaws and it decreases the value of its life (E-learning infographics.com, 2016).

Cloud Computing – the present and future of education

An important attribute of m-learning education is the Cloud computing service. Data storage enables the use of program applications placed in Internet environment. Companies such as Google, IBM and Microsoft offer cloud for free, without any cost for providing

an educational system. If it is used in a right way, it can provide a high quality education (Burianová et al., 2015).

Cloud computing in e-learning enables the users and students an access to educational contents without any need of installation onto their own devices. The applications would run directly through an arbitrary mobile browser. The educational contents are added immediately because there are no intermediate availabilities. Their update is smooth and the updated parts are consequently accessible. Educational institutions using the technology do not have to take care of any upgrade of the applications. E-learning in this form provides a possibility to keep up with the newest technology. The trend shows that the future would certainly belong to cloud computing and to mobile devices. The Figure 4 was concerned about students using cloud computing and which type.

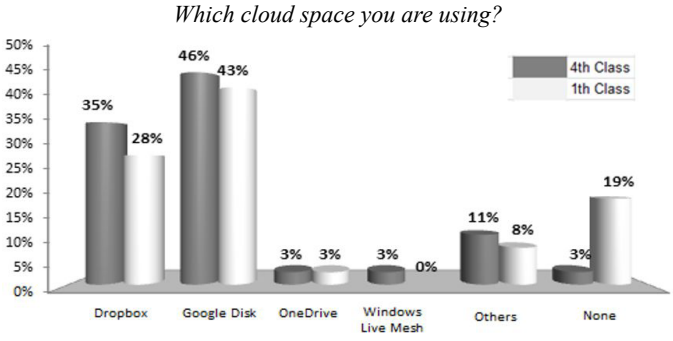

Fig. 4: Using Cloud spaces

Results and Discussion

The hypothesis was as follows: students of the fourth year would reach higher score in using mobile devices than first year students. It was supposed that students of higher grade would be more flexible and more susceptible to use mobile devices for studying. In Figure 1 there is the result of the introduction question of the questionnaire.

The first result that we evaluated in Figure 1, surprised us. Opposite result was expected. 78 % of fourth year students and 75 % first year students use PC with Internet connection. Thus they are linked to the environment. Only 21 % of fourth year students and 25 % of first year students use mobile devices less. It means that they rely on fixed network connection more and they are not prepared enough for a full-scale introduction of mobile education.

Figure 2 points to which activities are for students priority and on which position is the use of mobile devices for learning. It is obvious in Figure 2 that the communication on social networks represents the majority. Then it is communication only with family and friends, sending SMS is on the third place, in fourth place is photographing and the last point is given to the training. Other activities which were not mentioned in the questionnaire were listening to music, games, banking, reading daily press, Internet shopping, reading books, watching videos, recording, watching films. They appeared in the same order in the research.

According to the results of the above mentioned items, a question has been asked how many subjects students would be able to complete with the support of m-learning. Results are shown on Figure 3. From the research it is visible that 54 % of fourth year students

and 60 % of first year students would complete one subject. Just 3 % of fourth and first year students is able to complete all subjects. Only 14 % of fourth year and 1 % of first year students venture to complete all the subjects during their study at the university (3 or 5 years).

In Figure 4 there is the result of the research on the use of cloud services by students. 97 % of fourth year students and 81 % of first year students stated a cloud space they use. Only 3 % of fourth graders and 19 % of first graders do not use cloud services. Similar results were expected.

M-learning does not need to compete with introducing formal approaches in schools. Also, it should not be viewed as substitution or alternative of existing ways of education implementation or vocational training. It should be understood as an additional way how to spread or improve the environment supporting the education. Mobile learning is different from e-learning in characteristic features by personalization, wireless connection, unlimited space and time, interactivity, special educational content edit, learning style and entertaining. Just-in-time approach is the simplest way how to enrich formal learning by informal.

M-learning quality can be reflected only when securing certain special limitations and advantages of mobile devices. It is obvious that mobile education has its mobility advantages and that is the reason why it differs from e-learning. E-learning is committed to educational space, there is fixed network to Internet and desktop computer with accessory. The student approaches this kind education in a way that he stipulates an exact time and space. He shares LMS system with other users. He communicates online, but mostly offline. Learning styles are also an important attribute. Students should be aware of their learning styles, they should know what their strengths and weaknesses are, and should be provided with a variety of instructional methods and approaches to choose the most suitable ones (Šimonová et al., 2013).

Conclusion

Naturally, the most basic and most important element of e-learning education is custom content, teaching material. It has to be didactically well composed into a form of base to create an e-learning or m-learning unit. We believe that the negative aspect in a form of lack of technical content creators would overcome gradually and the Slovak e-learning would reach the world´s trend the successor of which is now the m-learning. Educational materials and methodology is needed to be prepared and created for this type of learning. We expect that in coming years, people might study anywhere without being committed to a fixed environment whether standard or distant.

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USING VIDEO ANALYSIS TOOL AND SELF-REFLECTION AS A RESPONSE TO EDUCATION CHANGES IN TEACHERS' EVALUATION IN MEXICO

[1]✉Michaela Cocca, [2]Armando Cocca

[1]Faculty of Sports Management, Autonomous University of Nuevo Leon, Ciudad Universitaria s.n., San Nicolas de los Garza, 664 50, Nuevo Leon, Mexico, +521 818 2540096, michaela.cocca@gmail.com

[2]Faculty of Sports Management, Autonomous University of Nuevo Leon, Mexico

Abstract

Teachers' evaluation policy has become one of the key components of the Mexican education reform. As a consequence of these changes, school teachers face a new and difficult challenge, since they are required to fulfill stricter criteria and maintain their teaching standards at a higher level than in previous years. For this reason, new strategies need to be adopted in order to answer to this demand. The ability of self-reflection has been considered by many authors as one of the key factors that can positively affect the overall teaching-learning process in both pre-interactive and interactive phases. Video annotation tools can provide educators with essential data that can be used to scaffold and support teachers' reflection. Thus, the aim of our study is to analyze the ability of self-reflection in terms of noticing and knowledge-based reasoning processes in teachers of English as a second language using a video annotation tool.

Keywords

ESL teachers, knowledge-based reasoning, learning-teaching process, noticing, self-reflection, video annotation tool

Introduction

Teachers' evaluation policy with its primary focus on assessing and improving teachers' quality has become one of the key components of the Mexican education reform in both primary and secondary education levels. In order to improve teachers' quality, rather than only leaning towards students' learning outcomes, the Mexican policy makers have introduced a more rigorous evaluation process coming in force in the academic year 2015/2016 (Secretaría de Educación Pública [SEP], 2015). The Ministry of Public Education of Mexico (SEP) has identified five key profile areas within the evaluation manual, which describe pedagogical, interpersonal, methodological, organization, and relational competencies with their own parameters and corresponding indicators. As a consequence of these changes, school teachers face a new and difficult challenge, since they are required to fulfill stricter criteria and maintain their teaching standards at a higher level than in previous years. For this reason, they need to adopt new strategies that can help them increase the quality of the teaching-learning process in their classes. Among them, authors consider self-reflection as one of the key factors that can positively affect teachers' skills in both pre-interactive and interactive phases (Calandra and Rich, 2015).

Self-Reflection through a Video

The concept of self-reflection is not new to the profession. In 1980's, after a decade of research focused on educational effectivity and dynamics, Schön (1983) concluded that

skilled practitioners are those who are able to reflect on their own teaching, as well as utilize professional experience in order to assess and revise existing theories to develop and apply appropriate teaching strategies. Since then, the conception of critical reflection of one's teaching practice has gained more importance and become the key component of both pre-service and in-service teachers' training programs worldwide (Tripp and Rich, 2012a: 728). Moreover, many authors consider the ability to analyze and reflect upon one's teaching as the key to successful learning (Sherin and Russ, 2015: 3), as well as it contributes to the development of one's teaching expertise (McFadden et al. 2014: 460).

To support teachers' self-reflection, many techniques, strategies and instruments such as reflective journals, diaries, portfolios, or self-reports have been proposed (Picci, Calvani and Bonaiuti, 2012: 601). Yet, with the technological advancement, the use of video-based analysis has become a prevalently used strategy and a powerful tool to help improve the teaching-learning process and assess effective teaching in teachers' professional development due to its unique capability to capture the complexity and richness of an authentic classroom practice (Sun and van Es, 2015: 203; Rosaen et al. 2013: 173). In fact, it allows us to see the smallest nuances that we might have not been able to notice in the moment of observation and reflect on them later. Using videos gives individuals the possibility of coming back to a particular moment, scrutinizing one segment of a lesson after another, and analyzing them from different critical points of views - e.g. students' interaction, engagement, instructions, or content knowledge (van Es, Tunney, Goldsmith and Saego, 2014: 341). Through a video we might be able to understand if the strategies used are working or whether we need to rethink them. As Tripp and Rich (2012a: 729) suggest, using video analysis leads us to improve the ability to evaluate our own teaching, since it draws attention and comprehension to different patterns in our teaching practice, and thus it results in effective teaching behavior. Other studies have demonstrated that video analysis also helps teachers articulate their tacit assumptions and purpose regarding teaching and learning (Powell, 2005: 415), and assess strengths and weaknesses of teaching, i.e. identify problem areas in teaching (Pellegrino and Gerber, 2012: 1). Several studies also reported that by means of video analysis teachers re-evaluated their question-asking strategies (van Es et al., 2014: 342).

Cognitive processes taking place during video-based self-reflection

Research has demonstrated that within the framework of self-reflection skills such as *noticing* and *interpreting* are very important in the teaching-learning process in the context of education reforms (van Es and Sherin, 2008: 245). Based on Goodwin's work (1994), Sherin (2007: 385) identifies two major cognitive processes that take place during a self-reflection analysis: selective attention and knowledge-based reasoning. *Selective attention* during video viewing referrers to the selective perception of moments when teachers pause a video and comment on a specific event that might be interesting or relevant to their expertise (Kleinknecht and Schneider, 2013: 14). These authors define *knowledge-based reasoning* as the ability to reflect on and interpret perceived events; further identifying three categories within: (1) to describe what has been selected; (2) to explain perceived events based on previous knowledge of teaching and learning; and (3) to evaluate and predict, in which the explanation is used to asses the situation and provide possible alternatives. Research suggests that by means of a content-based analysis of teachers' written or oral comments, we are able to reveal such processes (Kleinknecht and Schneider, 2013: 14; Santaga and Guarino, 2011: 143).

It has been argued that unlike novice teachers, experts are more likely to provide

more meaningful insight in the area of their expertise (van Es and Sherin, 2008: 245). Many studies in the area of mathematics, science, and technology have confirmed this hypothesis. In fact, as pointed out by van Es and Sherin (2008: 246), the difference in reasoning related to perceived events is also dependent on the field of expertise with its corresponding knowledge and beliefs, i.e. mathematics teachers may reason about perceived events more accurately than literature teachers.

Considering the emerging importance of teachers' evaluation, being able to reflect on one's own practice is a key ability that can respond to the requirements established by SEP. Video-based analysis of teaching practice therefore provides both teachers, teachers' trainers, and researchers with essential data that can be used to scaffold and support teacher reflection. Despite of the large number of studies found in the area of mathematics and science, there seems to be a lack of literature on noticing abilities in teachers of English as a second language (ESL). Research on pre-service or novice teachers has reached a general consensus that in order to foster the process of self-reflection, researchers should provide teachers with some guidelines or frameworks (Tripp and Rich, 2012b: 683). Yet, there is a few evidence on whether experienced ESL teachers do need such a support, or as suggested by van Es and Sherin (2008: 245), they can provide a more meaningful insight in the perceived events.

Thus, the aim of our study is to analyze the ability of self-reflection in terms of noticing and knowledge-based reasoning processes using a video annotation tool in experienced ESL teachers without following any rubric or framework. Our main interest is to understand what do teachers see when reflecting upon their own teaching practice.

Materials and Methods

Design

The study is based on a quasi-experimental design using a quantitative approach to investigate the reflective practices of experienced ESL teachers and to understand the types and relative frequency of different stances.

Participants

15 ESL female teachers with 7-to-30 years of teaching experience took part in this study. The sampling technique was non-probabilistic based on convenience, including all ESL teachers working in the selected school. Although the participants did not have a particular experience in using a video annotation tool as an instrument for self-reflection, 75% of them had experienced self-reflection practice during their degree studies as a part of micro-teaching approach.

Instruments

Video Annotation Tool

As a video annotation tool we used a prototype of a computer-based program, Lloyd's Video Annotation Tool 5, created by Lloyd P. Reiber, a professor from the University of Georgia, to help pre-service or in-service teachers better understand their teaching practice, as well as for educational researchers or trainers to capture and analyze qualitative data. To start a video analysis, a new project needs to be created. Once a video is uploaded, the user can identify a segment and add a corresponding tag – code. Although a five-second interval is automatically allocated to each segment, it can be easily modified using a command panel.

Additionally, comments and transcripts can be created. Once the analysis is done, reports can be generated both as a plain text and in an Excel-ready form.

Procedure

The study was carried out at a bilingual primary school in Guadalupe, Nuevo Leon (MEX). As a first step, all participating teachers were invited to a one-day workshop on using Lloyd's video annotation tool to reflect on their own teaching. Teachers were asked to bring their own laptops in order to download the program. A random 10-minute-long video from an ESL class was selected in order to practice with the software and understand its functions. To help teachers work with the trial video, the participants were firstly asked to brainstorm aloud ideas on what could they notice, followed by an individual annotation, pausing and commenting on whatever event they felt to be important.

As a second step, the participants were asked to record two videos of 45-to-50 minutes of their own teaching practice. Although there are contradictory findings on the length of a video for self-reflection, teachers might get overwhelmed by the amount of data they are viewing (Sherin and Star, 2011: 68). As indicated by researcher, teachers should select elements to attend in order to pay a closer attention to the details and thus increase the opportunities for improving the overall teaching-learning process (Tripp and Rich, 2012b: 684). Therefore, we firstly asked the teachers to create shorter segments representing specific teaching episodes such as warm-up activity, practice of skills, grammar, etc. Secondly, each teacher was asked to upload individual episodes as new "projects" into the program and reflect upon them. Except for the first demonstration, teachers were not provided with any guiding framework, since this approach, as previously mentioned, is predominantly recommended for pre-service teachers.

Data Analysis

Teachers' written comments were codified by means of NVivo11 software. We adapted dimension and coding categories from different theoretical frameworks used in literature. As a result of our search, we decided to focus on cognitive processes of selective attention and knowledge-based reasoning. For the purpose of our study, we used adapted dimensions of selective attention and knowledge-based reasoning that were presented in Kleinknecht's and Schneider's (2013: 18) study. Data was coded individually by two researchers and successively compared in order to assess the reliability of observations. The Intraclass Correlation Coefficient was 0.89. Disagreements were resolved through consensus. Data was successively exported to SPSS 22.0. Descriptive analysis was run in order to assess relative frequencies of the codes.

Results

The results from our analysis showed that in the first dimension of selective attention 85.5% of teachers focused their attention on *teachers' activities* rather than focusing on *activities performed by pupils* (15.5%). Furthermore, very little attention (17.4%) was paid to the *focus on learning processes* compared to 82.6% of no focus on such processes. The results from the second analyzed dimension on knowledge-based reasoning revealed that 86.2% of the overall process comprised of teachers *describing* events that occurred in the video segments. In only 9.3% teachers *evaluated* what was good or bad or should have been done in a different way. The *explanation* of inferences about what teachers noticed represented 4.3% of the overall number of comments. A closer look at the values for *dealing with negative events* showed that in more than half of the comments (56.5%)

the teachers perceived a negative event without any explanation, only 8.3% regarded its evaluation, and 11.7% reflection on the consequences. On the other hand, higher percentage of comments, 23.7%, reflected on possible alternatives. In the second category 65.1% account for no positive event. Positive events were perceived only in 6.0%, and evaluated in 7.9% of teachers' comments. Compared to the negative events, the teachers reflected on considerably less alternative actions (5.6%), yet more on their consequences (15.4%). Table 1 shows the relative frequencies of codes in the two dimensions of selective attention and knowledge-based reasoning.

Cognitive Processes	Relative frequencies in %
Selective attention:	
No focus	0
Focus on teachers' activities	84.5
Focus on pupils' activities	15.5
No focus on learning processes	82.6
Focus on learning processes	17.4
Knowledge-based reasoning:	
Reasoning processes:	86.2
Describe	9.3
Evaluate	4.5
Explain	0
Dealing with negative events:	56.5
No negative event	8.3
Perceive negative event	11.5
Evaluate	23.7
Reflect on consequences	65.1
Reflect on alternatives	6.0
Dealing with positive events:	7.9
No positive event	15.4
Perceive positive event	5.6
Evaluate	
Reflect on consequence	
Reflect on alternatives	

Table 1: Content analysis of teachers comments: Relative frequencies of selective attention and knowledge-based reasoning codes (source: own calculation)

Discussion

The objective of our study was to explore what do experience ESL teachers notice when they observe and reflect on their own teaching practices. Our analysis was based on 157 comments. Our findings revealed that despite of the experience in teaching and a previous experience with micro-teaching episodes as a part of teachers' university studies, the participants were predominantly focusing their attention on their own activities (84.5%) – listing the events that occurred in the class and where the teacher was the main actor, rather than on those performed by students (15.5%) and their participation or performance. As a consequence, little focus (17.4%) was paid to the learning process itself. As noted by Sherin and Russ (2015: 3), this behavior of chronologically listing classroom events is more typical for pre-service or novice teachers. However, as demonstrated on a case of three teachers in the study of van Es and Sherin (2002, in Sherin and Russ, 2015: 13), also teachers with extensive teaching experience are engaged in this type of list making description. This tendency was also confirmed by analyzing reasoning processes. As shown

by the results, the predominant percentage of all comments was coded as *description*. In contrast with other studies that focused on teachers viewing and analyzing their own videos demonstrating that the participants were in their first reflections more likely to be positive than negative (Kleinknecht & Schneider, 2013: 18-19), our participants noticed a significantly higher number of events which they referred to as negative. Despite of the fact that our participants were viewing class incidents more critically, they were able to reflect on possible alternatives in less than half of them. The exact opposite can be seen between the reflection on alternatives and consequences of positive events. We assume that this shift could be caused by the nature of the event itself. In other words, it is more likely to reflect on consequences of positive events rather than on negative ones, as well as to provide more alternative solutions of negative events rather than positive ones.

Conclusion

In the era of constant teaching changes when teachers are trying to keep abreast with the latest innovative methods and instruments seeking for the most suitable strategies for their classrooms, using videos for an authentic insight offers a useful lens for analyzing and strengthening such practices. As confirmed by research, using video-based tools and self-reflection approach helps teachers identify and improve the teaching-learning process with more focus on students' learning needs (van Es and Sherin, 2008: 247). However, as suggested by van Es et al. (2014: 340), simply viewing a video does not ensure teacher learning. There is consensus among authors on using a classroom checklist or any kind of observational form or guided theoretical framework. This will avoid teachers' reflection to be superficial and allow them to move from a simple listing to start paying closer attention to students' thinking and learning (Sherin and Russ, 2015: 3).

Despite the common believe that teachers with extensive teaching experience are able to self-assess their own teaching in a deeper way, our results demonstrated the need of guided training throughout the process of self-reflection regardless of years of teaching practice and experience with micro-teaching approach. Thus, for future studies we recommend to use an assessment tool (observational form, framework, etc.) to facilitate teachers' critical thinking.

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PATTERN OF ORGANIZATION STRUCTURE DEVELOPMENT: THE CASE OF HIGHER EDUCATION

Igor Denisov

Department of Management, Faculty of Business Administration, University of Economics in Prague, nám. W. Churchilla 4, Prague, 130 67, Czech Republic, +420 224 098 449, +420 224 098 449, deni01@vse.cz

Abstract

An organizational structure of the higher education institutions in the course of their development, formed in accordance with the requirement of continuous efficiency improvement and is subject to objective laws. The article hypothesized that each education organization can change from initial serial organizational structure to the next parallel development level and after that again transitions to serial of higher level and so on. All educational institutions with the same structures and sizes have similar efficacy parameters, so they can be combined into clusters. Knowledge these development patterns and their application can accelerate and significantly increase the efficiency of universities activity. Our study was carried out on the basis of data of Czech Republic educational institutions. At present, the logic of development has formed four clusters and suggests the emergence of a new type of higher educational institute – the research university as the next development level, which should form the fifth cluster.

Keywords

Higher education, organizational structure, development level

Introduction

Almost any educational institution can be regarded as an organization, which transforms the basic knowledge of students into the knowledge of graduates. This applies to all levels of education, starting with the 1st level of elementary school, which ends with the award of vocational certificate. It is possible to consider any educational organization as a production process, combined with the process of knowledge consumption (Marginson, 2006).

Winston (1999: 13) noted that 'higher education is a business: it produces and sells educational services to customers for a price and it buys inputs with which to make that product'. This approach allows the use of production functions (Hanushek, 2003). But some researchers argue that the university is not a factory (Chattopadhyay, 2013). It would seem that profit maximization postulate is not applicable to the education system. However, the world best universities, with leading positions in international rankings are mostly private (Bridgestock, 2013). In recent years, we can see the trend of growth of private universities, which are profit-oriented (Bridgestock, 2015).

In Czech Republic there are 26 public higher education institutions (HEIs) and more than 40 private institutions of higher education (MEYS, 2016). At the same time most of them sell their services on the market, i.e., they are subject to laws of the market. Moreover, the system of public funding is now mostly dependent on the position in the international rankings (Pusser, Marginson, 2013), i.e. determines the effectiveness of their activities.

For the management of any company, which focused on the commercial result, the production process (in this case, education) is only part of the business process, although

the main part. In this context the defining characteristic of organizations is their structure that characterizes the business process.
Therefore, permissible to assume that we can apply to the HEIs the same approach as in the industry namely the theory of economic-technological development of firms. Higher education is well suited for testing the findings of economic-technological theory of the firm in connection with the fact that the structure of its "production", on the one hand, is relatively simple, and on the other is familiar to all people with higher education (Denisov and Yusim, 2013: 5-16).
In our study, we will try to demonstrate that the development of the education system goes in accordance the objective laws and caused by the need to improve performance and is accompanied by repeated changes in the organizational structure.
For a confirmation of this hypothesis we will be based on the methods of cluster analysis according to the data of educational institutions of the Czech Republic. Cluster analysis is widely used for the determination of relatively homogeneous groups, combining elements of a sample with similar characteristics. This method is used, including for a definition of higher education structure (Brint, Riddle and Hanneman, 2006). In the event that we have received groups (clusters), which largely coincide with the theoretical predictions then we can talk about the existence of, or the identification of objective trends (or pattern) the formation of such groups.

Materials and Methods

Theoretical framework

In order to identify the organizational structure of the organization (in this case educational institution) should be considered the simplest process of education. Then more complex processes can be considered as the development of the simplest processes.
The educational organization of the first level implements a simple educational process (Fig. 1). In this example educational process consists of a sequence of lessons teaching a single discipline. The reality of the existence of such firms confirms that in addition to a variety of primary, secondary and higher education organizations on the market there is a significant number of single teachers (e.g., foreign language teachers, etc.). Note that even in such a simple process there are support activities such as advertising, book-keeping, a trip to the disciples, etc. Here we use the ideas of Porter's (1985) value chain and we will try to divide our activities on the primary and support activities.

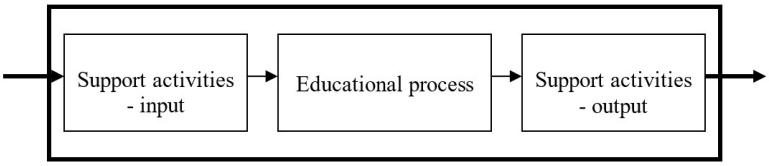

Fig. 1. The serial educational organization structure of the first development level

The first that can be done to improve efficiency is the improvement of the organization and production technologies such as using of multimedia tools, saving time and greatly enhances the visual presentation of educational material. In the XXI century this also fast-paced interactive forms of learning and remote form, allows teachers to work with groups of students who are at a distance (e-learning, m-learning). As a result, we can reduce time, decrease costs, and increase our efficiency.

However, sooner or later the company of the first level, which implementing the simplest manufacturing process of learning will have reached the maximum existing scientific and technical level. Our employee (teacher) will have reached the limits of his physical capabilities.

It can be assumed that a volume of sales of services such firms will be limited to a specific value, which can reach one person, who owns modern teaching technologies.

Next the most obvious way to increase production and reduce costs will be duplication of the production process or hiring another employee (or partner involvement), for teaching the similar subjects. In this case happens abrupt increase in production volumes (at least twice) and change of the organization structure from the serial to the parallel. In the current business process, which consists of support and production process (in this case, the educational process) added another educational process (see Fig. 2). Finally, it may be, for example, foreign language training center, bringing together linguists or training courses for driving.

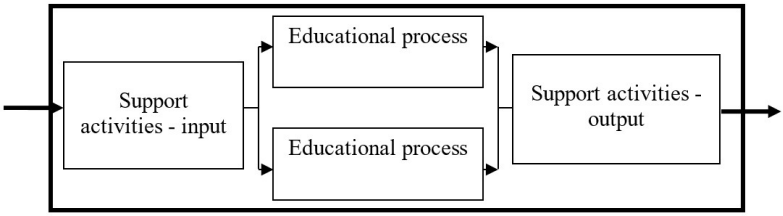

Fig. 2. The parallel educational organization structure of the second development level

Transition to the parallel organization structure allows to increase productivity without changing the existing technologies. This occurs because the costs of supporting processes grow to a lesser extent than turnover, and, for example, advertising costs per unit of production will decrease proportionally to the increase of production, etc. In addition, the horizontal company becomes more adaptive for progressive technological improvements (reducing time of learning process) proposed by a single element, are able to use in all similar parts of the system, etc.

The law of alternation of the organizational structure of the company is stated as follows: the organizational structure alternates from serial to parallel one and back during the company's development (Denisov and Yusim, 2013: 7).

We emphasize that the model of alternation of serial and parallel structures will be discrete. In reality, we will see continuous growth of the organization within the same level and a constant structure, and the transition is characterized by a change in structure.

In education, the development of the third organization level will be presented by the college in the sense in which this term is used in the United States. Its organizational structure again looks like on Fig. 1. American college often provides a two-year learning, in something similar to secondary vocational education (Associate Degree), or at the limit of its possibilities - a four-year education with BA (Bachelor Degree). (The college with the same features can be part of the university and then it is appropriate analogy with the faculties of the European universities). Serial faculty structure (third level) is known to consist of the Departments that are parallel structures (second level), including Professors (lecturers and etc.) which are the first level. In this case all of these levels of government are within the same organization.

The practice shows that instead of a serial educational third level organization – the colleges (in American terminology) come parallel systems. This are classical university faculties

(colleges) as the systems supporting the implementation of undergraduate programs. That is the development is today in strict accordance with the laws of philosophy when infinity is achieved through the transformation of quantity into quality. In economics, this translates into the law of alternation of serial and parallel organization structure in the process of their development.
Universities (fourth level of development organizations) duplicates of the main processes, but in this case, not only by increasing the number of hired personnel, but also by a full repeat of faculties, each of which corresponds to the company in the third level (see fig. 2).

Material

We used the initial data from the database Albertina Gold Edition of Bisnode Česká republika, a.s. For the study were selected enterprise category of Education (CZ-NACE: Education, division: Professional, scientific and technical activities or Education), excluded research organization (division: scientific research and development), with a positive (more than one) number of employees and turnover for 2013 or 2014 all forms of ownership. All interval variables were recalculated into the arithmetic ones. The total number of entries - 10 890 education organizations. All the organizations on the form of ownership include next categories: state-owned, private, municipality-owned, cooperative-owned, foreign, ownership of associations, political parties and churches, not ascertained yet. And by type of activity: Car driving school activities, Cultural education, Driving school activities, Education, Tertiary education, Other education, Other education nec, Primary education, Primary education (second level), General secondary education, Higher education, Secondary vocational schools, Pre-school education, Technical and vocational secondary education, Educational support activities, Secondary apprentice centres, Environmental education, Plane driving school activities, Sports and recreation education.

Method

Two-step cluster analysis was conducted to prove our hypothesis. Continuous variables: number of employees, sales volume, number of jobs, number of activities, labor productivity; Categorical variables: Number of Employees (interval), Activities. The calculation was made by using IBM SPSS Statistics.
We hypothesize that in the first cluster must enter the organizations in which one workplace and less than 5 employees. Unfortunately, the available data do not allow to make a more detailed analysis and to prove that the actual sequential structure of the first level of development forms one person. The second cluster will be evaluated, as a group of companies (probably with parallel structure) as the characteristics of such organizations will be a small number of employees, increasing the number of jobs and a limited number of activities. The third cluster will be formed mainly organizations with a consistent structure. In the fourth cluster will include classical universities obviously have a parallel structure, because they include several faculties.

Results

As a result of the two-step cluster analysis we were able to produce the decomposition of the data set into groups (or clusters). In Table 1 we can see that organizations with number of employees less than 5 people, as expected form the basis of one of the clusters (column №3). The second and third cluster is formed, as expected by the following size (number of employees and turnovers) organizations (columns №2 and №4). The fourth

cluster (№1) has included as expected the major universities and also the “emissions” of previous levels.

		Cluster			
		1	2	3	4
1 (1 - 5)	Frequency	45	0	2311	0
	Percent	1,90%	0,00%	98,10%	0,00%
2 (6 - 9)	Frequency	12	0	235	1130
	Percent	0,90%	0,00%	17,10%	82,10%
3 (10 - 19)	Frequency	12	0	166	2217
	Percent	0,50%	0,00%	6,90%	92,60%
4 (20 - 24)	Frequency	4	0	0	736
	Percent	0,50%	0,00%	0,00%	99,50%
5 (25 - 49)	Frequency	7	2242	0	0
	Percent	0,30%	99,70%	0,00%	0,00%
6 (50 - 99)	Frequency	2	1498	0	0
	Percent	0,10%	99,90%	0,00%	0,00%
7 (100 - 199)	Frequency	12	232	0	0
	Percent	4,90%	95,10%	0,00%	0,00%
8 (200 - 249)	Frequency	2	8	0	0
	Percent	20,00%	80,00%	0,00%	0,00%
9 (250 - 499)	Frequency	8	8	0	0
	Percent	50,00%	50,00%	0,00%	0,00%
10 (500 - 999)	Frequency	4	0	0	0
	Percent	100,00%	0,00%	0,00%	0,00%
11 (1000 - 1499)	Frequency	8	0	0	0
	Percent	100,00%	0,00%	0,00%	0,00%
13 (2000 - 2499)	Frequency	4	0	0	0
	Percent	100,00%	0,00%	0,00%	0,00%
14 (2500 - 2999)	Frequency	1	0	0	0
	Percent	100,00%	0,00%	0,00%	0,00%
15 (3000 - 3999)	Frequency	2	0	0	0
	Percent	100,00%	0,00%	0,00%	0,00%
17 (5000 - 9999)	Frequency	2	0	0	0
	Percent	100,00%	0,00%	0,00%	0,00%
18 (10 000 - and more)	Frequency	1	0	0	0
	Percent	100,00%	0,00%	0,00%	0,00%

Table 1: Four clusters of Czech Republic education system, 2013-2014 (source: own calculations)

Discussion

Definitely prove the existence of a specific organizational structure by statistical methods is quite complicated. In our case, we got the expected results because the clusters are joined together precisely those companies that we expected. At the same time, we cannot assert the uniqueness of getting result. Only the logic of development allows to suggest that cluster analysis confirmed the alternation of serial and parallel systems.

In the case of higher education institutions, we can agree with the authors of the theory

of economic and technological development about the existence of the law of alternation of serial and parallel structures (Denisov and Yusim, 2013). In addition, we can also talk about the existence of the development levels of the organization one of the characteristics which is the organizational structure, which is changing as the organization grows.

As proof of the alternation may be noted that the next the most promising step in the development is emergence of research universities which are now recognized by scientists (Marginson, 2014) It is obvious that such a university is a bigger structure of the next development level in comparison with educational universities.

The pattern of evolution of a firm are based on two components. A breakthrough in the economy causes the appearance of serial levels of firms. A lack thereof or time lag is compensated by a creation of firms of parallel levels. The alternation of serial and parallel structures in the course of the growth of a firm's development was shown in a conventional pattern (see Table 2) and illustrated by the results of cluster analysis (see Table 1).

The best way to increase production efficiency in such cases is an extension of the process chain due to the inclusion of the previous or subsequent redistribution. But for educational institutions it is the newest scientific knowledge. That is why the educational institutions of the fifth level of development of its production units are made up of blocks of Science and Education, and together form a coherent system. And their supporting processes ensure the effective support of just such a production system of education.

In accordance with the conclusions of the economic and technological theory of the firm, cardinal increase the quality of education and the efficiency of large commercial institution provides only the transition to the fifth level of development. The level of educational organization Research University means that after a significant increase in output within the parallel structure again there is a transition to a consistent system. And it caused due to, as always, the requirement to increase the efficiency of the company.

The structure of national educational system consists of educational institutions and is shown in table 2 (which, of course, is a bit simplistic, but, in fact, quite informative).

Level of development	Educational institute	Organizational structure
1	Private teachers	serial
2	Training (education) centers	parallel
3	College (school)	serial
4	Education University	parallel
5	Research University	serial

Table 2. Levels of educational institutions development

Conclusion

The current developmental level of the educational organization describes the static state. Dynamical evolution represents a shift from the level achieved toward a higher one and the structures change from serial to parallel (and vice versa). We can argue that there is the pattern (may be even law) of permanent alteration serial and parallel organizational structures in long-term corporate evolution.

Unfortunately, in the modern statistics or corporate data there is not any information about the structure and we had to use indirect signs. We interpreted the organization of the first level of development as consisting of one person. Such organizations by definition, can only be serial. The second level of development - are organizations with a common activity, but having several workplaces. Obviously, they should characterize the parallel structure. The largest organization - a classic university with the faculty organization, and

therefore parallel. The third level is in many respects was obtained based on the analysis of activities can be seen as consistent organization.

Certainly our article can only be seen as a first step and thorough proof requires larger studies, involving analysis of the structure of specific organizations.

The next step in the study which can confirm our hypothesis must be offered a field study of several organizations of each level of development. It would be desirable to produce a representative sample of the educational institutions of the Czech Republic and a comprehensive analysis of their organizational structure.

It can be assumed, that the general pattern of the organization's evolution which presented in the article is universal, because the approaches underlying it, can use it with certain clarifications to educational organizations from any country with a market economy in different historical periods for the purpose of an objective determination of current situation, assess the prospects and development of methods and strategies for accelerated development both individual educational organization and the national educational system as a whole.

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STUDENTS PERCEPTION ON HIGHER EDUCATION OPPORTUNITIES

[1]Anca Draghici, [2]✉Larisa Ivascu

[1]Department of Mangement, Faculty of Management in Production and Transportation, Politehnica University of Timisoara, Romania

[2]Department of Mangement, Faculty of Management in Production and Transportation, Politehnica University of Timisoara, Romania, 14 Remus Street, Timisoara, 300191, Romania, larisa_ivascu@yahoo.com, larisa.ivascu@upt.ro

Abstract

This paper is focused on analyzing the perception of university students on the opportunities offered by the higher education institution in which they are enrolled. The main aim is to provide an analysis of the results obtained by applying the method based on questionnaires and by analyzing statistical data obtained from its faculty website. The target group of this research consists of students studying at the Faculty of Management in Production and Transportation, from Politehnica University of Timisoara, Romania. The research results shows an inventory of factors that determine motivation for involving students in research and collaboration with businesses. The categories of factors significantly influence overall satisfaction of students to the institution of higher education, professional development and help motivate them to become actively involved in research.

Keywords

Career decision, education, open innovation, perception, student's satisfaction, research

Introduction

The education system is a pillar of the national economy, it is important for economic development and national stability. The legal framework of the higher education is based on related laws published nationwide, according to the procedures for recognition and accreditation of diplomas (Law 88/1993[1] amended by Law 144/1999[2]). The overview of the Romanian higher education quality, as derived from the analysis of public data of students and employers, is a relatively high level of quality. In terms of trends, however, whether the perceptions of teachers and employers remain stable, the students recorded an impairment over the past few years. Higher education contributes to the development of skills and abilities that form the business professional. Currently academia face reality in which students choose to pursue a particular career since the early years of university studies. Thus, professors adapt to these needs and the teaching process involves improving techniques, practical applications, interaction with business, teamwork, to develop stimuli that attracts students. This issue of identifying new stimuli that respond to the factors that attracts students in educational and research activities is studied in different countries and from different perspectives, e.g. Ceronia et al. (2016), Kurmanov, Zhumanova, and Kirichok (2013); Ahrweiler, Pyka, and Gilbert (2011), Zimmerman, and Cleary (2006), Cote and Levine (2000). So how highlights and studies, e.g. (Chinomona and Sandada (2013), Moore and Bowden-Everson (2012), Carvalho and Mota (2010), the competitive

1 Law 88/1993, [Online], http://www.legex.ro/Legea-88-1993-3890.aspx

2 Law 144/199, [Online], http://www.legex.ro/OUG-144-1999-181 82.aspx

environment in which it operates, leads universities to the development of a single strategy, focused on the student, to attract and maintain many more students. Lustigova (2015) and Majovska (2015) studies show that both teachers and students adapt to new techniques of teaching and learning so that the process is extremely efficient. Thus there is a need amongst universities to identify factors that contribute to meeting students' needs and obtain good results. Helgesen (2008) points out that both the factors and the actions of the student contribute to his career development and to shape its profile since the early years. The paper highlights in the next section of the paper the method used in this research and the structure of the questionnaire applied to respondents, then the results obtained are presented, and following there is the discussion section with an inventory of the factors that contribute to meeting the needs of students in their career development.
The paper presents an analysis of the results obtained by applying the method based on questionnaires and by analyzing statistical data obtained from its faculty website. The questionnaire survey was administered to students enrolled in the Faculty of Management in Production and Transportation, from Politehnica University of Timisoara (UPT), Romania.

Materials and Methods

This research was performed during the 2015/2016 academic year. The purpose of the research is to analyze the students' perception of higher education and to systematize the factors contributing to meeting their needs. It used questionnaire survey and analysis of data regarding the number of hits to the faculty website scripts. The questionnaire was administered to 400 students who study engineering at the Polytechnic University of Timisoara, Romania. The questionnaire is divided into four parts which outlines four categories of factors: engineering teaching-learning, abilities and IT environment, research and open innovation, and identification of learning style and personal information, see Figure 1: The structure of the questionnaire.

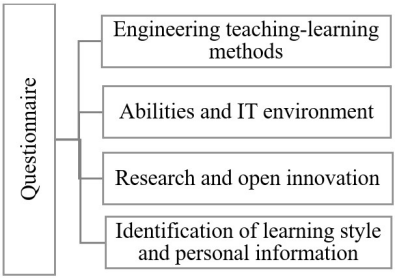

Figure 1: The structure of the questionnaire

The present research is based on the following elements: higher Technical Education in Timisoara /Politehnica University of Timisoara; students of Faculty of Management in Production and Transportation (FMPT); using the survey questionnaire. The questionnaire was applied online to identify current characteristics of higher education in the vision of students; Analysis of public data found on university websites; and statistics of accessing the site MPT (2013) by students involved in the teaching-learning.
FMPT is one of 10 faculties of the Politechnica University of Timisoara. Fundamental domain is Engineering Sciences, Graduation domain are Engineering and Management and Public Administration. For Engineering and Management domain the Science Branch

are: Mechanical Engineering, Mechatronics, Industrial Engineering, and Management. Undergraduate specializations are: economic engineering in the industrial domain, economic engineering in the electrical, power and electronic, economic engineering in construction, and economic engineering in the chemical and materials industry. For this research we applied the questionnaire to students from Engineering and Management, without taking into account the Public Administration (following this program the students are specialists in Public Administration). Engineering and Management specialization offers general information and competences in engineering and economics, with an accent on management competences.

The respondents can be characterized by: young people between 18 - 22 years of age, they are Romanian citizens, and are FMPT undergraduate students. The responding students attend Engineering and Management during four years of study, obtaining the title of "engineer" after graduation.

RESULT AND DISCUSSION

The applied questionnaire is divided into four parts. Analysis of the results obtained is made on each category and in the end section there is the inventory of factors contributing to the satisfaction and professional development of the student.

A. Engineering teaching-learning

In this part of the questionnaire, a number of dimensions were investigated. The revealed dimensions to be analyzed concern: the typology of teachers, course content and format, content and format of seminars, interactive teaching-learning methods, technology environments used by students in learning and programming environments.

It can be concluded that 97.4% of students participated in each activity of the curriculum in each discipline at a rate of at least 50%. This leads to the shaping and development of skills and competencies that help their employability. From the perspective of typology of teachers, 28% of respondents think that the role of initiator in teaching is appropriate, see Table 1: Teacher typology and learning methods. The Methods of teaching and interactive learning in group is valued in proportion of 39% of respondents, see Table 1: Teacher typology and learning methods.

Category	Type	Percent	Category	Type	Percent
Teacher typology	Initiator	28%	Interactive teaching-learning methods	Methods of teaching and interactive learning in group	38,50%
	Organizer	23%		Methods for problem solving by stimulating creativity	30,80%
	Tutor	21%			
	Participant	11%		Research methods in group	15,80%
	Resource	8%			
	Correcting	6%		I prefer individual learning	15,20%
	Controller	3%			

Table 1: Teacher typology and learning methods

The Respondents, 46.2%, prefer structuring the course material by dictation. The respondents prefer for the seminars / labs, examples and visits to the companies in proportion of 30.8%. They are followed at a distance by case studies, 7.7%. The respondents prefer the course material in electronic format, 53.8%, and appreciate the interactive method of teaching in working groups prefer the course material in electronic format, 53.8%, and appreciate the interactive method of teaching in working groups.

B. Abilities and IT environment

The IT skills and knowledge is analyzed in detail as student profile is technical, engineering, and use of technology in this field is mandatory. Outlining a profile in which IT skills meet a favorable level leads to a student trained in this area. The skills developed in the faculty interferes in two areas: engineering and management, with a management focus. Therefore, economic disciplines prevail. IT tools known and used by students are not numerous, summarized in processing of text, graphics, programming and design. From this perspective, the results include the following dimensions: technological environments used by students in learning, communication skills in business, social media, and motivation. Of these dimensions, social media is used more intensively by students. This area lies at the crossroads between the use of IT and communication in the learning process. A social environment leads to student's motivation to actively integrate in each learning activity. As shown by Balakrishnan and Lay (2016), social media allows users to create, share and exchange data with other people. Services of social media sites such as Facebook, Twitter and YouTube allow people from diverse backgrounds to express their thoughts, and to connect to users worldwide. These conclusions are also found in the Lenhart et al. (2010), and Cioca et al. (2013b) studies.

Of the respondents, 335students use word processors and spreadsheets, and only 5 students use Microsoft Access and other databases. Social networks are used on a daily basis by 95% of the students surveyed. Of these, 90% use organized email groups at the start of the academic year. Most students choose technical education in Timisoara, UPT, based on the reasons: the reputation of the university (51.3%), training as an engineer (43.6%), friends and family as stimulus (33.3%), Internet searches (15.4%).

C. Research and open innovation

In the research Draghici et al. (2015) the success factors for open collaboration between university and business are shown. This collaboration can be supported by the activities of students. Among students, 67% consider the work of research and want to get involved. 75% of students want to engage in more research projects. All respondents were involved in internships that contributed to collaboration between universities and business. Factors that motivates students in collaboration with the business are: compensation (87%), knowledge gained (69%), understanding the processes of production (61%), and subsequent collaboration (91%).

D. Identification of learning style and personal information

To identify learning styles and personal information the following dimensions were analyzed: learning style, temperament, demographics. Learning styles defines the preferred means of receiving, processing, storage and updating of information and are formed through education. As the survey shows: 87% of respondents are defined as visual style, 28.2% auditory style 7.7% tactile and 2.6% kinesthetic. Sanguine temperament is available in 48.7% and 10.3% melancholic. Students have a basic technical training in a proportion of 85%, coming from math or computer science high schools. They do not assume risk in professional development, developing risk bypassing activities, as presented in the study Cioca and Ivascu (2013a). From the statistical analysis of the related faculty site scripts (MPT, (2013)), Table 2: Scripts viewed by students, it is seen that the bulletin board page (display information about schedules, rooms and others) and collaboration with the business environment recorded the highest bandwidths. Students are interested in learning process necessary resources, employment opportunities and collaborations with companies.

Day	Number of visits	Pages	Hits	Bandwidth
01 Jan 2016	0	0	0	0
02 Jan 2016	0	0	0	0
03 Jan 2016	0	0	0	0
04 Jan 2016	0	0	0	0
05 Jan 2016	0	0	0	0
06 Jan 2016	47	143	933	237.67 MB
07 Jan 2016	97	369	2068	374.55 MB
08 Jan 2016	75	339	1664	435.40 MB
09 Jan 2016	74	231	1361	320.73 MB
10 Jan 2016	76	283	1702	542.54 MB
11 Jan 2016	121	362	2665	722.34 MB
12 Jan 2016	117	378	2506	647.45 MB
13 Jan 2016	109	369	2526	575.11 MB
14 Jan 2016	110	265	1792	523.61 MB

Table 2: Scripts viewed by students

The results of the four sections of the questionnaire lead to the systematization of some factors that need to be addressed and integrated into the university's strategy to be competitive and attract more students. The four parts that outlines the four categories of motivators for students are:

- engineering teaching-learning: 4 factors; abilities and IT environment: 3 factors; research and open innovation: 3 factors; identification of learning style and personal information: 4 factors.

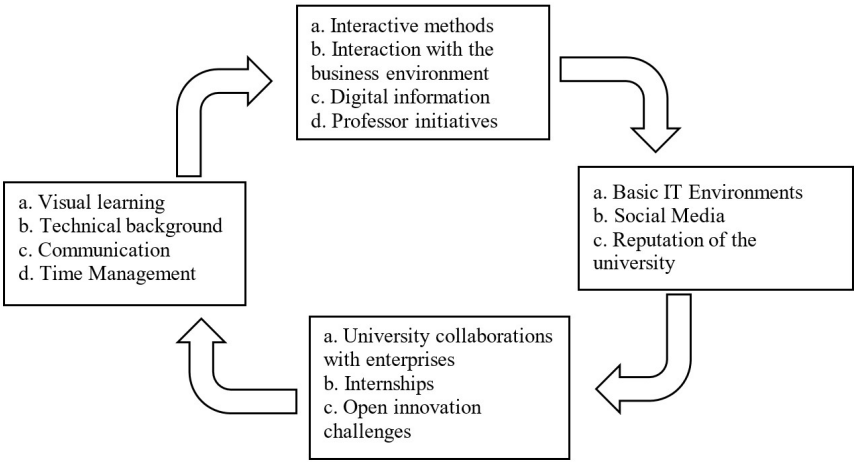

Figure 2: Inventory of motivating factors of students (source: own development)

The factors that motivate students are inventoried in the model from Figure 2: Inventory of motivating factors of students. There are four categories of factors that correspond to the four categories of questions from the questionnaire's structure.

Conclusion

This study provides an insight into the perceptions of university students in technical

education and presents an inventory of factors that contribute to the professional development of students by involving them in various activities. From the management point of view, in a competitive academic environment where competition is high, inventory of success factors represents a starting point in developing strategies. As Cova, Dali, and Zwick (2011) study shows, developing a competitive strategy generates value for university students and contributes to delimitation in the competitive environment. Future research will include actions of surveying other universities in Romania and comparing the results to generate a model of factors that contribute to a good collaboration between universities (including students) - industry. Also investigating the perception of teachers in relation to these factors contributes to shaping the fundamental requirements of the teaching-learning relationship. The prospect of (re) thinking teaching and communication techniques, especially searching methodologies to link specific knowledge to the practical part of teaching, shows the need to reflect on teaching in higher education. A number of researches, Moore and Everson (2012), Kiraz (2014), show the necessity of reflecting on the learning process.

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COMPARISON BETWEEN ENTREPRENEURSHIP EDUCATION IN ROMANIA AND GREECE - THE CASE OF TWO HIGHER EDUCATION INSTITUTIONS

[1]✉Anca Draghici, [2]Kerstin Siakas, [3]Claudiu Tiberiu Albulescu

[1]Department of Management, Faculty of Management in Production and Transportation, Politehnica University of Timisoara, Romania, 14 Remus str., Timisoara, 300191, Romania, +40-(0)256-403610, anca.draghici@upt.ro

[2]Department of Informatics Engineering, School of Technological Applications, Alexander Technological Educational Institute of Thessaloniki, Greece

[3]Department of Management, Faculty of Management in Production and Transportation, Politehnica University of Timisoara, Romania

Abstract

The process of transforming creative ideas into commercially viable businesses is recognized as the core idea of entrepreneurship. Successful entrepreneurship is based not only on luck and money, but also on excellent skills related to: creativity, risk taking, marketing, management, leadership, forecasting and planning or communication. These abilities can be developed and nurtured through educational programs tailored to set a basic framework required to understand entrepreneurship and to allow developing unique careers in the field. The paper objective is to present a research on students' entrepreneurship potential and the education in the field, in the case of two universities: one from Romania and one from Greece. The results of the statistical data processing underline entrepreneurship education gaps in both universities. The discovered good practices and efficient solutions for the entrepreneurship education were shared between educators and students of both institutions in order to improve quality and effectiveness of the education.

Keywords

Comparative study, entrepreneurship, education effectiveness, skills, survey

Introduction

Entrepreneurship is perceived as "any attempt at new business or new venture creation, such as self-employment, a new business organization, or the expansion of an existing business, by an individual, a team of individuals, or an established business" (Reynolds et al., 1999; p3).

Global Entrepreneurship Monitor (GEM, 2014) report has underlined that the Romanian economy is *efficiency-driven* while the Greek economy is an *innovation-driven* economy. The entrepreneurial activity prevalence rates along the phases of the life-cycle of a venture (information on entrepreneurial dynamics) for Romania and Greece are presented in Table 1.

Country	Nascent Entrepreneur-ship rate	New business ownership rate	Early-stage entrepreneur-rial activity (TEA)	Established business ownership rate	Discontinuation of businesses (% of TEA)
Greece	4.60	3.40	7.90	12.8	2.80
Romania	5.30	6.20	11.3	7.60	3.20

Table 1: Phases of entrepreneurial activity by geographic region according to (GEM, 2014), (% of population aged 18-64)

The total early-stage entrepreneurial activity rate (percentage of individuals aged 18-64 in an economy who are in the process of starting a business or are already running a new business, not older than 42 months) in Romania is 11.3%, more than in Greece (7.9%). The established business ownership rate (percentage of individuals aged 18-64 in an economy who own and manage a business older than 42 months) in Greece is 12.8%, bigger than in Romania (7.6%). The discontinuation rate (percentage of individuals aged 18-64 who owned a business but discontinued it for different reasons during the last 12 months) is around 3% in both countries. This evidence can be explained by a different economic development level of the two countries: the Romanian entrepreneurial activity is more active in the early stage while the Greek entrepreneurial activity is considered a mature one.

Furthermore, (GEM, 2014) analysis of social values towards entrepreneurship reveals a deep difference between countries: the Romanians have a stronger, more positive perception related to the first three features than the Greeks (Table 2).

Region and economies	Entrepreneurship as a good career choice	High status to successful entrepreneurs	Media attention for entrepreneurship
Greece	58.4	66.4	45.8
Romania	73.6	75.2	71.3

Table 2: Social values towards entrepreneurship (%)

Table 3 shows how the economies of the two countries differ in terms of individual attributes towards entrepreneurship, as measured by the (GEM, 2014). The perceived capabilities are higher than the perceived opportunities in both countries. Taking into consideration the recent Greek economic crisis, a higher discrepancy is recorded between perceived capabilities vs. perceived opportunities (45.5% vs. 19.9%). The Romanians have a positive perception on opportunities, capabilities (48.4% vs. 32.4%) and their intention for entrepreneurship (they are more enthusiastic) than the Greeks who are more mature when thinking on risks associated to starting their own venture (fear of failure 61.6%).

Country	Perceived opportunities	Perceived capabilities	Fear of failure[1]	Entrepreneurial intentions[2]
Greece	19.9	45.5	61.6	9.5
Romania	32.4	48.4	41.3	31.7

[1] Denominator: 18-64 age group perceives good opportunities to start a business.

[2] Respondent expects to start a business within three years; denominator: 18-64 age group that is currently not involved in entrepreneurial activity.

Table 3: Individual attributes towards entrepreneurship (%)

On the other hand, the European Commission report regarding entrepreneurship education shows the following needs (European Commission, 2014):

- "Introduce entrepreneurship as an *explicit curriculum objective for formal and non-*

formal education at national level, supporting this with implementation guidelines;
- Ensure that *curriculum frameworks are flexible* enough to enable introduction of *more innovative teaching and assessment methods*, giving educators and education institutions the flexibility to choose the most appropriate approaches for their teaching;
- *Encourage interdisciplinary curriculum approaches* to support and enhance the introduction of entrepreneurial methodologies at education institution level; make practical entrepreneurial experiences widely available throughout all stages of education and training, with a minimum of one during compulsory education for all learners;
- *Make entrepreneurial learning relevant to the real-world* through active engagement between education, business and community, particularly in the design and development of practical entrepreneurial experiences;
- Encourage *the use of innovative information and communication technologies (ICT)* based learning in entrepreneurship education;
- *Share good practice and encourage collaboration* between formal and non-formal education environments".

So, the challenge is to develop interdisciplinary approaches, making entrepreneurship education accessible to all students specialization curricula, creating teams for the development and exploitation of business ideas, mixing students from economic, business, engineering studies and students with other specializations and with different backgrounds (by interdisciplinary training modules or courses) (Riel, 2006; Welsh & Dragusin, 2013). Universities have a key role in these developments, through their high quality and effective entrepreneurship programs (Davidsson, 2015).

In this context, the paper objective is to present a research on students' entrepreneurship potential and the education in the field, in the case of two universities: one from Romania (an *efficiency-driven* economy) and one from Greece (an *innovation-driven* economy) in order to discover gaps of entrepreneurship education though the characterization of the learning outcomes perception. The described research aims to make an overview of students' entrepreneurship potential and the education in the field.

Materials and Methods

The Research Context and Methodology

The comparative study was developed with the support of students (respondents, subject of the performed investigation) and teaching staff (responsible for the research scenario design and implementation) from two higher education institutions: Politehnica University of Timisoara, Faculty of Management in Production and Transportation[1] from Romania and Alexander Technological Educational Institute of Thessaloniki, Business Administration and Economics and Informatics Departments[2] from Greece.

In the case of UPT, the research targeted mainly master students (239 persons) from the on-going three programs, namely: Engineering and Competitive Management, Engineering and Logistic Systems Management and Entrepreneurship and Business Administration (academic year 2014-2015). In the case of ATEITH, the investigation focused mainly

1 Official web page of the Romanian institution considered in the research, www.mpt.upt.ro

2 Official web page of the Greek institution considered in the research, http://www.it.teithe.gr/?lang = en

on the Bachelor students (250 persons) from the on-going three programs in the field of marketing.

The research objective was to investigate the students' entrepreneurship potential and the education in the field, in the case of the aforementioned higher education institutions.

The research established scenario consists of the implementation of the survey method based on a designed questionnaire with the following structure: (1) a first section with five questions for the sample's demographic characterization (by subjects' country of study, gender (M, F), age, completed education level, specialization type); (2) a second section with 10 questions conceived to describe the entrepreneurial education and students' potential to become entrepreneurs.

Data were obtained from self-administered questionnaires, filled in by a total of 193 students (99 students in Romania, with a response rate of 41.42% and 94 students in Greece with a response rate of 37.60%). The total response rate of 39.47% is considered as good and adequate for the study.

Using SPSS, Amos software as a basis for the descriptive statistics approach, the 193 valid questionnaires were processed in order to compare the two subsamples characteristics, by each question in the proposed questionnaire (among the considered variables country and gender). Contingency tables were defined to display the multivariate frequency distribution of the variables; the statistical analysis was based on the calculation of the probability (p), Pearson's chi-squared test $\chi 2$ (which can be applied given the expected frequency), the Student t – test, Mann-Whitney U test, z-score testing, odds ratio (OD) and the confidence intervals (CI) were determined when appropriated.

Research Sample Characterization

Sample demography is based on the responses given to the first five questions. Results are presented briefly in Figure 1. From the perspective of the gender distribution of the related subjects per each country, the two samples are not homogenous ($\chi 2(1) = 27.07$, $p<0.001$). The subjects' age distribution shows that Greek participants are significantly younger, as compared to Romanians ($t(191) = 2.136$, $p = 0.034$, 95% CI = (0.078 – 1.949)). In addition, it can be observed that the mean age for the Romanian and Greek subjects by gender is not statistically different ($p = 0.05$ and respectively, $p = 0.122$). Regarding the completed level of education, the Greek participants in the survey have lower levels of completed education, as compared to Romanians ($U = 3087$, $z = -5.04$, $p<0.001$). Furthermore, in the case of Romanian respondents, there are no significant differences between males and females regarding the completed level of education ($p = 0.421$). In the case of Greek respondents, females have a higher level of completed education, as compared to males ($U = 672.5$, $z = -2.18$, $p = 0.029$).

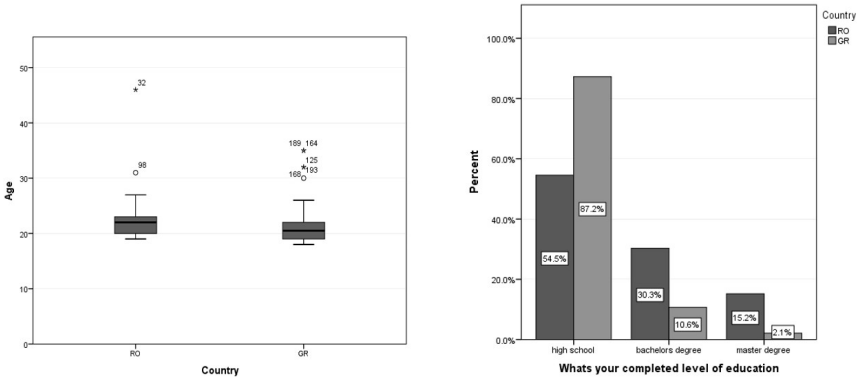

Figure 1: Representation of the sample's main demographic characteristics (age distribution and completed level of education)

Students involved in the research were enrolled in different specialization programs, at Bachelor and Master levels. The educational background of the survey participants is quite heterogeneous: engineering (148 students), economic sciences (18 students), journalism (9 students), communication and public relations (7 students), public administration (6 students), mathematics-informatics (3 students), architecture (1 student) and dental medicine (1 student). These characteristics of the sample were not used further in the statistical analysis because of the large variety of the answers given.

Research results on entrepreneurship education and knowledge acquisition sources

The items that were considered for the entrepreneurship skills development are depicted in Figure 2. These were the topic of five questions included in the designed questionnaire. The approached items were considered as a synthesis of other similar questionnaires in the field. First, the students' enrolment in *entrepreneurship courses* was investigated. The research results did not identify significant differences between countries, related to subjects' attendance to entrepreneurship courses ($p = 0.378$). In the Romanian group, males have significantly attended more frequently entrepreneurship courses, as compared to women ($\chi2(1) = 4.20$, $p = 0.040$, $OR = 2.38$). Amongst the Greek respondents, the differences between genders are not statistically significant ($p = 0.618$) in respect of how frequently they attend entrepreneurship courses. The results highlight a poor involvement in the entrepreneurship courses included in the academic curricula of students from both universities. Male students, from both countries, have attended more entrepreneurship courses and this has proven their interest in developing their competencies in such a field. On the other side, students' responses have shown that they are not aware of the fact that they have attended courses related to entrepreneurship education (e.g. general management courses, marketing, communication skills are included in most of the specializations curricula at the Bachelor level, in both universities), as probably their teachers (trainers) did not mention the link with and the support to the entrepreneurship skills and behaviour development.

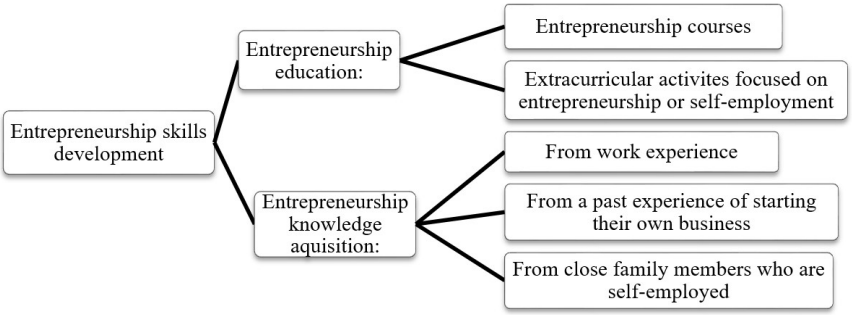

Figure 2: The investigated items related to students' entrepreneurship skills development

Despite this lack and misunderstanding in entrepreneurship education, the research results have discovered that *students' involvement in extracurricular activities that focus on entrepreneurship or self-employment* are considered the most interesting and attractive ways for their entrepreneurial education. The collected responses have revealed that Romanian students, as compared to the Greeks, have participated 4.3 times more often in extracurricular activities that focus on entrepreneurship or self-employment ($\chi^2(1) = 21.33$, $p<0.001$, OR = 4.3). Furthermore, within the Romanian students, the differences between genders related to the frequency of attending extracurricular activities that focus on entrepreneurship or their self-employment are not statistically significant ($p = 0.786$). The results show that many Romanian students (55.3% males and 52.5% females) were involved in extracurricular activities that focus on entrepreneurship or self-employment, an expected result in line with the (GEM, 2014) findings. Generally, they build their professional career (starting very early when they are still enrolled in the Bachelor programs) as employees of different companies (most in the automotive field, which are located in the Romanian West Region) or as entrepreneurs in their families' companies and rarely, by establishing their own companies. Despite the economic crisis, Greek students (21.1% males and 21.7% females) are less involved in extracurricular activities focused on entrepreneurship or self-employment. This result is also similar with the GEM (2014)'s findings.

Other investigated aspect was the students' *work experience* that can be considered a source for entrepreneurship knowledge acquisition. The results show no difference related to the length of work experience between the respondents of the two countries ($p = 0.340$). With 55.6%, most of the Romanian students had less than one year of work experience (34.2% of the male and 68.9% of the female students). Furthermore, within the Romanian sub-sample, the females had significantly less work experience, as compared to males ($U = 758.5$, $z = -3.18$, $p = 0.001$). The same situation was discovered for the Greek students, as 64.9% of them had less than one year of work experience (71.8% of the male and 43.5% of the female students). Within the Greek sub-sample, females had significantly more work experience, as compared to males ($U = 610.5$, $z = -2.13$, $p = 0.033$). As a comparative conclusion, Greek students had more work experience than the Romanians, underlined even by the gender analysis.

Another important entrepreneurship knowledge acquisition source has been considered the past experiences as entrepreneurs by having *started their own business in the past*. Research results show that 10.1% of the Romanian students have started a business in the past (23.7% males and 1.6% females), compared to 9.6% of the Greek students (8.5%

males and 13% females). There are no differences related to the frequency of starting their own business in the past between countries (p = 0.903). Within the Romanian group of students, males have significantly started a business in the past more frequently than females (p = 0.001 and Fisher's Exact Test). Within the Greek group of students, the differences between genders related to frequency of starting their own business in the past are not statistically significant (p = 0.687). Generally, this knowledge acquisition source is less considered by the respondents because of the associated risks (including the financial one).

Having close family members who are self-employed was expected to be considered the most useful knowledge acquisition source for entrepreneurship skills. According to the research results, 52.5% of the Romanian students and 58.5% of the Greek students have recognized that they have close family members who are self-employed. Despite this, the statistical analysis by respondents' gender has underlined a very low influence to students' entrepreneurial skills development. There are no differences related to the frequency of having close family members who are self-employed, between countries (p = 0.404). On the one hand, within the Romanian group of students, males declare having close family members who are self-employed more frequently than females ($\chi^2(1) = 6.29$, p = 0.012). On the other hand, there are no differences related to the frequency of having close family members who are self-employed, between genders in the case of the Greek group of students (p = 0.095). As a general conclusion, students from both countries do not consider their close family members who are self-employed as a potential source for entrepreneurship knowledge.

The synthesis of the research results are shown in Figure 3.

Data process of YES answers	Romania	Greece
Entrepreneurship courses	37.4%	43.6%
Extracurricular activities on entrepreneurship	53.5%	21.30%
Entrepreneurship education (average score)	*45.45%*	*64.90%*
Entrepreneurship knowledge acquisition from work experience (most answers given for "less than one year")	55.60%	64.90%
Entrepreneurship knowledge acquisition from past experience	10.10%	9.60%
Entrepreneurship knowledge acquisition from close family members who are self-employed	52.50%	58.50%
Entrepreneurship knowledge acquisition (average score)	*39.40%*	*22.70%*

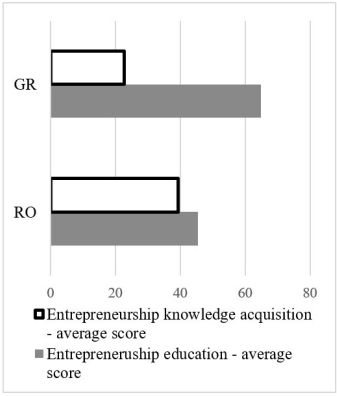

Figure 3: Synthesis of the research results on education and knowledge acquisition in the field of entrepreneurship

Research results on students' entrepreneurship potential and their implications on education in the filed

Students confidence on their *20 abilities on becoming entrepreneurs,* was first analysed and this was then linked with related education subjects that are usually included in

entrepreneurship training programs (action done through a group of discussions between Romanian and Greek professors involved in such trainings) in order to discover students education needs in the field. Table 4, 5 and Figure 4 present the research results. The analysis has been done by considering the countries sub-samples of respondents only. Gender analysis is irrelevant because the education is not limited by gender, in both countries.

How much confidence do you have in your ability to....?	Average confidence score (1 low…5 highest confidence):		Entrepreneurship education subjects
	Romania	Greece	
Lead and manage a team	3.71	3.49	Human resource management
Identify ways to combine resources in new ways to achieve goals	3.49	3.41	Innovation and creativity
Manage time during projects	3.58	3.34	Project management
Brainstorming for new ideas discovering	3.64	3.54	Innovation and creativity
Put together the right team in order to solve problems	3.81	3.36	Human resource management
Conduct analysis for a project that aims to solve a problem	3.44	3.33	Business analytics and management
Read and interpret financial statements	2.74	2.79	Project management (Accounting and finance)
Identify potential sources of resources	3.23	3.05	Business analytics and management
Persist in the face of setbacks	3.17	3.04	Risk management
Networking capacity/skills	3.71	3.47	Communication
Set and achieve project goals	3.80	3.77	Project management
Learn from failure	4.21	4.05	Risk management
Get others to identify with and believe in my vision/plan	3.62	3.50	Human resource management
Clearly and concisely explain verbally/in writing my ideas in everyday terms	3.46	3.17	Communication
Manage uncertainty in projects and processes	3.21	3.23	Risk management
Work productively under continuous stress, pressure and conflict	3.28	3.21	Human resource management
Think outside the box	3.78	3.72	Innovation and creativity
Estimate a budget for a new project	3.19	3.72	Project management (Accounting and finance)
Easy find a solution for a problem	3.69	3.54	Innovation and creativity
Start his/her own business	3.88	3.64	Business analytics and management

Table 4: Research results on students' confidence in their entrepreneurship abilities

The research results have shown a good average score of the Romanian (3.54) and Greek (3.41) students on their confidence related to the 20 selected entrepreneurship abilities (Table 5, Figure 4). A deep analysis on these expressed level of confidence

on their entrepreneurship abilities in relation with education subjects has underlined that Romanian students have small confidence and less skills on project management (including accounting and finance), but big confidence and good skills on innovation and creativity, human resource management and communication. Greek students have small confidence and less skills on communication, but considerable confidence and good skills on innovation and creativity, risk management and project management (including accounting and finance). In the field of risk management, Greek students are less confident (more prudent) in their abilities than the Romanian students.

Entrepreneurship education subjects:	Average confidence score	
	Romania	Greece
Business analytics and management	3.52	3.34
Human resource management	3.61	3.39
Project management (including accounting and finance)	3.33	3.41
Innovation and creativity	3.65	3.55
Risk management	3.53	3.44
Communication	3.59	3.32
Total average score of confidence	3.54	3.41

Table 5: Research results on students' confidence on their abilities related to education subjects in the field of entrepreneurship

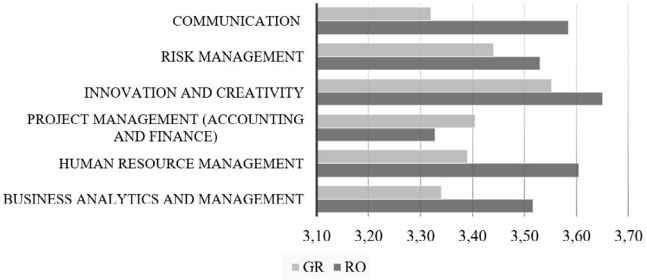

Figure 4: Graphical representation of students' confidence on their abilities related to education subjects in the field of entrepreneurship

Conclusion

The research analysis performed allows the answer to and debates on the question: *How should the entrepreneurship education in technical universities (particularly in the case of UPT and ATEITH) be reconsidered to create effectiveness and satisfaction for both students and trainers?* Embedding entrepreneurship into higher education is still a challenging task, but one in which progress has been achieved in the past few years.

The results' synthesis for the first investigation done shows higher average scores for entrepreneurship education (45.45% of the Romanian students and 64.90% of the Greek students have respond with "yes") than for knowledge acquisition from different sources in both sub-samples (Figure 3). Learning entrepreneurship from different sources is not seen as a potential practice for students in both countries (only 39.40% of the Romanian students and 22.70% of the Greek students have responded with "yes"). In this case, acceptable average scores were found only in the case of own work experience (but it is "less than one year") and lower average scores were found "from past experience on starting own business".

The results' synthesis (Table 5 and Figure 4) related to students' confidence on their 20 abilities in entrepreneurial skills, and their connection with education subjects in the field were analysed and debated by teachers and trainers from Romania and Greece in order to re-design the university curricula. In Greece there is a strong need for communication and business analytics and management skills development. In Romania there is a strong need for project management skills development.

The research results are important for researchers, universities' managers/leaders, and policy makers that should focus on their quest to define entrepreneurship curricula that should be attended by students of all specializations. The university curricula in the field of entrepreneurship should be interdisciplinary and trans-faculties or departments in the university and with a strong support of information and communication technologies. In addition, one of the most important results of the research is that Romanian and Greek students expressed a high level of interest on following an entrepreneurship career. This issue has to be better explored in order to design adequate programs that have to be supported through cooperation for innovation and exchange of good practices.

One of the main limitations of this research is the sampling technique used in the research, as convenience sampling is part of non-probability sampling techniques. Another limitation of this research is the small sample size (193 respondents, representative for the master program of UPT students group but not for ATEITH) and the differences in age and levels of education programs of the subjects from the two countries.

In the future, questionnaires have to be collected from more students of both universities. Probability-sampling techniques should be used to provide a sample size large enough so that the results obtained could be generalized to the entire investigated population.

Acknowledgements

The authors gratefully acknowledge the support from the students of the UPT, Romania and the ATEITH, Greece, who accepted their involvement in the research survey.

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E-COURSE ASSESSMENT PREFERENCES IN A GROUP OF PROFESSIONAL ENGLISH LANGUAGE STUDENTS

Dagmar El-Hmoudova

Department of Applied Linguistics, Faculty of Informatics and Management, University of Hradec Kralove, Rokitanskeho 62, Hradec Kralove, 500 03, Czech Republic, dagmar.el_hmoudova@uhk.cz

Abstract

In this paper reasons for assessing tertiary students of different learning fields are considered as well as how technology affects and enhances assessment process. Two groups of bachelor students were asked to take part in designing professional English language e-course specialised in their study fields. With respect to Assessment for Learning teaching approach, which enables personalization of learning, students of Financial Management and Management of Tourism suggested preferred formative and summative assessment methods used in relevant e-courses administered in Blackboard LMS.

The data were collected from the researcher-made questionnaire, which was uploaded in the e-courses in summer semester 2014/15. The results confirmed that students, regardless their study fields, were highly motivated to take part in the research as assessment is always stressful part of learning process; they strongly preferred face-to-face instruction, however, technology enhanced language learning, including assessment, was considered to be inevitable part of their professional English language instruction, most preferably delivered in the blended form.

Keywords

Assessment for Learning (Afl), formative assessment, summative assessment, technology enhanced language learning

Introduction

Assessment in this paper is understood as Boud (1995) states it as educational measurement which takes for granted the basic assumptions of conventional assessment: that is, testing follows teaching, the links between subject content and assessment technique are unproblematic and assessment is quantitative. The main concerns of educational measurement are to make assessment more rational, efficient and technically defensible. Ideas drawn from the field of psychometrics are part of the vocabulary.

Assessment is an essential component of learning and teaching environment. It is extremely broad term that covers different types of activity with different purposes, Carr (2011) divides the assessment purposes as follows: *diagnostic, placement, proficiency, achievement, formative, summative* and *quality assurance,* see Table 1.

Type of assessment	Purpose of assessment
diagnostic	to determine the needs of a student
placement	to assign students to groups
proficiency	to assess how good a student is at something
achievement	to award a grade or certificate
formative	to give feedback to students and determine the direction of future learning opportunities
summative	to establish what a learner has achieved at the end of a course
quality assurance	to evaluate teaching

Tab. 1: Different purposes of assessment

Assessment can either take place at any time during the semester in order to establish how well students are progressing and what their following learning needs are (*formative assessment*) see Fig. 1, or it can be delivered at the end of the semester to see how much students have learned (*summative assessment*) (Aboulsoud,S.H., 2011). Moreover, assessment is an important quality assurance tool, checking the quality of teaching.

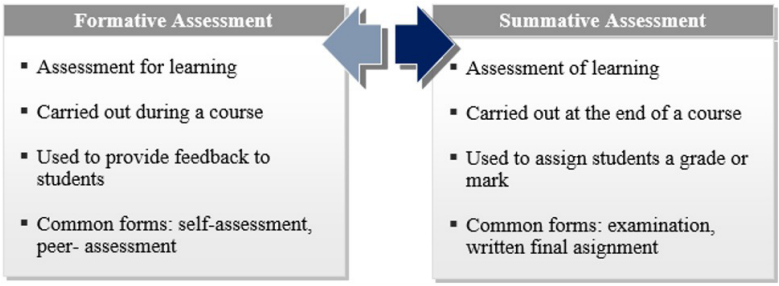


Fig. 1: Formative and summative assessment

Lately there has been move towards *Assessment for Learning* (Afl) (Blac and Wiliam, 1998) which is teaching strategy enabling personalization of learning. It provides frequent assessment that enable targets to be set for individual students. In this respect Afl is in accordance with the learning style model. Students should know what they need to learn and how far they are progressing towards the desired outcomes. This means that instructors – course designers should be explicit about intended learning goals (Petránek, K., Janečka, P. and Milková, E., 2013).

Computer-based formative self-assessment can be taken by students at any time and without checking the answers. Tests can also compile the results and give a grade automatically, feeding the results back to the teacher. The use of technology in assessment creates also new possibilities e.g. *computer adaptive testing* (CAT) see Figure 2.

The principle of CAT, which can be part of Afl, is that the tests adapt to the candidate, so that the questions become more difficult or easier depending on the student´s previous answers. This can deliver learning opportunities that are personalized to the individual (Choi, S. W., Reise, S. P., Pilkonis, P. A., Hays, R. D., and Cella, D., 2010).

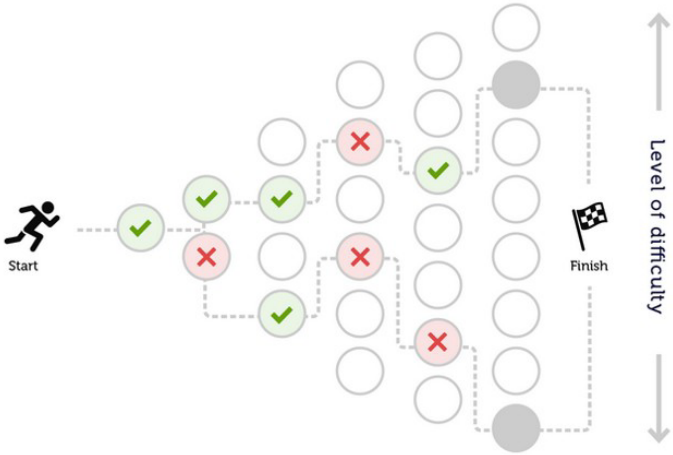


Fig. 2: Computer adaptive test: the first item dictates the second item which will be served and so on (source: Learnosity)

Common types of tests in language instruction include multiple-choice questions, close and gap filling, short answers questions, composition writing, and oral interviews. Listening tests commonly use recorded conversations or lectures with multiple-choice, or short answer questions. Reading tests use items of text with multiple-choice or short answer questions. Assessment of speaking is more problematic and that is why it is very rarely delivered in electronic form.

The important question is also reliability and validity of assessment. Validity means that an assessment should test what it is intended to test. Weir (2005) also believes that an assessment should be considered valid only if the marks or grades are an accurate reflection of the candidate´s knowledge and skills. This may be an interesting argument, but based on the long term teaching practice we know that student´s performance can be affected by many different factors, so a mark that does not give an accurate reflection of ability does not mean that the test was invalid, it would rather be evidence for reduction in its validity. All the above mentioned aspects of assessment where technology is introduced as a mediational tool had to be taken in account when the e-courses of professional English for Financial Management and Management of Tourism were designed. Moreover, following the idea of Afl, it was decided to involve students into the process of course assessment tools implementation. The main objective of this research was to detect the students´ preferences for particular assessment tools and thus not only reduce the stressful elements from this part of learning environment but consequently raise their learning motivation.

Materials and Methods.

This research was intended to assess students' preferences of the assessment tools used in the e-course of English for Tourism and English for Financial Management administered in the university Blackboard LMS. Descriptive research design was employed to explore students' preferences. Both primary and secondary sources of data were collected. The primary data were collected through questionnaire, and secondary data were also collected via literature reviews.

The researcher selected the target group from 3rd year Tourism Management students (No: 138; 81 F, 57 M) and 3rd year students of Financial Management (No: 63; 21 F, 42 M) for the questionnaire survey in summer semester 2014/15. Close ended questionnaire was administered to investigate students' preferences of assessment and their reasons and factors for their preferences.

The data collected through close-ended questions were analysed to investigate the correlations between the two groups of students' preferences.

The questionnaire consisted of two parts. The first set of questions was dealing with the students´ attitude to the existing English courses of professional English, which were basically general English courses with very little diversification in the professional fields. The second part of the questionnaire was inquiring about the assessment tools and students´ preferences in this segment of the course. Assessment was chosen as the main topic, because it is particularly important when technology is involved. The instructor should be sure that what is being tested is language knowledge or skills rather than familiarity with technology. Godwin-Jones (2011) has remarked that perhaps the biggest current challenge for teachers is to help students to become self-directed learners. Godwin-Jones also make the point that if students are motivated to learn, and know how to direct and monitor their learning, they can turn any experience with technology into a language-learning opportunity.

The main objective of this research was based on the Afl, CAT and CAA (*computer adaptive assessment*) principles to design the professional English language courses, especially the computer assisted assessment in the form of formative assessment, which would answer the students' preferences.

Results

Data detecting the students´ evaluation of current content of Professional English e-courses at the Blackboard university LMS (BB) revealed that 37% students would definitely welcome further differentiation in the course content based on specific field of study, 49% would partially welcome that, and only 14% think it is not necessary (see Fig. 3). This gives a firm basis for further innovation in this direction. It was decided that the only efficient way how to achieve this within the given curriculum is to transform current face-to-face teaching into a blended course (using Blackboard LMS), where the e-learning part would include different e-courses for the respective field of study, while the in-class teaching would focus on more general language competences and professional skills. This is also supported by the fact that, although 51% students still prefer face-to-face teaching, almost equal percentage (49%) view e-learning or blended learning as a suitable option (see Fig. 4).

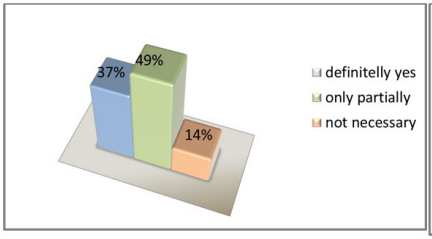


Fig. 3: The opinion on differentiation.

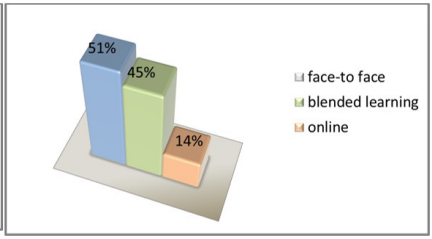
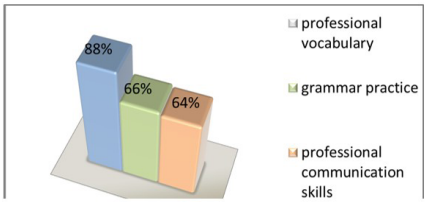


Fig. 4: Preferred ways of study.

Students were also asked for specific suggestions concerning the content of the intended e-courses. It became evident that students perceive professional vocabulary acquisition (88%), grammar practice (66%), and professional communication skills (64%) as their

highest priorities in an on-line professional English course, see Fig. 5. For distribution of other preferences see Fig. 6.



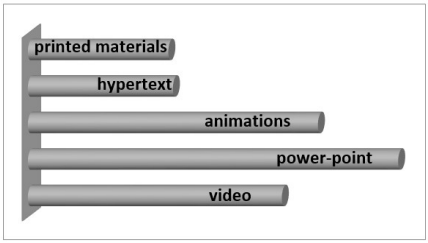


Fig. 5: Suggested content of intended e-course.

Fig. 6: Preferred ways of study materials presentation.

As for the practicing methods used in the on-line course, students preferably suggest incorporating different types of vocabulary exercises (71%), they would also like to practice listening skills (62%) and to use visual materials, such as videos, cartoons, games (54%). It also came out that students still prefer combining the foreign language with their native tongue in the form of translation exercises and an English-Czech vocabulary list of professional terms (see Fig.7).

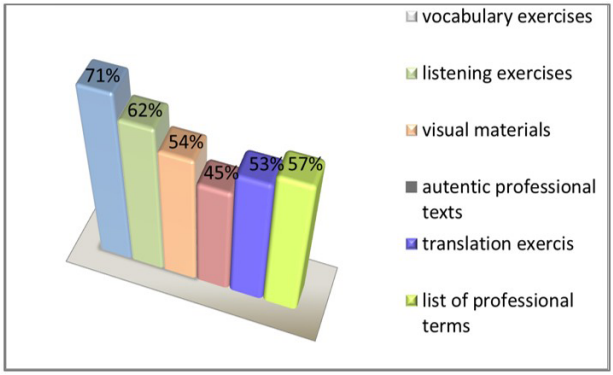


Fig. 7: Suggested practicing methods of the intended e-course

The second part of the questionnaire which was aimed at students´ attitude to e-course content and especially to the preferences in assessment methods proved that Tourism Management students (TMS) as well as Financial Management students (FMS) use e-study materials in BB very often but not always, see Fig. 8. Both groups of students consider e-study materials suitable for their study fields, although in a group of Financial Management there are some students, who claim never or very rarely to use them, se Fig.9. This may be caused by the fact, that especially Financial Management professional English language course in BB lacks enough professionally oriented materials.

Special emphasis is placed on the use of authentic materials specialized in the particular study field, which students encounter not only in academia but also in terms of their practical training in companies. Some students even admit working with authentic materials very rarely, which may negatively influence their inclusion in the working environment in the future.

As Gilmore (2007:110) states that "authentic materials enable learners to interact with the real language and content rather than the form. Learners feel that they are learning a target language as it is used outside the classroom." Considering this, it may not be wrong to say that at any level authentic materials should be used to complete the gap between the competency and performance of the language learners, which is a common problem among the non-native speakers.

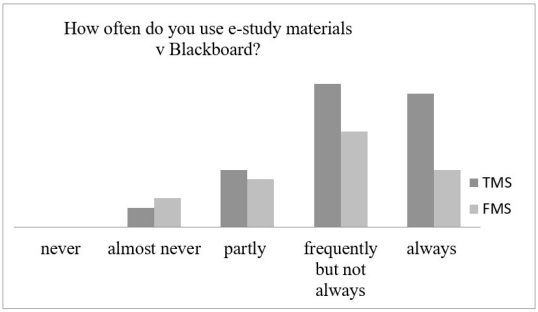


Fig. 8: The usage of e-study materials in BB course

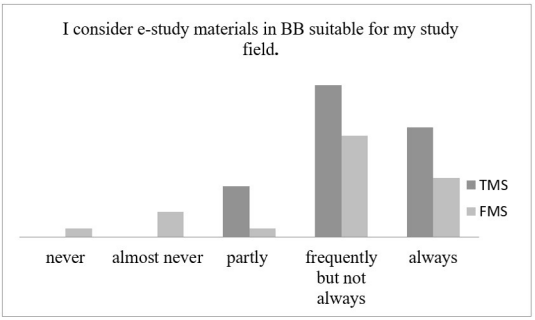


Fig. 9: The suitability of e-study materials in BB course

Students were also asked to appoint their preferences in types of assessment. They consider multiple-choice, multiple matching, cloze filling, gap filling, and short answer questions as highly reliable assessment tools, see Fig. 10. Students also pointed out that in reality their results may be affected by their emotional states or external factors.

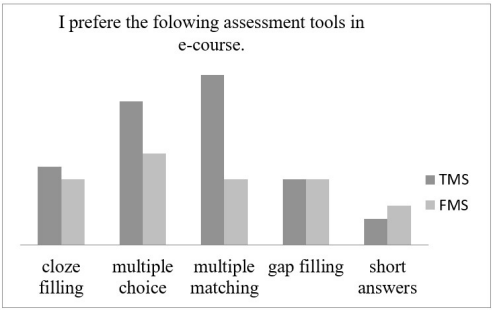


Fig. 10: The students´ preferences in assessment tools

Students appreciate continuous testing of language skills, such as reading, listening, writing and speaking. Grammar and especially professional vocabulary are often tested separately, which does not answer the reality, as language skills are complex, not isolated.

Discussion

Based on the collected data, we can claim that except for our students´ preferences concerning the content of the intended Professional English language course (see Fig.3-7), students of TM (30%) use e-study materials much more frequently than FM students (16%). At the same time 31% of TM students consider e-study materials in BB suitable for their study field as opposed to FM students (20%). Concerning our students assessment tools preferences multiple matching (13% of TM and 5% of FM students) as well as multiple choice (11% TM students and 7% FM students) are most convenient assessment tools for both groups of students. They are undoubtedly very common assessment and evaluation tools in universities. This type of assessment is quick and easy to score, by hand or electronically, it can test a wide range of higher-order thinking skills and cover lots of content areas on a single exam. On the other hand teachers are aware of the fact, that this type of assessment often tests only literacy skills: providing unprepared students the opportunity to guess, and with guesses that are right, they get credit for things they don't know. It is up to the course instructor to balance the assessment tools so that the outcomes are more relevant.

Conclusion

In this paper tertiary students of different study fields (Tourism Management, Financial Management) were asked to express their attitude to e-course materials in Blackboard LMS as well as to suggest their preferences in assessment methods within technology enhanced environment. The data collected from the author-made questionnaire proved that both groups of students clearly prefer face-to-face teaching method, however, they consider blended learning very efficient. Further differentiation in study field especially in professional vocabulary and professional communication skills is demanded. Both groups of students use e-course materials very often, preferably in the form of power-point, animation and hypertext.

In terms of assessment preferences, students consider traditional technology-enhanced assessment methods as suitable, although the validity may be affected by some external elements, especially emotional states. They like interactive multimodal assessment based on the principles of Afl, CAT and CAA.

The next logical step will be to implement the acquired data into a newly designed online courses of professional English language that respect not only the requirements for quality language teaching with respect to the study field, but also adapts to the needs of our students in order to increase both their motivation and academic performance.

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EVALUATING TEACHERS' ATTITUDE REGARDING IMPLEMENTATION OF MIXED RESOURCES AT CLASS

[1]Maria-Ema Faciu, [2]✉Iuliana Lazar, [3]Liliana Mata, [4]Gabriel Lazar

[1]Doctoral School in Environmental Engineering, Faculty of Engineering, "Vasile Alecsandri" University of Bacau, Marasesti Str. 157, Bacau, 600115, Romania

[2]Department in Chemical and Food Engineering, Faculty of Engineering, "Vasile Alecsandri" University of Bacau, Marasesti Str., 157, Bacau, 600115, Romania, +40 234 542 411, ilazar@ub.ro

[3]Department for Teacher's Training, Faculty of Sciences, "Vasile Alecsandri" University of Bacau, Romania

[4]Doctoral School in Environmental Engineering, Faculty of Engineering, "Vasile Alecsandri" University of Bacau, Marasesti Str., 157, Bacau, 600115, Romania

Abstract

The research studied the teaching and learning process using mixed educational resources for improving the educational quality. These mixed resources include interactive technologies (interactive whiteboard, online educational platform, online collaborative applications) and a set of interactive and collaborative learning strategies adapted to an online environment as a pedagogical component. The research focused on teachers' degree of acceptance or rejection of these educative innovations. The research methods included a pre-intervention interview to assess trainees' knowledge and experience in use of technology in the class, and a pre- and post-intervention survey to measure the study participants' attitude regarding the taught concepts. The intervention consisted in a six weeks training course. The study concluded that the teachers' initial perception on needed skills changed after the course, and also highlighted a change in attitude in terms of efficiency, their choices regarding the necessary mixed resources being based on the class needs.

Keywords

Interactive whiteboards, learning management system, online educational platform, teachers' attitude

Introduction

The emergence of increasingly complex new learning environments based on new technologies involves new approaches centred on developing a competency-based teacher education pedagogical model (Dobber, Akkerman, Verloop and Vermunt, 2012: 609). Interactivity provided through interactive whiteboards, online educational platforms, or collaborative software applications proved their benefits regarding improvement of students' achievement (Al-Adwan, Al-Adwan and Smedley, 2013: 4; Armstrong, Barnes, Sutherland, Curran, Mills and Thompson, 2005: 455; Behzadi and Manuchehri, 2013: 1; Emron and Dhindsa, 2010: 1; Goh, Quek and Lee, 2010: 90; Huang, Liu, Yan and Chen, 2009: 84; Leong and Alexander, 2013: 75; Wey, Lin and Chen, 2014: 34). In the same time, the introduction of modern training technologies causes changes regarding the approaches from the field of science education in general and highlights the "educational potential" of interactive whiteboards (IWB) (Cutrim, 2008: 338) in particular. According to Buff

(Buff, 2012), these changes represent a challenge for those involved in the administration of the educational process in terms of three directions: resource allocation, modifying the curriculum and the professional development of the staff.

The *mixed educational resources* package proposed in this study is based on a pedagogical model of teachers' interactive training which integrates the following elements: *interactive learning* as a process in which teachers actively engage both mentally and physically in discovering, building and understanding information; *pedagogical skills* as a reference framework for developing concepts and implementation abilities in educational practice, at the level of the following main categories: ensuring the functionality of the educational process; applying the curriculum methodology; stating educational goals; selecting teaching strategies - teaching methods, teaching materials, organization methods; preparing teaching design documents; performing school evaluation; *the interactive technology* like interactive whiteboards, online educational platforms, and collaborative software applications (Mata, 2014: 341). Thus, the *mixed resources* package integrated not only technology components, but also a pedagogical component through a set of interactive and collaborative learning strategies adapted to an online environment. The technology components included: interactive whiteboard (IWB); a new educational online platform (EnoLMS – www.enoeducation.ro) which integrates a learning management system and an authoring tool; as well as a collection of interactive and collaborative software applications oriented on specific subjects which can be used online, offline or on mobile devices. A presentation of mixed resources integrated considering mainly the technological component for improving educational quality process, was subject of previous communications of authors (Lazar, Faciu, Lazar, Malureanu, Mata and Mateian, 2015).

This study focused on the benefits of quality education based on the *mixed educational resources* package as a whole, considering both the pedagogical and technological components and investigated the attitude of the teachers related to the acceptance or rejection of these educative innovations. The attitude was analysed in relation with their perception considering: the usefulness of teaching using interactive whiteboards, EnoLMS educational platform and collaborative software applications; the performance of EnoLMS educational platform in relation with other platforms and the teachers' needs; the needed skills to efficiently integrate technology.

Research methodology

Context of the research

The larger goal of the research was to study the teaching and learning process using *mixed educational resources* to improve quality of education. Some of the goals fulfilled by *mixed educational resources* are: 1. supporting the continuous learning process through a modern learning management system that is easy to use, both on ceramic interactive whiteboards (Mata, Lazar and Lazar, 2016: 278) and on EnoLMS educational platform; 2. providing support for the computer assisted instruction in various subjects; 3. creating a virtual space where the student and the teacher can meet; 4. creating and presenting a set of interactive, appealing lessons which fit the needs of each student; 5. easing the learning process by stimulating the students' creativity and their competitive spirit.

The *mixed educational resources* package was provided to teachers through a training course over a period of 6 weeks with a total of 43 hours in the university laboratories, and another 42 hours being dedicated to online activities. Answering to different tasks

certified the participation in the research. This study complies with the Declaration of Helsinki on the rights of human subjects who take part in research activities. The use of responding data cannot be performed without the consent of the authors. All data will be used exclusively for research purposes.

Each session covered a different aspect of: 1. Acquisition of basic knowledge about the main types of e-learning services and their role in the efficient conduct of the educational process; the principles of ethics of the teaching profession during the use of educational platforms; 2. Skills' training for the use of IWB and interactive educational platforms (Moodle, Sakai and EnoLMS) in terms of the roles of teacher and student; 3. Development of the teachers' selection ability considering teaching-learning-assessment methods, strategies and forms of organization closely linked to the particularities of IWB and interactive platforms; 4. Development of effective communication and networking skills regarding use of IWB, interactive online platforms, and collaborative software applications.

Objectives and research questions

The *main goal* of the study was to analyse the attitude of the teachers related to the acceptance or rejection of the *mixed educational resources* package as educational tool.

Five research questions were investigated:

Question 1: Which is the perception of the teachers on usefulness of new technologies and teaching using mixed educational resources?

Question 2: Which is the attitude of the teachers towards the performance of EnoLMS educational platform?

Question 3: Which are the skills considered necessary by teachers in order to use efficiently the mixed resources package as educational tool?

Question 4: Is there an effect of the training course on the perception of teachers about the necessity of specific skills in order to use efficiently the mixed resources package as educational tool?

Question 5: Is there an effect of the training course on the perception of teachers on the skills they own in order to efficiently use the mixed resources package as educational tool?

Participants

The experimental study was conducted during April-May 2015 period. All participants were registered for the teacher training course, and accepted to take part in the study group. Consent forms were signed. The research group consisted of 20 teachers: four men and sixteen women, three teaching at primary (K-4) level, fourteen at secondary schools (5-8 level) and three in high-schools (9-12 level). Considering the residence, nine were from urban environment and eleven from rural. The range of subjects taught by participants included: Mathematics and Sciences, Language and Communication, Social sciences, Technology and Computer science. Also the range of experience into education field was wide: less than five years (four participants), 6-15 years (six participants), over 15 years (ten participants).

Research methods and procedure

Before the training, an informal interview was conducted in order to assess trainees' knowledge and experience. The questions were related to their expertise in using technology during classroom activities with particular questions about use of IWB and online educational platforms; and to their perception on the need of specific skills in order

to achieve effective lessons using technology. Also, pre- and post-intervention surveys were given to assess the change in teachers' attitude regarding the taught concepts.

Statistical analyses

To respond on research Question 4 and Question 5, two variables were defined: (Q4)"Teacher's perception considering the necessity of specific skills" and (Q5)"Teacher's perception considering the specific skills they own". The scale was coded based on the responses from the survey questions: "Do you consider that specific skills are needed in order to efficiently implement technology at class?"(Q4) – *1. Agree, 2. Partial agree, 3. Not agree*; "Do you consider that you own the specific skills in order to efficiently implement technology at class?"(Q5) – *1. Yes, 2. Still learning, 3. No.* SPSS version 20 statistical package for MS-Windows was used to represent graphic the distribution of the answers before and after completion of training.

Results

Pre-intervention interview

All participants declared having IT skills and to have used online platforms for professional development, during university or training courses. Also, all participants declared that the proposed course curricula and the mixed resources responded to their identified needs regarding use of technology and only two declared to be interested on the pedagogical modules.

Four of them declared that they are using online platforms on regular basis, all their students being registered with personal accounts. Other six trainees declared that they are using online platforms occasionally, on specific learning units, the platforms providing them the necessary online materials.

Regarding the use of IWB, eleven teachers declared that they have in school an IWB, and they need to share it with the other colleagues. Only one of them declared that was using the interactive built-in functions, the rest specifying that the need for proper training in efficient use of IWB was one of the main reasons for registering into the training course.

Results for research questions

Question 1: Which is the perception of the teachers on usefulness of new technologies and teaching using mixed educational resources?

The attitude of participant teachers varied between:

- We have an IWB [at school], but I realized that we do not actually use it at its maximum potential. Meanwhile I discovered many other functions, truly interactive and I already use them in the class;
- During the course I found some very useful interactive applications for my subject. I will change my unit plans to integrate them from the next school year;
- I would like to use them, but only if I will manage to create interactive applications [usable on IWB], because for my discipline, they do not exist on the market;
- I have to stick to what I already use, I work with pre-schoolers, but I learned ways to be more efficient. I will try to build a class blog to strengthen the link with the parents;
- I do not consider that I really need new technology [IWB, educational platforms]. It [IWB] would be useful during collaborative applications [using online tools] that I wish to introduce in my lessons, but how it will not take place every day I do not

think it will recoup the cost.

75% of participants *recognized the importance* of interactivity provided by the new technologies and *declared prepared* to implement the mixed educational resources during their classes. The other *25%*, even if they have acknowledged the usefulness of new technologies, they declared that they *will not adopt* them and that they will use, from the course, the collaborative online applications and the pedagogical strategies.

Question 2: Which is the attitude of the teachers towards the performance of EnoLMS educational platform?

The attitude of participant teachers varied between:

- It is easy to use for a beginner and I do not have to be the administrator. I am confident now that I will manage my lessons on this platform;
- I could use it to store my educational materials and to collaborate with other teachers, members of the platform;
- I would post materials for students and they would send me their homework. I would have a better control over how they organize their activities and how they study;
- It is easy to use for a beginner, but I am an experienced user and from my point of view it doesn't provide me enough functions.

The performance of the platform was positive appreciated by 19 of the participants, and *it was preferred for implementation* by *65%* of teachers, the main advantages being the easy use interface and the existence of an administrator. The *experienced users* (20%) *preferred to continue* to work on the *educational platforms with which they were accustomed*, while the rest declared that the use of an educational platform will not be effective in their classes.

Question 3: Which are the skills considered necessary by teachers in order to use efficiently the mixed resources package as educational tool?

The skills identified by the teachers after completion of the training were:

- ICT skills (mentioned also before training in specific components: use of IWB, use of learning management system, use of collaborative applications, etc);
- adapting teaching methods and strategies for efficient use of technology (mentioned by a single trainee before the course);
- classroom management during the lessons that use technology (mentioned by a single trainee before the course);
- opening towards new (mentioned also before training).

Question 4: Is there an effect of the training course on the perception of teachers about the necessity of specific skills in order to use efficiently the mixed resources package as educational tool?

The distribution of opinions regarding the question "Do you consider that specific skills are needed in order to efficiently implement technology at class?" before and after intervention, was represented in Figure 1a). A major concentration of responses can be observed in *Agree* category after the intervention (75% of responses), all participants showing a firm view: *Agree* or *Not agree*.

In order to determine the degree of success of the training course, the responses from the pre-intervention interview were considered also. All participants declared that the proposed curricula responded to their identified needs regarding use of technology, which highlights an already existing awareness of necessity of specific skills. What changed during the course was not the degree of awareness (70% before to 75% after *Agree + Partial agree*), but the focus on skills needed, as it could be seen from the responses on Question 4.

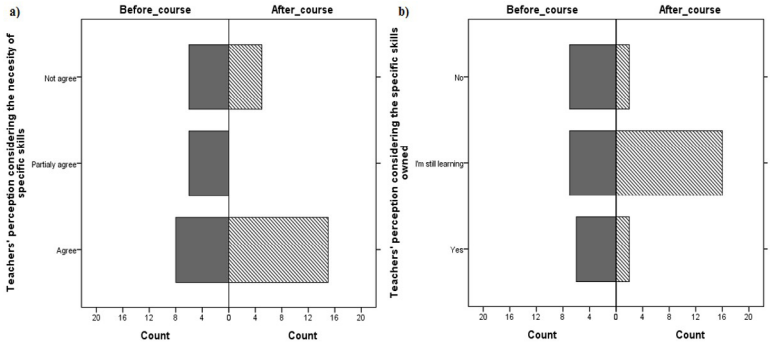

Figure 1: Distribution of opinions regarding the research questions Q4 (a) and Q5 (b), 2015, (source: own graphic representation)

Question 5: Is there an effect of the training course on the perception of teachers on the skills they own in order to efficiently use the mixed resources package as educational tool?
The distribution of opinions regarding the question "Do you consider that you own the specific skills in order to efficiently implement technology at class?" before and after the intervention, was represented in Figure 1b). A major concentration of responses can be observed in *Still learning* category after the intervention (80% of responses) which highlight an increase of their awareness on complexity degree of specific skills needed for an efficient implementation of the mixed educational resources package at class. In the same time, it can be interpreted as a decrease of their confidence in the skills they owned. Analyzing the responses from pre-intervention interview, all participants declared having certain IT skills and looking for improvement or completion on other IT&C skills. Also, all participants considered having the necessary pedagogical skills, and only two considered the need to adapt them to a technical educational environment. Thus, the effect of the training course was manifested mainly on the awareness on complexity degree of specific skills, after intervention only two participants still considering that they have the necessary skills. Also the distribution of opinions may suggest that a course of only six weeks was not sufficient to develop and improve the needed skills.

Discussions

The research focused on teachers' degree of acceptance or rejection of mixed educational resources package as an educational tool and on their attitude regarding the effective implementation at the class. As intervention, the participants were trained on the use of the interactive technology during lessons from both perspectives: development of technological skills (how to perform with the equipment or software application) and adaptation of the pedagogical skills, already owned, in sense of efficient integration of technology in class activities.
During the intervention, participants' attitude changed differently for each component of the package. The technology component (interactive whiteboard, online educational platform, online collaborative applications) was regarded as the most important before intervention, all trainees being aware of their need to develop the specific skills. After the intervention, their degree of awareness considering the importance of using technology during lessons remained high, with changes considering the effectiveness of each technological tool in the class specific context. Thus, from the responses, it was observed that the participants from the higher levels in teaching classification (secondary,

high school) were more willing to implement the mixed educational resources package as a whole, while the participants from preschools and primary schools chose to implement only the components considered relevant. A better adaptation of practical applications addressed to this group may be a possible solution in order to increase the degree of acceptance.

At the end of the intervention 80% of participants considered that they "*Still need to learn*", which can be considered as an increase of their awareness on complexity degree of specific skills needed for an efficient implementation of the mixed educational resources package at class, but also can be interpret as a decrease of their confidence in the skills they owned. An extension of practical modules or an addition of a monitoring period for class implementation could be a solution.

Considering the pedagogical component, it was regarded, at the beginning of the training program, of lower importance than technical component, only two of the participants being aware that they need to adapt their already owned pedagogical skills in order to achieve an efficient integration of technology. At the end of the intervention, both components were perceived on the same level of importance, all participants considering "adapting teaching methods and strategies for efficient use of technology" a mandatory skill as well as ICT skills.

The performance of EnoLMS educational platform was favorable evaluated by the large majority of participants, being selected for implementation by 65% of teachers mainly due to its easy to use interface and the existence of an administrator. In the same time, some of the users, felt restricted by the interface, considering that it does not provide some of the functions they would need at class, and also by the need to submit all their requests to an administrator and not having the possibility to organize the learning space as they desire.

When the level of previous experience on using online platforms at class was considered, it was observed that most of the "beginners" (never used online platforms at class) chose EnoLMS for implementation, while most of the "experienced" (have used online platforms at class) chose other platforms. The large appeal of the "beginners" to EnoLMS platform is considered a strength and a proof of its accessibility, and also an assessment of the training program. Also, most of the "experienced" preferred to continue to work on the educational platforms with which they were accustomed, showing a tendency to resist towards change.

Conclusions

Overall, it can be considered that, in order to increase the degree of acceptance of the mixed educational resources, the training program was a successful intervention. Participants became aware on the necessity to adapt their teaching methods to the technology used, and in the same time they have refined the selection of technology in terms of educational efficiency. Differences between the attitudes of teachers, according to participants' level in teaching classification were determined, which implies adaptation of future teacher training programs. It was also observed that an intervention of only 6 weeks was not enough to improve digital literacy, which highlights the complexity of training and the need for a program with distinct and specific steps.

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HEAD TEACHERS' PERCEPTION OF TEACHERS' ORAL AND WRITTEN ASSESSMENT

[1]Eva Fandelova, [2]Zdenka Gadusova, [3] ✉Igor Lomnicky

[1]Department of Media Studies and Advertising, Faculty of Arts, Constantine the Philosopher University in Nitra, Slovakia

[2]Department of English and American Studies, Faculty of Arts, Constantine the Philosopher University in Nitra, Slovakia

[3]Department of General and Applied Ethics, Faculty of Arts, Constantine the Philosopher University in Nitra, Slovakia, Hodžova 1, Nitra, 949 74, Slovakia, +421 905 979 112, ilomnicky@ukf.sk

Abstract

Assessment of teacher's competences is one of the most discussed issues of current educational systems. Requirements on professional competences of teachers are rapidly changing, but the ways of assessment stay the same, very diverse and often not relevant. In the presented partial outcomes from the questionnaire research total number of 145 head teachers was addressed. In one of the questionnaire items they expressed their opinion about possible introduction of oral and written assessment as the part of teachers' assessment procedure. The paper presents the most important findings about the positives and negatives of both ways of the assessment as the head teachers see them. The findings will further be used to design tools for teacher professional competences assessment. The paper presents the head teachers' perception analysis of a proposed teachers' written and oral assessment. The results can serve as an indicator of head teachers' attitude towards a certain form of assessment and at the same time as a facilitator of teachers' competences in the application of the preferred form of assessment.

Keywords

Assessment of competences and teachers, head teachers, oral assessment, written assessment

Introduction

Evaluation of teachers is an inseparable part of head teacher' managerial work at school. Considering the Act N° 317/2009 (Zákon č. 317) on teaching staff and other experts, head teachers assess each teacher in their schools at least once a year. Based on our interviews with some of the head teachers in different Slovak schools, they do this job as it is required by the Act. Majority of them, just like in other countries (Brandt, et al., 2007; Heneman et al., 2006), use classroom observation as one of the most common forms of teacher evaluation. Their evaluation varies widely from rather a formal process to an informal, unannounced classroom visit to develop a quick impression of what a teacher is doing in the classroom. Credibility of this kind of assessment is not very reliable either as head teachers may not always have the specialized knowledge to make informed judgments (Gadušová and Vítečková, 2014; Hockicková and Žilová, 2015). Others rely more on value-added scores of student achievement either in school or national tests. The similar approach to the issue can be found also in research studies abroad (Jacob and Lefgren, 2005, 2008; Wilkerson et al., 2000).

Whether classroom observations sheets or value-added models, they are not fully appropriate for assessing teachers. Such instruments are validated for a particular

purpose, and their validity is dependent on whether they are used as intended. The main aim of teacher's assessment should be to provide information that can be used to identify weaknesses in instruction and to design relevant strategies for instruction improvement. Thus we expect that there should be more discussion with teachers involved in the assessment process and possibly also introduction of the possibility for teachers to defend themselves in writing. This was a part (item N°11) in our questionnaire for head teachers where they could express their opinions about the issues stated above.

Materials and methods

The survey analysis was focused on the process of teachers' assessment from the point of view of assessors - head teachers. Given the demands that are placed on teacher in the educational process, the assessment has a specific position and, we expect, that its implementation will have facilitating effects. This effect is visible indirectly in how school managers perceive the assessment process and how they characterize it. The idea stated above is the result of our analysis.

To collect the data, we used a questionnaire as a research method. The questionnaire consisted of 13 items: two items served as demographic indicators, four items were aimed at the professional characteristics of the head teacher and their activities, the other seven items were aimed at evaluated teachers' assessment issues. Overall, in the questionnaire there were used nine closed items. Two items were scaled, one of which contained ten and the second one seventeen subheadings. The last two items in the questionnaire were open. The paper deals with the data analysis from one of the open items in the questionnaire, item N°11 asking about the opinion of head teachers on the positives and negatives of possible introduction of the oral discussion with the assessed teachers and their written statement about the assessed issues. Respondents were 145 head teachers, out of which 99 women (68%) and 46 men (32%). Head teachers from primary and lower secondary schools prevailed - in the number of 112 (77.24%). From upper secondary schools there were just 18 (12.41%) grammar school head teachers and 15 (10.34%) secondary vocational schools head teachers. The respondents were from all regions of Slovakia, but most of them from Nitra region - 70 head teachers (48.27%). The other regions of Slovakia were presented by 19 (13.10%) head teachers from Žilina region, 17 (11.72%) from Trenčín region, 13 (8.96%) from Trnava, and 11 (7.58 %) from Banská Bystrica regions. The least head teachers were from Prešov region - 9 (6.20%), and from the region of Bratislava - 4 (2.76%) and Košice - 2 (1.38%).

To process the collected data we used content analysis (CA) in its quantitative and qualitative form (Schultz, 2011; Miovský, 2006). CA categories are in a code table (available at the paper presenter) and are apparent from the tables. The results are processed in percentages and presented in the tables. To illustrate the findings we present some authentic statements written by head teachers as we have identified them for each of the categories.

Results

The item N°11 was aimed at the way assessment of teachers' competences could be carried out. Results from the item data analysis were differentiated according to selected indicators for the discussion with assessor - oral assessment (OA, 1) and the written statement about the assessment (WA, 2). In both cases we followed equally positive and negative aspects of the assessment in the way the head teachers wrote about them.

Oral assessment (OA)				Written assessment (WA)			
N°		%		N°		%	
162		78.64		44		21.35	
Positives		Negatives		Positives		Negatives	
N°	%	N°	%	N°	%	N°	%
124	60.19	38	18.45	11	5.34	33	16.02

Table 1: Total score - the positives (P) and negatives (N) for oral and written assessment, 2015 (source: own calculation)

The results in Table 1 show a strong preference for oral assessment (78.64%) in comparison with the written one (21.35%). While for oral assessment its positives (60.19% to 18.45%) prevail, for written assessment its negatives dominate (16.02% to 5.34%). The above mentioned findings indicate the attribution of the addressed head teachers to more comfortable way of evaluation in the form of the oral procedure in which the positives of oral assessment (60.19%) significantly outweigh its negatives (18.45%). More reserved and critical view of the head teachers on written assessment indicates its lower preference by the addressed sample, and its positives are less presented (5.34%) than the negatives (16.02%). A more detailed analysis offers a more differentiated view at the issue and very appropriately illustrates the specificities of the two assessment approaches.

1. Oral Assessment

The results of the collected data analysis are presented in tables, and the different categories are illustrated by concrete, authentic verbal statements.

	Oral assessment - the positives							
	C	FB	M	CT	PD	A	PC	O
N°	53	29	11	9	7	5	4	6
%	42.74	23.38	8.87	7.25	5.64	4.03	3.22	4.83

Table 2: Oral assessment - the positives, 2015 (source: own calculation)

As it follows from the Table 2 the addressed head teachers emphasized among the positives of oral assessment (discussion with assessor) the following aspects: Communication - C (42.74%), Feedback - FB (23.38%), Motivation - M (8.87%), Control - CT (7.25%), Personal development - PD (5.64%), Attitude - A (4.03%), Personal Contact - PC (3.22%) and other, occasionally occurring, phenomena which we included in the category Other - O (4.83%).

To illustrate the head teachers' opinions some concrete examples can be stated:

Communication (C)

- *In the discussion the ones who were assessed can explain and clarify their teaching procedure. They can point to what they consider to be key aspects in their work and assessor did not consider that a priority and, therefore, their opinions diverge. Interview brings together and leads to understanding.*
- *Interview and discussion leads both parties to the development of mutual trust. It gives both parties the opportunity to communicate their opinions, proposals and reach consensus, or to defend their own opinions.*

Feedback (FB)

- *Feedback for both the assessor and the assessed one.*
- *The assessor has the opportunity to become aware about the standpoint(s) of the assessed one.*
- *The assessment is directly related to self-assessment.*

Motivation (M)

- *Good advice always acts as an incentive for teacher.*
- *Assessment acts as an incentive for teachers.*
- *Oral assessment can be motivating, inspiring.*

Control (C)

- *It is important to set the values, priorities, and the school profile and align them with the work of teachers.*
- *The goal of the assessment is to improve and develop the work of teachers in achieving the school objectives; evaluative interviews update the goals and objectives of the school.*

Personal development (PD)

- *Assessment interviews address and solve problems of teachers' performance.*
- *Assessment interviews collect information for staff development.*
- *Assessment interviews collect information for self-improvement of teaching staff.*

Attitude (A)

- *Discussion helps to explain different positions.*
- *Discussion helps to find the attitude of teachers towards the assessment.*
- *For the assessor it is important to know the attitude of the assessed ones to their assessment.*

Personal Contact (PC)

- *Oral assessment ensures direct contact of both parties involved.*
- *Oral assessment is more personal, more intimate.*

The data presented in the Table 3 shows that among the negatives there were expressed such phenomena as: Time-consuming work - TC (26.31%), Unaccepted criticism - UC (13.16%), Stress - S (13.16%), Misunderstandings - MU (5.26%), Superiority - SP (5.26%), Distrust - DT (5.26%), and Others - O (31.58%).

	Oral assessment - the negatives						
	TC	UC	S	SP	MU	DT	O
N°	10	5	5	2	2	2	12
%	26.31	13.16	13.16	5.26	5.26	5.26	31.58

Table 3: Oral assessment - the negatives, 2015 (source: own calculation)

To illustrate the head teachers' opinions some concrete examples can be stated:

Time-consuming work (TC)

- *It takes more time.*
- *It needs longer preparation for assessment and also the assessment process itself is more time-consuming.*

Unaccepted criticism (UC)

- *Not every teacher can accept assessment criteria.*
- *Not everyone can accept constructive criticism.*
- *There are situations when a teacher is more sensitive to personal criticism.*

Stress (S)

- *It is stress for teachers.*
- *If there is no systematic assessment in a school, teachers are stressed, when State School Inspectors come.*

Misunderstandings (MU)

- *Misunderstanding of the situation, disability to defended own opinion can also be a negative aspect of the assessment.*

- *Sometimes teachers experience problems to express their opinion in terms of teaching and they perceive assessment as a personal attack.*

Superiority (SP)

- *Assessment is expressed only from the position of superior to his subordinate.*
- *It is just pure statement of one of the two parties.*

Distrust (DT)

- *Assessment widens distrust and lack of cooperation, uncertainty begins.*
- *I can see a negative aspect of the discussion between the assessor and the assessed teacher in their personal contact that is often impaired by their personal relationship (between superior and subordinate), although, this should not happen in the case of teacher' assessment.*

2. Written Assessment

Similarly, we also processed the data collected about the written assessment.

	Written assessment - the positives		
	E	QF	O
N°	3	2	4
%	27.27	18.18	54.54

Table 4: Written assessment - the positives, 2015 (source: own calculation)

The positives of the written assessment (see Table 4) are least presented by the addressed head teachers. Surprisingly the category Other (O), in this case, reached the highest score (54.54%) among all categories listed for the positives of the written assessment, and among all categories listed for both forms of the assessment (oral and written, regardless of the sign plus or minus). The positives are identified in such categories as Evidence - E (27.27%), and Quick Form - QF (18.18%). From the category Other some statements are inspiring and therefore we present them. According to these statements in oral assessment the most positive and useful is the fact that it has a summarizing character and it is useful for school management.

To illustrate the head teachers' opinions some concrete examples can be stated:

Evidence (E)

- *Written statement serves as an evidence, or a proof in which teacher can express/ reason their teaching procedures, their approval or disapproval in writing.*
- *Teacher receives a written evaluation once in a year.*
- *Informative written conclusion from the assessment can follow if the teacher wishes to receive it.*

Quick Form (QF)

- *It is a quick assessment form.*

	Written assessment - the negatives			
	B	IP	TC	O
N°	14	5	4	10
%	42.42	15.15	12.12	30.30

Table 5: Written assessment - the negatives, 2015 (source: own calculation)

In case of written assessment the negatives prevail over the positives (see Table 5) and are expressed in such categories as: Bureaucracy - B (42.42%), Impersonal activity - IP (15.15%), Time-consuming activity - TC (12.12%). In this case there also are some categories included into the category Other - O (30.30%) which can be considered to

be inspiring statements and, therefore, we present them. According to these statements the negative of the oral assessment is that it is not objective, it causes stress to assessors, teachers are uninterested in it and it also is quite authoritative.
To illustrate the head teachers' opinions some concrete examples can be stated:
Bureaucracy (B)

- *Written assessment is unnecessary duplication of bureaucracy.*
- *We have more than enough paper work.*

Impersonal activity (IP)

- *Written assessment is impersonal, it lacks personal contact. Interactivity is absent.*
- *Both parties do not always understand in the same way what's written on the paper. It suits those who resist personal confrontation.*

Time-consuming activity (TC)

- *It takes a lot of time*
- *Its preparation is time-consuming.*

Discussion

The system of teachers' assessment has its own specifics that we were able to identify on the basis of the answers of the addressed assessors - head teachers of schools, which show how subjectively they are formulated. The prevailing tendency to prefer the oral assessment stems from the most frequently applied way of assessment - traditional school lesson observations (compare Putnam and Borko; 2000), backed by law N° 317/2009 on teaching staff and system of university teacher training. The assessment is carried out in direct interaction of assessor and assessed teacher, in mutual interaction by means of discussion, interview, communication and application of feedback. Thus, assessment can motivate teachers (see also McBer; 2000), can be challenging for streamlining of management process in schools and allows personal development and contact, and also identifies attitudes. Preferred characteristics replicate what the head teachers have incorporated into their routine managerial competences and responsibilities; they are part of their managerial work at schools (compare Geijsel et al.; 2009). The problem is to ensure a constructive look at the drawbacks, where, at the forefront of responses, rather limiting functions of the assessment (as time-consuming activity, inability to take criticism and stress) dominate. There is a lack of the application of those aspects which could eliminate problems, improve or increase efficiency of assessment. What we have in mind is a specific link between teacher's assessment and their professional development, career progress, bonuses, remuneration. This also applies to the rejected written assessment that was of least interest for the head teachers and they subjected it to criticism as bureaucratic, impersonal and time-consuming procedure. The data show the lack of effort to find support mechanisms for the process improvement. Despite the minimum number of responses we identified also positive and inspiring aspects of this type of the assessment. Though they were isolated and very low-represented, they can serve as the evidence, which has summarizing character and can positively contribute to the management of schools.

Conclusion

Considering the analyzed data, we can conclude that the research did not confirm that the head teachers regard the assessment of teachers to be a facilitating phenomenon for their work at school. The assessment is carried out with a significant preference for discussion with the assessed teacher and a minimum use of the written assessment. The results were

obtained on the basis of data processing from just one part of the research questionnaire (the item N°11). We expect that the total results will be more differentiated and they will uncover other aspects of the assessors' perception of teachers' assessment depending on other criteria that we followed in the research. However, it is now clear that the answers of head teachers can serve as appropriate indicators for development of methodologies, tools and documentation for teachers' assessment.

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COMPETENCY-BASED APPROACH IN EMPLOYEE TRAINING AND DEVELOPMENT

[1]✉Martina Fejfarova, [2]Jiri Fejfar

[1]Department of Management, Faculty of Economics and Management, Czech University of Life Sciences Prague, Kamýcká 129, Prague 6 – Suchdol, 165 21, Czech Republic, +420 224 382 037, fejfarovam@pef.czu.cz

[2]Department of Systems Engineering, Faculty of Economics and Management, Czech University of Life Sciences Prague, Czech Republic

Abstract

The article focuses on the use of the competency-based approach to employee training and development. The main objective is to evaluate the application of the competency-based approach to employee training and development in organisations in the Czech Republic in the period from 10/2014 to 06/2015. A partial objective is to test dependencies between selected qualitative features and to compare the results obtained with the results from the previous period (from 10/2011 to 06/2012). The results of the survey have shown that only 21.2% of organisations apply the competency-based approach. 72.2% organisations applying the competency-based approach apply it to the area of employee training and development, in particular for employees in managerial, specialist positions and administrative staff. An individual training and development plan, based on the competency-based approach to human resource management, helps respond to real needs in the area of employee training and development.

Keywords

Competency-based approach, development, organisation, survey, training

Introduction

A competency-based approach to management represents an important human resource management tool (Cardy and Selvarajan, 2006; Sanghi 2007; Vazirani, 2010; Horng et al., 2011). In conformity with the resource-based approach to competitive advantage, it is essential for organisations to identify, evaluate and develop competencies of their employees in order to gain a competitive advantage (Pablos and Lytras, 2008; Sanchez and Levine, 2009; Poorkiani, Beheshtifar and Moghadam, 2010; Horng et al., 2011; Adsule and Berad, 2014).

The application of competencies in management processes helps combine an organisation's requirements and employees' abilities to promote their mutual development and ensure competitiveness of the organisation in the market. 'The term competency has been defined from several different perspectives' (Mitchelmore and Rowley, 2010: 94). Competency-oriented research, as well as practice in organisations, is driven by the aspiration to achieve excellent performance both at the individual and organisational levels. 'The competency-based approach to human resource management is not a new approach' (Poorkiani, Beheshtifar and Moghadam, 2010: 114). It is possible to divide competencies into three main development phases: The first phase is represented by individual competencies, the second phase is competency management in organisations using competency models and the third phase is focused on key competencies of the organisation (Fejfarová and Urbancová, 2015).

Competency development is a crucial aspect of working with competencies. It is in the interest of organisations not only to recruit high-quality employees, but in particular to develop them in order to achieve their strategic goals. Today training is perceived as a life-long process necessary for an individual to succeed in the labour market. The competency-based approach to employee training is a more efficient way of training and development. The competency model helps identify training and development needs and career goals that employees want to achieve. If employees undergo training and development programmes and have opportunities to apply what they have learnt, it increases the probability of making use of and developing their skills in practice.

The article focuses on the use of the competency-based approach in employee training and development with the aim to increase its efficiency. The main objective of the article is to evaluate the application of the competency-based approach to employee training and development in organisations in the Czech Republic in the period from 10/2014 to 06/2015. A partial objective of the article is to test dependencies between selected qualitative features and to compare the results obtained with the results from the previous period (10/2011 to 06/2012).

Materials and Methods

The application of the competency-based approach to employee training and development in organisations in the Czech Republic was monitored through a questionnaire survey that was conducted in the period from 10/2014 to 06/2015. This research represents a part of the long-term research that is focused on the use of competency-based approach in organisations in the Czech Republic (Fejfarová and Urbancová, 2015). The sample group consisted of 181 small, 100 medium-sized and 92 large organisations. The total thus was 373 organisations. The response rate was 62.2%. Organisations were selected by simple random sampling among organisations in the Czech Republic. The structure of organisations is shown in Table 1.

Area operated	**Private**		**Public**		**Total**
	71.8		28.2		100
Economic sector	Primary	Secondary		Tertiary	Total
	6.2	23.8		70	100
Size of organisation	**Small**	**Medium-sized**		**Large**	**Total**
	48.5	26.8		24.7	100
Size of the market	National		International		Total
	66.2		33.8		100

Table 1: Structure of organisations in percentages

The data have been processed by means of descriptive statistics using the Microsoft Excel 2013 programme and the IBM SPSS Statistics 22. Pearson's Chi-Square Test was used to test 5 null hypotheses. The level of significance was set at 0.05. A scale according to De Vaus (2002) was used to interpret the strength of Cramer's V. The results obtained were compared with the results from 10/2011 to 06/2012 (Fejfarová and Urbancová, 2015).

Results and Discussion

The results of the survey have shown that only 21.2% of organisations apply the competency-based approach to management of organisations. It is primarily large organisations (43.5% of responding large organisations) that apply the approach, followed by medium-sized organisations (20% of responding medium-sized organisations). Only

10.5% of responding small organisations take advantage of this approach. Organisations applying the competency-based approach apply it in particular to the following areas: training and development (72.2%), employee performance appraisal (72.2%), employee selection (59.5%) and recruitment (46.8%), job analysis (46.8%), work team development (32.9%) and career management (25.3%). These areas of the competency-based approach application in organisations are shown in Figure 1.

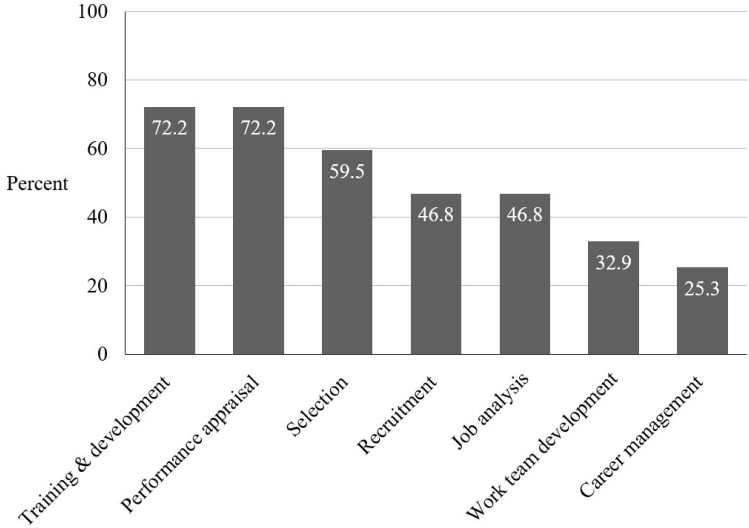

Figure 1: Areas of the competency-based approach application

The above results confirm importance of the competency-based approach application to the area of employee training and development. In this aspect, it means the application of individual competencies, i.e. individual characteristics necessary to achieve the required level of performance of the given employee. The application of the competency-based approach to employee training and development is important primarily because it enables us to correctly define the content of employee training and development in compliance with competencies that are needed in their jobs. Individual competencies thus represent the individual characteristics necessary to gain the required (superior) level of employee performance. Each work position requires the employee to have individual competencies developed to the required level. Competency development then focuses on elimination and balancing of differences between the real and ideal situation. Therefore, it is crucial to identify competencies that are developed in relation to the position of the employee in the organisation, i.e. to respond to his/her specific training and development needs.

The results of the survey show that organisations often do not find use for the competency-based approach in the area of career management (25.3%) although they apply it to the area of employee training and development (72.2%) and performance appraisal (72.2%), which provides them with essential information for the career management of their employees. Despite the above said, investment in talent development is very important for organisations and in the long term it pays off. If talented employees leave to join a competitor, it has an adverse impact on goal achievement of any organisation. Improved and efficient training and development result in a lower employee turnover because employees rate higher overall job satisfaction (Kalargyrou and Woods, 2011).

When taking into account employee categories, in responding organisations employee training and development are most frequently undertaken in the category of managers (68.4%), specialists (63.3%) and administrative staff (57%). The least attention is paid to the category of workers (26.6%). The application of the competency-based approach to the area of employee training and development according to employee category is displayed in Figure 2.

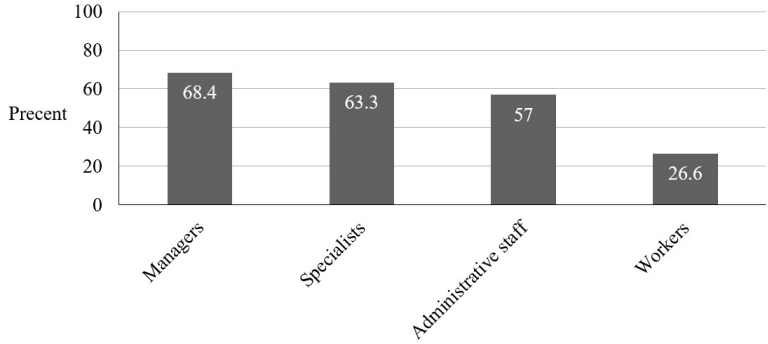

Figure 2: Competency-based approach application in the area of employee training and development according to employee category

Determining the level of competencies of individual categories of employees is crucial to identifying their training and development needs in order to choose the most suitable method of employee competency development. For this reason, it is important to invest in employee training and development. In the entire process of employee training and development, the following factors are essential: active participation of managers, management support, the organisational culture open to training and development, and willingness to learn. To ensure efficiency of the whole competency-based management process, it is necessary for organisations to work efficiently with competencies, i.e. to develop competency models based on identified competencies and, in turn, define employee competency training and development possibilities. Davis and Olson (In Sanghi, 2007: 78) state that the use of the competency-based model as a basis for employee training and development helps organisations 'avoid short-term perspectives and focus on the right things rather than the latest things'.

For the purpose of comparison of results of tested dependencies between selective qualitative features in the period from 10/2011 to 06/2012 (Fejfarová and Urbancová, 2015) and 10/2014 to 06/2015 and verification of the conclusions made, the testing of dependencies of selective qualitative features was repeated. The results are shown in Table 2.

No.	Null hypothesis	Asymp. Sig.	Decision	Value of Cramer's V	Strength of the relationship
1	The use of the competency-based approach in an organisation does not depend on the size of the organisation.	0.000	Reject the null hypothesis	0.282	Low
2	The use of the competency-based approach in an organisation does not depend on existence of an HR department.	0.000	Reject the null hypothesis	0.242	Low
3	The use of the competency-based approach in an organisation does not depend on the position of the person responsible for human resource management in top management.	0.033	Reject the null hypothesis	0.110	Low
4	The use of the competency-based approach in an organisation does not depend on existence of an HR strategy.	0.000	Reject the null hypothesis	0.188	Low
5	The use of the competency-based approach in an organisation does not depend on the sector in which the organisation operates.	0.738	Do not reject the null hypothesis	-	-

Table 2: The results of the qualitative features test

Four out of five tested null hypotheses were rejected and one null hypothesis was not rejected. The results of the Pearson's Chi-square Test have revealed the following.

The use of the competency-based approach in an organisation depends on:

1. the size of the organisation ($p = 0.000$, Cramer's $V = 0.282$),
2. existence of an HR department ($p = 0.000$, Cramer's $V = 0.242$),
3. the position of the person responsible for human resource management in top management ($p = 0.033$, Cramer's $V = 0.110$),
4. existence of an HR strategy ($p = 0.000$, Cramer's $V = 0.188$).

The use of the competency-based approach in an organisation does not depend on:

5. the sector in which the organisation operates ($p = 0.738$).

The strength of dependencies, compared to the previous period from 10/2011 to 06/2012, is low. In the period from 10/2011 to 06/2012, significant factors that influenced the use of competency-based approach in an organisation included existence of an HR department ($p = 0.001$, Cramer's $V = 0.316$, moderate), the position of the person responsible for human resource management in top management ($p = 0.036$, Cramer's $V = 0.201$, low) and the HR strategy defined ($p = 0.006$, Cramer's $V = 0.310$, moderate) (Fejfarová and Urbancová, 2015).

The competency-based approach is an important human resource management tool to gain a competitive advantage. Competencies have a number of interpretations and

applications both at the individual and organisational levels. If organisations apply the competency-based approach, it is essential to apply it to all key areas of human resource management. The outcomes of the survey have revealed that organisations that make use of the competency-based approach do not apply it consistently to all areas of human resource management. This is also valid for individual categories of employees (organisations focus primarily on managers, specialists and administrative staff). Thus, there is no synergic effect which would occur should the competency-based approach be applied in a comprehensive way.

An efficient system of employee training and development is targeted at the long-term needs of the organisation, and, therefore, needs to comply with the organisation's HR strategy, that arises from its business strategy. Employee training and development should mirror the current needs of the given organisation. An individual training and development plan, based on the competency-based approach to human resource management, helps respond to real needs in the area of employee training and development. Vnoučková, Urbancová and Smolová (2015: 1) state that 'employees who are lacking the adequate level of development are usually key and knowledge employees; it is necessary to support their career plans and development to retain them in the organisation'. If organisations want to be successful and proactive, they need to focus on the preparation of their human resource reserves in order to be a step ahead of their competitors, which must then take costly corrective measures to match the organisations that are prepared. Understanding the system of human resource management is a basis for the correct integration of the competency-based approach to the area of human resource management. It is also confirmed by Tomšík and Lišková (2013) who underline the linkage to strategic management.

Conclusion

The article focuses on the use of the competency-based approach to employee training and development in organisations in the Czech Republic. The outcomes of the survey have demonstrated that only 21.2% of organisations apply the competency-based approach to management of the organisation. These are primarily large organisations (43.5% of responding large organisations). 72.2% of organisations using the competency-based approach focus on competencies in the area of employee training and development, in particular of employees in managerial, specialist positions and administrative staff. Important factors that influence the use of the competency-based approach in organisations in the Czech Republic include the organisation's size, existence of an HR department, the position of the person responsible for human resource management in the organisation's top management and a developed HR strategy. Importance of the sector in which the organisation operates has not been proven.

Acknowledgements

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MODELLING FOR INCREASING EFFICIENCY IN EDUCATION OF DECISION PROCESSES

Petr Fiala

Department of Economics and enterprise management, Faculty of Production Technology and Management, The University of J. E. Purkyně in Ústí nad Labem, Pasteurova 3334/7, Ústí nad Labem, 400 96, Czech republic, +420 475 285 532, pfiala@vse.cz

Abstract

Modelling provides a valuable way for students to learn. This paper is devoted to use modelling for efficiency in education of decision processes. There is a variety of decision processes that are intended by conditions. Modelling allows to focus substantial parts of the decision processes and to determine their basic elements. Classification according to the basic elements allows to define basic types of decision-making processes and to prepare students for their practical applications. The paper mentions the basic elements and basic concepts of the solution to the problem. A set of model cases tests the modelling suitability for education of decision processes. The tests are prepared before and after the course completion and results allow focusing on further improvements in education.

Keywords

Basic elements of decisions, decision processes, modelling, solution concepts, tests

Introduction

Decision making is a common activity that meets everyone. Decision making is the process of selecting options from the set of alternatives according to the established criteria in order to achieve specific goals. The decision maker is a crucial entity that chooses the possible alternatives of the decision. Decision processes are formulated in a variety of conditions and take place at different levels from very simple to very complex. For students, it is difficult orient themselves in real decision situations. Therefore, it is useful to formulate specific decision models as patterns for decision making in real situations.

Modelling is a central skill in scientific reasoning and provides a way of articulating knowledge. Learning to formulate, test, and revise models is a crucial aspect of understanding science and is critical to helping students become active. Supporting students in articulating models of a domain and refining them through experience, reflection, and discussion can lead to deeper, systematic understanding.

There are many tools which can improve the efficiency in education (Fiala, 2015: 104), (Majovska, 2015: 341). The main hypothesis of this paper is that modelling is an important tool for improving the efficiency in education of decision processes. Basic components of decision processes are defined in the paper. Classifications according these components allow to define types of decision processes. In the paper, a set of simple discrete decision problems are proposed for experiments for testing efficiency in education of decision processes. Groups of students in courses Decision Processes at the University of J. E. Purkyně in Ústí nad Labem solved the problems before and after course completion to test influence of modelling approach to the results of solving the problems.

The rest of the paper is organized as follows. The section 2 presents basic elements of decision models. A design of the 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

A mix of methods is used in the paper. A general method of modelling is used for education of decision processes. What models bring? A model is a reflection of reality. Students using models easier capture the reality and are better oriented. Modelling plays key roles in the conduct of and education in science (Gilbert, Justi, 2015). The formation, change and testing of models is central to the processes of learning. Teachers construct special models in order to support the learning of their students. An understanding of these processes and outcomes draws on a wide range of disciplines.

To increase the efficiency in education it is suitable to explain the decision processes on the examples and use experiments. Experiments have been used to evaluate performance in a wide variety of situations (Douglas and Charles, 1993). Experiments provide an inexpensive way to examine various decision proposals. Experimentation may allow identification of proposals that are unlikely to be effective.

Specific decision models are used to explain the typical decision situations. There is a large number of decision processes. The basic types of decision situations are formulated that students are prepared for decision making in practice.

In the process of formation and solving models it is important to establish:

- Basic elements of decision processes.
- Solution concepts.
- Types of additional information.
- Solution procedures.

Basic elements of decision processes are:

- The decision maker (one or multiple).
- The set of decision alternatives (discrete, continuous).
- The evaluation criteria (one or multiple).
- Environment (certainty, uncertainty, risk).
- The sequence of decisions (one-stage, multi-stage).

In the case of multiple decision makers it should take into account the interests of others. In the case of continuous sets of alternatives it is necessary to use specific optimization procedures. We will consider only discrete sets with a small number of alternatives so that is not influenced solving of test problems. Multiple criteria correspond to the actual decision processes but complicate solutions. Environment factors affect the consequences of our decisions. Multi-stage decision processes search trajectory of decisions.

Combining basic elements gives rise to various specific decision models that form the types of real decision-making situations. There is plenty of literature on decision making models. Some publications focus on general decision situations (Fiala, 2012), (French, 1988), (Luce and Raiffa, 1957). Some publications focus on specific models.

Specific models and concept solutions:

- One decision-maker, one criterion - the concept of optimal solutions (Fiala, 2012).
- One decision-maker, multiple criteria - the concept of effective solutions (Hwang and Yoon, 1981), (Vincke, 1992), (Zeleny, 1982)
- Multiple decision makers, each one criterion - the concept of equilibrium solutions (Dlouhý and Fiala, 2015), (Chobot and Turnovcová, 1980), (Jones, 1980), (Maňas, 1974).
- More decision-makers, multiple criteria - the concept of efficient equilibrium

solutions (Hwang and Lin, 1987).
- Multi-stage decision processes - decision trees (Fiala, 2012).

Additional information are needed for some models to facilitate solutions
- Preference information - the criteria and alternatives (aspiration levels, ordinal and cardinal information)
- The type of conflict (multiple decision-makers) - antagonistic, non-antagonistic, cooperative, non-cooperative.

Experiment design

Students solved set of decision problems at the beginning of the course Decision Processes. Discrete models were selected with a simple structure, not necessary to use complicated calculation procedures. Students should determine the essential parts for mapping the process and get the best solutions of the decision problems. The same problems were solved at the end of the course with knowledge of the fundamental parts of the decision models and concepts of solutions. These results were compared and evaluated. We provide a single version of the Colonel Blotto game to illustrate the solved decision problems.

Formulation of the decision problem

Colonel Blotto is planning his defense of a city for the next day. The walls are around the city. He wants to defend the two gates of the city, and he has 3 regiments of troops. The opposing commander wishes to attack those two gates, and he has 2 regiments. To make the problem precise, it is necessary to ascribe payoffs to possible outcomes. The attacker gains the city when he will have more regiments of troops than the defender in one gate. Colonel Blotto has to decide how to split the regiments of troops to the gates for the defense of the city.

Students should identify the decision makers, their sets of possible decisions (strategies), and the best strategies for both decision-makers. Students do not need any specific procedures, only logical reasoning.

Solution to the Colonel Blotto game

Colonel Blotto has 4 strategies at his disposal: he can send 3 troops to either gate; he can send 2 to one gate and 1 to another. We will abbreviate these in set notation (3, 0), (0, 3), (2, 1), and (1, 2). By similar reasoning, the opposing commander has 3 strategies at his disposal that can be abbreviated (2, 0), (0, 2), and (1, 1). Colonel Blotto will play (2, 1) with probability ½ or he plays (1, 2) with probability ½. He never plays strategies (3, 0) or (0, 3). The opposing commander will play (2, 0) with probability ½ or he plays (0, 2) with probability ½. He never plays the strategy (1, 1).

The decision problem is possible to formulate as a 4 x 3 matrix game with above mentioned strategies. The payoff will be equal + 1 for the winner and -1 for the loser of the city. The equilibrium solution is mentioned above.

The results of the problem solved before (denoted as 1) and after (denoted as 2) the course were compared and evaluated according to:

a) Elements of the decision process (max. 3 points).
b) Formulating sets of alternatives (max. 3 points).
c) Selection of the best alternative(s) (max. 4 points).

The evaluation according to these characteristics provides a tool for detailed analysis of the key elements of individual decision problems. Such assessments were done for each individual decision problem.

The sets of 6 simple discrete decision problems (DM1,…, DM6) from various typical models of decision processes were tested. The Colonel Blotto game is one of them (DM1):

- zero sum game (Colonel Blotto game),
- non-zero sum game (prisoner's dilemma),
- game with multiple criteria (coordination games),
- multiple stage decision problem (decision trees),
- multi attribute decision making (choice of a car),
- decision with one criterion (preference relations).

Results and Discussion

Results of the tests are summarized in following tables. Overview of the evaluation results (in points) for Colonel Blotto game for 12 students according characteristics (a, b, c) before (1) and after the course (2) is given in Tab. 1.

Student	**a(1)**	b(1)	**c(1)**	**a(2)**	b(2)	**c(2)**
1.	1	2	1	2	3	4
2.	2	2	2	3	3	3
3.	0	1	0	2	2	3
4.	2	1	2	3	2	3
5.	2	3	3	3	3	4
6.	1	1	1	2	2	3
7.	0	2	2	2	3	4
8.	2	1	2	3	3	4
9.	1	1	1	3	3	4
10.	2	2	2	3	3	4
11.	2	2	1	2	2	3
12.	1	1	2	2	3	3
Average	1.33	1.58	1.58	2.50	2.67	3.5

Tab. 1: Evaluation of the problem DM1

From Tab. 2 it is possible to see the evaluations of students for the characteristics and to see progress after the course. Student's results are possible to compare with average results. The same analysis is provided for all individual problems.
Tables 2 and 3 provide evaluations of students for all 6 problems before and after course (max. 10 points).

Student	DP1	DP2	DP3	DP4	DP5	DP6	Sum
1.	4	3	6	2	5	4	24
2.	6	4	3	5	4	6	28
3.	1	1	3	4	3	3	15
4.	5	3	4	4	2	4	22
5.	8	7	9	4	6	8	42
6.	3	5	2	7	4	2	23
7.	4	2	3	3	5	4	21
8.	5	3	2	5	4	3	22
9.	3	2	5	4	3	4	21
10.	6	3	6	4	5	3	27
11.	5	4	4	3	5	2	23
12.	4	2	5	3	4	4	22
Average	4.50	3.25	4.33	4.00	4.17	3.92	X

Tab. 2: Evaluation of all decision problems before the course

From Tab. 2 it is possible to see the evaluations of students from all decision problems and the average evaluations of problems before the course. The best student is the student No. 5 with 42 points before the course completion. The best answered problem is the problem DP1 with 4.50 points.

Student	DP1	DP2	DP3	DP4	DP5	DP6	Sum
1.	9	8	8	7	8	9	49
2.	9	7	6	8	9	7	46
3.	7	6	5	7	5	8	38
4.	8	7	8	7	6	8	44
5.	10	10	10	9	9	10	58
6.	7	9	6	7	7	10	46
7.	9	6	8	6	7	8	44
8.	10	7	6	8	9	7	47
9.	10	7	9	8	9	9	52
10.	10	8	10	7	9	9	53
11.	10	8	9	6	8	8	49
12.	8	7	9	8	8	7	47
Average	8.92	7.50	7.83	7.33	7.83	8.33	X

Tab. 3: Evaluation of all decision problems after the course

From Tab. 3 it is possible to see the evaluations of students from all decision problems and the average evaluations of problems after the course completion. The best student is the student No. 5 with 58 points before the course completion. The best answered problem is the problem DP1 with 8.92 points.

From comparisons of Tab. 2 and Tab. 3 it is possible to see progress by students and parts of the course. The student with best progress is the student No. 9 with 31 points. The part with best progress is the part DM1 with 4.42 points. The presented evaluation is for one year but results for a time series allow the teacher to focus on the more difficult parts of the course.

This experiment was the first attempt to detect and analyze the causes of efficiency improvements. Using the modeling approach may not be the only cause of the improved test results. Further research will focus on thorough preparation of the experiment

and its evaluation using more sophisticated tools such as regression analysis and data envelopment analysis.

Conclusion

Experiments have shown a very good suitability of modelling approach for education of decisions processes. Students learn to determine the essential elements of the processes and determine the types of standard models and solution concepts. Efficiency in education of decision processes were analyzed by test results before and after course completion. Students are clearly better oriented in decision-making issues after explaining the basic elements of the model. The problems were formulated so that for their solutions special treatment was not needed. Discrete models with a small number of variants were used. Logical reasoning was sufficient for solving problems. Monitoring progress is the advantage of this approach in terms of individual students, decision problems and their characteristic parts. The possible time series allow the teacher to focus on the more difficult parts of the course.

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REGIONAL IMPACT OF HEI'S CLOSEDOWN: METHODS OF QUANTIFICATION USING RIOT

[1]Jakub Fischer, [2]✉Kristyna Vltavska

[1]Department of Economic Statistics, Faculty of Informatics and Statistics, University of Economics, Prague, Czech Republic

[2]Department of Economic Statistics, Faculty of Informatics and Statistics, University of Economics, Prague, nám. W. Churchilla 4, Prague, 130 67, Czech Republic, +420 224 095 451, kristyna.vltavska@vse.cz

Abstract

The aim of the paper is to present the input-output tables as one of possible tools for assessment of the macro-regional economic impact of closedown of one higher education institution (HEI). Last year, the first paper focused on using input-output analysis for estimating the national economic impact of HEI closedown has been published. Nevertheless, the first experimental estimates of the regional input-output tables for all 14 Czech regions have been published. The paper demonstrates the possibilities of improvement the results previously achieved. For further research, the key challenges consist in taking into account the substitution effects and in combining of this approach to quantification of HEIs' social and economic impact with another approaches.

Keywords

Higher education institution, employment, input-output model, regional input-output tables

Introduction

Fischer and Finardi (2010) present selected facts on higher education in the Czech Republic, social selectivity of higher education, main principles of the tertiary education reform and its perception according to student survey EUROSTUDENT IV. One of the key reform goal was to change the system of HEIs' funding and to decrease the number of HEIs. Mazouch (2013) comments the recent development in higher education regarding the demographic change and points out the decreasing demand for higher education. Mazouch and Fischer (2011) analyse the impacts of higher education for the whole economy and for the individual regions as well. There are different ways how to evaluate the impact of higher education and its institutions (HEIs) on the social and economic situation of the region. For example, Mazouch and Fischer (2011) constructed the models based on the aggregate regional data on GDP, gross value added, labour productivity, employment and unemployment, wages and education level (where the education level could be measured by different approaches).

Probably the first paper focused on the macro-economic impact of individual HEI's *closedown* has been published last year (Vltavská and Fischer, 2015). This paper uses input-output modelling at the national level. Using national input-output tables it is not possible to distinguish the impact of HEI's closedown to the economy of different regions. As Sixta and Vltavská (2016) showed the technical-economic relations differ in individual Czech regions (using NUTS 3 classification). It means that previous estimates based on national input-output tables should be improved by the regional input-output tables

(regional tables will be published at the website of Dept. of Economic Statistics during the Spring 2016). The aim of our paper is to realize this improvement.
The higher level of modelling the HEI's operation impact on the economy was presented by Blackwell, Cobb and Weinberg (2002). However, their approach needs very detailed set of the input data (on students, budget flows of the university, off-campus expenditures of students, parents, relatives and alumni) including some conditional data. This data set is not available for the Czech Republic although the annual reports of the HEIs are very extensive including detailed tables and although the different student surveys (e. g. EUROSTUDENT) are at a disposal.

Materials and Methods

The analysis is based on symmetric input-output tables and symmetric input-output model (Zbranek and Sixta, 2013), which represent an extension of the core of national accounts for analytical use (according to Hronová et al, 2009). Symmetric input-output tables are derived from a supply and use tables and they are compiled in two different ways – product by product and industry by industry. These two possibilities of the compilation come from the definition of the intermediate consumption matrix. The structure of the symmetric input-output tables constitute on three quadrants – intermediate consumption matrix, final usage (final consumption expenditures by institutional sectors, gross capital formation, export) and items of gross value added plus import (see Hronová et al, 2009).
Input-output model represents the discipline that is used among different groups of users. There are many analyses focused on the impact of some administration effect into the economy (Sixta and Fischer, 2015) or environment (Růžička et al, 2013) which used input-output tables of the national economy. Thus, regional input-output tables bring new possibilities how to improve such analysis just for one region of the country.
As in the previous model presented by Vltavská and Fischer (2015) the falloff in the activity of a public HEI takes approximately 5 years of gradual falloff. Accordingly, the Ministry of Education, Youth and Sports decreases the amount of money transferred to the HEI. Using the assumptions on the linear decreased amount, it is possible to 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. Besides, one can estimate not only the primary impact on the indicators but also the consequent impact on the decreasing final consumption expenditures. The analysis is based on 'ceteris paribus' assumption. Thus, it does not expect any other factors to the results. Detailed model and its assumptions are described by Vltavská and Fischer (2015).
For the modelling of the partial impact in individual region in the individual years we use simple static input-output model and the Leontief inversion

$$\Delta \mathbf{x} = (\mathbf{I} - \mathbf{A}_D)^{-1} \Delta \mathbf{y}, \tag{1}$$

where

$\Delta \mathbf{x}$ .....vector of the production change,
$\mathbf{I}$ .....identity matrix,
$\mathbf{A}_D$ .....matrix of technical coefficients which is derived from the matrix of the usage of domestic products under the intermediate consumption,
$\Delta \mathbf{y}$.....vector of partial change of final consumption,

$(\mathbf{I} - \mathbf{A}_D)^{-1}$.....Leontief inversion.

The model uses regional input-output tables (hereafter: RIOTs) of the year 2011 since this is the only year for which were RIOTs compiled. These tables were prepared according to the European System of Accounts ESA 1995 (Eurostat, 1996) as the project which was focused on this problem started in January 2013. It means before the revision of national accounts and employing standard ESA 2010. However, the methodology first published by Sixta and Vltavská (2016) is fully transferable into ESA 2010 (EU, 2013). The significant advantage of RIOTs represents the look into the detailed structure (using Classification of Products CPA, 2 digits level) of individual region from the side of intermediate consumption, gross valued added, final consumption expenditures by individual sectors, import and export (both international and interregional) etc. As RIOTs are primarily used in regional input-output analysis they are split into imported products and domestically produced ones. It means that RIOTs of all Czech regions are divided into import matrices and RIOTs for domestic output. These tables can be used for researchers analyses as well as for the policy making decision by regional politics. For the better understanding how interesting data source RIOT brings see the example of aggregate RIOT of the capital city of Prague in Appendix.

As an example of the impact of the closedown we chose 3 typologically different regions – the capital city of Prague, the Central Bohemia Region and the South Bohemia Region. From the point of view of the structure of gross value added these three regions represent different parts of the Czech Republic. The capital city of Prague is the centre of the services (information and communication, financial and insurance activities etc.). On the contrary, the Central Bohemia Region is more focused on manufacturing industries and it is the only region from the selection which does not have any public HEI. The South Bohemia Region is mainly focused on manufacturing and tourism services. Two public HEIs have its centre in the region.

Moreover, this paper examines the changes in these regions in comparison with the results for the Czech Republic. For all regions we assume HEI with the same annual budget of one thousand million Czech crowns and a linear decrease of the budget send by the Ministry. If the HEI has 1 bn. CZK annual budget the budget sent by the Ministry decreases 200 mil. CZK every year. The amount of 1 bn represents approximately 5% of the total budget for educational activities at public HEIs in the Czech Republic. This closedown is recorded as the decrease of final consumption expenditures by government institution in particular product (CPA 85 – Education services).

Results and Discussion

Table 1 presents the overall impact of the closedown of HEI on the economy. The results show that even if the falloff of the budget was the same for all regions the impact on individual region differs. From the purely economic point of view the most significant impact (from the point of view of percentage) is recorded in the South Bohemia Region which represents the smallest region from the point of the share of this region on the gross value added of the Czech Republic (5% versus 11% of the Central Bohemia Region and 24% of Prague) in our selection. The output of the region decreases by 0.3% (1.2 bn CZK) and the final consumption expenditures decrease by 0.6%. The impact on the whole Czech economy (expressed as a percentage) is naturally lower.

		CZE	Pha	Stc	Jhc
P.1	Output (basic prices)	0.0	-0.1	-0.1	-0.3
D.21-D.31	Net taxes on products	0.0	0.0	-0.1	-0.1
P.7	Import	0.0	0.0	0.0	0.0
	Resources	**0.0**	**-0.1**	**-0.1**	**-0.2**
P.2	Intermediate consumption (purcharsers' prices)	0.0	0.0	0.0	-0.1
P.3	Final consumption expenditures	0.0	-0.2	-0.3	-0.6
	of which households	0.0	0.0	0.0	0.0
P.5	Gross capital formation	0.0	0.0	0.0	0.0
	of which GFCF incl. valuables	0.0	0.0	0.0	0.0
	of which changes in inventories	0.0	0.0	0.0	0.0
P.6	Export	0.0	0.0	0.0	0.0
	Final use	**0.0**	**-0.1**	**-0.1**	**-0.2**

Table 1: The total impact of closedown of HEI, % (source: own calculation)

Note: GFCF – gross fixed capital formation, CZE – the Czech Republic, Pha – the capital city of Prague, Stc – Central Bohemia Region, Jhc – South Bohemia Region

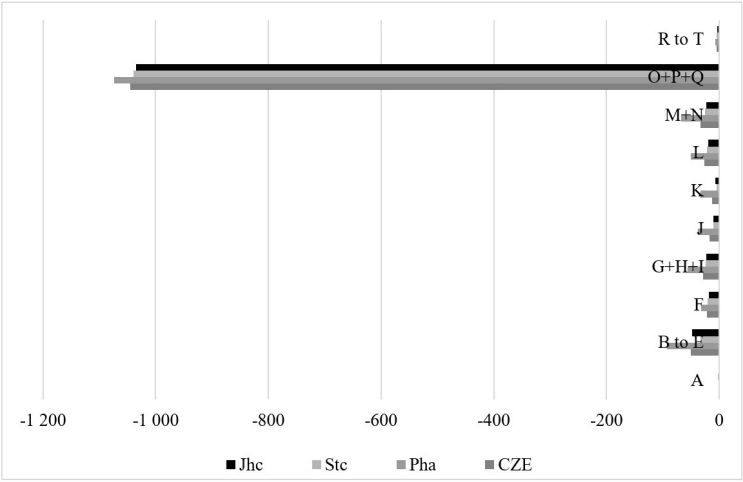

Figure 1: Total change of output, mil CZK (source: own calculation)

Note: A - Agriculture, forestry and fishing, B - Mining and quarrying, C – Manufacturing, D - Electricity, gas, steam and air conditioning supply, E - Water supply; sewerage, waste management and remediation activities, F – Construction, Services: G - Wholesale and retail trade; repair of motor vehicles and motorcycles, H - Transportation and storage, I - Accommodation and food service activities, J - Information and communication, K - Financial and insurance activities, L - Real estate activities, M - Professional, scientific and technical activities, N - Administrative and support service activities, O - Public administration and defence; compulsory social security, P – Education, Q - Human health and social work activities, R - Arts, entertainment and recreation, S - Other service activities, T - Activities of households as employers and producers for own use.

The decrease of budget will differ in individual regions. Figure 1 illustrates the total change of output of individual industries according to the officially published regional data by the Czech Statistical Office. The Central Bohemia Region represents the region the closest to the average by the structure of the Czech Republic. The capital city of

Prague differs the most as many HEIs take place in here. The most significant impact is detected among industries in which HEIs take parts (more than 1 bn CZK in each region). Thus, industries Public administration and defence (O), Education (P) and Human health and social work activities (Q).

	CZE	Pha	Stc	Jhc
A	-1	0	-1	-1
B to E	-15	-19	-11	-14
F	-8	-8	-7	-7
G+H+I	-12	-18	-11	-11
J	-9	-19	-3	-4
K	-7	-18	-2	-4
L	-13	-18	-14	-11
M+N	-13	-26	-9	-8
O+P+Q	-801	-696	-805	-836
R to T	-2	-3	-2	-2
Total	**-880**	**-826**	**-866**	**-898**

Table 2: The total impact of closedown of HEI on gross value added, mil CZK (source: own calculation)

Besides the structure of output the structure of gross value added differs among regions (table 2). It is given by the availability of regional producers to satisfy specific regional demands. When analysing the decrease of the budget of HEI the highest decrease of gross value added was investigated in the South Bohemia Region (898 mil CZK). The decrease of the capital city of Prague is lover (826 mil CZK) than the average of the Czech Republic (880 mil CZK).

The results show that using RIOT we are able to investigate the economic impact of the closedown of individual HEI in particular region. From the analytical point of view RIOT delivers unique data source for such analysis. However, deeper analysis using more detailed data is not possible these days as they are not at a disposal in next year for any of Czech HEI.

Conclusion

The aim of this paper was the short presentation of the usage of newly developed regional input-output tables. The example of the closedown of the HEI in selected regions indicates how these tables can be used for the analysis. Using simple input-output analysis we found out that the closedown of the HEI with the same annual budget would have the most significant impact in the South Bohemia Region which is the smallest one in our selection. These data shows that the Central Bohemia Region is the closest to the average of the Czech Republic in all indicators. On the other hand, the capital city of Prague differs the most as many HEIs take place here.

These results detects only purely economic impact of the closedown on the region. Further analysis should focused on the social impact and the impact on the employment as well. However, these analysis are demanded on data which are not published.

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APPENDIX

Regional input-output tables, use of domestic product, Prague, 2011, mil. CZK

		Intermediate consumption (CPA)										TOTAL	Final consumption expenditures			GFCF incl. valuables	Changes in inventories	Export (FOB) P.6			Final use total	Used sources total
		A	B+C+D+E	F	G+H+I	J	K	L	M+N	O+P+Q	R+S+T+U		Households	Governments	NPISH			total	internationa l	regional		
												P.2	P.3			P.51+P.53	P.52					
CPA	A	304	3 020	21	1 024	2	0	35	103	18	52	4 580	1 421	7	6	25	133	1 586	1 586	0	3 178	7 758
	B+C+D+E	1 012	84 958	9 464	25 068	7 587	3 413	16 171	9 260	6 608	1 828	165 370	36 128	432	38	13 549	2 208	181 300	150 981	30 319	233 855	399 225
	F	118	3 863	81 328	8 765	625	889	10 392	10 156	6 146	722	123 005	193	4	0	92 214	-2 572	31 391	3 819	27 572	121 231	244 236
	G+H+I	893	33 294	8 312	121 103	9 514	8 489	7 943	30 408	5 055	3 099	228 110	46 898	12 356	84	10 352	3	216 093	90 665	125 428	285 787	513 897
	J	44	2 874	891	7 886	57 883	13 306	1 808	9 912	3 976	2 319	100 900	8 476	202	17	14 801	-56	105 708	47 180	58 528	129 148	230 048
	K	157	4 426	3 906	13 919	1 082	47 447	25 839	11 180	1 455	1 577	110 989	9 727	25	0	204	99 419	10 255	89 164	109 375	220 364	
	L	50	2 441	2 922	24 590	5 301	8 783	12 599	12 290	9 746	3 557	71 140	6 537	1 004	5	137	0	64 540	1 452	63 088	122 992	194 132
	M+N	191	9 619	37 369	31 892	8 783	12 599	12 290	96 438	9 746	3 557	222 413	6 537	7 217	177	363	-891	112 647	45 534	66 513	125 450	347 863
	O+P+Q	42	886	105	1 671	539	1 736	1 054	1 533	6 644	553	14 563	6 365	135 557	141	0	0	11 659	8 010	3 649	154 721	169 284
	R+S+T+U	3	419	96	4 588	924	1 007	897	898	687	4 998	14 496	12 638	5 009	5 845	626	-2	17 755	5 544	12 211	41 871	56 367
P.2	Intermediate consumption (basic p.)	2 814	145 801	144 353	240 508	92 239	94 212	90 852	178 927	43 648	21 212	1 055 566	185 690	161 813	7 313	132 066	-973	841 698	366 026	476 672	1 327 608	2 383 174
P.2 IMP	IC from imports	2 442	122 813	47 986	93 736	24 311	11 130	32 279	43 390	12 920	6 407	447 414	72 621	27 286	362	92 853	-208	2 418	120	2 298	195 331	642 745
D.21-D.31	Net taxes on products	668	5 441	1 250	7 023	553	514	1 065	1 195	4 793	986	23 488	31 802	1 222	54	7 886	25	1 449	1 449	0	42 438	65 926
P.2	Intermediate consumption (purchasers' p.)	5 924	324 055	193 589	341 267	117 103	106 856	124 196	223 512	61 361	28 605	1 526 468	290 113	190 321	7 729	232 805	-1 156	845 565	366 595	478 970	1 565 377	3 091 845
B.1g	Gross value added (basic p.)	1 834	75 170	50 647	172 630	112 945	113 508	69 936	124 351	107 923	27 762	856 706										
P.1	Output (basic p.)	7 758	399 225	244 236	513 897	230 048	220 364	194 132	347 863	169 284	56 367	2 383 174										
P.7	Import total	22 668	462 367	34 010	43 436	25 539	5 172	938	37 546	14 960	6 119	642 745										
	Import - international	7 133	312 712	2 704	29 061	25 539	5 172	938	33 536	1 379	1 097	419 271										
	Import - regional	15 525	139 655	31 306	14 375	0	0	0	4 010	13 581	5 022	223 474										
Resources total		30 416	861 592	278 246	557 333	255 587	225 536	195 070	385 409	184 244	62 486	3 025 919										

Source: own elaboration

Note: NPISH – Non-profit institutions serving households, FOB – Free on Board

TEACHING COMPETENCES AND THEIR ASSESSMENT: INTENTIONS AND REALITY

[1]✉Zdenka Gadusova, [2]Jana Hartanska

[1]Department of English and American Studies, Faculty of Arts, Constantine the Philosopher University in Nitra, Štefánikova 67, Nitra, 949 74, Slovakia, +421 905 537 611, zgadusova@ukf.sk

[2]Department of English and American Studies, Faculty of Arts, Constantine the Philosopher University in Nitra, Slovakia

Abstract

One of the currently most discussed issues within school education is the quality of teachers and the possibility for the objective assessment of their competences. Social requirements concerning the professional competences of teachers are constantly changing due to the rapid changes in the information and knowledge society. The assessment system, however, is resisting this pressure and opinions on the current situation of teacher assessment are not changing rapidly and substantially, as we found out in research carried out among 145 head teachers and 670 teachers in Slovakia. The paper presents selected data collected from questionnaire research related to the importance of selected teachers' professional competences that influence the success of their educational performance in comparison with the aspects of teachers' teaching performance head teachers most often assess. The obtained data will be used for the development of tools and instruments aimed at the assessment of teachers' professional competences.

Keywords

Assessment, head teacher, questionnaire, research, teaching competences

Introduction

Currently there are many methods (based either on observation or value-added models) of teacher's evaluation and assessment (Darling-Hammond, et al., 2016; Gustafsson, et al., 2015; Elmore and Fuhrman, 2001; Nichols, Glass, Berliner, 2006). The common feature of the majority of them is the effort to improve instruction and student learning, although, in general, they provide little evidence regarding the quality of teacher practice. Policymakers call for reliable and rigid assessment measures and means, but practitioners and researchers are doubtful of their validity.

When assessing teacher competences through classroom observation, not only are the relevant instruments crucial, but equally important are observers trained to use those instruments, which is not always the case. Classroom observation, aimed either at general teaching practice or focused on subject-specific techniques, can be conducted by a school manager or an outside evaluator, often an inspector. Research studies (Heneman et al., 2006; Brandt, et all, 2007; Jacob and Lefgren, 2005, 2008; Medley and Coker, 1987; Wilkerson, et al., 2000) showed that though school managers are aware of the context of their schools, they may not be trained in the utilization of assessment instruments, and their ratings of teachers may be subjective. Other researchers (Little, Goe and Bell, 2009; Stodolsky, 1990; Weber, 1987; Yon, Burnap, and Kohut, 2002) state that because of a lack of subject-specific knowledge school managers cannot make informed judgements.

Other studies examined reveal (Braun, 2005) that value-added models based on test scores are also problematic in making evaluation decisions for individual teachers, as gains

in student achievement are influenced by many more factors than any individual teacher. "Researchers have found that teacher effectiveness ratings differ substantially from class to class and from year to year" (Darling-Hammond, 2016, p.2) and most of them have concluded that value-added modelling is inconsistent and not appropriate as an instrument for assessing teachers (Briggs & Domingue, 2011).
The paper presents and discusses selected data collected from questionnaire research related to the importance of selected teachers' professional competences that influence the success of their educational performance in comparison with the aspects of teachers' teaching performance that head teachers most often assess.

Materials and methods

The data presented in the current paper was collected from questionnaire research carried out as a start-up activity for the research project APVV-14-0446 *Assessment of Teachers' Competences* which is planned for the period 1 July 2015 to 30 June 2019. The main aim of the research project is to develop and design a set of tools and criteria for the assessment of teachers' professional competences which will enable the evaluators of teacher performance to make their assessment more standardized and objective. The developed model for teacher assessment has the ambition to become not just a checking tool but to incorporate motivating and self-reflective elements of the job of teaching as well.
In the first stage of the project, the research team decided to map the current situation in the area of teacher assessment – who does this job, how do they do it, and how do assessed teachers perceive it. For this purpose, two questionnaires were developed – one for head teachers (further QHT) and another one for teachers (further QT) which to a large extent emulated the one developed for head teachers. The first five socio-demographic questions (further Q) asked about the respondents' gender identity, length of teaching experience and length of time in the position of head teacher or teacher, type and profile of their education, and type and location of the school they work at. The following six questions were directly connected with teacher assessment – inquiring about the frequency of assessment, the passing of this responsibility to other school managers or colleagues, the importance of some teachers' professional competences (Q8) and frequency of their assessment (Q9) and, finally, the impact of assessment on teachers. The last two questions in both questionnaires were aimed at discussing the possibility to introduce changes in the current assessment system. Finally, both groups of respondents, i.e. head teachers and teachers, could express their opinion about the current methods of teacher assessment.
Most questions in the questionnaires were closed ones offering the respondents some options to choose from. In question N° 8 (in the QHT) the respondents were asked to rate the stated competences according to a five-degree numeric scale in which number one represented the lowest value of importance and number five the highest. Question N°9 provided the respondents (head teachers) with 16 educational issues which the researchers had selected from various materials and observation forms currently used by head teachers and inspectors for teachers assessment. Using the provided five-level scale - *always, almost always, sometimes, almost never and never,* they could indicate which of the listed issues they pay attention to and how often they consider them in the assessment process. The questionnaires are used as qualitative research instruments; the obtained data is analysed via a simple statistical method. The findings are valid and will help enable the researchers to achieve their crucial objective, i.e. to design a model for teacher assessment as the outcome of the whole research project.
The questionnaires were distributed to school head teachers and teachers through our tea-

cher trainees leaving for teaching practice at schools as well as through some contacts the research team has with school (head) teachers. Thus, they were delivered to all regions of Slovakia, either in paper form or online. The questionnaire for teachers can be viewed via this link: https://docs.google.com/forms/d/1datDo-vqncYlRwGXFu6FBK8RdA-OIQx-siAHitmtAKyU/viewform and the questionnaire for head teachers via this link: https://docs.google.com/forms/d/1hdKeuc92D3wbenMf3W1sbthgGpXvZaSzDoR_0-8dK3E/viewform.

Currently, data has been collected from 145 head teachers and 670 teachers from schools all over Slovakia. The majority of head teachers (as well as teachers) were women (68.3%). The length of the respondents' teaching practice varies from 7 to 44 years and they have been in the head teacher's position from 1 to 33 years. The majority of them work in primary and lower secondary schools (76.6%) in the Nitra Region (48.3%), followed by the Žilina (13.1%) and Trenčín (11.7%) regions. However, the research team is still collecting questionnaires. It is important to state that by the time of submission of this paper, the gathering of both questionnaires has not been completed and their number is expected to increase.

Results and discussion

Respecting the extent and focus requirements of the paper, below are presented and discussed some of the most significant findings based on two questions only – question N° 8 and question N° 9, in the Questionnaire for Head Teachers. They are directly related to the teachers' professional competences that head teachers most often intend to assess and do assess in real teaching.

Question N° 8 focused on head teachers' opinions on the importance of the selected teacher's professional competences that influence the success of their educational performance (see Table 1).

CN°	Teachers' professional competences (C) that influence the success of their educational performance
1	ability to identify learners' developmental and individual characteristics
2	ability to identify psychological and social factors of learners' learning
3	ability to develop learners' personalities and their competences
4	ability to create and maintain positive atmosphere in class
5	ability to plan and implement their professional development
6	subject-related professionalism
7	ability to plan and manage educational process
8	ability to use a variety of teaching aids in educational process
9	ability to choose and use relevant teaching approaches, methods, techniques and forms
10	ability to self-reflect, assess educational process and evaluate learners' learning achievements

Table 1: Teachers' professional competences that influence the success of their educational performance listed in Q8, 2015 (source: own calculation)

Though we have exact data on how the competences listed in Table 1 were assessed by the head teachers addressed, we are not going to present all the details for each of the competences. Our intention is to compare the expressed vision (in Q8) of the head teachers with the reality stated in Q9 in the QHT and the perceived reality by the teachers in Q9 in the QT. That is why we simply summarize the findings based on the generalization of the data from Q8. The competences considered by head teachers in this question can be

split into two groups. In the first group there are competences (C1–C4) closely connected with knowledge of the psychological traits and personalities of learners. The majority of head teachers (from 71% to 91%) regarded these competences to be of very high importance for teachers' successful educational performance. The second group of competences (C6-C10) covers teachers' subject knowledge, and methodological and managerial skills. The importance of these competences was assessed differently. Subject knowledge (C6), managerial (C7) and assessment (C10) competences were considered to be highly important by more than 90% of respondents. Considerably less valued are teachers' abilities to choose and use relevant teaching approaches, methods, techniques and forms (80% out of the respondents regard C9 as very important). The least important competence was regarded as C8 – the ability to use teaching aids (only two thirds of head teachers shared this view). Teachers' ability to plan and implement their professional development (C5) stands out from the two groups of competences. Just 64.8% of respondents consider it very important.

Question N°9 tried to find out what aspects of teachers' teaching performance head teachers most often assess. The question provided the respondents with 16 educational issues which the researchers had selected from various materials and observation forms currently used by head teachers and inspectors. In the paper all the detailed findings from the question are not presented. The focus of the paper is placed upon just five items (further I) – I 1, I 2, I 4, I 6 and I 10, with a certain degree of interrelation with the relevant competences (C6, C7, C8 and C10) as listed in Q8. They will be presented in increasing order of congruence, starting with the lowest match and proceeding to the highest one. To confirm the discrepancies between head teachers' intentions and their real performance, we also state the findings from Q9 in QT (see Table 2).

QHT				QT	
Q8: Teachers' professional competences that influence the success of their educational performance		Q9: Aspects of teachers' teaching performance head teachers most often assess		Q9: Aspects that teachers' assessment is aimed at	
Item N°	Analysed aspect	Item N°	Analysed aspect	Item N°	Analysed aspect
7	ability to plan and manage educational process	1	check of written lesson plans	1	check of written lesson plans
		2	structure and management of the lesson	2	structure and management of the lesson
10	ability to self-reflect, assess educational process and evaluate learners' learning achievements	6	assessment and evaluation of learners' achievements	6	assessment and evaluation of learners' achievements
6	subject related professionalism	4	knowledge of school subject	4	knowledge of school subject
8	ability to use a variety of teaching aids in educational process	10	use of teaching aids	10	use of teaching aids

Table 2: List of analysed and compared aspects from QHT (Q8 and Q9) and QT (Q9), 2015 (source: own calculation)

As mentioned earlier in the part "Materials and methods", the seventh competence in

Q8 in the QHT addressed *teachers' ability to plan and manage the educational process*. Though a vast majority of the respondents regard the competence to be of very high importance (93.1%), the data from Q9 surprisingly shows a different, contradictory reality. Here head teachers state they check teachers' written lesson plans only sometimes (65%), almost never (36%), or never (26%). Thus, only 11.7% out of the respondents do it always or almost always. This is the lowest congruence out of the all discussed educational aspects. We can assume that head teachers do not find formal lesson planning that influential on the quality of the real observed and assessed educational process. On the other hand, the tenth examined educational aspect – whether *the head teacher assesses the structure and management of the lesson*, shows a higher degree of congruence with the previous research findings, as 82.1% of the respondents claim they do it always or almost always. It can be concluded that sometimes a number of head teachers do not really assess what they claim is important to be assessed, or they consider real teacher performance in its multifaceted complexity at the lesson more significant and decisive. Furthermore, another reason may also be a lack of time for checking the written lesson plan, or head teachers' reluctance to deal with additional administrative work.

Additionally, the analysis of the data from the QT (Q9, item 1) proves the claims of head teachers, as one third of the research sample of respondents states their head teachers either never check their written lesson plans (35%), or they do it almost never (17.9%) or sometimes (33.3%), and only 13.8% out of them check lesson plans almost always or always (c.t 11.7% of the head teachers). Interestingly, the perception of reality by both groups of respondents is very similar, as is the experience of teachers with their head teachers' assessment of the structure and management of their lessons: 86.3% of the teachers hold the view their head teachers assess educational aspects almost always or always (c.t. 82.1% of the head teachers).

The other chosen educational aspect with the second lowest congruence with the relevant competences listed in both questions – Q8 and Q9, is *teachers' ability to assess instruction and impact of the lesson on their learners' educational achievements* (mentioned as the tenth one in Q8 in QHT, Table 2). A vast majority (91%) of the research sample of head teachers regard this competence to be of high importance (as expressed in Q8). Surprisingly, the analysed data stated in Q9 (I 6) reveals that head teachers pay much less attention to this competence; only 74% of them assess it almost always or always and 21.8% sometimes. Similarly, an obvious discrepancy can be noticed between head teachers' intentions of what to assess and their implementation in real practice. To have a more complex view of the discussed topic, the research sample of teachers demonstrated the same opinion in the Questionnaire for Teachers (Q9); this time, 73% of them claim the head teacher assesses teachers' ability to diagnose and assess their learners almost always or always.

The next analysed aspect *teacher's knowledge of school subject and subject-related professionalism* (stated in the QHT as the sixth item, Table 2) reveals a discrepancy of more than 8% between the data obtained from Q8 and Q9 (I 4). Even though a clear majority of head teachers (91.7%, Q 8) consider this competence to be of high importance, in fact, not that many of them focus their assessment on it; just 83.5% out of the respondents claim they do it; 12.4% do it sometimes (Q9). Surprisingly, the data from the QT (I 4 in Q9) shows that only 73.6% of the research sample of teachers claims their knowledge and mastery of the subject is assessed almost always or always. It can be concluded that the difference of more than 10% is quite significant and its reasons must be an issue for a future deeper analysis of more valid data.

The last presented aspect *teacher's abilities and skills to use a variety of teaching aids*

in the educational process shows the highest congruence with the relevant competences listed in both Q8 (I 8 in Table 2) and Q9 (I 10 in Table 2). Three quarters of head teachers (75.8%) claim they find a teacher's ability and skills of very high importance and 80.7% out of them assess it almost always or always. Also, as data from the Questionnaire for Teachers show, 75.7% of teachers state this competence is assessed by their head teacher almost always or always. A reason for the high congruence of this aspect may be its visibility and ease of observation in lessons. Even though not all head teachers regard the competence that highly influential, it is obvious that both groups of respondents find using modern non-technical and technical media natural and a matter of course. On the other hand, one could expect a higher percentage of relevant positive responses.

Conclusion

Even the limited number of questionnaire items discussed above shows that the assessment of teachers is a very broad and diverse area which different assessors approach in different ways. Furthermore, their awareness of the aspects to be assessed (c.t Q N°8 results of the research) does not guarantee they really assess what they intend to assess (c.t Q N°9 results of the research) and they do it objectively. As mentioned in the Introduction, the performed research studies focused on different assessors – internal: peers and head teachers; and external: (inspectors, municipal administrators (Elmore and Fuhrman, 2001; Gustafsson et al., 2015; Jacob and Lefgren, 2008; Little et al., 2009; Yon et al. 2002) and different approaches to assessment – some based on observations (Stodolsky, 1990) and some on students' achievements (Braun, 2005; Little at al., 2009; Nichols at al., 2006). Similarly, in Slovakia assessment of teachers is also done by different assessors and bodies who do not share the same assessment instruments, nor the same standards. The majority of the assessment tools were developed by individual institutions (school inspection ones) or assessors (head teachers) and furthermore, they are not publicly accessible, as they are considered to be confidential. This deliberately hazy situation prompted the research team to carry out research in the field of teachers' competences (they started with mentor competences – see Bilíková et al., 2014; Gadušová and Harťanská, 2015; Hockicková and Žilová, 2015; and continued with novice teachers – see Gadušová and Vítečková, 2014 and 2015; Gadušová et al., 2014) and currently the research is aimed at assessment of teachers' competences, a prior task of which is to design more objective and reliable assessment tools and criteria for which the questionnaire research was a correct and valuable springboard in mapping the situation.

Considering the obtained results on a national level, in particular the significant discrepancy between the intentions and reality in head teachers' assessment of performance, makes the research team confident in the value of their research and the tasks they want to complete within the following years of the project run, which are to design new approaches to teacher assessment and offer new tools and instruments for teacher assessment based on prior piloting and discussion with the stakeholders, as well as criteria and guidelines on how to use them. The research team believes that the new challenges for school education in the 21st century must also be reflected in the ways in which teachers are assessed in order to make the assessment process more unified, standardized and objective, and last, but not least, to make it less stressful, more teacher-friendly and humanistic.

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STATISTICAL EVALUATION OF TEST SIMILARITIES AT THE UNIVERSITY OF ECONOMICS, PRAGUE

[1]Filip Habarta, [2]✉Petr Mazouch, [3]Kristyna Vltavska

[1]Faculty of Informatics and Statistics, University of Economics, Prague, Czech Republic

[2]Department of Economic Statistics, Faculty of Informatics and Statistics, University of Economics, Prague, nám. W. Churchilla 4, Prague, 130 67, Czech Republic, +420 224 095 453, mazouchp@vse.cz

[3]Department of Economic Statistics, Faculty of Informatics and Statistics, University of Economics, Prague, Czech Republic

Abstract

The fact that testing knowledge by means of multiple-choice tests with a single correct answer may lead to unnaturally similar results among applicants sitting next to each other is well known. The article introduces a probability model that can indicate – with a chosen level of significance – couples of applicants whose results are similar. The aim of the approach is not to find specific persons who copied their tests with a certain likelihood but to assess the processes that influence realizing the given test. Besides defining the problem theoretically, the article also features practical application on data from the entrance exam to the Faculty of Informatics and Statistics in the academic years 2014/2015 and 2015/2016. Results show that pairs of applicants suspected of copying their tests were found in both academic years. The problem of copying was especially located in spacious lecture halls.

Keywords

Multiple-choice test, cheating, probabilistic model, entrance exam

Introduction

Cheating in the more or less sophisticated way appears almost everywhere and academic area is not an exception. More likely, we can expect people to cheat at multiple choice tests. Some of the cheating can be prevented by taking precautionary measures for assessing the results of those measures we can use various statistical methods that can on precise level of significance flag cheaters.

General view on the topic is given by Cizek (1999). More focus just on statistical methods can be found in Kingston and Clark (2014). The quality of tests were discussed in many other papers like Kaspříková (2013) or Brožová and Rydbal (2013).

First methods used for revealing cheaters based on the answers on the test appeared in the 1960 (Saupe, 1960). With development of computing power more methods appeared, for example study of Frary (1993) or Harpp and Hogan (1993). Among the papers following the newest statistical trends we can mention Belov and Armstrong (2010) and Linden and Charles (2014) but there are also some older works as Lord (1980) where questions about testing teory is discussed.

In this case study we apply a theoretical model created by Weselowsky (2000) and show our application of this model on the data from the entrance exams to the Faculty of Informatics and Statistics. This should make an example of how to apply this or similar basic models on the available test data to evaluate problem of cheating at the given tests.

In the first part of this study we focus on the overall basic description of the entrance exams to the Faculty of Informatics and Statistics. We show a short introduction to the theoretical model that is used for discovering cheaters and present the structure of available data. Moreover, we show the specific application of the theoretical model on the data for the entrance exam to the Faculty of Informatics and Statistics and results of this application. Finally, we discuss the results and overall conclusion focused mainly on the basic principles of applications of the statistical methods for revealing cheating people after the test.

Aim of the paper is to introduce basic model to evaluate system of tests where multiple choice answers are used and apply this analysis to real example of Faculty of Informatics and Statistics. Results of this model could help to eliminate cheating at tests and help to test student's real knowledge.

Data

For the analysis we use the data from the entrance exams which took place in June 2014 and June 2015. We use only data from the mathematics which consists of 15 questions (the first ten questions worth of 50 points as the last five of them).

From the anonymized set of applicants we obtained a seating order, gender and study programme. Other sets of data provided us with concrete answers of all applicants on each question and with the correct answers divided by exam variant they wrote and also with the final score of the applicant (used for control).

The entrance exam is created as multiple choice with only one correct answer. Measures taken to prevent cheating during the test are following:

1. There are several variants of each test. There are two different tests in each testing room which are distributed in the way that the person on the left and right hand side of you always gets a different version.
2. Sitting order is generated randomly and it is obligatory for applicants. Applicants are expected to sit next to each other. However, not all the students invited to the entrance exam actually arrive to the test. Thus, there may occur gaps between applicants. This rule is set to eliminate that people who knows each other would sit next to each other.
3. There are at least two teachers in each room who control the process of exam and possibly discover cheating students. In our example in all rooms two teachers were.

Methodology

For the application we chose a model created by Weselowsky (2000). This model belongs to the group of models that are less complicated and work with less assumptions than some other more complex models based on the Bayesian statistics or Item response theory. We use several assumptions. Firstly, we expect students suspected from cheating sitting next to the neighbour on the left or right. That means we always suspect a pair of applicants from cheating at once not distinguishing the source and the copier. Secondly, we assume that we know an answer to each question from each student and correct answers to all questions.

Our goal is to test of hypothesis that "Chosen pair of applicants cheated" (H_0) against hypothesis that "Chosen pair of applicants didn't cheat".

We need to find test criterion with its probability distribution while H_0 is valid. Let's assume (Weselowsky, 2000):

n = number of applicants in the class,

q = number of questions within the exam,
m_{jki} = the probability of a match between applicants j and k within question i,
p_{ji} = probability of applicant j being correct on question i,
r_i = proportion of the class that answered correctly on question i,
c_j = proportion of questions answered correctly by applicant j,
w_{ti} = the probability that, given the answer is wrong, wrong choice t is chosen on question i.

We want to find a probability of a match in a question between two applicants. This probability can be divided in to two probabilities. The first one when both of them answer correctly. Thus, the probability is

$$m_{jki} = p_{ji} p_{ki} \tag{1}$$

The other possible option represents when both of applicants answer the question with the same wrong answers. Then

$$m_{jki} = (1 - p_{ji})(1 - p_{ki}) \sum_{t=1}^{v_i} w_{ti}^2 \tag{2}$$

There are many ways how to estimate p_{ij} from the simpliest assumptions like that each answer has the same probability of being chosen to the most advanced models using logistic regression for the estimation. In our case we stay somewhere in between of these two approaches. We assume that it is more likely to answer the question correctly if an applicant did well in the test (ratio of wrong answers on the test) and also if the question was less difficult (ratio of wrong answers on the question). Based on this assumption we get ability coefficient a_j for each student from equation (3).

$$(-qc_j) \sum_{i=1}^{q} (1 - (1 - r_i)^{a_j})^{\frac{1}{a_j}} = 0 \text{ ; for: } i = 1,\ldots, q \tag{3}$$

When ability coefficient $a_j = 1$ then the applicant is expected to do as well as the average test taker. Test taker with $a_j < 1$ is expected to be worse than an average one and vice versa for test taker with $a_j > 1$.

Using ability coefficient a_j we get the estimated probability

$$\hat{p}_{ji} = (1 - (1 - r_i)^{a_j})^{\frac{1}{a_j}} . \tag{4}$$

The final estimate of a probability of a match on a question is in the equation (5).

$$\hat{m}_{jki} = \hat{p}_{ji} \hat{p}_{ki} + (1 - \hat{p}_{ji})(1 - \hat{p}_{ki}) \sum_{t=1}^{v_i} \hat{w}_{ti}^2 \text{ ; for } j = 1,\ldots, n\text{-}1;\ k = j\text{+}1,\ldots, n;\ i = 1,\ldots, q \tag{5}$$

As a probability distribution we use compound binomial distribution. Since we have q independent bernoulli processes where each of these processes represents a chance of both applicants are answering the question same. Detailed description can be found in Weselowsky (2000).

The last step represents setting the right level of significance α. In this case we compare all the possible pairs in the given group $(n^2\text{-}n)/2$ (where n is the number of test participants). This is a case of multiple hypothesis testing. We adjust the level of significance by using bonferoni inequality. Level of significance will then become our chosen α divided by N. Different seating plans may change calculation of the final level of significance (for more information see Weselowsky, 2000).

Data were processed by created Matlab script (Habarta, 2015) employing previously described methodology. The script imports data in the given format and exports a table with results, see table 1.
For generating a compound binomial probability distribution we use a recursive formula (Linden and Jeon, 2012). This recursion is very computationally complicated and takes a lot of time to process. Due to that it is used just for the pairs already flagged by normal approximation on the higher level of significance.

Results

Every year there were around 650 applicants attending the entrance exam. After sorting applicants to the groups that could possibly cheat (by variant and place) we receive 18 different groups of applicants for testing for each year. Example of how the test results looks like for one concrete group is given in table 1.
Table 1 shows that there are 3 suspected pairs of applicants flagged out of 77 applicants taking test. First two pairs had 11 identical answers out of 15 and the third pair had all 15 answers identical.

Flagged pair	1	2	3
First person ID	2	44	68
Second person ID	57	60	84
Standardized normal value	3.2	3.6	4.9
Number of identical answers	11	11	15
Evaluating criterion (α = 0.01)	0.0008	0.00025	0.00000017
Evaluating criterion (α = 0.05/N)	2.4	0.72	0.0005
Score for first person	0.53	0.47	0.53
Score for second person	0.40	0.33	0.53
Number of applicants	77		

Table 1: Example of results of three pairs of applicants (from 77 tests in total) with significant level of test similarities (source: authors' calculations)

The most important part of this table represent rows containing evaluating criterions. First *Evaluating criterion (α = 0.01)* let us reject the hypothesis that this pair was cheating if it is higher than *0.01*. This criterion is usable when we have some prior evidence of cheating about that pair (e.g. report from test supervisors). Second *Evaluating criterion (α = 0.05/N)* let's us reject the hypothesis that this pair was cheating if it is higher than *0.05*. Pairs that do not pass this test were almost surely cheating during the entrance exam and we can flag them even without a prior evidence.
After processing all groups and both years we receive numbers of flagged students during the entrance exams (table 2). We can see that all pairs flagged by the second *Evaluating criterion (α = 0.05/N)* where found in adjacent seating. This proves the strength of the second *Evaluating criterion (α = 0.05/N)*. Note that we didn't use the information about seating plan until we got the results from the analysis.

Academic year	Level of significance		Pairs of Students found in adjacent seating*
	α = 0.01	α = 0.05/N	
2014/2015	22	5	5
2015/2016	9	4	4

Table 2: Result of the analysis of test similarities from admission 2014/2015 and 2015/2016 for all applicants in mathematics (source: authors' calculations; note: * according to seating plan)

Discussion

Table 2 proves that cheating at the entrance exams to the Faculty of Informatics and Statistics does not pose a problem. Although there are a few applicants each year who are probably copying answers it presents less than 1% of all applicants. If we take less conservative criterion ($\alpha = 0.01$) than it is under 3% of applicants.

Tests took place in lecture halls that could be divided in to two categories by their size, small (rooms up to 190 seating that means around 95 applicants) and big (rooms with 250 and 450 seating). Using this differentiation we can say that there were more suspected pairs in the big lecture halls (usually 3-4) than in the small ones (usually 1-2).

From the number of seats of suspected pairs we found out that 7 out of 9 pairs were in the second half of the room in the direction from the desk. This suggests that supervisors should pay more attention to the students sitting further away from the desk. There is no significant difference that applicants incline to cheat in different groups of questions (for example questions with more points).

Arrangements against cheating are applicable a priori or a posteriori. A priori methods eliminating cheating could be (UOW, 2016):

- Using multiple versions of the exam,
- Using randomized assigned seating for exam,
- Space students at least one seat apart,
- Have at least one proctor per 20 students and remind them of the importance of monitoring students carefully for the duration of the exam.

A posteriori methods (as one of those was described in this article) are based on evaluation of responses if there are not many "similar" answers. This method is widely used in some universities as McGill University in Canada where "Responses on multiple-choice examinations are normally checked by the Exam Security Computer Monitoring Program. The program detects pairs of students with unusually similar answer patterns on multiple-choice examinations. Data generated by this program can be used as admissible evidence, either to initiate or corroborate an investigation or a charge of cheating." (McGill, 2016)

Conclusion

Goal of evaluating the extension of the problem of cheating during entrance exams was successfully accomplished. We managed to find applicants suspected from cheating and were able to confirm that by comparing them with the seating plans. We showed that the problem of cheating concerns just minority of applicants.

The best way to approach this problem lies in advising supervisors focusing more on the back of the lecture halls. The next preventive measure could also reflect more the size of the lecture halls. It could be also advice to control the results regularly each year and in case there would be a spike in the number of suspected pairs adopt more preventive measures. Other way is to apply system known from some universities as McGill University in Canada where suspicion of cheating can cause investigation or charge of the student.

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TWO-STAGE DEA MODEL FOR COMPARING THE EFFICIENCY IN TERTIARY EDUCATION

Jana Hanclova

Department of Systems Engineering, Faculty of Economics, VSB-Technical University of Ostrava, Sokolska tr. 33, Ostrava, 701 21, Czech Republic, +420 597 322 285, jana.hanclova@vsb.cz

Abstracts

The purpose of this paper is to examine the possibility of efficiency measurement in countries in the context of tertiary education in the public institutions during years 2013 and 2014. We investigate the two-stage process using output oriented DEA model. The first stage measures the efficiency of education process for bachelors, masters and doctoral students. The second phase evaluates the efficiency of the possible graduates´ employability in the labor market in the European Union. We estimate the efficiency for each stage and the overall efficiency using centralized cooperative DEA model and projection frontier model. We divide the examined countries in the context of the overall efficiency scores for the two-stage process into 4 groups using quartile values. The results show that the average overall efficiency has improved during years 2013 and 2014.

Keywords

Data envelopment analysis, efficiency decomposition, employability, graduates, tertiary education, two-stage process

Introduction

The tertiary education sectors of many countries obtain at least some of their income from public funds. This is the most important for the performance at national level. The tertiary education sector has characteristics which make it difficult to measure the efficiency (Johnes, 2006): it is non-profit making; there is an absence of output and input prices; and higher education institutions produce multiple outputs from multiple inputs. The determinants of education efficiency are also analysed in the paper by Maryska, Novotny and Doucek (2010).

An assortment of methodological approaches has been employed in an effort to resolve the problem of efficiency measurement - ordinary or panel least squares regression (OLS) methods, frontier methods as data envelopment analysis (DEA) (Johnes, 2006, Melecky and Stanickova, 2014) and also stochastic frontier analysis (SFA) (Izadi et al., 2002).

DEA studies related to universities' level efficiency evaluations appeared somewhat earlier than the SFA studies. The first studies employed the cross sectional data. Ahn et al. (1988) and Breu et al. (1994) applied DEA to U.S. higher education using 1984 and 1992 academic year data. Two studies of the United Kingdom universities, Athannassapoulos and Shale (1997) and Glass et al. (2006), used the production related to data for 1992 and 1996. McMillan and Chan (2006) provided efficiency estimations for year 1992 for Canadian universities. The education efficiency scores among all studies is in range from 0.14 to 1.00.

Agasisti and Johnes (2009) employed DEA to compare the technical efficiency of 57 Italian and 127 English public universities. They analysed efficiency trends over years 2002-2005. They found institutions in England are more efficient (over 0.81) than those

in Italy (about 0.70). They also saw that Italian universities have improved their technical efficiency while English universities have stable scores.
The purpose of this paper is to explore the issue of technical efficiency measurement in the tertiary education of the public institutions in the EU countries between years 2013 and 2014. The rest of the article is organized as follows. Section Materials and Methods provides formulation and estimation of efficiency using output-oriented and also two-stage DEA model. We also specify inputs, intermediate measures and outputs. In section Results and Discussion is our model applied to the data and we examine the differences between efficiency in each stage and overall efficiency. Conclusions are given in the last part.

Materials and Methods

The efficiency of two-stage process

Data envelopment analysis (DEA) is a method for measuring the efficiency of peer decision making units (DMUs), in presence of multiple inputs and outputs (Charnes, Cooper and Rhodes, 1978 and Hanclova, Banarova and Nemec, 2013). Recently, DEA has been extended to examine the efficiency of two-stage processes, where all the outputs from the first stage (S1) are intermediate measures that make up the inputs to the second stage (S2). The resulting two-stage DEA model provides not only the overall efficiency score for the entire process, but as well yields the efficiency score for each of the individual stages.

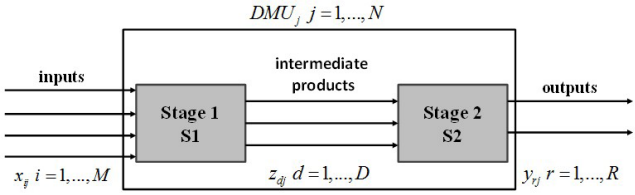

Figure 1: Two-stage process (source: own calculation)

Seiford and Zhu (1999) developed DEA approach for evaluation of US commercial banks in a two-stage process characterized by profitability and marketability. They applied the standard DEA approach to each stage, which did not address potential conflicts between the two stages arising from the intermediate measures. The next study sought alternative ways to address the conflict between the two stages or to provide efficiency scores for both individual stages and the overall process. Liang, Cook and Zhu (2008) investigated the two-stage processes via concepts adopted from non-cooperative and cooperative games. The resulting models were linear and the overall efficiency was a product of the efficiencies of the two individual stages. When there was only one intermediate measure connecting the two stages, both the non-cooperative (with leader-follower assumption) and cooperative models provided the same results as if the standard DEA model would be applied to the two steps separately and the efficiency decomposition was unique. Liang, Cook and Zhu (2008) developed **the centralized (C) or cooperative** DEA model under multiple intermediate measures where the overall efficiency decomposition was unique. This model provided a set of optimal weights on the intermediate factors that maximizes the global efficiency scores, i.e. efficiencies of both stages are evaluated simultaneously. Chen, Cook and Zhu (2010) developed an approach for determining the DEA frontier or DEA projections for inefficient DMUs.
Consider a two-stage process, as it is shown in Figure 1, for each of a set of N DMUs. We

assume each $DMU_j\ (j=1,2,\ldots,N)$ has M inputs $x_{ij},(i=1,2,\ldots,M)$ to the first stage and D outputs $z_{dj},(d=1,2,\ldots,D)$ from that stage. These D outputs then become the inputs to the second stage and are referred to as intermediate measures. The outputs from the second stage are $y_{rj},(r=1,2,\ldots,R)$. For each DMU_j we denote the efficiency for the first stage as e_j^1 and the second as e_j^2. On the basis of the radial (CRS - constant return to scale) output-oriented DEA model we define:

$$e_j^1=\frac{\sum_{i=1}^{M} v_i\, x_{ij}}{\sum_{d=1}^{D} w_d\, z_{dj}} \text{ and } e_j^2=\frac{\sum_{d=1}^{D} \tilde{w}_d\, z_{dj}}{\sum_{r=1}^{R} u_r\, y_{rj}}, \tag{1}$$

where $v_i, w_d, \tilde{w}_d$ and u_r are unknown non-negative weights. It is assumed that $w_d=\tilde{w}_d$ for all *d.* If the *output-oriented DEA model* is used, then the two-stage **overall cooperative efficiency** is defined as decomposition of $e_o^{1,coop}$ and $e_o^{2,coop}$:

$$e_o^{coop}=e_o^{1,coop}\cdot e_o^{2,coop}=\min\left(e_j^1\cdot e_j^2\right)=\frac{\sum_{i=1}^{M} v_i\, x_{io}}{\sum_{r=1}^{R} u_r\, y_{ro}} \tag{2}$$

$$s.t.\ e_j^1\geq 1 \text{ and } e_j^2\geq 1,\quad j=1,2,\ldots N.$$

As indicated in Chen, Cook and Zhu (2010), the centralized model (2) does not provide information on DEA projection. They developed models for determining the DEA projection for the inefficient DMUs. The output-oriented **projection frontier** (PF) model can be expressed as the dual model:

$$\begin{aligned}
\max\quad & \tilde{\phi}\\
s.t.\quad & \sum_{j=1}^{N}\lambda_j\, x_{ij}\leq x_{io},\quad i=1,2,\ldots,M,\\
& \sum_{j=1}^{N}\mu_j\, y_{rj}\geq \tilde{\phi} y_{ro},\quad r=1,2,\ldots,R,\\
& \sum_{j=1}^{N}\lambda_j\, z_{dj}\geq \tilde{z}_{do},\quad d=1,2,\ldots,D,\\
& \sum_{j=1}^{N}\mu_j\, z_{dj}\leq \tilde{z}_{do},\quad d=1,2,\ldots,D,\\
& \tilde{z}_{do}\geq 0,\quad d=1,2,\ldots,D,\quad \tilde{\phi}\geq 1,\lambda_j\geq 0,\mu_j\geq 0,\quad j=1,2,\ldots,N,
\end{aligned} \tag{3}$$

where $\tilde{z}_{do}$ represents the set of new intermediate measures to be determined as "outputs" in the third set of constraints and also as "inputs" in the fourth set of constrains.

Issue in specification of outputs and inputs

There are considerable problems of specification and measuring the inputs and outputs in the DEA model (Bazsova, 2015). We focus on measuring the efficiency of tertiary

education process and the possible graduation employability in labour market in the European Union using the output-oriented DEA model. We use DEA frontier for two-stage processes with the first stage (S1) evaluating the efficiency of tertiary education process and the second stage (S2) measuring graduation employability in labour market. We provide comparing the technical efficiency on a national level in years 2013 and 2014. The data were obtained from the Eurostat database[1] - Population and social conditions – Education and training (edtr) and Labour market (labour). The inputs to the first stage are: ENRT_B = number of students enrolled in tertiary education on the Bachelor's level in the public institutions with intensity of participation representing full-time equivalents [educ_uoe_enrt01], ENRT_M = number of students enrolled on the Master's level [educ_uoe_enrt01], ENRT_D = number of students enrolled on the Doctoral level [educ_uoe_enrt01] and TAS = total in full-time equivalents of classroom teachers and academic staff on the public universities [educ_uoe_perp02]. There are three intermediate measures between the two stages: GRAD_B = total number of graduated Bachelors in the public institutions [educ_uoe_grad02], GRAD_M = total number of graduated Masters [educ_uoe_grad02], GRAD_B = total number of graduated doctoral students [educ_uoe_grad02]. The outputs from the second stage are from the Eurostat database1 - population and social conditions - labour market - employment and unemployment - detailed annual Labour Force – employment by educational attainment level (lfsa_egaed): EMPL20-24 = employed persons with tertiary educational attainment level and with age for 20 to 24 years, EMPL25-29 = employed persons with tertiary educational attainment level and with age for 25 to 29 years.

The two stage application involves 23 countries in the year 2013: Belgium (BE), Bulgaria (BG), Czech republic (CZ), Germany (GE), Ireland (IE), Spain (ES), Croatia (HR), Italy (IT), Cyprus (CY), Lithuania (LT), Hungary (HU), Malta (MT), Netherland (NL), Austria (AT), Poland (PL), Portugal (PT), Romania (RO), Slovenia (SI), Slovakia (SK), Finland (FI), Sweden (SE, Norway (NO) and Yugoslav Republic Macedonia (MK). There are missing data for 7 countries (IE, HR, PL, SI, SE, NO, MK) in the year 2014, therefore 16 countries are evaluated in 2014 by DEA model.

Results and Discussion

The efficiency scores for each stage and also the overall efficiency are presented in Table 1 for years 2013 and 2014. The efficiency scores that result from the centralized (C) cooperative DEA model (2) are presented in first three columns - from C2013-all up to C2013_S2 for year 2013 and similarly in the 5th – 7th column for the year 2014. The overall efficiency scores for the output-oriented projection frontier (PF) model (3) are in the 4th and 8th column. Output orientation focuses on the amount by which outputs can be proportionally increased without increasing in the inputs.

The first step of the analysis is the classification of the **overall efficiency scores** for the two stage processes based on 4 groups - quartile values in the year 2013. The first group with the overall efficiency scores from 1.076 up to Q1=3.119 includes CY, MT, MK, BE, NL, HR, NO and SI. The second group contains SE, PL, LT and IE with the upper limit Q2= 3.454. We involve ES, HU, BG, SK, RO and FI into the third group with the overall efficiency less than Q3=4.943. There are 5 countries which belong into the last group. Group with very poor technical efficiency up to the level 8.444 include DE, CZ, AT, PT and IT. The results obtained in 2014 are not fully comparable because we have different number of countries for the rest of the years. It is also necessary to note that there are

1 http://ec.europa.eu/eurostat/data/database

missing countries in year 2014 which had the education efficiency equal 1.00 in 2013 (HR, PL and MK). It can be stated that the changes in the classification of countries based on 4 groups for years 2013 and 2014 are not relatively very different. Improvement in the overall efficiency is detected in ES and HU, while worsening of the technical overall efficiency is recorded for the NL. Figure 2 demonstrates a level and variability changes comparing the average overall efficiency in 2013 and 2014. The results show that the average overall efficiency is improved from 3.819 to 2.850 under a relatively constant variability. The comparison of obtained empirical results as a two-stage process in education with other empirical results cannot be done resp. it cannot be comparable. It is caused by the inclusion of two degrees and also by terms of time, space and the inclusion of other inputs and outputs.

At the next step of the analysis we can compare the efficiency of **education process** and also **graduation employability in labour market** in the second stage of the DEA model. Figure 2 shows that the efficiency of the second stage is much more serious problem than efficiency in the first stage - education process (the average efficiency for the first stage is 1.520 in year 2013 and 1.550 in year 2014; the average efficiency for the second stage is 2.551 in year 2013 and 1.897 in year 2014). We can also see on Figure 2 that the average efficiency is improving in the second stage of the DEA model which may be caused by missing data (countries). Therefore, the main problem of tertiary education in the EU is the possibility graduation employability in the labour market. In nowadays there are not empirical results of efficiency evaluation of graduation employability in labour market for European universities on countries level.

The DEA studies related to the **one-stage education efficiency** evaluation, mentioned in the introduction, show that the output-oriented education efficiency score is from 1.00 to 7.14. The results obtained in this study are in the range from 1.00 to 2.57. In terms of comparison of the trend lines of university efficiency development, we found concordance with the conclusions of Agasisti and Johnes (2009), i.e. Italian universities improved their technical efficiency – from 1.62 (C2013_S1, IT) into 1.32 (C2014_S2, IT). Sav (2012) also provided data envelopment analysis of graduation rate efficiencies across public and private universities. The analysis was based on panel data from the USA. Carnegie classified the masters universities over four academic years (2005-2009). The DEA estimation of the mean graduation efficiency for four years was equal to 1.76 for the public universities. We received the mean education efficiency equal to 1.54 for the two years.

DMU	C2013_ all	C2013_ S1	C2013_ S2	FP2013_ all	C2014_ all	C2014_ S1	C2014_ S2	FP2014_ all
BE	2.304	**1.000**	2.304	2.304	1.414	1.000	1.414	1.414
BG	4.042	1.017	3.973	4.042	2.643	1.173	2.253	2.643
CZ	**5.472**	1.893	2.890	5.472	4.005	1.527	2.623	4.005
DE	5.426	2.383	2.277	5.426	4.649	2.567	1.811	4.649
IE	3.454	1.863	1.854	3.454				
ES	3.510	**1.000**	3.510	3.510	1.948	**1.000**	1.948	1.948
HR	3.119	**1.000**	3.119	3.119				
IT	8.444	1.621	5.210	8.444	5.204	1.315	3.957	5.204
CY	1.076	1.076	**1.000**	1.076	**1.000**	1.000	1.000	**1.000**
LT	3.280	1.564	2.098	3.280	2.041	2.041	**1.000**	2.041
HU	3.911	1.726	2.267	3.911	2.522	1.893	1.332	2.522
MT	1.108	**1.000**	1.108	1.108	**1.000**	1.000	1.000	**1.000**
NL	2.858	1.887	1.515	2.858	1.958	1.891	1.035	1.958
AT	5.930	2.292	2.587	5.930	2.064	2.064	**1.000**	2.064
PL	3.257	**1.000**	3.257	3.257				
PT	6.164	1.638	3.762	6.164	4.845	1.783	2.718	4.845
RO	4.595	1.505	3.052	4.595	3.052	1.320	2.313	3.052
SI	3.159	1.260	2.508	3.159				
SK	4.215	1.315	3.206	4.215	3.453	1.095	3.152	3.453
FI	4.943	1.663	2.971	4.943	3.801	2.126	1.788	3.801
SE	3.231	2.178	1.484	3.231				
NO	3.134	2.072	1.513	3.134				
MK	1.215	**1.000**	1.215	1.215				

Table 1: The efficiency scores for output-oriented model, 2013 and 2014 (source: own calculation)

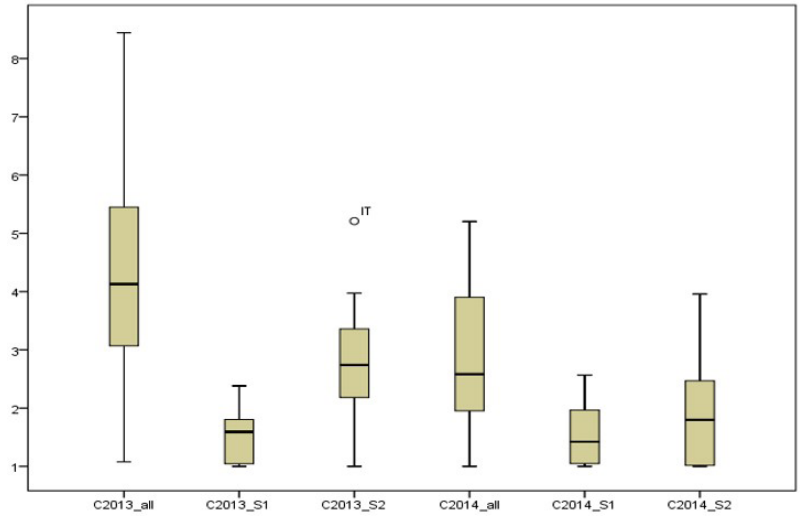

Figure 2: Technical efficiency scores for all countries, 2013-2014 (source: own calculation)

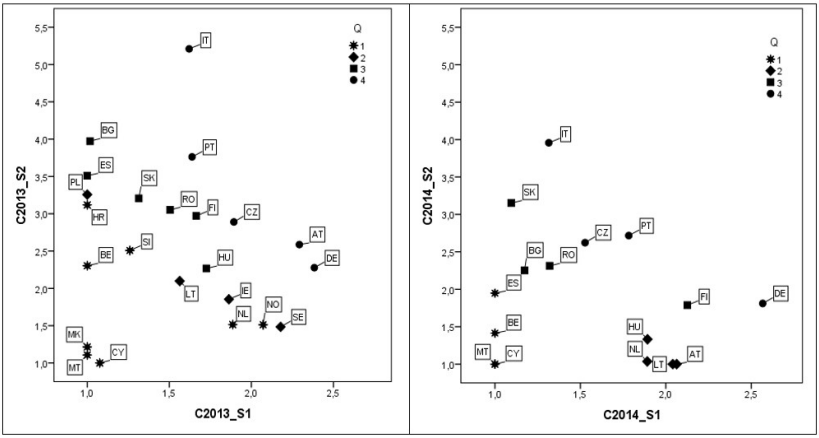

Figure 3: Classification of the countries into 4 groups, 2013 and 2014 (source: own calculation)

The following Figure 3 presents the classification of surveyed countries in 4 groups according quartile values of the efficiency in the first and second stage of DEA modelling examined in each 2013 and 2014. The results show that the benchmark countries according to the efficiency of the two-stage process are MT, CY and MK. We can also see a group where HU, NL, LT and AT are included where there is higher efficiency in the first stage of education process in year 2014 with comparison of efficiency in the second stage. On the other hand, there are countries as BG, ES, SK and RO, where the predominant problem of inefficiency is only in the second stage. The worst efficiency in the process of graduates' opportunities in employability in labour market is for IT, but it seems that this situation has been slightly improved since year 2014.

Conclusion

We examine the possibility to measure the efficiency in countries in the context of tertiary education in the public institutions during years 2013 and 2014. The first stage measures the efficiency of education process for bachelors, masters and doctoral students. The second stage evaluates the efficiency of possible graduates' employability in labour market in the European Union. We estimate the efficiency for each stage and also the overall efficiency using centralized cooperative DEA model and projection frontier model.

The first stage of the analysis is the decomposition of the overall efficiency scores for the two-stage processes into 4 groups using quartile values. It can be stated that the changes in the classification of countries during year 2013 and 2014 are not relatively very different. The results show that the average overall efficiency is improved under a relatively constant variability. At the next stage of the analysis we can compare the efficiency of education process and graduates' employability in labour market. According to the efficiency of the two-stage process, the results show that the benchmark countries are MT, CY and MK.

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PREPARATORY COURSE FOR STUDENT MOBILITY AND ITS EVALUATION

[1]✉Krystyna Heinz, [2]Martina Chylkova

[1]Department of Tourism and Leisure Activities, School of Business Administration, Silesian University in Opava, Czech Republic, Univerzitní náměstí 1934/3, Karviná, 733 40, Czech Republic, +420 596 398 514, heinzova@opf.slu.cz

[2]Department of Tourism and Leisure Activities, School of Business Administration, Silesian University in Opava, Czech Republic

Abstract

The Erasmus+ charter for student mobility brings with it new requirements in respect of the recognition of mobility activities and language preparation. The outgoing students should not only acquire linguistic, but also cultural knowledge, which involves developing a cultural module to be used by students participating in Erasmus+. In accordance with the Erasmus+ charter, School of Business Administration in Karviná, Silesian University in Opava, has introduced a new module – Preparatory Course for Student Mobility – in the academic year 2014-2015.

The course has been designed as preparation for student mobility both in bachelor and master studies using a modern critical incident technique requiring active and creative students´ attitudes.

The presented article attempts to evaluate the pilot run of the mentioned course on the basis of the questionnaire survey conducted among the participants of the course in 2015. It also involves teachers´ feedback and recommendation for the future.

Keywords

Erasmus+ mobility, evaluation, preparation, skills

Introduction

The Erasmus+ charter for student mobility brings with it new requirements in respect of the recognition of mobility activities and language preparation. Under Erasmus+ it is the sending institution's responsibility to ensure that outbound participants have attained the necessary level of proficiency, which should be measurable against the Common European Framework of Reference for Languages. It is the Erasmus coordinator´s responsibility to ensure students are aware of the Erasmus exchange opportunities and the associated language preparation and qualification requirements. Student selection criteria for participating in Erasmus exchange should take into account both the relevant language skills at the selection stage and the capacity of the students to improve their language skills. It must be ensured that outgoing mobile participants have attained the level of linguistic proficiency specified by the host institution in the Erasmus agreement (http://ec.europa.eu/education, 2014).

School of Business Administration in Karviná, Silesian University in Opava, has been involved in the Erasmus+ programme since 2014. It has introduced a new module focusing on intercultural skills (Hes and Hesová, 2015) – Preparatory Course for Student Mobility – in the summer term of the academic year 2014-2015. The course has been designed as preparation for student mobility both in bachelor and master studies using modern case study and critical incident techniques requiring active and creative students´

attitude. Students acquire knowledge in the following three interconnected areas needed for successful stays in target cultures:
1 Solving case studies (Thomas, 20011) and critical incidents related to major potential problems, especially different culture values as well as adaptation and culture shock (Josek, 2015) in target cultures followed by the clarification of typical culture phenomena in the background and justification of proper solutions.
2 Creating a portfolio of documents necessary for stays in foreign countries, including CVs, motivation letters and self-reflective questionnaires evaluating students´ progress in the area of intercultural skills.
3 Developing students´ culture awareness and sensitivity to foreign cultures (Bauman, Kobicki and Zeidler-Janiszewska, 2009) facilitating their stays abroad and leading to empathy and tolerance in their future professional lives (Heinz, 2015).
A big emphasis is put on understanding various culture values, especially those different in home and target culture, and to values and threats conveyed by culture diversity (Bobáková and Heinz, 2015). According to Hofstede (2001) culture values are invisible behaviours and the values that are the most important in one culture, can be not very significant in another one.
The goal of the article is to evaluate the pilot run of the Preparatory Course for Student Mobility and improve its content and form in accordance with students´ and teachers´ feedback so that it prepares outgoing students for successful stays abroad within the Erasmus+ Programme. The programme Erasmus+ was introduced by the EU for the first time in 2015. As the authors of the article shared the design of the mentioned course, they expected to have a feedback confirming suitability of the structure and the form of the course for faculty students. There exist numerous ways of assessing students´ progress. As K. Heinz states, acquiring the feedback from students is a key item in a course evaluation (Heinz, 2014). In the first part, the presented article attempts to define culture awareness and its development in the difficult period of the migration crisis and clash of religions (Roux, 2015), in the following one it shows participants´ attitudes expressed in the final evaluation of the course carried out on the basis of a questionnaire survey. The last part involves teachers´ feedback and recommendation for the future.

Materials and Methods

The mentioned questionnaire distributed to the participants of the pilot course was based on the Method of the Semantic Differential which measures people's reactions to stimulus words and concepts in terms of ratings on bipolar scales defined with contrasting adjectives or nouns at each end. The method belongs to psycho-semantic ones investigating individuals´ attitudes in the system of positive and negative evaluation. Each attitude involves cognitive, emotional and conative aspects. The method is based on locating a concept on a scale in the multidimensional semantic space. The poles of the scales are represented by pairs of words with the opposite meaning. The Semantic Differential enables to measure connotative meanings of the concepts and to facilitate an insight into the individual´s inner world. The bipolar adjective scales are a simple, economical means for obtaining data on people's reactions. As Vašťatková and Chvál (2010) state, the method of the Semantic Differential in applicable is the measurement of pupils´ attitudes towards particular concepts of educational reality. The comparison of the data obtained in the form of anonymous feedback is an available and valuable source of information for researchers.
The Semantic Differential measures people's reactions to stimulus words and concepts

in terms of ratings on bipolar scales defined with contrasting adjectives or nouns at each end. As K. Heinz and I. Orszulik state, the Method of the Semantic Differential enables to discover students´value attitudes (Heinz and Orszulik, 2014). Each attitude involves cognitive, emotional and conative aspects. The method is based on locating a concept on a scale in the multidimensional semantic space. The poles of the scales are represented by pairs of words with the opposite meaning. Acquired data can be statistically processed using qualitative and quantitative approaches and classified in several ways – an analysis within an item, an analysis based on evaluation of global similarity, and an analysis related to specific dimensions.

The method is possible to be used both with adults, children coming from any culture. The most important general contribution of the Semantic Differential is the provision of a single attitude space for all stimuli. This permits analyses, comparisons, and insights that were impossible with traditional instruments.

It is necessary to emphasize that the presented questionnaire survey has been conducted with the aim to evaluate students´ attitudes after the pilot course introduced at School of Business Administration in accordance with the requirements of the Erasmus+ programme. The authors of the article who also had designed the mentioned course obtained a valuable feedback confirming adequacy of the form and content of Preparatory Course Student Mobility.

The pilot course was registered by 56 students of Bachelor and Master Studies in the summer term 20014-2015. The requirements involved a portfolio of documents (20 points), a presentation about a target culture (30 points), and a colloquium (10 points). The course was successfully passed by 49 students who obtained the following grades: A 8 students, B 15 students, C 8 students, D 15 students, E 4 students, and F 6 students. The reason of the failure and bad marks can be seen in not participating in the course itself and in underestimating the requirements – critical mistakes in motivation letters in English, lack of preparation for the colloquium as well as a low level of English (at least 20% participants of the course) can be estimated for approximately B1 level, and even a lower one related to A 2.

Participants of the course were asked to fill in a questionnaire, designed on the basis of the semantic differential method, involving questions aimed at students´ knowledge and skills developed during the course. Although the questionnaire was handed in only by 30 students, it can be considered a valuable source of feedback. The participants of the course generally evaluated the course in a positive way as a needed one contributing to the knowledge of foreign cultures and the language before Erasmus+ mobility. They also had an opportunity to express their own comments which are listed at the end of the questionnaire survey. Some negative opinions about the course expressed by students are related to the fact that those who had already spent some time abroad do not need such preparation and are self-confident enough to face new environment. Some participants of the course have pointed out that they are interested only in the specifics related to their target cultures – this attitude gives evidence that students are not able to understand the significance of intercultural training yet whose goal is firstly to develop culture awareness and only secondly to provide information about culture specifics.

Students´ own comments, their portfolio of documents as well as their reactions during the seminars and the colloquium have shown that approximately 20% of them have serious problems with written English and with making themselves understood.

Results

Students' evaluation

The results of the questionnaire survey are the following:

1 In my opinion the course

Is needed before Erasmus mobility.	3	2	1	0	1	2	3	Is not needed before Erasmus mobility.
	12	10	5	2	0	0	1	

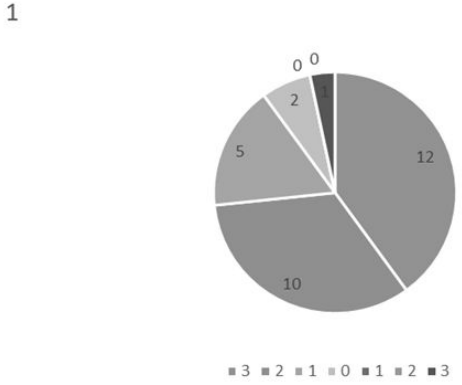

Figure 1: Replies to question 1, 2015 (source: own calculation)

2 The course

Has increased my culture awareness.	3	2	1	0	1	2	3	Has not increased my culture awareness.
	9	12	4	0	4	0	1	

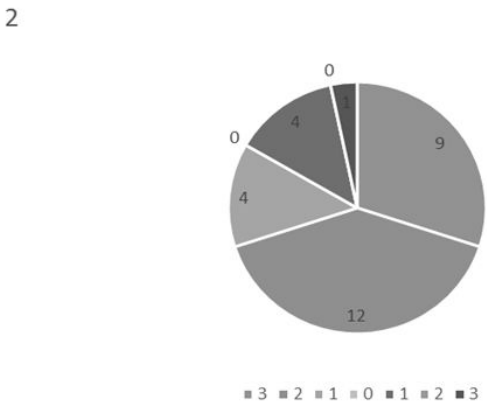

Figure 2: Replies to question 2, 2015 (source: own calculation)

3

I am more empathetic and tolerant.	3	2	1	0	1	2	3	I am not more empathetic and tolerant.
	9	13	4	1	0	1	2	

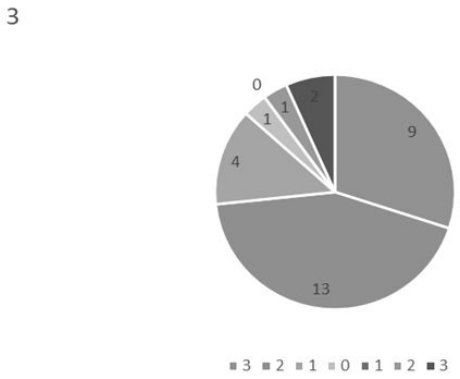

Figure 3: Replies to question 3, 2015 (source: own calculation)

4

I have more information about various cultures.	3	2	1	0	1	2	3	I don´t have more information about various cultures.
	16	9	2	0	2	0	1	

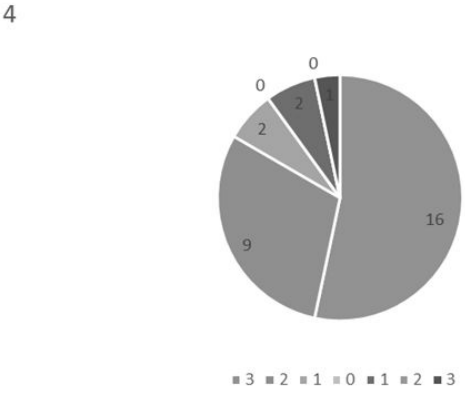

Figure 4: Replies to question 4, 2015 (source: own calculation)

5

I feel more confident about my stay in the target culture.	3	2	1	0	1	2	3	I don´t feel more confident about my stay in the target culture.
	7	13	6	4	0	0	0	

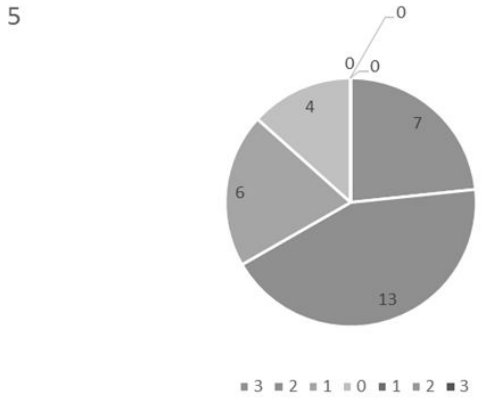

Figure 5: Replies to question 5, 2015 (source: own calculation)

6

My English skills have improved.	3	2	1	0	1	2	3	My English skills have not improved.
	4	13	8	4	0	0	1	

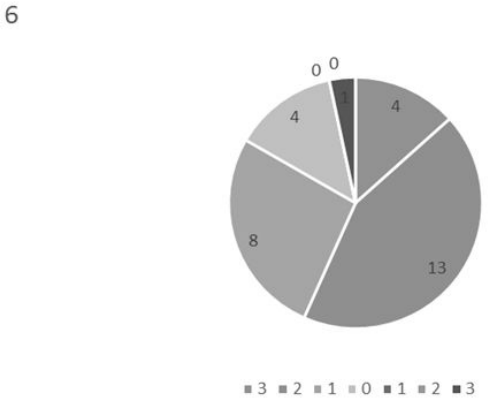

Figure 6: Replies to question 6, 2015 (source: own calculation)

7

The length of the course, its content and structure (critical incidents) are adequate to my needs.	3	2	1	0	1	2	3	The length of the course, its content and structure (critical incidents) are not adequate to my needs.
	3	11	9	5	1	1	0	

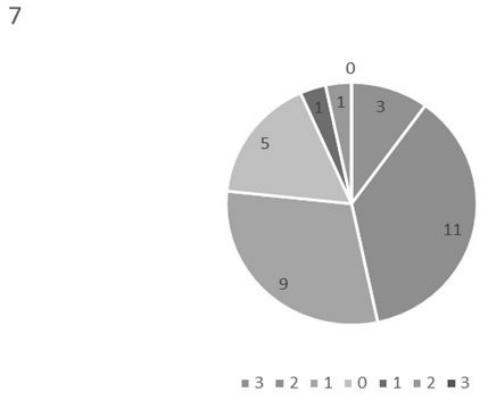

Figure 7: Replies to question 7, 2015 (source: own calculation)

8 My further comments about the course – recommendations.
Students have presented various opinions, however, basically, the course has been evaluated in a positive way. Participants of the course have especially appreciated acquired culture knowledge that can be used during their Erasmus+ stays abroad. They have also improved their English speaking kills and stated that they will be more confident during their study abroad.

Teachers´ evaluation

Teachers´ evaluation is related to amendments before the course itself (informing outgoing students in advance that they will have to pass the course in a standard way – with registering into the STAG system, arranging smaller seminar groups – up to 15 students – to ensure conditions for discussion and better interaction, preparing a structured outline of the presentation about the target culture, and especially insisting on students´ better language skills when being accepted for mobility), during the course itself (preparing more facts related to specific target cultures, emphasizing the fact that acquiring culture awareness is the main goal of the course, developing language skills during the course, further involving students in solving case studies and critical incidents and creating their own one) and after the course itself (handing in and checking the portfolio of documents 1 day before the final colloquium, evaluating students´ language and culture progress, and recommending students additional English language courses if necessary).

Discussion

The presented course is a new module involved in the curriculum at School of Business Administration in Karviná, Silesian University in Opava. It has been introduced with the goal to prepare outgoing students for mobility within Erasmus+ and currently it is difficult

to compare its results to a similar course at other universities. However, the comparison to the second run of the course finalized in the winter term 2015-2016 has proved that the suggested amendments have improved the quality of the course both in terms of content and its form.

The respondents of the questionnaire generally evaluated the course in a positive way as most of students´ answers are placed in the left part of the Semantic Differential scale. They have stated that the course is needed before going for mobility and it develops their culture awareness. They are more empathetic and have acquired more information about their target culture, which means they will feel there more confident. The students also appreciated using case studies and critical incidents as these methods encouraged their interaction, and led to the improvement of their language skills.

Conclusion

The article dealt with a recently introduced module within the curriculum at School of Business Administration in Karviná, Silesian University in Opava. Preparatory Course for Student Mobilities focuses on the development of intercultural and language skills of outgoing students. The course has been designed as preparation for student mobility within Erasmus+ both in bachelor and master studies using modern case study and critical incident techniques requiring students´ active and creative attitudes. The evaluation of the pilot run of the course proves that both the content and form of the course have met the students´ needs. However, a few students have stated that the course should only involve important details related to a target culture, which proves that students are not able to understand the significance of intercultural training yet whose goal is firstly to develop culture awareness and only secondly to provide information about culture specifics. The authors of the article intend to continue conducting similar questionnaire surveys not only before students´ mobility, but also after it to ensure a valuable feedback for the teachers and the International Office staff. In the future, the authors intend to acquire and process information related to the fact how the requirement of culture courses for Erasmus+ programme is fulfilled at other universities.

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CORRELATION ANALYSIS OF SELECTED INTERNATIONAL UNIVERSITY RANKINGS

[1]✉Pavlina Honsova, [2]Vaclav Trojan

[1]Department of Managerial Psychology an Sociology, University of Economics, Prague, nám. W. Churchilla 4, Prague, 130 67, Czech Republic, +420 777 012 462, pavlina.honsova@seznam.cz

[2]The School Management Center, Faculty of Education, Charles University in Prague, Czech Republic

Abstract

This paper deals with selected international rankings and their correlation with other rankings. Firstly, some methodological issues were explained. Secondly, a correlation analysis of fifty randomly chosen ranks and the first fifty ranks of three leading rankings was carried out. Subsequently, a correlation analysis with other three rankings was carried out and the results were compared. Results showed a strong correlation of the three leading rankings in case of randomly chosen ranks while the correlation was substantially weaker in case of the first fifty ranks, which raised some question concerning issues related to rankings´ methodology. The correlation of other ranking was weak or moderate with two exceptions.

Keywords

Quality assessment, universities, university assessment, university rankings

Introduction

This paper aims to explore a popular phenomenon – University rankings. They offer a comparison of universities and rank them according their quality. Some rankings concern only universities meeting certain conditions, others attempt to rank all institutions of higher education. There are rankings comparing universities at the national and the international level. This paper focuses on global rankings and their context.

University rankings are an important tool for educational management as they influence a university´s prestige, its reputation, position, interest and international comparison. It is necessary for university leaders to be knowledgeable in this area, to know the methodology of individual rankings and to assess weaknesses of their university and their causes. It is essential to improve and enhance the reputation of the university in the public´s eyes. This article explains the methodology of international rankings and analyses resulting correlation of the rankings.

Students use university rankings to facilitate their decision-making while choosing a university where they are going to apply (Pilař et al., 2015). Rankings, while popular with many, carry an array of arguable issues. They have a salient impact on students´ decisions and universities´ management as well. Many rankings face a criticism related to objectivity - some for favoring their own universities. For instance, Leiden Ranking rated Leiden University in 2013 on 58th position. Leiden University ranked in the QS Ranking as 74th, in THE as 67th and in ARWU as 74th again. It is appropriate to ask what caused the discrepancy. Other rankings are challenged concerning their finances. QS Ranking is operated by Quacquarelli Symonds, a profitable organization which also offers a program for university profile enhancement (Altbach, 2012).

Other concerns involve data sources. Generally, three data sources are widely used.

1. Survey data – surveys or polls of reputation or experience.
2. Independent third parties – government organizations, sometimes private institutions.
3. University resources – provided by universities themselves (Usher, Savino and Liu, 2007: 8).

All these three carry certain issues. If the data are to be supplied by a university, a distortion can happen easily. Independent organizations may not agree to cooperate or lack necessary data. Surveys are, on the other hand, frequently criticized for being too subjective (Giannias and Sfakianaki, 2012). They rely on a notion that experts possess exceptional knowledge and are able to provide a competent point of view. Some rankings focus on this approach entirely. But the capability of, for instance, a chemistry professor from Germany to assess the best university in Malaysia is, at least, questionable (Altbach, 2012). Even though reputation surveys might seem too intuitive to measure quality, Australian research on this topic revealed that experts´ opinions usually concur with other, more rigorous indicators (Williams and Dyke, 2008).

Other reasons for these rankings´ criticism are methodological flaws and an excessive emphasis on irrelevant indicators. There is a wide ranging discussion if the quality of teaching should be preferred to scientific citations. Some rankings attempt this, for instance by measuring teachers/students ratio etc. (Altbach, 2012). Moreover, the methodology of the major global rankings is usually available online, but the final computations are rarely at everybody´s disposal and this fact hinders a better transparency of the rankings (King, 2009).

This paper aims to explore some discrepancies in methodology and results. It is divided into five sections – introduction, methods, results, discussion and conclusion.

Materials and Methods

At first, three global rankings were chosen. These were THE (Times higher education), QS (QS World University Ranking) and ARWU (Academic Ranking of World Universities). A list of universities that were present in all the three rankings was made. After that, 50 universities were randomly drawn. These universities were assigned to the ranks they accomplished in the rankings. Subsequently, a correlation analysis of the three vectors was carried out. Next, an analysis of the first fifty positions was made. All universities were ordered by their average ranking position and a correlation analysis was carried out for the first 50, 25 and 10 positions. Pearson correlation coefficient was used as a suitable means to measuring correlation between two variables. When computed with Spearman coefficient, the results were similar.

Subsequently, the same random sampling was compared to the data from three other rankings – NTU (National Taiwan University Ranking), Webometrics (Ranking web of universities) and Leiden Ranking. Four universities were eliminated due to lacking data. Only universities scoring up to 500th position were involved in the sampling. All the data is from 2013/2014 and was derived from rankings available on the rankings´ web pages.

Hypothesis:

H0: The most significant rankings correlate and measure the same aspects.

H1: The most significant rankings do not correlate and do not measure the same aspects.

Rankings Aims and Variables

ARWU´s methodology is focused on education, alumni and faculty quality as well as research (see http://www.shanghairanking.com/ARWU-Methodology-2013.html). THE has 13 indicators involving quality of teaching, research, number of citations,

industry income and international outlook (see https://www.timeshighereducation.com/world-university-rankings-2012-13-methodology). The major indicators of QS are academic and employee reputation, faculty/student ratio, citations and internationality so it provides a similar complex methodology to the two mentioned above (http://www.topuniversities.com/university-rankings-articles/world-university-rankings/qs-world-university-rankings-methodology). The main indicators of NTU are research productivity, research impact and research excellence (http://nturanking.lis.ntu.edu.tw/BackgroundMethodology/Methodology-enus.aspx). Leiden ranking is focused on measuring a scientific impact of universities based on bibliometric indicators (http://www.leidenranking.com/methodology). Webometric´s uniqueness is in the efforts to rate all universities. It measures many criteria such as number of files on webs, international links, number of citations etc (http://www.webometrics.info/en/Methodology).

Results

As shown in Table 1 and Figure 1, authors found out that in case of THE, QS and ARWU, the three rankings correlated with a coefficient approaching p=0.8, which shows a strong correlation (Jackson, 2013: 313). The differences between rankings´ correlations are not statistically significant.

Corr. coefficients		
ARWUxQS	QSxTHE	THExARWU
0,796973	0,730958	0,786848

Table 1: Correlation coefficients of the 50 randomly chosen universities

In case of fifty randomly chosen ranks:
H0 was not rejected for any combination.
In case of first fifty positions on average in the three ranking, it was necessary to order universities by their average ranking in ARWU, THE and QS. Table 3 shows correlation coefficients for first 50, 25 and 10 universities. The data suggests substantially different results than those found on a random sample of 50 universities.
When only the first ten universities are considered, the correlation is a great deal lower especially in case of ARWU and QS. Regarding the first twenty five positions, correlation is low in case of ARWU and QS and moderate for QS and THE or THE and ARWU, similar results apply for the first fifty universities. Summarising, the strongest correlation occurs in the case of THE and ARWU, the lowest for ARWU and QS.

	ARWUxQS	QSxTHE	THExARWU
Correlation 50	0,219291	0,56236	0,630948
Correlation 25	0,36191	0,665589	0,723415
Correlation 10	-0,00383	0,293869	0,356348

Table 2: Pearson correlation coefficient of first fifty, twenty-five and ten universities

In case of first fifty, twenty-five and ten ranks:
H0 could not be rejected in case of the first twenty-five ranks in THE and ARWU.
In case of other combinations, H0 was rejected.
In the next step, the three most influential ranking – QS, ARWU and THE were compared to other three international and widely used rankings – NTU, Leiden Ranking and Webometrics. As seen in Table 3, apart from the correlation between ARWU, QS and THE, which was already found, also in case of THE x Leiden and NTU x ARWU a strong correlation was observed.

	ARWU	QS	THE	NTU	Webometrics	Leiden
ARWU	-	0,810253	0,76462	0,841414	0,356768	0,330062
QS	0,810253	-	0,715565	0,612145	0,207925	0,388463
THE	0,76462	0,715565	-	0,615779	0,287607	0,702669
NTU	0,841414	0,612145	0,615779	-	0,452787	0,157842
Webometrics	0,356768	0,207925	0,287607	0,452787	-	0,067719
Leiden	0,330062	0,388463	0,702669	0,157842	0,067719	-

Table 3: Pearson correlation coefficients of six rankings

In case of other three rankings (Leiden, NTU, Webometrics):
H0 could not be rejected for THE X Leiden and NTU X ARWU.
In case of other combinations, H0 was rejected rejected.

Discussion

The data suggest that according to a randomly chosen sample of 50 universities, the rankings correlate highly and thus measure the same characteristics. However, the term quality is so ambiguous that it is not possible to determine whether the rankings measure quality. If we consider "quality" of a university as having broad research, citations, award winning scientists, good reputation and international importance, we can argue that the rankings do in fact measure the quality of a university.

QS Ranking thus does not correlate in case of the first fifty positions on average with ARWU and there is not a strong correlation with THE either. On the contrary, THE and ARWU correlate with the correlation strength of 0.63. If a ranking correlates less on the first fifty universities on average than on randomly chosen universities (positions 2 to 486 in rankings), it is legitimate to ask what is so dissimilar about the first positions and the question of their disinterestedness and methodological flaws arises in accordance with findings of other authors (Altbach, 2012; Giannias and Sfakianaki, 2012).

Another reason for this discrepancy might be the methodological difference. QS has the most dissimilar methodology and a weak correlation with the others which might stem from the reputation polls used. That is the reason for which the first positions are taken by "renowned" universities. The ranking is not based on exact data on research, citation quantity and so forth. QS has also been questioned due to lacking data and their objectivity in the past. It is necessary to mention that QS also offers commercial services, promising universities profile improvement, aka ranking position enhancement. Future research should question in detail other possible reasons for these dissimilarities.

Conclusion

This paper explored the phenomenon of university rankings from various perspectives. Students use rankings to choose the university they consider investing into, they seek prestige and education with good quality and reputation. They want rankings to be understandable and clear and they want to set their own criteria. Universities use rankings as a managerial and marketing tool and institutions act on rankings, analyze them and avail of the impacts the good ranks have. Some rankings (e.g. QS, Leiden…) are criticized for various reasons such as the emphasis on reputation, irrationality and simplicity, methodological errors and so forth.

There is an array of rankings available. The research focused on the most influential – ARWU, THE and QS. A correlation analysis was carried out to find out that THE, ARWU and QS correlated when random sample was observed. As far as the fifty top ranks were

concerned, the correlation was substantially weaker, which raises some questions about the rankings' methodology and objectivity. Moreover, a correlation of other three rankings was explored, showing different rates of correlation with individual rankings.

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DIFFERENT TYPES OF EDUCATIONAL TEXTS: DIFFERENCES PERCEIVED BY THE STUDENTS

[1]✉Tereza Horakova, [2]Milan Houska

[1]Department of Systems Engineering, Faculty of Economics and Management, Czech University of Life Sciences Prague, Kamýcká 129, Prague 6 - Suchdol, 165 21, Czech Republic, +420 224 382 354, horakovat@pef.czu.cz

[2]Department of Systems Engineering, Faculty of Economics and Management, Czech University of Life Sciences Prague, Czech Republic

Abstract

Text is an important medium for knowledge transfer within the pedagogic process. The form of educational texts can influence the efficiency of knowledge transfer. Before measuring the efficiency itself which is connected to the measuring of behavioural characteristics of students and their brain activity during the processing of text, it is necessary to verify whether the results of objective measurement cannot be misrepresented due to characteristics and abilities of selected respondents. Therefore, the aim of the article is to determine whether respondents show statistically significant differences in characteristics that influence the knowledge transfer for both text types (knowledge text vs. normal text). Influence of the text type and the respondent age on the time needed to study the text, perceived level of difficulty of each professional field of the text, and ability of respondents to distinguish each type of text is examined. Based on the achieved results, there is no statistically significant dependency between any of the examined factors which makes the selection of respondents according to the needs of future experiments much easier.

Keywords

Knowledge unit, knowledge text, knowledge transfer, waste management, biological waste

Introduction

Within the framework of interdisciplinary cooperation among related branches of science which deal with acquiring the knowledge and working with it, pieces of knowledge from the area of "knowledge engineering" commence to be used in pedagogic and didactic disciplines. Knowledge engineering provides formalized models for representing explicit knowledge which is a subject of transfer and sharing during teaching or at expert consultations. Several authors, e.g. Glava and Glava (2011), emphasize the importance of the general theory of systems and system approach for this purpose. System approach has been used for deriving a new representation of knowledge, the so-called knowledge unit (Dömeová, Houška and Beránková, 2008) as well. The advantage of this representation is the possibility of expressing the formal model of knowledge in a natural language which makes it accessible for human users. It also allows to create educational texts which contain the knowledge in an explicit form (knowledge text). As Rottensteiner (2010) states, the key variable is the extent of understandability of text for readers and students in this case.

Many authors, e.g. Duric and Song (2012) or Asaishi (2011), focused on the analysis of educational texts especially from the point of view of their semantic and syntactic

difficulty. Other authors, e.g. Izgi and Seker (2012), follow the difficulty of educational texts determined by the sentence syntax using the so-called readability formulas which express the amount of difficulty of the text for reading and the level of education it is possibly suitable for. Most difficulty indicators are based on the sentence syntax; advanced indicators, e.g. Coh-Metrix, also take account of other factors, e.g. cohesion and coherency of the text (Graesser, McNamara and Louwerse, 2003). This leads to the desire of recording and quantyfing the factors of originally subjective nature which influence the success rate of data, information and knowledge transfer using text.

Knowledge texts as compared to common educational texts have been already tested within the education process as a tool for knowledge transfer (Horáková and Houška 2014a), their efficiency of creation has been measured (Rauchová and Houška, 2013), quantitative profile of knowledge text and its difference from the text that is common from the linguistic point of view has been determined statistically (Rauchová et al., 2014), semantic and syntactic difficulty of knowledge text has been measured as compared to common educational text (Horáková and Houška, 2014b) and the hypothesis of the difference between the number of characteristic concepts of knowledge text as compared to common text has been verified; knowledge text has shown significantly higher rate of these concepts (terms) which, as stated by Horáková and Houška (2014b) is determined by the specific structure of the knowledge unit.

We are preparing experiments with the aim of proving objectively whether there are differences between normal texts and the knowledge ones when they are processed (reading, studying, recalling the acquired information and knowledge) by a human. For this purpose, we need to determine whether respondents show differences in their perception, difficulty of processing and other characteristics. If this was the case, the selection of respondents would need to be adjusted based on the proven differences so that the acquired results are comparable within their homogenous groups.

The aim of the article is to determine whether respondents show statistically significant differences in characteristics that influence the knowledge transfer for both types of text. For this purpose, the following hypotheses were formulated:

1. There is an influence of the text type on the time needed to study the text.
2. There is an influence of the respondent age on the time needed to study the text.
3. The area with the lowest difficulty (problem domain) from the topic point of view as perceived by the respondents is the area of practice.
4. More than 75% of respondents can recognize the text that differs from the other texts regarding the structure.

Using the methods of statistical analysis, the validity of these hypotheses will be verified.

Materials and Methods

Experiment design

The experiment had the form of a test procedure and it consisted of 4 parts: pretest, educational text, posttest, and final questionnaire. Several pedagogic experiments (e.g. Tarchi, 2010) have already proven that the influence of the initial level of knowledge on further transfer in the process of education is significant; therefore, the experiment includes the pretest, too, which is a tool for determining the initial level of knowledge of the participants of the test without the influence of the educational text.

Text is a tool of knowledge transfer from four sub-areas (chemistry, practice, legislation,

economy) within the scope of the selected problem domain corresponding to the topic of the project, i.e. biogas, biogas stations and treatment of agricultural waste.
Each person participating in the test received the text in the form of a brochure where the knowledge from two sub-areas was captured using a common educational text, and the other two were captured using a knowledge text according to the methodology proposed by Houška and Rauchová (2013). There are 4 formats of the brochure available in total and they use 4-digit code consisting of 0s and 1s (1100, 0011, 1010, 0101) where 0 denotes a sub-area processed using the common form, 1 denotes a sub-area processed using the knowledge form, the first position within the code represents the sub-area of chemistry, the second position within the code represents the sub-area of practice, the third position represents the sub-area of legislation, and the fourth position represents the sub-area of economy. For example, a brochure with the 1100 code contains the sub-areas of chemistry and practice processed using the knowledge form and the sub-areas of legislation and economy processed using the form of common educational text. Posttest is a tool for determining the effect of knowledge transfer using text. The aim of the whole experiment was to determine whether the transfer using knowledge text differed significantly from the knowledge transfer using common text. All text fragments are available at:
http://ulozto.cz/uploaded/736432402283501595/91897101%3B91897104%3B91897107%3B91897110/5c67107b3435e00a8e5e40d5e9692341?uploaded=0&_fid=6tr2.
As the didactic tests (pretest as well as posttest) constituted a tool for an experiment and they should have been used to measure the knowledge transfer in a reliable way, it was necessary to verify their didactic properties within the scope of the pre-research as well. Both tests contained 20 assignments with the choice of one correct answer; each of the four sub-areas was referred to by 5 questions. The questions of pretest and posttest were looking into the same matter but they were formulated in a different way, i.e. if a task was presented as completing the information in the pretest, it was formulated as a question requiring to complete the knowledge and vice versa. In each test, one half of the questions were formulated for completing the information, and the other half for completing the knowledge. The results of didactical analysis of tests as a pre-research tool for improving the experiment methodology and the testing itself were published by Horáková and Houška (2014a). Questionnaire is a tool for finding out the opinions of the experiment participants on each text. Participants has evaluated the text from the point of view of text understandability, thematic difficulty and naturalness. It is the questionnaire that constitutes the source of data for analysis in this paper.

Acquired data

63 respondents in total took part in the experiment; these were students of secondary agricultural schools, farmers and agronomists. They also provided feedback on the impression they had from each text fragments and on their perception of them. Their responses are statistically analysed in this paper so that some of the selected factors can be determined as well as their influence on the perception of text in the knowledge and common form. Based on the questionnaire results, a follow-up experiment will be prepared with the aim to measure the change in the brain activity of probands when reading the same text fragments (knowledge and common texts) as in the previous experiment using functional magnetic resonance by employing the methodology (Horáková, Houška and Luhanová, 2015).

Applied statistical methods

In order to establish the basic idea about acquired data, indicators of descriptive statistics are used, especially the measure of central tendency and the measure of variance of acquired data which are described in detail in books (Basset et al., 2009). Graphical representation of the variable distribution is provided using classical histograms or two-dimensional histograms (Lindsey, 2009). Furthermore, determination of relative frequencies, pivot tables, or calculation of the confidence interval for the average from the area of statistical induction (Basset et al., 2000) are used. Moreover, the testing of an assumption of normal distribution of data using the distribution test (Shapiro-Wilk W-test) was used; these are described in detail in books (e.g. Gravetter and Wallnau, 2009). The method of single-factor analysis of variance (ANOVA) is used to determine the statistical differentness of averages for more groups. ANOVA is one of the most commonly used statistical techniques. It is a summary name for a group of very efficient methods with the common idea of decomposing the total variability into components that can be assigned to each reason of variability. The aim is to compare the level of the studied quantitative variable in several groups which the basic set is decomposed into. The sorting criterion for decomposing the basic set into groups was one or more variables of the nominal type (Bassett, Bremner and Morgan, 2000). For one-dimensional analysis of variance, the influence of one factor on a certain dependent variable is observed (Lindsey, 2009). All calculations and graphical representations of analyses are outputs from the Statistica program (version 12).

Results

Influence of the text type on the time needed to study the text

First we wanted to determine whether there was any influence of the text type on the average time needed to study the brochure, i.e. the text used as a tool to transfer knowledge. The average time to study the text was 27.44 minutes, minimum time was 24 minutes, maximum time was 30 minutes. *H0: all average time values are identical for all types of brochure* was tested using one-factor ANOVA. The P-value for the F-test is 0.87753 which means that H0 cannot be dismissed on the significance level alpha ($\alpha = 0.05$). The type of brochure, i.e. the order of areas processed by the text in the knowledge form and the common form, does not influence the average time to study the text.

Influence of the age type on the time needed to study the text

Furthermore we wanted to determine whether there was any influence of the respondent age on the average time needed to study the brochure, i.e. the text used as a tool to transfer knowledge. The average value of the respondent age is 36.127 years. The minimum value of age is 16 years, the maximum value is 65 years. *H0: all average time values are identical for all age categories* was tested using one-factor ANOVA. The P-value for the F-test is 0.28762 which means that H0 cannot be dismissed on the significance level alpha ($\alpha = 0.05$). The age category type does not influence the average time to study the text.

Difficulty of topics in problem domains

Furthermore we wanted to determine how difficult from the content point of view were the text fragments from each of the 4 sub-areas, i.e. chemistry (a), practice (b), legislation (c) and economics (d). Respondents were asked to rate these areas from 1 (very easy

topic) to 4 (very difficult topic). The following four histograms show each rating with the distribution of areas as well as the rating assigned to them by the respondents. For all histograms, normality of the distribution was also tested using the Shapiro-Wilk W-test; as the value of *p* is known to be p=0.00 for all of them, i.e. it is lower than the selected significance level alpha (α= 0.05), the *H0: data come from a file with normal distribution* is dismissed in all cases.

As the very easy topic the respondents selected the area of legislation, i.e. area c. As the easy topic the respondents selected the area of chemistry, i.e. area a. As the difficult topic the respondents selected the area of economics, i.e. area d. As the very difficult topic the respondents selected the area of practice, i.e. area b (see Table 1).

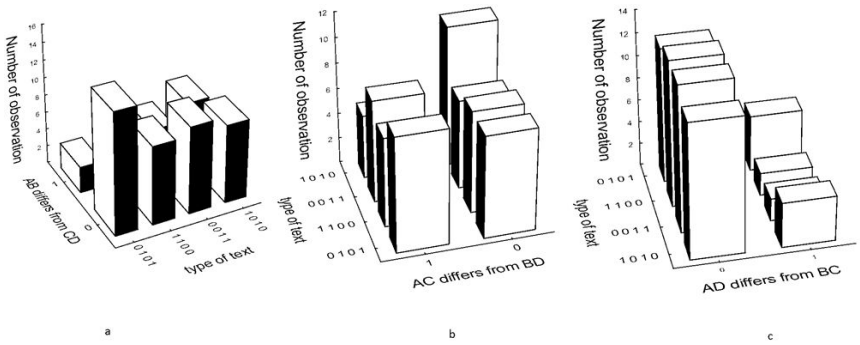
		Difficulty of topic			
		1	2	3	4
Topic area	a	18	30	8	7
	b	12	8	13	29
	c	29	17	12	6
	d	4	8	30	21
Total	sum	63	63	63	63

Table 1: The absolute frequency of text fragments of difficulty depending on the topic (source: own calculation)

Perception of differences of the structure of texts

Respondents had an opportunity to express how they perceived the difference of the nature of the text (its structure, not in the sense of the area of the topic). It means that their task was to select whether there is a difference from the text structure point of view between parts A, B and C, D, or A, C and B, D, or A, D and B, C in the brochure they were given to study. Answers recorded by the respondents depending on the type of the text they were working with are graphically represented using two-dimensional histograms (Figures 1a, 1b and 1c). The x-axis of these figures represents the text type (1010, 0011, 1100, 0101), the y-axis shows whether the respondents perceived differences between selected pairs (1) or did not perceive any differences (0); the z-axis shows the number of observations.

Figure 1a) implies that the difference between the text structure in A, B and C, D was perceived by 11 respondents who were working with texts of the 0011 and 1100 variant where the difference was really present. It was determined by the type of processing, i.e. knowledge form of the text or common form of the text. The difference was also perceived by 10 respondents who were working with the other type of brochures; however, these texts did not really contain a difference that would have been intentionally applied into fragments when creating the text. Figure 1b) implies that the difference between the text structure in A, C and B, D was perceived by 9 respondents who were working with texts of the 1010 and 0101 variant where the difference was really present, i.e. it was determined by the type of processing, i.e. knowledge form of the text or common form of the text. The difference was also perceived by 4 respondents who were working with the other type of brochures; however, these texts did not really contain a difference that would have been intentionally applied into fragments when creating the text. Figure 1c) implies that the difference between the text structure in A, D and B, C was perceived by 13 respondents; however, they were not really given any brochure containing difference that would have been intentionally applied into fragments when creating the text.



a) A, B differs from C, D depending on the variant of the text
b) A, C differs from B, D depending on the variant of the text
c) A, D differs from B, C depending on the variant of the text

Figure 1: Two-dimensional histograms of the difference of texts depending on the variant of the text

Discussion

The need to measure and record further differences in a qualified way in order to complete the complex quantitative profile of the knowledge text constitutes the basis for planned follow-up research which proposes the use of neurotechnologies for determining the neuropsychological characteristics of learning for various types of educational texts. Use of neurotechnologies, in particular the functional magnetic resonance (fMRI), for the research of the core activity when reading knowledge text and the implementation of the experiment itself on a relevant sample of respondents with an application of statistical methods has not been put into practice by researchers yet. This is a subject of future intended research. However, it is important to know which factors will be significant within the scope of measuring using the functional magnetic resonance, and which will be not. Based on the research of Ezzyat and Davachi (2011), Kim et al. (2012) as well as other authors, it is obvious that the gender of the proband, his/her hand preference for writing (right-hander/left-hander) or the presence of a serious neurological disease (like epilepsy) can cause a significant misrepresentation of results. On the other hand, based on the results above it was found out that if the same text fragments are presented within the scope of measuring as in an experiment already carried out, the time for presenting each text type can be the same because the respondents were reading the text for the same length of time on average. Another finding is that it is not necessary to distinguish among several age groups and adjust the specification of measuring accordingly. It was observed that more than 75% of probands cannot subjectively recognize which text differs from the other texts from the structure point of view; therefore, it is desirable to verify also using fMRI whether the activity is higher/lower with different text types as well as in comparison to the so-called baseline (text string without semantic content). It is also necessary to track the knowledge transfer through various types of knowledge texts, answers to questions in pretests and posttests and reactions of brain activity when presenting questions from various areas according to their difficulty, as perceived by the respondents and according to the structure of questions on different levels of hierarchy, i.e. data, information and knowledge (Dömeová, Houška and Beránková, 2008).

Conclusion

The paper is based on the statistical analysis of the feedback from the participants on the experiments; this results in objectivising the subjective opinions on knowledge texts which were tested during the experiment within the scope of the knowledge transfer. Within the scope of the findings, all research hypotheses are dismissed; this means that on the selected significance level alpha ($\alpha = 0.05$):

1. Statistically significant influence of the text type on the time needed to study the text cannot be proven.
2. Statistically significant influence of the respondent age on the time needed to study the text cannot be proven.
3. Perception of an area as the least difficult by the respondents cannot be proven.
4. The fact that more than 75% of respondents can recognize the text that differs from the others regarding the structure cannot be proven.

Based on the results above as well as results from other authors, a specification of the experiment using functional magnetic resonance for objective determination of the influence of the text type (of the knowledge or common nature within the scope of matching problem domain, i.e. biogas, biogas stations, treatment of agricultural waste) on the brain activity of probands will be prepared.

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TRANSITION TO SENIOR SECONDARY SCHOOL: STUDENTS' EXPECTATIONS AND THEIR ACADEMIC EFFICACY

[1]✉Simona Hoskovcova, [2]Lenka Krejcova, [3]Eliska Kodysova

[1]Department of Psychology, Faculty of Arts, Charles University, Nám. J. Palacha 2, Prague 1, 116 38, Czech Republic, +420 221 619 677, simona.hoskovcova@ff.cuni.cz

[2]Department of Psychology, Faculty of Arts, Charles University, Czech Republic

[3]Department of Psychology, Faculty of Arts, Charles University, Czech Republic

Abstract

Academic efficacy is a form of self-efficacy that is tightly linked to academic achievements, motivation and future professional careers. Previous research has shown that changes occur in academic efficacy throughout the course of one's educational process. Our research project focuses on transitions between levels of education and changes in academic efficacy. Such changes in academic efficacy are also connected with students' expectations about their future schooling. Our research results show a close coherence between all the observed variables. In general, adolescents tend to have a good academic efficacy measured by MALS (Burden, 1998) and a shorten Child Self-Efficacy Scale (Pastorelli et al. 2001). Just 16% (measured by MALS) and 7% (measured by ChSE) of adolescents reach lower scores, which would require attention. Adolescents, in general, express higher levels of efficacy in coping with the change and report mostly positive emotions connected with the transition of school.

Keywords

Academic efficacy, self-efficacy, transitions in education, adolescence, senior high school, secondary schools

Introduction

Our paper in the last issue of ERIE proceedings (Hoskovcová and Krejčová, 2015) explored experiences of transition between elementary school and junior high school children of the ages 10-11 years. In the following year of our project, we focused on students who finished junior high school and moved on to senior high school. In our testing conditions, this meant a change of institutions. Students attended new schools, with new school subjects, new teachers, and also new and more diverse requirements on their school achievements. The key issue of our project includes the changing of students' academic efficacy and self-regulation in connection with their expectations and real schooling experience. There is sufficient scientific evidence stating that academic self-efficacy can significantly affect school success and therefore this needs to be encouraged (e.g. Doll, Zucker and Brehm, 2004; Jacobs et al., 2002; Pajares, 2006).

One of the crucial aims of a successful transition which promotes academic efficacy is the independence of students (Knesting, Hokanson and Waldron, 2008). This requires the development of their skills in a way which leads to academic efficacy. Therefore, the moments of mastery experiences in the transition process appear crucial. Such independence also means a gradual reduction of support and prompts. Students should learn to ask for help when needed, especially adolescent students in secondary schools. However, this situation appears slightly controversial and deserves more attention.

Students with low academic efficacy tend to avoid asking for help in any situation as they regard the helplessness as their own fault and failure (Ryan, Gheen and Midgley, 1998). These students tend to get into a vicious circle of repeated school failures as they are not working well at school, and they are afraid to ask for assistance. Thus, the failures and lack of communication of these students put special demands on their teachers. The teachers should pay more attention to the students' reactions to instructions, their school work and to their adaptation in a class.

The second source of self-efficacy involves vicarious experience and learning through modelling. All participants in the process of transition look for experience and models of behaviour in their environment (Craig, 2005). When supporting a successful transition process, we can offer positive models for each student, his peers, for the teacher and the parents too. Praise and complaints (3th source of self-efficacy) pose an interesting question from the educational point of view (Bandura et al., 2003; Pajares, 2006; Schunk and Meece, 2006; Schunk and Zimmermann, 1997). There is no clear answer as to how to respond to student's successes or failures so that they retain their initiative and develop healthy confidence. However, positive encouragement seems to work best at producing the desired behaviour.

The academic efficacy can obviously be affected by different variables which appear at the transitory moments. Among others, self-efficacy of teachers seems to have a direct impact on students' academic self-efficacy (Midgley, Feldlaufer and Eccles, 1989). The higher teachers' self-efficacy is, the more stable students' self-efficacy stays. Risk factors include gender, ethnicity, low family SES (Bailey and Baines, 2012). However, there are also protective factors which influence the transitory moments and the development of academic efficacy - including students' social skills, their positive expectations about new school years, optimism, and levels of cognitive abilities (West, Sweeting and Young, 2010).

From our previous research (Hoskovcova and Krejcova, 2015) we recognized the necessity to support children from risk groups with low academic efficacy. Similar to this, a study by Seidman with colleagues (1994) examined the effects of the normative school transition during early adolescence on the self-system and perceived school and peer social contexts of poor, afro-American, Caucasian, and Latino youth in the public school systems. The results revealed negative effects of the school transition on the affective and behavioural domains of the self-system. These declines in self-esteem, class preparation, and grade-point average (GPA) were common across race/ethnicity and gender. Transition into a new school, peer changes and, in particular, changes in daily hassles with the school were associated with changes in the academic dimensions of the self-system, that is, academic efficacy expectations, class preparation, and GPA.

The aim of our study was to survey students' expectations about their transitions to a new school environment and to study the relationship between such expectations and their academic efficacy. In the last 15 years we have not had evidence about such a research in the Czech context. Research has been done in pedagogy and does not focus on personal aspects of the transition (Walterová, Greger and Novotná, 2009).

Materials and Methods

In our research we used self-report questionnaires compiled into an assessment battery. We used the same battery for 5th-graders (Hoskovcova and Krejcova, 2015) and for 9th-graders. The questionnaires focused on academic efficacy and expectations about the transition from the 9th grade to the higher educational level. The questionnaires were

administered three times per the data collection to each adolescent - once in April 2015 before the transition and then after the transition in September 2015 and November 2015. The adolescents answered our questionnaires on-line or in paper-pencil form at their school. After their transition, they either received an e-mail with the link to the questionnaire or were contacted via the participating high schools.

The first part of the questionnaire battery included MALS (Myself-As-a-Learner Scale) which focused directly on students' perceptions of their own 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 (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 a pilot stage of the project, we had to reduce the questionnaire with respect to the capacity of the children's ability to complete them. We then selected 17 items which covered 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) (Hoskovcova and Krejcova, 2015).

We asked three questions about students' expectations on the transitions (school demands, different requirements of teachers, finding friends) where participants expressed their efficacy in percent (%SE). In connection with these three questions, we asked about related emotions: 5 positive and 5 negative (ECh).

Sample

In this study, we present outcomes from the first data collection. In April 2015 the sample contained 354 adolescents (148 girls and 206 boys) from different junior high schools throughout the Czech Republic, 136 from towns with less than 30,000 inhabitants and 218 from larger cities. Age of the adolescents was 14-17 (M=14.85). The adolescents were recruited at time of their entrance examinations to senior high school. The consent forms signed by their parents were collected.

Results and Discussion

For MALS the maximum is 100, the minimum is 20, where a higher score means a higher academic efficacy (in the original opposite, but for our research transformed). For ChSE the maximum is 85 and the minimum 17, the higher score means a higher self-efficacy. Questions about transition-related efficacy have the maximum 10 and minimum 0, where a lower score means lower efficacy. The average of the three questions %SE has the maximum 30 and minimum 0. The score ECh, where students expressed their positive and negative emotions, has the maximum 120 and minimum 30, where a lower score means more negative emotions about the transition.

Variable	Mean	Min	Max	SD
MALS	70,04	32	100	11,28
ChSE	66,66	39	85	9,24
%SE average efficacy of transition	21,57	0	30	5,36
How sure about friends between new classmates	7,35	1	10	
How sure about new demands of curriculum	6,8	0	10	
How sure about contact with new teachers	7,3	0	10	
ECh Emotions connected with transition	86,61	51	120	11,53

Tab. 1: Mean, min, max and SD of perceived academic efficacy, general efficacy and expectations about school transition

The results showed that most of the adolescents reported a healthy self-efficacy as learners (MALS) and more general self-efficacy (ChSE). In MALS 16% of the adolescent reflected a low efficacy in school and in the more general ChSE. Based on findings from the questionnaires, "only" 7% of adolescents deserve special professional attention due to their low academic efficacy. This percentage is counted on the base of the raw score, which reflects the meaning of the given answers.

If we look at the results concerning expectations about the transition, we see feeling of general efficacy towards the change of school. The adolescents tended to show a strong efficacy, but not absolutely. There are also big differences among individual adolescents as the answers reached both extreme possibilities of the response. As we see in Tab. 1, in the results for the partial questions, the adolescents feel most efficacious about finding friends in the new environment and coping with requirements of new teachers. In this field, the adolescents state that they are around 73% sure about coping with the new demands. The adolescents are less sure about new demands of the curriculum (68% sure). Most adolescents state that they are able to cope with the transition, but there are 10% of adolescents who report serious worries and low efficacy for the transition. These students are certainly in need of support.

Worries seem to be more on the social cognitive level, which is expressed by the belief about coping with the situation. When asked about emotions that an adolescent could experience during changing of a school, our respondents expressed mainly neutral or positive emotions. There was no student in the sample who expressed extremely negative emotions connected with the transition.

Correlations exist between our measures. For MALS the Pearson correlation with %SE is r=.485 and with ECh r=.480. For ChSe with %SE r=.468 and with ECh r=.406. It seems that the academic efficacy as a learner and general self-efficacy of the adolescent are somehow connected with expectations about the transition, but the effect is not very strong. From open-ended answers we estimate that factors from the social environment may play a role – among others, experience from the junior high school or information about the future school. We are currently working on predictive models based on the three data collections during the transition. Perhaps, this will help us understand the results better.

Effect of gender on the dependent variables

An independent-samples t-test was conducted to compare MALS, ChSE, %SE and ECh in girls and boys. There was not a significant difference in the scores for MALS in boys (M=68.9, SD=12.2) and girls (M=70.8, SD=10.6); t(352)=-1.581, p = 0.115. There was

a significant difference in the scores for ChSE in boys (M=64.1, SD=9.68) and girls (M=68.5, SD=8.50); t(352)=-4.51, p <0.001. There was not a significant difference in the scores for %SE and ECh in boys and girls. Overall, results of general self-efficacy appear the only variable which differs between genders.

Effect of the size of town where the children lived on the dependent variables

An independent-samples t-test was conducted to compare MALS, ChSE, %SE and ECh in children living in towns with less than 30,000 inhabitants, and those living in towns with more than 30,000 inhabitants. There was a significant difference in the scores for MALS (small M=67.6, SD=11.5; big M=71.5, SD=11.0); t(352)=-3.194, p = 0.002. There was a significant difference in the scores for ChSE (small M=65.3, SD=9.52; big M=67.5, SD=9.00); t(352)=2.235, p =0.026. There was not a significant difference in the scores for %SE and the scores for ECh. It is noteworthy that students from larger cities express higher general self-efficacy and they are more confident about their academic skills as the results of academic efficacy show. The expectations about the transition are similar in both groups.

Effect of study average on dependent variables

A one-way between subjects ANOVA was conducted to compare the effect of study average on MALS, ChSE, %SE and ECh among the adolescents with GPA 1.5 and below, between 1.5 and 2.5, and above 2.5.

There was a significant effect of GPA on MALS at the p<.05 level for the three conditions [F(2,351) = 63.4, p <0.001]. Post hoc comparisons using the Tukey HSD test indicated that the MALS mean score for the adolescents with GPA 1.5 and below (M = 74.1, SD = 9.45) was significantly different from the mean score of the adolescents with GPA between 1.5 and 2.5 (M = 66.0, SD = 10.2), and both were significantly different from the mean score of the adolescents with GPA above 2.5 (M = 56.9, SD = 10.0).

For *ChSe*, the homogeneity assumption was violated as found by the Levene test (3.387, p=0.035), therefore Welch F test was used. There was a significant effect of study average on ChSE at the p<.05 level for the three conditions [F(2,92.0) = 23.0, p <0.001]. Post hoc comparisons using the Games-Howell test indicated that the ChSE mean score of the adolescents with GPA 1.5 and below (M = 69.0, SD = 7.97) was significantly different from the mean score of the adolescents with GPA between 1.5 and 2.5 (M = 64.3, SD = 9.67), and both were significantly different from the mean score of the adolescents with GPA above 2.5 (M = 59.3, SD = 9.67).

There was a significant effect of GPA on %SE at the p<.05 level for the three conditions [F(2,351) = 4.02, p = 0.019]. Post hoc comparisons using the Tukey HSD test indicated that the *%SE* mean score of the adolescents with GPA 1.5 and below (M =22.1, SD = 5.03) was significantly different from the mean score of the adolescents with GPA above 2.5 (M = 19.5, SD = 5.56).

There was a significant effect of study average on ECh at the p<.05 level for the three conditions [F(2,351) = 4.33, p = 0.014]. Post hoc comparisons using the Tukey HSD test indicated that the *ECh* mean score of the adolescents with GPA above 2.5 (M =81.6, SD = 8.44) was significantly different from both mean scores of the adolescents with GPA between 1.5 and 2.5 (M = 86.8, SD =11.3) and of the adolescents with GPA 1.5 and below (M = 87.4, SD = 11.9); however, the latter two were not significantly different.

Adolescents differ significantly in their academic efficacy and expectations about the

transition in relation to their GPA. Low GPA is connected not just with lower efficacy, but also lower expectations, which deserves our attention.

Effect of the number of adults living in the same household on the dependent variables

A one-way between subjects ANOVA was conducted to compare the effect of study average on MALS, ChSE, %SE and ECh of the adolescents living with one, two, three and more adults in the same household. There was not a significant effect of the number of adults living in the same household on *MALS, ChSE, %SE of ECh.*

Effect of the number of siblings on the dependent variables

A one-way between subjects ANOVA was conducted to compare the effect of the number of siblings on MALS, ChSE, %SE and ECh in children with no sibling, one sibling, two siblings and three or more siblings. (For the purpose of this analysis, two participants who lived in foster care and referred a higher number of "siblings" were excluded.)
There was a significant effect of the number of siblings on *MALS* at the $p<.05$ level for the four conditions [$F(3,348) = 5.739$, $p = 0.001$]. Post hoc comparisons using the Tukey HSD test indicated that the MALS mean score of the adolescents with three siblings ($M = 63.9$, $SD = 13.4$) was significantly different from the mean score of the adolescents with no sibling ($M = 72.2$, $SD = 10.7$) and with one sibling ($M = 71.3$, $SD = 10.5$), but the latter two did not differ significantly either from each other or from children with two siblings ($M = 68.5$, $SD = 11.3$).
There was a significant effect of the number of siblings on *CHSE* at the $p<.05$ level for the four conditions [$F(3,348) = 5.044$, $p = 0.002$]. Post hoc comparisons using the Tukey HSD test indicated that the CHSE mean score of the adolescents with three siblings ($M = 61.8$, $SD = 9.79$) was significantly different from the mean score for children with no sibling ($M = 67.3$, $SD = 10.1$) and with one sibling ($M = 67.8$, $SD = 8.60$), but the latter two did not differ significantly either from each other or from children with two siblings ($M = 65.6$, $SD = 9.47$).
There was not a significant effect of the number of siblings on %SE and on ECH.

Discussion and conclusion

Considering the expectations about the transition between school levels, we see a rather high self efficacy as well as academic efficacy towards the change of school. Our outcomes seem more optimistic than our original hypothesis, based on previous studies (e.g. Seidman, Allen, Aber, Mitchell and Feinman, 1994). Most adolescents express a sufficient or high academic and general efficacy. Adolescents are looking forward to the change of school. We could express it by around 70% confidence to cope with the three main fields of change (peer group, new curriculum, and new teachers).
We compared results of self-efficacy and academic efficacy for the transition, and emotions connected with the transition among specific groups divided by gender, number of adults at home, number of siblings, size of town, and GPA. The only truly noteworthy difference is between groups with average, high and low GPA, which is in agreement with previous studies on the mutual effects among academic efficacy, self-efficacy, and study results (Doll, Zucker and Brehm, 2004; Jacobs, Lanza, Osgood, Eccles and Wigfield, 2002; Pajares, 2006). Students with low academic efficacy tend to avoid asking for help in any situation as they regard the helplessness as their own fault and failure (Ryan, Gheen and Midgley, 1998).

From the view of a practitioner, there is a field for raising the competencies of adolescents to promote their stronger efficacy (Bandura at al., 2003; Doll, Zucker and Brehm, 2004), especially in case of students with low GPA. It is crucial to search for other competencies of the adolescents to allow mastery and build a healthy efficacy.

Furthermore, we compared results of academic efficacy and general efficacy among the same groups. There are more significant differences than in the expectations about the transition. Higher self-efficacy is connected with female gender as reported also in other studies (Vantieghem, Vermeersch and Van Houtte, 2014), with the size of a city, and a number of siblings. The differences are more apparent than in our research with 5th graders (Hoskovcova and Krejcova, 2015). In the younger cohort of children we had no difference between groups. This difference needs further analysis and seems important to us.

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ASSESSMENT IN INQUIRY BASED EDUCATION IN PRIMARY MATHEMATICS

[1]✉Alena Hospesova, [2]Iva Zlabkova

[1]Department of Pedagogy and Psychology, Faculty of Education, Jihočeská univerzita v Českých Budějovicích, Jeronýmova 10, České Budějovice, 371 15, Czech Republic, hospes@pf.jcu.cz

[2]Department of Pedagogy and Psychology, Faculty of Education, Jihočeská univerzita v Českých Budějovicích, Czech Republic

Abstract

The contribution reports on the findings of research in the area of peer-assessment and self-assessment in inquiry based mathematics education on primary school level. On the basis of analyses of 20 inquiry based lessons that included pupils' self-assessment and peer-assessment we identify the phenomena that hinder this approach: problem of supporting self-assessment and formative peer-assessment (form of working sheets, support from the teacher), formulation and operationalization of learning objectives, understanding vaguely or inaccurately formulated pupils' solutions, identification of correct solutions of the problem, institutionalization of knowledge.

Keywords

Inquiry based mathematics education, formative assessment, peer-assessment, self-assessment

Introduction

Inquiry based education in mathematics has become a promoted way of developing understanding in natural sciences and mathematics and of raising interest in scientific disciplines. The nature of this teaching method requires specific approaches to assessment of findings pupils come to in their "inquiries".

What do we understand by inquiry based education?

In simple terms, inquiry based education means that the teacher creates such conditions at school that allow the pupil to discover on their own a part of the knowledge to be learned. It has recently been regarded as a promising way that promotes interest in the study of natural sciences and mathematics. The goal of this approach is to prepare a situation in which pupils will use in the classroom methods that are similar to methods used to gain knowledge in scientific research (Artigue and Blomhoj, 2013). Jorde et al (quoted from Ropohl et al, 2013) stress that pupils must get involved in authentic problem solving, experimenting and rich communication with their peers and their teacher.

Inquiry in primary school mathematics is launched by an appropriate problem (properties of these problems are listed e.g. in Samková et al, 2015). Pupils grasp the problem, look for ways of its solution (experiment with numbers or geometrical objects, create suitable models, search for regularities and relations), interpret results, formulate conclusions and generalizations, communicate their findings to classmates and the teacher. The teacher initiates the educational situation, helps pupils during the inquiry if requested (scaffolding), directs the final discussion (institutionalizes the discovered knowledge). Without any doubt this situation is more difficult for the teacher than standard transmissive approaches, as he/she must often react to unclear, sometimes only partially correct or

incorrect pupils' contributions. Despite these difficulties the teaching public tend to speak highly of the potential of inquiry based education. However, at the same time they point at the difficulties related to implementation of inquiry based education in a classroom. One of these objections is the problematic nature of assessment of pupils' progress, especially if learning in inquiry based education is to be assessed in the traditional summative way, focusing more on knowledge than competences.

Since 2013 we have been actively involved in the solution of the project of 7th EU framework programme Assist-me (Assess Inquiry in Science, Technology and Mathematics Education), whose goal is to create and test a set of concrete procedures of formative assessment, e.g. continuous teacher's interactions with pupils (remarks, recommendations, "*ad hoc*" corrections), self-assessment and peer-assessment, marking and grading of pupils' solutions. The Czech team is responsible for application of peer-assessment in mathematics and science education. The here presented study focuses on teaching mathematics on primary school level.

What do we understand by formative assessment?

Assessment is a mental process that gives feedback information on the quality of the assessed object (i.e. the concerned object or activity) and can be communicated (Slavík, 1999). Assessment as part of the learning process includes collection and interpretation of data relevant for a pupil's learning. The purpose is (a) to help learning of the pupils (the formative use of assessment, in other words *assessment for learning*), (b) to find out what the pupils have learned (the summative use of assessment, simply said *assessment of learning*). (Black and Wiliam, 1998; Black et al, 2004; Earl and Katz, 2006).

Formative assessment is especially important in the situation of inquiry based education. Peer-assessment, which is the focus of this study, is understood here in accordance with Slavík (2003) as a way to autonomous assessment, i.e. deeper reflection on one's own learning and its results "… that learners use on their own, master it, that they understand to the needed extent, that they can explain or defend" (Slavík, 2003: 14). Development and deepening of autonomous assessment partially depends on self-assessment and partially on assessment of somebody else's performance (most likely of a classmate, i.e. peer-assessment) through which pupils learn to reflect on their work (Slavík, 1999). Pachler et al (2010) stressed that learner self-regulation is a core factor in formative assessment and that it is linked to motivation and emotional factors which affect learners' engagement.

The goal of the research study is to identify those phenomena that could be observed in a planned implementation of inquiry based education in mathematics at primary school level. Integral part of this teaching experiment was pupils' formative peer-assessment.

Materials and Methods

This study is based on a qualitative analysis of 20 teaching experiments conducted in mathematics lessons on primary school level. The experiments were realized in 3 stages: 6 experiments were conducted in the 5th grade (pupils aged mostly 10) in autumn 2014, 6 experiments in the 2nd grade and 2 in the 3rd grade in spring 2015, 3 experiments in 5th grade and 3 in 4th grade in autumn 2015. Each stage was conducted in collaboration of two teachers from parallel classes and the authors of this study (the last stage in cooperation of 2 teachers from neighbouring classrooms and authors of this study). The teacher, authors of the paper and one person technically supporting the recording of video were present in the classrooms during the experiment. The number of pupils varied from16 to 24. They solved the problems and assessed their peers in groups of 4.

The teaching experiments were conducted with the goal of creating space for pupils' independent inquiry and subsequent peer-assessment of the findings from this inquiry. The planning of the experimental lessons always had the form of a discussion among the teachers and the authors of this paper. In this discussion the learning objective of the particular teaching unit was formulated, the possible ways of achieving this objective proposed and the possibilities of implementation of formative assessment sought. Each of the teachers then created a detailed lesson plan for the teaching experiment in her own class. In most cases this meant creation of a worksheet into which the pupils recorded their solutions as well as assessments of their peers and reactions to this assessment.

The teaching experiments were 45 to 90 minutes long. All of them were video recorded and transcribed. Pupils' group discussions were recorded on voice recorders. All pupils' written production was documented. Also other data were collected to get as accurate view of the teaching experiment as possible: teachers' self-reflections, questionnaires structuring assessment of teachers' self-reflection, self-assessment tools for pupils.

The data were analysed qualitatively as we were entering *terra incognita.* Video recordings were watched more times, transcripts of them and pupils' written production studied to pinpoint the phenomena connected to formative assessment.

Results and Discussion

In this paper we will not analyse how pupils' cognition and knowledge has changed thanks to inquiry based education. We will comment on significant phenomena identified in implementation of assessment in the teaching experiments.

Supporting self-assessment and formative peer-assessment

The teaching experiment involved pupils with different experience with self-assessment and peer-assessment. That is why worksheets were prepared for assessment in the experiment. These worksheets were used both for recording the solution of the problem and assessment (a sample worksheet created for *Lentils problem* is in Appendix 1).

At first we asked questions to encourage assessment in general: Do you like your classmates' solutions? If not, what advice would you give them? However, answers to these questions gave no supporting feedback to the solvers. One of the possible ways to dealing with this problem seemed to split the solution into stages and ask for separate assessment of each stage. E.g. the pupils' task was to find how long "path" they will build if they put spaghetti from one package into a line. In this case we could have asked a sequence of questions: Did the solvers state correctly that there were about 500 spaghettis in one package? Did they measure that the length of one spaghetti is 23 cm? Did they calculate correctly the length of 500 spaghettis in one line? However, these questions make the evaluators acknowledge only one correct way of solving the problem. But the solvers could have proceeded in a different way. For example, they could have divided the spaghetti into ten roughly equal piles, out the spaghetti from one pile into one line, measure the length and multiply the result by ten.

This is why we were looking for a compromise. In case of the *Spaghetti problem* we asked the following questions: Did your classmates state the number of spaghetti correctly? Was their procedure of stating the length of the line correct? Do you understand their solution? What advice would you give them?

Formulation of learning objectives

It is essential and not only in an inquiry based lesson that the didactical goal to be achieved in the lesson should be clearly defined. This premise is often discussed in the materials for teachers. When teaching mathematics at primary school level in the Czech Republic it is often only the topic of the lesson that is defined and sometimes also the teacher's activities: "I will explain…", "We will revise…". The teacher is more likely to plan what problems will be included in the lesson, how they will be arranged and what form of class management will be used. We think this is partly the consequence of availability of workbooks and worksheets that enable this style of work. The teacher does not plan the lesson with respect to what the pupils will learn but with the objective of solving problems provided in textbooks, workbooks and worksheets correctly.

When planning the teaching experiments, we gradually found out that the quality of the feedback that pupils may gain from their solutions depends on accuracy of the definition and operationalization of the learning objective of the "inquiry". At the beginning the objectives defined in cooperation with the teachers were quite general (e.g. "get experience", "apply a known procedure in a new environment"). The experiments showed that it is essential for assessment to know what the pupil was expected to learn, to state the objective in terms of the expected pupil's performance. This can be illustrated on a problem in which the pupils were asked to formulate comprehensible instructions on how to determine the number of tiles needed for "tiling" the triangle in Fig. 1. Evaluators were assessing the correctness of the instructions by using these instructions for determining the number of tiles needed for tiling other triangles. This assessment could have been initiated by a concrete question: Did the solvers determine correctly that 15 tiles are needed? But asking this question would not correspond to the defined learning objectives: Pupils brush up pre-concepts that form the basis of measuring the area of a triangle, namely their experience with filling in a triangle with e.g. a square (i.e. by a selected unit).

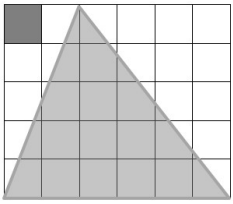

Figure 1: Tiling the triangle

Correctness of solution of the problem and peer-assessment

In some problems the pupils had been solving during inquiry it was difficult to decide whether the problem had been solved correctly, in other words to assess the individual steps of the solving procedure described by their classmates, and it was equally as difficult to communicate this assessment in a comprehensible way. The pupils used two ways to overcome this difficulty:

- they compared their classmates' solution with their own solving procedure, which they naturally saw as correct (S1 in Table 1)
- they commented on the single steps of the solving procedure rather vaguely (S2 in Table 1).

In Table 1 we present solution and peer-assessment of the problem: How many lentils are there in a 500 g package? (worksheet in Appendix 1)

Solvers	Evaluators
First we found that there are 80 lentils in 5 g. 500: 5 = 100, 100. 80 = 8 000 So there should be 8 000 lentils in one package.	☺We like that they have the same principles as we do. ☹ But the weighing should be accurate.
First we found out what the mass of the package was. Then we counted the number of lentils in one gram. At the end we calculated a problem and got the result 93 258.	☹ We can't assess this. They didn't state what problem this was. So we don't know how they solved it.

Table 1: Examples of pupils' solution of *Lentils problem* and peer-assessment

- Solution S1 is correct. Evaluators express this by emotional "We like it" and support this by comparing it to their own solution. The comment on accuracy of weighing comes out of the evaluators' own experience.
- Solvers of S2 described some steps that were not needed for the solution (the mass of lentils in the package was given in the assignment); other steps were not described clearly enough to make a decision on their correctness. The evaluators commented on the second part of the solution quite clearly. However, they did not comment on the fact that it was not needed to find out "what the mass of the package was". If the problem was assessed by the teacher she would have undoubtedly drawn pupils' attention to this point, i.e. to assessment of whether all the steps were really needed for the solution. Other problem is that number of lentils is approximately 10 times higher than the right solution. The peers did not comment this fact.

Essential in inquiries are those erroneous contributions that move the solution forward. However, these are not often assessed by an evaluator who is familiar with similar methods of work as the solver. The situation becomes even more complicated if the solution is not described clearly and comprehensibly by the solver.

Peer-assessment and institutionalization of knowledge

Formulation of the objectives of an inquiry is connected to the issue of institutionalization of the gained knowledge. We found out that at the end of inquiry based lessons the pupils expected an unequivocal decision on what had been done correctly. They expected the result of their solving – the discovered knowledge – to be shared by the group, critically discussed and then accepted. The final summary was in the hands of the teacher. However, if the teacher had not stated the learning objective clearly enough, their summary was very vague ("You worked very nicely", "I am pleased with your work."). Our findings are in agreement with the Theory of Didactical Situations. The need for the inclusion of institutionalization phase was theoretically grasped by Brousseau and Balacheff (1997) and introduced in the model of so called a-didactical situation (a situation in which the teacher let the pupils to discover (part of) mathematical knowledge). The presence (and necessity) of institutionalization phase in situations independent problem solving have been confirmed in the Czech educational context (Novotná and Hošpesová, 2013).

Conclusions

Our analyses show there are phenomena that make peer-assessment in inquiry based education in primary school mathematics difficult:

- Inquiry may result in finding more ways of solving the problem; some of these ways might not be understood by peers and then may be assessed as incorrect.
- Children's ability to describe solving procedures is in the process of construction on primary school level. Sometimes even the teacher finds it difficult to understand what exactly the children were doing while solving the problem and what they achieved.
- Mathematical knowledge is of cumulative nature. If the evaluator has no idea about the structure of mathematical knowledge, they are likely to fail to formulate appropriated learning objective and discern a valuable or substantial mathematical idea.
- It is very difficult for the teacher to define the objectives of the inquiry and what and how to assess. In this the teacher needs support as well as time and space for discussion with other teachers.

Our experiments showed that pupils adapted to inquiry based education and peer-assessment very quickly. Pupils' willingness to inquire and to assess each other and their success in these activities developed as they were gaining experience. Becoming independent both in case of individuals and groups while solving problems and development towards autonomous assessment is a gradual process which must be given enough space at schools. In our project these opportunities were given in the way expressed by the following schema (Fig. 2).

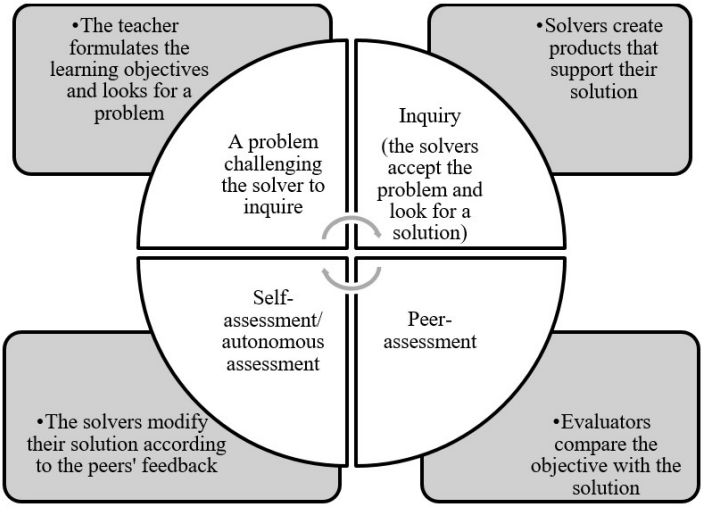

Figure 2: The process of formation of autonomous assessment (source: authors´ own schema)

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Appendix 1: Assessment Tool (Worksheet 1 - How many lentils are there in a 500 g package? (Coloured parts are intended for peer assessment. In the original version there was more space for pupils´ writings.)

Names of the pupils solving the problem:			
How did we proceed?			
Result:			
Names of pupils who assess the solution:			
Is the result correct? ☺ ☹	☺ What did you like in the solution?		
☹ Recommend your classmates how to get the correct number.			
Revision:			
Did the advice from your classmates help you? How? ☺ ☹			

DOES GRADE POINT AVERAGE OF STUDENTS REFLECT THEIR MANAGERIAL COMPETENCES?

[1]✉Daniela Hricova, [2]Marek Andrejkovic

[1]Department of Trade and Accounting, Faculty of Economics and Management, Czech University of Life Sciences Prague, Kamýcká, 129, Prague, 165 21, Czech Republic, daniella.romanova@gmail.com

[2]European Union Knowledge Economy Pass n.o., Slovakia

Abstract

Domestic and foreign literature often states the importance of creating an educated society and developing competencies during studies. The aim of each university is to educate students to understand their work creatively and constructively and to prepare skilled and highly qualified professionals capable of satisfying employers' high levels of required competencies. This research was conducted on students studying at the Faculty of Business Economics, and its primary objective was to identify the dependence of the assessment of students by grade point average and test results of managerial competencies. It was necessary to get the grade point average of students and to test their managerial competencies. A two-sample t-test for unpaired data was used. The result of this research is the fact that higher values were found among students with a better grade point average.

Keywords

Grade point average, labour market, managerial competency, student evaluation

Introduction

Present employers impose very demanding requirements on their potential employees. The reason is very simple: universities produce a large number of graduates and consequently employers adjust harder and more advanced criteria with the intention of hiring only the best graduates. This style of job interviews is performed mostly in a special form called assessment centres. Serious foreign companies invest enormous funds to obtain highly qualified manpower, and such employers expect great performance from applicants and that competencies are being developed during university studies. From the other perspective, there are potential graduates on the labour market who desire very well-paid employment in which they will apply the knowledge and competencies gained during their university studies. Recent research conducted by the Czech Student Union (Horáková, 2014) points out that most students from the branch of management and economy are interested in employers who pay attention mostly to managerial competencies. Other definitions were derived from the word competency. According to Óhida (2008), the definition of key competencies is not primarily a research issue, but rather a social issue. Andrawes (2011) defined competencies as a list of knowledge and skills that should be acquired by students at universities and tertiary schools. Winterton, Delamare and Stringfellow (2006) recognise two different types of key competencies: objective competency (potential performance measured by standardised tests) and subjective competency (assessing the ability and skill level required to perform tasks and solve problems). Potgieter and Coetzee (2010) point out that despite the changing roles of managers, it was not common to emphasise the improvement of their managerial competencies in the past. There are many existing links between individual types of

management competency showing that an effective leadership should have a broad range of skills. That is why various frameworks are being developed to identify areas for the improvement of competencies (Govender and Parumasur, 2010). Mayer (1992) defines problem solving as a management competency involving a cognitive process leading to the transformation of a given situation to a desired state when no solution methods are known. Sternberg (2003) has shown that a person must selectively decode available information in order to resolve a problem. In other words, it is necessary to select from the many available sources which information is relevant to solving the problem.

Problem-solving is a central goal of education in all school curricula of several countries. Teachers emphasise the development of student competencies that affect problem-solving in real life: understanding information, identifying critical elements and relationships between them, resolving issues, evaluating, justifying and communicating a solution. For this reason, problem-solving processes can be found in mathematics, science, art, language and social sciences as well as many other areas (Hricová, 2015b). To improve understanding of competency problem solving, the OECD (2003) provides a definition of selected terms - Cognitive process – this aspect deals with various components of problem-solving which include for example understanding problems and characterising them as well as representation, reflection and communication. Interdisciplinary tasks – in problem-solving, it is necessary to evaluate gained competency in broader areas than only the basic disciplines such as mathematics, science or reading. Real – the definition of problem-solving provided above emphasises problem-solving in real life. These problems require individuals to combine various strategies and sources of knowledge. The development of the quality of management job positions has multiple dimensions and includes types of management tasks that provide opportunities for obtaining new skills and improving the overall perspective (Dragoni et al., 2009). Several recent research projects such as Assessment of Higher Education Learning Outcomes, the Programme for International Student Assessment and the Maryland Performance Assessment Program aimed to measure managerial skills and to search for an answer to the question as to why managers do not have the qualifications needed for proper effectiveness in business activities (the Ministry of Education of the Slovak Republic, 2012; OECD, 2003). The Criterion-Referenced Evaluation System (hereinafter CRES) has been developed to support newly created curricula including effective communication skills, problem solving and critical thinking, social cooperation and ambition, responsible citizenship in society and responsibility towards the environment. CRES requires students to be able to respond flexibly to various types of performance tasks evaluating logic, reasoning and understanding. The system consisted of performance evaluations (Khattri, Reeve and Kane, 2012).

The mission of universities is to prepare highly qualified students for professional life and to fulfil employers' requirements for high levels of competencies from applicants. In this context, it is perhaps logical to assume that "the best-performing employees will be those who were most successful during their studies". Is this assumption reasonable? At universities, students are usually assessed by grading (with the exception of certain alternative schools). Without any deeper analysis, it seems that the claim should be valid: the better results achieved during studies, the more suitable the applicant. Does performance depends to a student's quality or not? At our schools, evaluation takes the form of grading. Slovakia uses a new system with the grades A, B, C, D and E (A is the best). Schools in the Czech Republic use the traditional model of grading by 1, 2, 3 and 4. On the labour market, there are still employers who consider this method as a proper

one, and in fact, candidates with a "red diploma" (which is given for an excellent grade point average) have priority over others. The disadvantage of the employers during the interviews is that they do not have the proper information about students' competencies acquired during their studies (Hricová, 2015a). There are also employers interested in the academic performance of graduates.. According to a survey of more than 200 employers conducted by the National Association of Colleges and Employers, 67% of companies said they screened candidates by their grade point average (Adams, 2013).

This article is focused on two lines of thoughts that are subsequently linked. The first thought is grading, which means the evaluation of students' gaining competencies significant for their application in the labour market. The second direction is based on the teaching process and the development of competencies directly at schools. By this we can deduce the main objective of the article, which is to verify whether the actual values of competencies are evaluated by the grade, in other words, whether grading truly reflects students' managerial competencies gained during their studies.

Materials and Methods

The main objective is to identify the dependence between the students' assessment in an educational system and the outputs of measuring managerial problem solving competencies required for working experience.

We decided to test this competency because the tested students are from the Business Economics and Management programme. The students are studying the Management program, which means that at the end of their studies they should have acquired not only managerial competencies, but also knowledge for applying them in their work. We assume that the evaluation process at the university is similar to test results of managerial competencies – problem solving. We assume that the students with the best grade point average will gain significantly better results from the problem-solving competency than those having the worst grade point average.

The sample was composed of second-year students studying for a master's degree at the Faculty of Business Economics of the Business Economics and Management programme. The tested group was composed of 175 students, and 140 of them took part in testing. This means that the research sample was realised by 80% of the second-year students (Hricová, 2015b). Than we have identified 10 students from each group, i.e. 10 students with the best average and 10 students with the worst. They were selected in order.

To ensure that we can fulfil the stated objective, it was necessary to acquire the two types of data. The first was the grade point average provided by the student officer representing the weighted average of the student on the basis of grading. The following action was to test students. The best criterion for companies assessing the suitability of candidates is testing specific competencies. For professions that include management positions, there are managerial competencies belonging to the problem-solving category. Therefore we decided to test this category for gaining the second data for our research. We were inspired by Organisation for Economic Co-operation and Development (next OECD) research (2003, 2004, 2006). The students were tested by a wide range of tools, each of which focused on another subtype of the problem-solving competency. There are three types (partial areas): decision-making, system analysis and design, and troubleshooting. We decided which of these three components of problem solving to evaluate. We finally concluded that in order to achieve a better image of the profile of future graduates, we would create all three types of tests. According to the OECD (2003, 2004, 2006), the

problem-solving competency is the result of mixing the three partial areas, calculated as follows:

Decision making + system analysis and design + troubleshooting = problem solving (1)

We created two groups from all of the students. The first one consisted of 10 students with the best grade point average, and the other one of those 10 students with the worst grade point average. In our case we want to identify the dependence between the two metrics, the managerial competencies measurement by means of standardied test, and by means of grade point average.

For this reason we decided to apply two sample t-tests for two independent samples according to Šoltés (2008) and Mankiewitz (2004). In this case, we follow the existence of a statistically significant difference in an observed variable (variable y) between two selected groups of the students. For the determination of the correct student t-test, we use the F-test for verifying the equality of variances of basic files. If we cannot reject the null hypothesis of equal variances of the core set of values, we proceed according to the "pooled" and when was the hypothesis of equality of variances denied the basic set, proceed according to the "Satterthwaite." Based on the p-value in the row, we then test the hypothesis of the equality of the mean values of the two main groups (equality of the mean variable y). This statistical hypothesis is formulated below:

$$H_0 : \mu_B = \mu_W$$
$$H_1 : \mu_B \neq \mu_W \quad (2)$$

Results

The grade point average in the sample is 2.32. None of the students achieved a grade point average of 1.0. One student had a grade point average of 1.1. The worst average score, more than three, was achieved by five students. Those were students who were graded FX for unknown reasons and had to retake the course. Most students have a grade point average of 2 and more. Only about 20% of students have a grade point average below 2.00. Roughly 3% of the students in the sample had a grade point average above 3.00. The students could gain 41 points in total from the problem-solving tests. The maximum achieved score was only 28.2 points, and the minimum 5.2 points. Between 20% and 25% of them had 12 to 18 points (Hricová, 2015b).

In order to analyse the results of the best and worst students we have identified 10 students from each group, i.e. the 10 students with the best average and 10 students with the worst. These students were compared to one another. We then used the t-test to determine if it can be assumed that differences in mean values are random or not, and therefore whether we can consider that mean values differ from each other in a statistically significant way or whether these are just minor, non-systematic differences. Conclusions are reached in evaluating the total number of points gained by students for problem solving. We can see in Tables 1, 2 and 3 that while this case does show some overlap in confidence intervals, this overlap is not sufficiently large, thus refuting the hypothesis of equal mean values. We can see that the F-test of equality of variances indicates the variances of groups, the p-value is 0.2037, which is more than 0.05, and then we need to check the Pooled t-test, in which the p-value is lower than 0.05. This is why we need to reject the null hypothesis for equality of estimated values.

Beginning/end	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
1		15.5800	11.87	19.9313	6.0827	4.1839	11.1047
2		9.00	6.41	12.59	3.83	2.83	7.1351
Diff (1-2)	Pooled	6.0000	1.65	10.35	5.1125	3.30	7.04
Diff (1-2)	Satterthwaite	6.0000	1.1364	10.36			

Table 1: Descriptive statistics of problem solving (source: own calculation)

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	18	2.62	0.0172
Satterthwaite	Unequal	15.349	2.62	0.0189

Table 2: Results of t-test of problem solving (source: own calculation)

Equality of Variances				
Method	Num DF	Den DF	F Value	Pr > F
Folded F	9	9	2.42	0.2037

Table 3: Results of F-test of problem solving (source: own calculation)

The results displayed in Tables 1, 2 and 3 are generated by the statistical program SAS. In the problem-solving competency, the difference is considered to be significant. It is clear that the mean values are not equal. Higher values of this indicator can be found among students with a better grade point average.

Discussion

The outcome of this research is that in the case of the overall evaluation of problem-solving skills, students with the best grade point average had better results than those with the worst grade point average. It is advisable to consider this dependence from the opposite side, where it is presumable that the problem-solving competency has helped students obtain better results. We can state that the study results depend on the ability of students to react promptly and effectively when solving the case studies during seminars (at school). In this case, we point out that study performance really reflects the evaluation based on the above variables applied to the group of students from the opposite end of the scale (best vs. worst). One aim to fulfil the main objective was to test students by metrics proposed by the OECD (2003, 2004, 2006). These tests are adapted to labour market requirements. Problem solving is a competency that appears frequently in advertisements on job portals for managerial positions. In Slovakia, the large-scale research conducted by Bašistová and Ferencová (2011) indicates that the problem-solving competency is heavily requested by employers. This competency was requested 3,753 times. From the test related to problem solving, the students did not achieve a very high score. The final conclusion of the research is that tested competencies are not developed as much as we had expected. Ultimately, schools are involved in the development of managerial competencies and in preparing graduates for practical life. The fact that some students scored worse on tests and others better can be caused by various factors that might be interesting to analyse in further research. The second interesting question involves what employers actually understand as problem solving. The concept of the research is based on the definition of problem solving and its metrics adopted from OECD recommendations. It is possible that our employers have different requirements; if so, their demands need to be examined and used to develop new metrics for this management competency. Making decisions, fixing errors and analysing various alternatives of possible solutions in working and non-working life are not possible without the utilisation of eight key

competencies. These were defined by the European Union in 2006 (European Parliament, 2006). All countries are obliged to incorporate them into the curricula of their education processes. For their development it is necessary to change traditional forms of education into modern forms (Pčolinská, 2012). A focus on the use of inquiry teaching, measuring its impact on important educational outcomes or on the use of goal-oriented learning, experimental evaluation and identifying knowledge for teaching based on analyses would be an important goal (Jiang and McComas, 2015; Björklund, 2014; Clements and Sarama, 2008; Loewenberg, Thames and Phelps, 2008). According to Pudło and Gavurová (2013), the use of simulation games can help students develop competencies.

A research restriction is the fact that the results could not be generalised, and in the case of monitoring and verification of all the students and the verification of a dependence between the value of the average grade and obtained score (variable y), this dependence is not statistically significant. The result of another study conducted in the Slovak Republic that focused on grading is the proposal of a performance evaluation model. The employer can learn which competencies the candidate has and can also determine from the results (using the equation) their grade point average at school (Hricová, 2015b). Hricová (2015a) and Romanová (2014) researched similar topics. If a company has highly qualified employees, its commercial success should be sustainable.

It is necessary to use various methods for the development of communication. As early as in 2016, the European Parliament integrated into the curricula of schools the development of eight competencies, including communication skills. Unfortunately, the way this competency should be developed was not further specified. Therefore, methods such as presentation, problem teaching and others were applied. In addition to all of these methods, we recommend applying in the educational curricula of schools a new form of development used by international companies known as "the big four". These companies started to apply the form of assessment methods during job interviews. This is a very interesting form showing, among other abilities, how applicants are able to communicate. Unfortunately, most applicants lack serious experience with this method until they begin job interviews. In our opinion, this why we should voluntarily integrate this form into educational processes for selected subjects. If it is proved in additional future studies that this method develops communication more effectively than other methods, it would be appropriate to consider the compulsory application of this method in school curricula. During the period of economic crisis, many companies did not manage to survive and suddenly fell into bankruptcy. While this is not of course the main problem, having qualified employees could slow their fall. In the future it would be interesting to conduct research with the aim of determining the extent to which grade point average is important for employers seeking to fill managerial positions. According to our research outcomes, it is has been shown that grading at universities of a certain type is not useless; on the contrary, it reflects the managerial skills of students.

Conclusion

It is important to point out the grading and competency development during studies. Students should not receive grades for only theoretical knowledge; instead, grading should reflect mainly their competencies that are fundamental for the future professional life of students. With respect to the fact that the research sample consisted of students focused on management, we focused in this article on the managerial problem-solving competency as defined by the OECD. Problem solving is a central goal of education in all school curricula of several countries. Teachers emphasise the development of

student competencies that affect problem solving in real life: understanding information, identifying critical elements and relationships between them, resolving issues, evaluating and justifying and communicating a solution. At universities, students are usually assessed by means of grading. Based on our findings, we have formulated the following objective: to verify if the method of evaluating students in an educational system reflects their outputs of the measurement of managerial competencies required for practice. Based on our objective presumption, we have deduced the research hypothesis. To confirm or refute the stated hypothesis, it was necessary to undertake three steps. The first of was to determine the study average of a research sample; the second action was to test the students, and consequently, the third step, the use of the t-test, helped us to fulfil the stated objective and to verify the hypothesis. The hypothesis was confirmed. It is a fact that the students with the best grade point average will achieve a significantly better evaluation in the problem-solving competency than the group of students with the worst grade point average.

The actual values of competencies are evaluated by the grading; in other words, grading truly reflects students' managerial competencies gained during the studies. As regards grading, only about 20% of students have a grade point average below 2.00. Roughly 3% of tested students had a grade point average higher than 3.00, which means that the managerial competency is not developed. From this it can be concluded that the majority of students are not ready for job interviews. On the labour market in the Czech Republic and Slovakia, specifically in the field of economics and management, there are companies called "the big four". They regularly offer employment opportunities for talented university graduates, and they were the ones testing their managerial competencies during job interviews. Test results point to the fact that students could gain 41 points in total from the problem-solving tests. The maximum achieved score was only 28.2 points, the minimum 5.2 points. The partial conclusion of the research is that tested competencies are not developed as much as we had expected. All of the students being tested were studying for a master's degree at the faculty, and for this reason we expected considerably better results.

Working in a group can be a very good starting point for the development of competencies. Students can be more open in front of a smaller group than in front of the whole class. Furthermore, there are several methods that focus on the development of communication skills, and it is recommended that they be used during the learning process. These methods were briefly mentioned in the discussion of this article and include the solution of case studies, transcript analyses, games, exercises, simulations, etc. Unfortunately, there are still courses that lack this kind of opportunity. This is a disadvantage, since many job interviews are conducted on the verbal level, where expressing oneself without stress or any bad feelings can be problematic.

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IS THERE A RELATIONSHIP BETWEEN KNOWLEDGE AND COMMUNICATION COMPETENCES OF STUDENTS?

[1]✉Daniela Hricova, [2]Lenka Pcolinska

[1]Department of Trade and Accounting, Faculty of Economics and Management, Czech University of Life Sciences Prague, Kamýcká 129, Prague, 165 21, Czech Republic, daniella.romanova@gmail.com

[2]Civic association Arboraetas, Slovakia

Abstract

Communication is an important tool for any interpersonal activity and also in the work area. Communication competences are important for the expression of people´s opinions, and for cooperation between them. Through communication, people get to know their views, and know each other. This study is focused on the communication competences of students and it was realised within the course "Sales and Vending Strategy of the Company", which is taught within a philosophical framework of a new educational concept. The activity, presentation and discussion were evaluated as communication competences. The aim of this paper is to identify whether there is a relationship between the activity of students and points gained from theoretical knowledge, and also between the presentation and discussion of the term work and points gained from theoretical knowledge. The result of the study is the existence of a weak negative correlation between the variables of interest.

Keywords

Activity, communication competences, discussion, educational process, presentation

Introduction

Communication and critical thinking are connected in many important ways. On a basic level, the ability to think critically, reason through a problem, and develop a cogent argument or explanation is important for all types of daily communication. People with the capability to really think about an issue and see it from a different perspective will then most likely be better communicators, and be less likely to react quickly in anger. On another level, critical thinkers often examine the way other people are thinking and making their arguments before they choose to respond themselves. This type of analysis is another very important aspect of the connection of communication to critical thinking (WiseGeek, 2016). The concept of competence is crucial for evaluating educational systems, as well as for basic research in education (Klieme et al., 2008). The development of competences may be the starting point of qualitative change in the ordinary curriculum (Jaegher, 2007). Current practices have taught us that to plan education by aiming at key competences is a difficult process. It is very important to develop competences on the basis of individual knowledge or the attitudes on which they are based (Hausenblas, 2008). In the process of education, the emphasis has been placed on the development of communication competences. Learning processes should develop in close cooperation with the requirements of the market. This means that the change in the learning processes and research profile creates a new pillar of inquiries into the competences of future workers (Modéer, 2012). According to Andrawes (2011), students should acquire the ability to perform specific behaviour connected with the pedagogic activity involved in the learning

process. This activity consists of the knowledge, skills, and attitudes that reflect the teaching; they are an output of the process and they are measurable and correspond to the expected goal. Education leads to graduates being able to express themselves both orally and in writing in different educational, life, and work situations (Jezberová et al., 2007). More authors started to deal with communicative competences (Aba, 2015; Arasaratnam, 2014; Busch, 2009; Piller, 2012; Coperías, 2009). The study (Mitchel et al, 2015) shows that a multi-strategy approach in an interactive, motivating atmosphere allows students to develop intercultural communicative competence. Teachers play a critical role in promoting interaction among students and engaging them in the learning process. Cooperative, small-group learning is widely accepted as one way in which teachers can promote this interaction to benefit all students. When students interact in cooperative groups, they learn to give and receive information, develop new understandings and perspectives, and communicate in a socially acceptable manner (Gillies, 2004). In recent years, student demand for courses in interpersonal communication has been rising. Faculties have responded by offering more classes, including advanced ones that help students learn to interact effectively in their everyday interpersonal encounters (Wood, 2012). Interpersonal communication does not simply involve the exchange of messages. It essentially involves the creation and exchange of meaning (Hartley, 1999). West and Turner (2009) define interpersonal communication as the process of the transmission of messages between people to create and sustain shared meaning. According to Hargie (2010), this type of communication can be thought of as a process which is transactional, purposeful, multi-dimensional, irreversible, and (possibly) inevitable. Skilled interpersonal involvement can accordingly be accounted for in terms of notions of personal-situation context, goals, mediating processes, responses, feedback, and perception. Interpersonal communication in the workplace is considered to be profitable (Dekay, 2012). Reinsch and Gardner (2011) define interpersonal skills as the critical attributes necessary for successful employees. Interpersonal communication can be a one-way or two-way process. According to Theodorson and Theodorson (1969), two-way communication involves interaction, with the different parties being able to contribute to and control the flow of events. In terms of verbal communication skills, verbal language can be spoken or written. Generally, speech is a more spontaneous process, whereas writing tends to be more deliberate (Berry, 2007). Non-verbal communication is the way in which we express our feelings, emotions, attitudes, opinions, and views through our body movements. In non-verbal communication we use our eyes, hands, face, and movements of other parts of our bodies to express our thoughts (Sen, 2006). Traditional educational methods and patterns are no longer able to meet the current level of innovation. It has become necessary to adopt modern, practical, positive methods in all areas of the educational process through comprehensive programmes and policies (Al-Keelany, 2001). Representation methods can be divided into activating and receptive methods (Strohner and Rickheit, 2009). Activating methods of representation are geared towards producing interactions in which conversations can be experienced and explored. These methods include simulations (role play), games, and exercises. Receptive methods of representation are characterised by a focus on the mental reconstruction of written records of communication reality (Davies, 2001).

In this study we focus on the evaluation of interpersonal communication. We wanted to find out how the communication competences of students are developed. The study was realised within the course "Sales and Vending Strategy of the Company". The aim of this paper is to identify whether there is a relationship between the activity of students

and points gained from theoretical knowledge, and also between the presentation and discussion of the term work and points gained from theoretical knowledge.

Materials and Methods

The sample consisted of final-year students studying at the University of Economics, Slovakia, via a chosen sample of thirty-four students in one class. The sample of students who were examined was anonymous. The students wrote two tests of a theoretical character during the course "Sales and Vending Strategy of the Company". From the first test they could gain a maximum of eight points and from the second one seven points. For our purposes, we worked with the sum of both test points, 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. 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. We suppose that knowledge in general and also theoretical knowledge motivate students to better expression and communication on the topic being discussed and solved. For the evaluation of the 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. Our aim was to identify the relationship between the activity of students and points gained from theoretical knowledge and between the presentation and discussion of the term work and points gained from the theoretical knowledge. Based on the main aim, we established two separate hypotheses:

1. We assume that there is no relationship between the activity of the students and the points gained for theoretical knowledge during the course "Sales and Vending Strategy of the Company".

2. We assume that there is no relationship between the presentation and discussion of the term work and points gained for theoretical knowledge during the course "Sales and Vending Strategy of the Company".

We present the outputs that were obtained by using the SAS statistical program. We used Pearson´s correlation coeficient for statistical processing. In this study, we use the Cohen's (1988) interpretation of effect size.

Results

Distribution analysis of communication

For the correlation of variables, we needed to give points to the students. Figure 1 shows us the percentage of points gained for communication during the course "Sales and Vending Strategy of the Company". The students could gain points from actively participating in; they joined the discussion during the lessons. The x-axis shows the points awarded for communication (activity, presentation and discussion), the y-axis the percentage number of the students. From Figure 1 we can see that the highest percentage of students (25) gained between eight and ten points, and the same percentage gained between fourteen and sixteen points. We can see that a small percentage of students gained the minimum number of points.

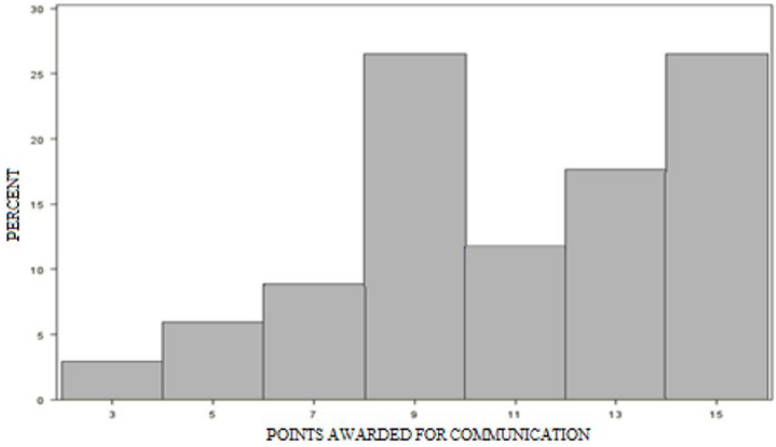

Figure 1: Distribution analysis of communication competences (source: own calculation)

Table 1 presents descriptive statistical data on the activity and scores of the students: mean, standard deviation, sum, and minimum and maximum values.

Variable	N	Mean	Std Dev	Sum	Min	Max
Score	34	12.51471	2.06792	425.50000	8.00000	15.00000
Activity	34	5.47059	2.63123	186.00000	1.00000	9.00000
Presentation and Discussion	34	5.33824	0.95917	181.50000	2.00000	6.00000

Table 1: Simple Statistics (source: own calculation)

Correlation analysis between activity and score

We present the second part of the study in tables and graphs, which are the output from the SAS statistical program. The results are very interesting, considering the contradictory correlation, as we assumed. In this part we verify the first hypothesis. Table 2 presents data obtained by calculating the Pearson Correlation Coefficients that describes the situation of full population because we analyzed of dataset of all members of population. The p value stated in the table (0.0886) 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). We can see that a moderate negative correlation of -0.29648 exists. This means that we can overturn the first hypothesis. It is not true that those students who acquired more points for theory also acquired more points for communication competence in terms of activity. On the contrary, the active students gained fewer points for theory.

Pearson Correlation Coefficients, N = 34, Prob > |r| under H0: Rho=0	
	Activity
Score	-0.29648
P value	<.0.0886

Table 2: Pearson Correlation Coefficients (source: own calculation)

Correlation analysis between presentation, discussion, and score

In this part we verify the second hypothesis. Table 3 presents data obtained by calculating the Pearson Correlation Coefficients. The p value stated in the table (0.2975) 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). We also presumed that there is no relationship between presentation skills of their term work and points from the tests. Again, we found an interesting implication. Our hypothesis was confirmed. It is certified by the Pearson Correlation Coefficient value of -0.184.

Pearson Correlation Coefficients, N = 34, Prob > |r| under H0: Rho=0	
	Presentation and Discussion
Score	-0.18401
P value	<.0.2975

Table 3: Pearson Correlation Coefficients (source: own calculation)

Discussion

According to the results we can declare that the ability to communicate is not linked to theoretical cognitive level. But university study should give a formation for better communication and preparation in communication competences for students future. The results lead to suggestions for the educational process. Henceforth, it is necessary to motivate students and give them the opportunity to learn how to express their thoughts, values, and attitudes in a communicative way. On the other hand, it is harder to teach

and motivate students to be more confident about performing when they are quiet, shy, or modest. For those students it is very important to create an atmosphere without stress, pressure, and depersonalisation and, if it is possible, to avoid the cruel comments of others in the class. Working in a group can be a very good starting point for the development of communication skills among shy students. Students can be more open in front of a smaller group than in front of the whole class. Furthermore, there are several methods that focus on the development of communication skills, and it is recommended that they can be used during the learning process. These methods were briefly mentioned in the theoretical part of this article and include the solution of case studies, transcript analyses, games, exercises, simulations, etc. Unfortunately, there are still courses that lack this kind of opportunity. This is a disadvantage, since many job interviews are conducted on the verbal level, where expressing oneself without stress or any bad feelings may be problematic. Many of the students who participated in this study were not interested in writing tests, although we had assumed they would be. In contrast, they are probably interested in original forms of education. Students obtain marks for courses that are based on the points earned during the whole term. The question arises of what would be more interesting – to rate students' competences and their theoretical knowledge separately, or to put more time into the development of competences and allocate less time to the testing of knowledge. The question arises of how students can be more communicative when they do not have enough theoretical knowledge. Of course, topics from practice can be managed and well discussed, but when we think about the future, they will be obliged to have a theory that underpins a professional approach to verbal communication. And since the school is a place of preparation for future managers, theoretical tests are still relevant. So it is important to test the knowledge that students gain and which they will use on the labour market and in their professional life. Therefore, is necessary to create an approach to education in which both individual competences (communication competences) and the acquisition of knowledge are developed. More authors started to deal with the evaluation of communication competences. For example, the institution NEFR-NELSON published series of tests. These tests mainly focus on the identification of leadership and management capabilities for various senior positions (Kollárik et al., 1993). They can be used to determine the structure of skills that are closely related to the ability to work in senior positions in industry, trade, services etc. They contain a numerical and verbal component. The Organisation for Economic Co-operation and Development (next OECD) research (2004) was realized for a similar purpose. The OECD organised the Programme for International Student Assessment research in which they tried to discover whether the future graduates are able to offer the competences demanded by the labour market. One of them was tested the ability to communicate effectively. It is a competence that may draw on an individual's knowledge of language, practical IT skills and attitudes towards those with whom he or she is communicating. The research, which was realized by Romanová (2014) researched verbal competence too. Students were contacted with an offer of testing their verbal capabilities. Participation was voluntary. 140 students took part. The testing was carried out in the academic environment before midday. It took 90 minutes in total. The research brought the results that according to Pearson´s correlation coefficient (0.14759), there is no a strong relationship between the two variables (the second variable was study performance). The aim of the another study realized by Hricová and Pčolinská (2015) was to find out how students' knowledge and communication competences are developed. We recommend that teachers use activities that encourage the students to

communicate, whether through some group works, or presentations in order to have the opportunity to practice their performing, argumentation, presentation skills etc.

Conclusion

Based on our aim presumption, we have deduced the two study hypothesis. As we compare the results of both correlations, we can see a moderate negative correlation when we measure the relationship between an activity and the theoretical score (-0.29648) than in the relationship between communication skills (presentation and discussion) and the theoretical score achieved in tests (-0.18401). This means that we can overturn the first hypothesis. There is a moderate negative correlation between researched variables. Those students who acquired more points for theory acquired less points for communication competence in terms of activity and those who did better in the presentation of their term work would gain less points from the tests. Again, we found an interesting implication.

There are two explanations for this situation. One is that "better" results for communication skills occur when the school exercise is mandatory. In our case, the presentation and discussion of the seminar work was mandatory, so each student had to somehow fulfil the task, in other words, to communicate more during the presentation of their work and to discuss during the round of questions and answers in front of the class. The activity, as another measured variable, was valued throughout the whole term when the students actively participated in the lessons, asked questions, and provided arguments. This was optional. Thus, those who did not want to join in the work did not have to. Therefore, those who were unused to communicating more gained fewer points for an activity during lessons. Another reason for these results is more psychological and can be connected with the nature, character, and disposition of individual students. According to the results, we can assume that those who gained more points for theoretical knowledge and did not gain comparable or identical numbers of points for communication might be less communicative and have lower communication skills. In a comparison of the correlation results, a stronger result is seen in the activity. We can state that some of the students who were tested had serious problems expressing their opinions and that they preferred a passive role in the work group and did not argue in class despite having good results in the theoretical tests. In contrast, those students who did not give more time to knowledge preparation had better results for communication skills.

As already mentioned in the discussion, it is needed to use various methods for the development of communication. As early as in 2016, The European Parliament integrated into the curricula of schools the development of eight competences, including communicative competence. Unfortunately, the way how this competence should be developed, was not further specified. Therefore, the methods, like presentation, problem teaching, and others were applied. Besides all these methods, we recommend to apply into educational curricula of schools a new form of development used by international companies, known as „big four". These companies started to apply the form of assessment methods during job interviews. This is a very interesting form showing among other abilities, how the applicants are able to communicate. Unfortunately, most of applicants have not the serious experience with this method until the job interviews. According to our opinion, this is the reason why we would voluntary integrate this form into educational process for selected subjects. If it was proved in additional future researches that this method develops communication more effectively than other methods, it would be appropriate to consider the compulsory application of this method into curricula of schools.

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DEVELOPMENT OF RURAL COMMUNITY EDUCATION IN THE CZECH REPUBLIC

[1]✉Jakub Husak, [2]Helena Hudeckova

[1]Department of Humanities, Faculty of Economics and Management, Czech University of Life Sciences Prague, Kamýcká 129, Prague 6, 165 21, Czech Republic, +420 224 382 190, husak@pef.czu.cz

[2]Department of Humanities, Faculty of Economics and Management, Czech University of Life Sciences Prague, Czech Republic

Abstract

The paper is based on the concepts of the learning society and community-led local development, specifically focused on community education in rural areas of the Czech Republic. The research question is connected with the development of activities of Rural Community Schools, both from the supply and demand perspectives. The aim is fulfilled through a secondary analysis of Rural Community Schools' websites and mainly through primary research carried out by interviewing techniques with a high level of standardisation conducted with the main actors (Community Coordinators) of Rural Community Schools. The results of the study show the demand for educational activities provided by Rural Community Schools as a positive factor in their development. On the other hand, weaknesses could be seen mainly in cooperation with local partners. This is also the main possibility or necessity for their successful future development.

Keywords

Community education, learning society, local development, Rural Community School, rural municipality

Introduction

The paper is based in general on the concept of the learning society and learning regions which are commonly used as the background for community education (Maskell and Malmberg, 1999; Lam, 2002; Morgan, 2007). Considering local education and especially community education in rural areas, it is also necessary to deal with the concepts emphasising endogenous development and "bottom-up" approaches to rural development (Atterton, 2007; Lee *et al.*, 2005; Shucksmith, 2000) and regional development theories dealing with the issue of the ability to learn through cooperation (Hudson, 2007; Lundvall and Nielsen, 2007).

The third theoretical concept used in the paper is the concept of community education as a modernisation trend in education (Coleman, 1987; Heers *et al.,* 2011; Sanders, 2003). The main mission of community education is to provide opportunities for lifelong learning and participation in community development for adults, working class people, minority learners, women with small children and also to members of rural communities who are disadvantaged due to the decreased availability of other educational possibilities (Staykova, 2012). The priority objective of rural community education is mainly to develop new skills and communication skills and cooperation with an educational institution within the rural community – e.g. local authorities, local action groups, whole families and various local associations and organisations (Biriescu and Babaita, 2014).

There is only marginal attention paid to the research of community education in the Czech

Republic, due to the short-term application of this concept (between 5 and 10 years). As stated by Kalenda and Smekalova (2015), the appropriate interpretative framework for community education in the Czech Republic is still absent. However, the research of these authors equates the perception of community education to the consensual concept defined by solidarity and stability.

In this context, the paper strives to deepen the knowledge of community education in the Czech Republic and specifically that of rural community education which is carried out by Rural Community Schools. This paper, based both on secondary and primary research, deals with the ensuing research questions: How do Rural Community Schools fulfil their mission in rural areas? Are their activities increasing or decreasing? The main aim of the paper is to evaluate the development of the various activities of Rural Community Schools (RCSs) in the Czech Republic, to identify their strengths and weaknesses and to propose further possibilities for their development. For this reason, the Results subsection of the paper is structured in four parts, focused on the supply and demand perspectives of RCS activities, promotion of the activities and networking of RCSs with partners at local and supralocal levels.

Materials and Methods

From the methodological perspectives, the paper is based both on primary and secondary research techniques. A secondary approach is used for the analysis of RCS websites, with special attention paid to educational courses provided and other activities of RCSs. In addition, websites of the National Network of Rural Community Schools (NNRCS) are used for secondary analysis.

Moreover, the paper stems from the long-term focus of the author on the issues of education and especially on community education in rural areas. Firstly, the significance of RCSs was identified by the author in 2010 under the project "Education for rural areas as a part of regional development priorities", supported by the Internal Grant Agency of the Faculty of Economics and Management of the Czech University of Life Sciences in Prague (IGA FEM CULS). Within this project, the main educational activities in rural areas of the Czech Republic were identified. The ensuing research project in 2012, called "Rural community school—institute for education and innovation workshop (case study of rural municipalities in the territory of LAG Pošumaví)" and also supported by IGA FEM CULS, was specifically focused on the research of establishing a network of RCSs on the territory of LAG Pošumaví. The third research project supported by IGA FEM CULS in 2014 – "Appreciation of Natural and Sociocultural Potential of Rural Areas through Activities Contributing to Social Inclusion" – was specifically focused on the selected activities of RCSs and mainly on the social inclusive activities. The above-mentioned experience of the author has also led to the ability to evaluate the development of various activities of RCSs in the Czech Republic.

The proposed primary research is based on above mentioned experiences. From the total number of 37 RCSs in the Czech Republic, 22 RCSs (after the correction in 2015) were identified as active (Husak and Hudeckova, 2015). Sixteen of the active RCSs were selected as an object for the research. Therefore, the primary research consists of 16 interviews (each of them with a duration of approximately 90 minutes) with a high level of standardisation. The interviews were conducted with the main actors (Community Coordinators) of the chosen RCSs in the Czech Republic. The selection of interviewed RCSs was based on the indicator of high/less activity of RCSs – 8 selected RCSs rank as being very active (more than 8 courses per year) and 8 selected RCSs ranks as being less

or moderately active (less than 7 courses per year) – according to the criteria specified in detail in previous research (Husak and Hudeckova, 2015). The interviews consisted mainly of the issues of the development of courses and other activities of RCSs, both from the supply and demand perspectives, promotion of RCSs within the locality and current and possible partnerships within the locality and also outside the locality.

Results and Discussion

The concept of community education is rather new (about 90 years). It has been implemented in Central Europe for about 20 years and in the Czech Republic specifically for 10 years with regard to the rural areas. Thirty-seven RCSs exist in the Czech Republic and, according to the valid rules (NNRCS, 2011), they may operate within municipalities of up to 5 000 inhabitants (there is one exception – Telč with 6 111 inhabitants). The first were established in 2005 and most of the RCSs were established by 2010. So, the 10 (or minimally 5) years of existence of RCSs are sufficient for the evaluation of the development of RCSs with regard to their activities. There are no dependencies considering the time of the existence of an RCS on the one hand, and an indicator of high/less activity of an RCS on the other hand. Among the very active RCSs are schools established in 2005 and also two RCSs established in 2012. The situation is similar with regard to less or moderately active RCSs. Therefore, the time of existence of the RCSs could not be evaluated as a factor influencing the activity of RCSs.

Table 1 focuses attention on the development of different types of courses (for a detailed distinction of the type of courses, see Husak and Hadkova, 2015) and other realised activities of RCSs – courses to increase opportunities on the labour market (A), courses with the mission of promoting active citizenship and local identity (B) and courses focused on the personal growth of participants (C).

Type of activity	Development of the activities of RCSs (% of RCSs)		
	Increase	Stagnation	Decrease
A	9.1	27.3	63.6
B	13.3	40.0	46.7
C	13.3	66.7	20.0
Others	10.0	70.0	20.0
Overall view	20.0	53.3	26.7

Table 1: Development of the activities of RCSs during their existence

The above-mentioned data depicted in Table 1 indicate development of the supply of courses and other activities for potential participants. The supply of organised courses provided by RCSs shows stagnation or significant decrease, in consideration of the courses increasing opportunities on the labour market and courses with the mission of promoting active citizenship and local identity. In only about 10 % of RCSs is the supply of courses increasing. There is a rather similar situation with regard to the supply of other activities (e.g. handicraft workshops, farmers' markets, occasional creative workshops, occasional discussions with locally interesting people, trips to surroundings of the municipalities, Children's Day), which supply stagnates in 70 % of RCSs. There is no difference (focusing attention on the structure of stagnant and decreasing RCSs) in the development of the supply of courses and other activities of RCSs, in consideration of the indicator of high/less activity. An increase of activities is possible to be observed only at very active RCSs (with one exception). The overall view provided by Community Coordinators of the development of activities of RCSs is also very interesting. The

Community Coordinators of 20 % of RCSs evaluate the development of activities of their RCSs as increasing, but if they pay attention to particular types of courses, the situation differs. Therefore Community Coordinators seem to be more optimistic in their evaluation of the development of RCSs than what the actual situation is when thinking about it in more depth.

Measure	Development of the demand for courses and other activities of RCSs (% of RCSs)		
	Increase	Stagnation	Decrease
Number of participants of organised courses	26.7	60.0	13.3
Number of participants of other activities	30.8	61.5	7.7
Others (e.g. information requests, queries)	46.7	40.0	13.3

Table 2: Development of the demand for courses and other activities of RCSs

Besides the supply side of the development of activities being the subject of the research, also the demand side is the centre of attention. The development of the demand for courses and other activities of RCSs is depicted in Table 2. Considering the development of the demand for organised courses and other activities, the situation of RCSs seems to be more positive than when considering the supply side. About 30 % of RCSs indicate an increase in the number of participants, both of organised courses and other activities and 46.7 % of RCSs observe an increase in the interest in RCSs shown in another way. Community Coordinators specifically mention requests for information about RCS, queries about the mission of RCS and also co-partnership requirements for the organisation of local events. There is no difference (focusing attention on the structure of stagnant and increasing RCSs) in the development of the demand for courses and other activities of RCSs, when considering the indicator of high/less activity of RCSs. The decrease in the demand for activities is possible to be observed at only less or moderately active RCSs.
If we compare the supply and demand perspectives of RCS activities, it is possible to evaluate the development of RCSs as positive, due to the predominance of the increasing demand on the one hand and the decreasing supply on the other hand. The demand for the activities of RCSs is a crucial precondition for their future development.

Tools	RCSs using the particular tools (%)	from this (%)	
		Regularly	Occasionally
Web pages	100.0	87.5	12.5
Local newsletters	93.8	73.3	26.7
Leaflets	81.3	38.5	61.5
Others (e.g. Facebook, Primary School pupils, local radio)	37.5	66.7	33.3

Table 3: Promotional tools of RCSs

Because the increasing demand for the activities of RCSs is not obvious, it is also necessary to research the promotional tools used by RCSs. The promotional tools used by RCSs are depicted in Table 3 and are sorted in descending order, according to the percentage of RCSs using the particular tool. All RCSs use web pages to inform the public of their activities; most of them regularly, and 12.5 % of RCSs use the web pages of a

Primary School within the municipality for occasional information about their activities. The second position, which is also mostly used regularly, is formed by local newspapers where RCSs usually have their own section. But the usage of local newspapers is strongly connected with close cooperation with the municipal council (see below). Another situation is with regard to leaflets, which are mostly used only occasionally for promoting current events organised by RCSs. However, the successful RCSs (very active) commonly use leaflets regularly. Their Community Coordinators state that, due to the social and age structure of the rural population, online communication and promotion are insufficient. Because there is no difference between the utilisation of the other promotional tools, when considering the indicator of activity of RCSs, it is possible to evaluate the regular use of leaflets distributed to households or through local schools as a significant tool to support the development of RCSs. The other promotional tools are used only by a minority of RCSs and, despite the fact that they are mostly used regularly, there is no difference with regard to the indicator of the activity RCSs.

Local level		Supralocal level	
Partners	Cooperating RCSs (%)	Partners	Cooperating RCSs (%)
Municipal council	75.0	NNRCS	50.0
Local associations (NGOs)	62.5	Other RCSs	18.8
Primary School or Nursery School	18.8	Network of mother centres	12.5
Local action groups	12.5	x	x

Table 4: Main partners of RCSs

The promotion of RCS activities, as well as their collaboration with other organisations, both within the locality and outside the locality, are prerequisites of their successful development. Table 4 depicts the most frequent partners for RCSs both at local and supralocal levels. The significantly most frequent partners at local level are municipal councils and other local associations, such as volunteer firefighters, Sokol association, hunting associations and others which are less frequent. The most important partner for RCSs at supralocal level is NNRCS. Other partners are only marginal, or only a few RCSs collaborate with them. However, not all partnerships may be considered as productive. A significantly higher proportion of successful (very active) RCSs actively cooperate with NNRCS. Therefore, this kind of cooperation may be classified as productive. On the contrary, collaboration with municipal councils provide possibilities for promotion in local newspapers (rather the same proportion of cooperating RCSs and RCSs regularly using local newspapers for promotion – see above), but could be classified as unproductive. This is because a higher proportion of less successful (less or moderately active) RCSs actively collaborate with municipal councils. On the other hand, according to Community Coordinators, for the long-term functioning of RCSs, if not cooperation, at least good relations with municipal councils are necessary. Cooperation with other local associations may be classified as neutral, because there is the same proportion of successful and less successful RCSs collaborating with them.

The development of activities of RCSs within the Czech Republic is quite ambivalent. With regard to the researched RCSs, half of them may be classified as successful (very active with increasing or at least stagnant activities) and half of them may be classified as

less successful (less or moderately active with decreasing or stagnant activities). Positive success factors (strengths) of the development of RCSs were identified as the increasing demand for courses and other activities of RCSs, regular use of personal and leaflet promotion (besides online promotional tools) and active collaboration with NNRCS. Negative failure factors (weaknesses) of the development of RCSs were identified as the decreasing number of realised courses, online communication as the only tool for promotion of RCS activities and unproductive cooperation with local municipal councils. However, according to Community Coordinators, cooperation with partners at local level is significantly improving. In comparison with the first years after the establishment of of RCSs (Hudeckova and Husak, 2015), there are no local partners which could only with difficulty be partners to RCSs. This acknowledges the results provided by Kalenda and Smekalova (2015), who found a relationship between community education and a consensual approach (rather than a conflictual approach). According to Community Coordinators, the development of RCSs in the Czech Republic and their activities are based not only on cooperation with other local partners, but also on the activity of actor groups involved in community education in rural municipalities. This is especially important with regard to small rural municipalities with a higher proportion of personal relationships, not only in the rural areas of the Czech Republic but also abroad, as stated by Laudams (2013).

Conclusion

The paper is focused on the development of community education within rural areas of the Czech Republic. Special attention is paid to the activities, promotion and current partnerships of RCSs. The issue is topical due to the ten years' existence of the oldest RCSs in the Czech Republic and due to the emphasising of institutional and knowledge-based approaches in current rural development theories.

Considering the main results of our research, it is possible to state that there are significant differences between the development of the supply and demand sides of RCSs' activities. While the supply of courses and other activities is somewhat decreasing or stagnant, the demand for various activities is rather increasing. This is one of the most important factors influencing the development of RCSs. It also indicates that RCSs have established themselves as significant actors in rural education and rural development. The confidence of local people in RCSs, as illustrated by the increasing interest in their activities, may be evaluated as fulfilling the mission of RCSs for the first decade of their existence. The possibilities for the future development of RCSs are connected mainly with stronger collaboration with other active local partners. As is apparent from our research, current partnerships (especially at local level) may be classified as unproductive or neutral. However, for the long-term successful existence of RCSs, cooperation in local networks is necessary.

The investigation of both the objective and subjective barriers to stronger cooperation of RCSs with potential local partners is also the focus of our ensuing research, starting in spring 2016.

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STATISTICAL LITERACY SUPPORTED BY STUDENTS TASKS HAVING ANALYTIC NATURE

[1]✉Aneta Hybsova, [2]David Hartman

[1]Department of Information Technologies, Unicorn College, V Kapslovně 2767, Prague, 13000, Czech Republic, anetahybsova@gmail.com

[2]Department of Information Technologies, Unicorn College, Czech Republic

Abstract

The goal of this paper is to evaluate the level of statistical literacy of students at universities before attending statistical courses. Complementary to this it also provides suggestion on how to modify other subjects of university study plan not directly related to statistics in order to improve statistical skills of students. The level of knowledge of statistical concepts is determined by a survey with 535 university students of different fields of study including students of information technology. This research provides evidence that statistical skills of corresponding students are not high especially for notions like standard deviation or interquartile range. Although there are differences between students of different study fields, the need for improvement can be considered general. This includes also students of information technology that are of no difference. To solve this situation, we suggest modifying courses of primary study field in a way that helps to improve statistical literacy as well as provide a deeper understanding of topics from a corresponding course. This modification is based on a specific project design of tasks assigned to students. We show this approach on a particular example of modification of two consecutive courses organized at Unicorn College, Prague.

Keywords

Statistical literacy, IT students, algorithm, teaching IT

Introduction

Statistical literacy is a concept well-developed in foreign countries and it has an impact on many subjects not only at primary and secondary schools, but also at universities. Most of the fields of human activity do require some minimal statistical skills. Therefore, statistical subjects are a natural part of most of university programs. Moreover, having statistically skilled graduates is again a natural objective. To educate students in understanding and using statistics, we have to count with two main phenomena. The first is represented by the quality of *previous knowledge of statistics* among university students before attending statistic course. Based on this knowledge, we can *improve the ability of using statistics* via various tools. There are practically two essential ways to achieve further statistical skills. The first is via attending statistical course, and the second is via using statistics as a tool in other subjects related to a corresponding field. Based on the results of previous knowledge, this paper suggests using more intensively the second approach, i.e. using statistics in subjects related to primary field of study, and provides a case study for students in information technology.

Development of concept of statistical literacy

The concept of statistical literacy has been discussed and gradually formed over the

last two decades. President of the American Statistical Association, Wallman, defined statistical literacy as the ability to understand and critically evaluate statistical results that permeate our daily lives – coupled with the ability to appreciate the contribution that the statistical thinking can make in public and private, professional and personal decision (Wallman, 1993). Statistical literacy was also defined by Watson (1997) as understanding text, meaning and implication of statistical information. Later, Schield (1999) defined it as critical thinking about statistics with arguments. Garfield (1999) wrote that the statistical literacy is an understanding of statistical language: words, symbols and concepts. Being statistically literate means ability to interpret graphs, tables and statistical information published by media according to Garfield´s research. Statistical literacy was later defined by many others (e.g. Gal, 2000; Rumsey, 2002).

Watson and Kelly (2003) refer to the problem, saying that that statisticians put more emphasis on concept of "statistical" rather than "literacy". To find the optimal definition, it is necessary to ensure a balance of both concepts. These two levels can be described simply. The first one – the ability to understand and critically evaluate statistical results – describes virtually all above mentioned international definitions. The second level – the creation of statistical results – is equally important. A statistically literate person knows of primary data to create a summary of information – statistics, which describes the data set and is capable of interpretation and critical evaluation of this information.

The above mentioned development of the statistical literacy concept shows how this topic was discussed in many countries (mainly in the US). Similarities and differences in the meaning of statistical literacy were described and summarized mainly in the articles of Rumsey (2002), Garfield, DelMas and Chance. (2003).

Handling statistical literacy

Working with statistical literacy for new students in college usually consists of several consecutive steps the first of which is a research of level of statistical literacy before attending statistical course. Outputs of this research provide insights into future abilities of students to achieve desired level of statistical literacy for graduates as well as their chance to pass statistical courses. We are mostly interested in students at Unicorn College in Prague providing study program in information technology. That is why we performed research of statistical literacy at mentioned study stage among IT students as well as other groups to achieve desired comparison. This step can be considered crucial as careful investigation of statistical literacy level can guide lectures to implement appropriate improving steps.

The second step within handling statistical literacy is usually represented by appropriate actions introduced in order to achieve its higher level. Most of the methods used for this purpose concentrate on improvements of statistical course itself, see Hulsizer and Woolf (2009). Aside from various e-learning tools, a strong technique is to use statistical analysis on data describing real world problems. Such a combination could be a powerful tool for supporting statistical literacy as already noted by Hulsizer and Woolf (2009). These could include essential statistic course augmented possibly by more problem oriented statistical seminar. This seminar sometimes can include statistical projects as reported by Smith (1998) or more recent by Dunlap and Sharyn (2014) who include also economic topics into mentioned projects. Additionally, these can be supported by some other courses like communication skills subjects.

Contrary to described approach we are suggesting to use this technique even outside of the statistical course. For students of information technology statistical analysis can be

used to study complexity of algorithms, see e.g. Goldreich (2008). Roughly speaking, an *algorithm* is a step-by-step description how to solve a problem, see Knut (2011), and its *complexity* is time needed to achieve this goal. As this complexity depends on size of input – note the difference between sorting 10 or 10000 numbers – we can learn much from testing this algorithm on many randomly generated inputs.

To complement primary goal of research of statistical literacy, we also suggest one specific improving activity within algorithmic courses. Instead of learning just theoretical properties of algorithms we are suggesting introducing statistical analysis of their behavior. During this task students are asked to study behavior of algorithms on randomly generated inputs from specific population via providing several statistical descriptors like average running time. We have introduced this approach in two consecutive courses at Unicorn College in Prague, namely *Essentials of Algorithm Design and Optimization* and *Graph Algorithms*. It is worth mentioning that students of these courses have not attended Statistic course yet. We believe that these tasks can help statistical literacy as well as understanding of algorithms themselves.

The overall goal of the paper

Statistical upskilling at universities depends on previous knowledge of respective students. It is usually assumed that incoming students in the first grade at universities know these concepts either from elementary school or high school (Hybsova, Leppink, 2015):

- mean
- arithmetic mean
- probability
- median
- mode
- standard deviation
- dispersion
- relative frequency
- random variable
- hypothesis testing
- coefficient of correlation
- quantile
- quartile
- interquartile range

Knowing these concepts implies awareness of essential data handling and analysis. But Rumsey (2002) described basic statistical competences more widely. According to him, basic statistical competences include the following components: *Awareness about data*; *Understanding some basic statistical concepts and terminology*; *Knowledge about the basics of collecting data and generating descriptive statistics*; *Basic skill of interpretation* (the ability to describe what the results mean in the context of the problem to be solved); *Basic communication skills* (ability to explain the results to someone else).

Experts from IT field should gain statistical competences during their university studies as their field of activity usually requires some statistical skills. In fact, most of the elementary notions from information technology deal with theory of communication which is based on probability theory and statistics as described already by Shannon (1948). Despite this fact, according to the experience of authors from teaching at Unicorn College, statistic courses are usually considered unpopular and difficult among IT students which follows the students' attitude in all fields as shown by Kvasz (1997).

The primary goal of this paper is to evaluate the level of statistical literacy of students at universities before attending statistical courses with emphasis to various groups according to their primary field of study. The paper is mainly interested in IT students and their abilities, from viewpoint of statistical literacy, among other study fields. That is why this goal includes analysis of various groups of students and their mutual comparison.
To make our work more complex in handling statistical literacy we also include a complementary sub-goal to provide an improving action specific for IT students. We suggest a modification of structures of subjects from their study plan in order to improve statistical skills.

Materials and Methods

We used two questionnaires. The first was designed to detect knowledge of basic statistical concepts – coefficient of correlation, interquartile range, mean, median, mode, quartile, relative frequency, standard deviation. To process data from the first questionnaire, we used, besides descriptive statistics, also analysis of variance (ANOVA). All assumptions as homogeneity of variance (Bartlett test) and normality (Shapiro-Wilk) were verified. Results of ANOVA are in Figure 2. We used t-test with Bonferroni correction to detect differences between groups.
We are focused mainly on IT students. Therefore we prepared the second questionnaire for IT students only. Statistics has corresponding subjects on Unicorn College as *Essentials of Algorithm Design and Optimization* and *Graph Algorithms*. The second questionnaire detected IT students´ opinions about these subjects and its impact to their statistical literacy.

Results

First, let us concentrate on input level of statistical literacy for new students. We have a sample of 535 students that were asked to fill in a questionnaire. There were 27.48 % man and 72.52 % woman in the sample. More than 70 % of students were students of teaching Biology or Math. The sample contains also smaller groups – students of ICT, Medicine and Demography (see Table 1).

Study field	Relative frequency
Teaching biology	55.14 %
Teaching math	18.13 %
Medicine	13.46 %
ICT	5.79 %
Demography	4.11 %
Biology	3.36 %

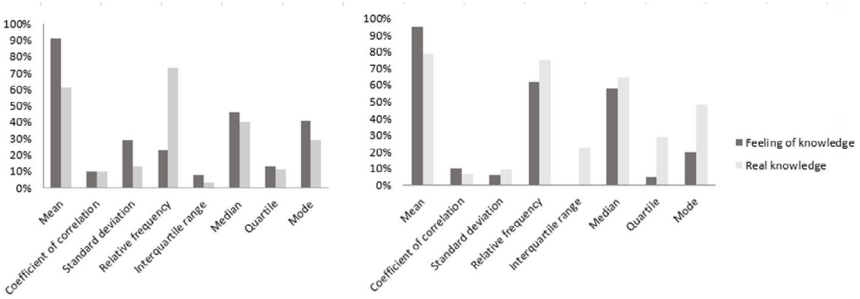
Table 1: Relative frequency of asked students by study field, n = 535

Students should 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:

- coefficient of correlation
- interquartile range
- mean
- median
- mode
- quartile

- relative frequency
- standard deviation

Next task was to complete a test of 12 questions containing several tasks verifying knowledge of above mentioned concepts. The average of correct answers was counted and compared to the average of answers *I know the concept and can use it* for each concept (see Fig. 1).



Figue 1: Comparison of Feelings and Real knowledge for each concept – field ICT (on the right side) and other fields (on the left side)

On average, students of all fields know only 44% of above mentioned concepts. The best are students of demography as they have answered correctly 9.27 questions (on average) from 12 in total. Students of ICT answered 6.23 questions (on average) from 12 test question. The worst result was shown by students of medicine (5.35 from 12) and students of teaching (4.53 from 12). There are statistical significant differences between feeling and real knowledge in all of mentioned concepts.

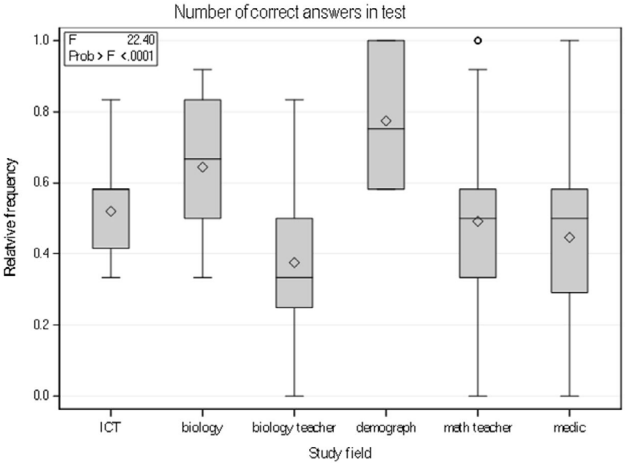


Figure 2 Box-plot of number of correct answers in statistic test

We can see that ICT students are not an exception from other fields – as they are more technically oriented, their statistical literacy is higher than expected. However, an interesting fact is that their real knowledge is higher than feeling only for the term of relative frequency. In all other cases feelings are always higher than real knowledge. This is in contrast with other fields where students have more often higher feelings compared

to their knowledge. The distribution of number of correct answers in test (real knowledge) is shown in Figure 2.

We use ANOVA for comparison of all groups because normality (p-value 0.061) and homogeneity (p-value 0.053) was confirmed. It is evident that means are statistically different (p-value 0.0001). Demographers have the highest knowledge – the mean of correct answers is 9.27, the lowest knowledge is shown by biology teachers – the mean of correct answers is only 4.53. According to pairwise comparison of groups it possible to say that there are three groups according to level of knowledge – the first are demographers and biologists, the second are ICT students, math teachers and medics and the third are students of teaching biology.

Considering suggested modification of teaching process, students actually attending statistical course were asked about its validity and benefits. The majority of students that previously attended corresponding subjects, with project tasks included, consider these tasks beneficial. Moreover, 56.3 % of students consider these types of tasks helpful for statistical literacy in general, i.e. not only for mentioned courses, and 87.5 % of students suggest keeping using these tasks within considered subjects or even extend their use for other subjects.

Discussion

Although statistics is not very popular, Hulsizer & Woolf (2009) mentioned that it is very important because of its impact. Especially ICT students need analytical thinking to find a better job. This is however true for other fields like biology or demography as they usually work with statistical software like SAS, SPSS or Canoco. According to results, these three groups (demographers, biologists and ICT students) were the best in test of real knowledge. It is interesting that medics, biology teachers and math teachers have a very high variability. There were students with a very high level of knowledge but also students that were very poor. It is possible that some of students believe that they will never need statistics again.

There are only two terms – mean and relative frequency – with more than 50 % correct answers in the test of real knowledge. Rate of mean is unexpectedly low. It is influenced by the fact that a lot of people have a problem counting weighted arithmetic average. In fact, this is not completely unexpected as already Parker and Leinhardt (1995) argued that generations of students, including those at the college level, have failed even to fully master percentage.

The reason for poor knowledge could also be represented by negative attitude of teachers to statistics as described for example by Martins, Nascimento, & Estrada (2012). On the other hand, students also consider statistics unpopular (Kvasz, 1997). Other possible reason could also be inclusion of thematic units of statistics and combinatorics into the curriculum of mathematics. These topics are placed as last topics in high school. Therefore, many students, who are not deeply involved in mathematics, study only graduation subjects. It may seem that a negative approach towards statistics could be due to relatively high mathematical demands. It has however been argued that rather motivation of students is one of the main components for improvement of statistical literacy (Gal and Ginsburg, 1994).

Back to our research, we can see that statistical literacy is not high in general as well as for ICT students and the task to have statistically skilled graduates could be threatened by that. Even attending statistic courses could not be strong enough to provide a sufficient study support to understand the use of corresponding tools deeply enough. A lot of authors

have focused on technological support, see the review by *Chance et al. (2007), including, for example, the use of interactive lessons or online students interactions tools. Especially e-learning tools prove to be efficient in general, see Beranek,* Bory and Vacek *(2016). Mentioned problems also led to a complex concept of Statistical Reasoning Learning Environment (SQLE), see Garfield and Ben-Zvi (2009), which is based on constructivist theory associated with the use of supporting tools, the use of real life motivating data, students' classroom activities and several other tools. Although using real life data has been accented by this approach as well as other studies, see e.g. Neumann,* Hood and Neumann *(2013), their use is limited to statistical courses or supporting seminars.*

By contrast, we propose introducing tasks having analytical nature using statistics in courses without direct statistical content in an attempt to understand more deeply the phenomena studied in the course itself as well as phenomena and approaches from field of statistics. This approach provides discovering and deeper learning of notions from the main field, here represented by algorithmic theory, along with the use of statistical notions. Such parallelism could help to improve skills in both areas. Moreover, such an approach also works with motivation of students and could be combined with those mentioned above. Additionally, presented results have shown that students believe in its beneficial role. Finally, it can also be used within courses planned after statistic course that could improve statistical reasoning even more. The inclusion of statistic based project oriented tasks is not intended to be used only in the field of information technology. It could be used more broadly to study phenomena from other fields. This could be supported by the fact that there exist studies incorporating the use of real world data in statistical course, see Zhong (2015).

Conclusion

The paper shows the level of statistical literacy of students at universities before attending statistical courses determined by a survey with 535 university students of different fields of study including students of information technology. Research has analyzed students' conviction about their knowledge as well as their real skills in several statistical concepts using an appropriately designed questionnaire. The results have shown that the level of statistical literacy is rather low for students of all considered study fields including IT. For some of the notions corresponding skills of students are very low like in case of interquartile range, although students declare awareness of the notion relatively frequently. Except some lower conviction about their knowledge, IT students are of no difference. We suggest introducing project oriented tasks into subjects that are planned before statistical courses. These tasks are based on statistical analysis of corresponding notions from primary field and are designed to enhance a deeper understanding of these notions and statistical literacy. The concept is shown on the example of two IT subjects taught at Unicorn College, Prague. Further advantage is that this approach can be combined with all other traditional tools to improve statistical literacy. According to opinions of students, inclusion of these tasks is helpful for their future handling of statistics.

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IDENTIFYING LEARNING STYLES OF ESP LEARNERS BASED ON THEIR PERCEPTUAL PREFERENCE

[1]✉Martina Jarkovska, [2]Milada Odstrcilova

[1]Department of Languages, Faculty of Economics and Management, Czech University of Life Sciences Prague, Kamýcká 129, Prague 6 - Suchdol, 165 21, Czech Republic, +420 224 382 838, jarkovska@pef.czu.cz

[2]Department of Languages, Faculty of Economics and Management, Czech University of Life Sciences Prague

Abstract

Just as students learn a foreign language - or any other subject - in many different ways, there are many different ways to define or describe a learning style. Throughout the years, learning styles have become a prominent issue within pedagogical science and many learning style models or approaches have emerged. One such model, based on sensory perception and distinguishing between Visual, Aural, Read/Write and Kinaesthetic learning styles is the VAK/VARK learning style model.

Based on their perceptual preferences, the paper aims to identify the learning styles of English language learners; university students in courses of English for Specific Purposes. The research was performed by means of a questionnaire distributed among the students of the Business English and Correspondence courses. Learning activities contained in the questionnaire are then subjected to the VAK/VARK learning modalities. Results are discussed and previous findings and implications for further research are drawn.

Keywords

English for Specific Purposes, learning style, questionnaire, Read/Write, VAK/VARK model

Introduction

Students learn a foreign language in many ways - by seeing and hearing, reflecting and acting, reasoning logically and intuitively, memorising and visualising - and in these ways combined. The ways in which an individual characteristically acquires, retains, and retrieves information are collectively termed the individual's learning style (Felder and Henriques, 1995). Learning styles may be defined in multiple ways, depending on one's perspective (Gilakjani, 2012). Brown (2000) argues that learning style preference is one aspect of learning style, and refers to the choice of one learning situation or condition over another. According to Celce-Murcia (2001), learning styles can be defined as general approaches - for instance, global or analytic, auditory or visual - that students use in acquiring a new language or any other subject. Cassidy (2004) distinguishes between learning style and cognitive style, the terms often used interchangeably. Cognitive style is described as an individual's typical or habitual mode of problem solving, thinking, perceiving and remembering, while the term learning style is adopted to reflect a concern with the application of cognitive style in a learning situation (Cassidy, 2004). Over the last thirty years, the proposition that students learn and study in different ways has emerged as a prominent pedagogical issue and learning styles have offered descriptive typologies that range from relatively fixed student natural dispositions to modifiable preferences for learning and studying (Hawk and Shah, 2007).

There are many learning style models; Coffield et al. (2004) identified as many as 71. The most influential and first learning style model is Kolb's model, based on experiential learning process rather than on fixed learning traits (Kayes, 2005). Kolb developed the Learning Style Inventory (LSI) - a method of assessment to identify an individual's learning style -, which identifies four distinct learning styles - diverging, assimilating, converging and accommodating (Manolis et al., 2013). The LSI based on Kolb's learning style model is an instrument used to determine a student's learning style. The original LSI was a simple self-description questionnaire, which has been - as well as its more elaborated further versions later revised by Kolb - often criticised for its lack of reliability and validity (Manolis et al. 2013). Unlike the previous versions of the Kolb's LSI (KLSI), the latest version 4 of the LSI replaces four original learning styles with nine new learning styles - initiating, experiencing, imagining, reflecting, analysing, thinking, deciding, acting and balancing (Hay Group, 2016).

Hawk and Shah (2007), for example, reviewed the six most prominent learning style models that have instruments that claim to give teachers as well as students an indication of an individual's learning style or approaches to studying disposition and/or preferences. Besides the already mentioned Kolb's model, their analysis also includes Fleming's Visual, Auditory, Read/Write, Kinaesthetic (VARK) learning style model. According to Fleming (2001), VARK belongs within the category of instructional preference, because it deals with perceptual modes. Fleming's VARK model is based upon the original three learning modalities - visual, auditory and kinaesthetic (VAK) - proposed by Barbe and Milone (1981) who point out that learning modality strengths are different from preferences and a person's self-modality preference may not correspond to his or her empirically measured modality strength. Apart from extending the VAK model with a Read/Write modality, Fleming (2001) also proposes two multimodalities. The VARK questionnaire available online (VARK Learn Limited, 2016) offers thirteen statements that describe a situation and asks the respondent to select one or more of three or four actions that the respondent would take. Each action corresponds with a VARK Learning Style preference (Hawk and Shah, 2007). Research that identifies and measures perceptual learning styles, i.e. visual, auditory and kinaesthetic or tactile, as kinaesthetic learning is sometimes also referred to, relies primarily on self-reporting questionnaires by which students select their preferred learning style (Reid, 1987).

The identification of language learners' learning styles and their impact on teaching is a much discussed and researched issue (Gilakjani, 2012, Juřičková, 2013, Kavaliauskienė and Anusienė, 2010). This study stems from previous research identifying learning styles of German language learners (Odstrčilová and Jarkovská, 2015).

The aim of the paper is to identify learning styles of learners of English for Specific Purposes (ESP) by means of a questionnaire responses analysis. The questionnaire administered to a group of ESP learners, university students, contained activities that helped determine the learners' learning styles based on the learners' perceptual preferences. To identify the learning styles, the VAK/VARK learning modalities are applied. Results are then discussed and compared with findings from the previous research and implications for both the learning and teaching of a foreign language and further research are drawn.

Materials and Methods

The study was conceived as a follow-up to previous research (Odstrčilová and Jarkovská, 2015), performed on a small group of German language learners with the aim of determining their learning styles or types using a questionnaire survey.

The current study is focused on learners of the English language, i.e. learners of English for specific purposes (ESP). The research was implemented among students of Business English and Correspondence courses, held by the Department of Languages at the Faculty of Economics and Management (FEM), Czech University of Life Sciences Prague (CULS). The research was performed in December of the winter semester 2015/2016 in four Business English and Correspondence courses, each course being attended by 20-25 students. In total, 85 students were addressed, most of them attending the first year of Bachelor programmes at FEM - 70%, with 20% attending the third year of Bachelor programmes at the Faculty of Technical Engineering and 10% attending the second year of studies in Bachelor programmes at FEM.

All 85 students, participants of 4 Business English and Correspondence courses, had similar initial knowledge and skills of the English language - intermediate - defined by the Common European Framework for Languages (CEFR) as B1 level. Although CEFR B1 level is prescribed as a prerequisite to attend the course, it cannot be taken fully for granted. There are no entry tests to enter the course and even though the students select a foreign language course in line with their study programme syllabi, it is often selected at their own will and many a times the same language level shared by all foreign language course participants cannot be justified.

The students were administered questionnaires during class, near the end of the winter semester 2015/2016. Upon filling in their anonymous answers, they were asked to return the questionnaires after the end of the lesson. The questionnaire used for the purpose of this research was adopted from Odstrčilová and Jarkovská (2015). It contained 16 activities that foreign language learners might find useful while learning a foreign language. The students were asked to evaluate each activity by assigning it a certain number of points - a grade on the scale from 1 to 4, with 4 being the highest and 1 the lowest. Of all 85 questionnaires administered only 83 were returned. 2 questionnaires were discarded from further analysis as not all the activities were assigned a grade (no grade was circled - marked).

Responses to 79 questionnaires were analysed. The grades assigned to individual activities on the questionnaire were counted and the order of activities ranging from the activity with the highest score to the activity with lowest obtained score was established. Using the VARK model (Fleming, 2001), the activities were then grouped to four sets according to a learning modality applied (visual, aural, read/write, kinaesthetic). Based on the scores received, learning styles were identified.

Results and Discussion

Table 1 presents the activities as they were obtained in the questionnaire, in order of the activity that received the highest score, down to the activity with the lowest score received. The most highly rated activity by the students – learners - was “putting to practice what I have just learnt” which received 249 (7.19%) points out of the total 3,463 (100%), while the lowest scored evaluated activity “keeping files or cards with new words or phrases written on them” received 190 points (5.49%).

I learn and remember a foreign language by	CEFR level B1	
putting to practice what I have just learnt	249	7.19
watching films in a foreign language	243	7.02
listening to dialogues, texts, etc. in English	238	6.87
having someone explain or describe the meaning of new words or expressions	230	6.64
reading words or text while simultaneously hearing it	225	6.50
seeing the text transcript while listening to it	224	6.47
applying what I learned to contact with English native speakers	221	6.38
reading and pronouncing aloud words, texts, etc. that I read	221	6.38
underlying words or texts and/or making notes from the text I read	216	6.24
cooperating in class with others, by team or pair work or by learning at home with another person	215	6.21
quiet reading words, texts, etc.	208	6.01
applying what I learned to a game	203	5.86
taking notes while watching films in a foreign language	195	5.63
making my own files or cards with new words	193	5.57
taking notes while listening to texts	192	5.54
keeping files or cards with new words or phrases written on them	190	5.49
Total	3,463	100%

Table 1: Scores received for the individual activities in the questionnaire

As Table 1 further reveals, there are no significant differences or gaps between individual scores; the score for the least evaluated activity being lower than the most highly rated activity by 59 points only. Moreover, Table 1 shows that while the most highly rated activity "putting to practice what I have just learnt" suggests kinaesthetic learning style (learning through or from experience), other prevailing, well-evaluated activities employ both visual and auditory perceptual modes, thus suggesting visual and aural learning styles.

As is described by Hawk and Shah (2007), visual learners prefer maps, charts, brochures, pictures and different spatial arrangements. Aural learners, on the other hand, like to explain new ideas to others, discuss topics with other students and their teachers and they are usually the ones who attend lectures and join in discussions. Haw and Shah (2007) further continue that kinaesthetic learners enjoy field trips, trial and error, doing things to understand them, hands-on approaches and using their senses while read/write learners prefer for instance lists, essays, reports, textbooks, printed handouts, Web pages and taking notes. Fleming (2001) even suggests activities or approaches for matching learning styles with teaching styles. His suggested classrooms activities for the support of VARK learning styles, as adopted by Hawk and Shah (2007), are presented in Table 2.

Visual	Aural	Read/Write	Kinaesthetic
Diagrams	Debates, Arguments	Books, Texts	Real Life Examples
Graphs	Discussions	Handouts	Examples
Colours	Conversations	Reading	Guest Lecturers
Charts	Audio Tapes	Written Feedback	Demonstrations
Written Texts	Video + Audio	Note Taking	Physical Activity
Different Fonts	Seminars	Essays	Constructing
Spatial Arrangement	Music	Multiple Choice	Role Play
Design	Drama	Bibliographies	Working Models

Table 2: Activities accommodating VARK learning styles (Source: Hawk and Shah, 2007: 8)

If the activities included in the questionnaire administered to the CULS students are distributed to match individual VARK learning styles in a similar way as it is done in Table 2, their rough distribution to accommodate the learning styles is as follows:

Visual

- seeing the text transcript while listening to it
- underlying words or texts and/or making notes from the text I read
- making my own files or cards with new words
- keeping files or cards with new words or phrases written on

Aural

- watching films in a foreign language
- listening to dialogues, texts, etc. in English
- having someone explain or describe the meaning of new words or expressions

Read/Write

- reading words or text while simultaneously hearing it
- reading and pronouncing aloud words, texts, etc. that I read
- quiet reading words, texts, etc.
- taking notes while watching films in a foreign language
- taking notes while listening to texts

Kinaesthetic

- putting to practice what I have just learnt
- applying what I learned to contact with English native speakers
- cooperating in class with others, by team or pair work or by learning at home with another person
- applying what I learned to a game

Such distribution is however only approximate. Many activities mentioned in the questionnaire do not employ just one perceptual mode and therefore do not conclusively fit into one category only.

Table 3 presents a percentage representation of the activities contained in the questionnaire as they are grouped to accommodate the VARK learning styles.

Learning style	%
Visual	23.77
Aural	20.53
Read/write	30.06
Kinaesthetic	25.64
Total	100

Table 3: Percentage representation of learning styles based on the VARK distribution of activities in the questionnaire

Although it may seem otherwise with activities such as "taking notes" and "quiet reading" having ended with a lower number of points assigned by the students (cf. Table 1), it is these activities involving traditional learning skills - reading and writing - that made up for the most predominant learning style - read/write. Such findings are more than plausible. Particularly in today's classroom, where students are surrounded by top modern technologies allowing for all perceptual modes - visual and aural especially - to be in the forefront. Given that the language learners in question are university students, the result is rather unsurprising as reading and writing abilities are necessary prerequisites for their successful academic performance and acquiring excellent reading and writing skills is part of their academic achievement.

The findings are in line with the previous research (Odstrčilová and Jarkovská, 2015). Among the German language learners, students at CULS, a kinaesthetic learning style also prevailed, on CEFR level B1, the practice with native speakers being rated the highest (Odstrčilová and Jarkovská, 2015: 418). The activities based on practical experience were highly appreciated by the ESP learners as well (cf. Table 1). The kinaesthetic learning modalities are thus predominant among the learners of both languages on an intermediate proficiency level, German and ESP (cf. Table 3), provided the read/write learning style is disregarded. In the previous study (Odstrčilová and Jarkovská, 2015) learning styles were deemed in terms of VAK learning style model only, e. visual, auditory and kinaesthetic. The expansion of VAK modalities and the use of VARK model in the current study however demonstrated that despite their preference for speaking and learning through experience, the students - learners - do continue to employ classical methods of learning which involve reading and writing skills. As Kavaliauskienė and Anusienė (2010) claim, perfecting students' proficiency in "read-to-write"' assignments is especially important in an ESP course whose cornerstone is unfamiliar lexis and numerous concepts of subject-matter. Such is the case of Business English and Correspondence ESP course at CULS where most of the course participants are in their first year of study. Students usually start doing an ESP course before learning subject-matter of their future profession or specialisation, i.e. in the first year (Kavaliauskienė and Anusienė, 2010).

In the field of learning a language, it is mainly the perceptual preferences that dominate the process of approaching the language (Juřičková, 2013). The VAK/VARK is a sensor-perception model. As Hawk and Shah (2007) argue, no learning style instrument can capture all the richness of the learning style phenomenon. Once the learners adopt their preferred learning style, they can consciously choose strategies that best suit their learning style. The strategies thus become a useful and powerful tool for an active, conscious and self-regulated process of learning the language (Juřičková, 2013). Hawk and Shah (2007) add that students should develop their abilities to use learning styles that are not their natural modes and preferences just as teachers should develop a repertoire of learning approaches and processes that embrace the diversity of learning styles in their classes.

The findings of the current research show that it is the activities that support students' reading and writing skills that should be given attention and developed. The findings however imply that while some classroom activities might be less popular than other, all four language skills - speaking, reading, writing and listening - should be equally enhanced in the learning process.

Conclusion

The paper set out to identify learning styles of the ESP learners in Business English and Correspondence courses held at CULS. This was done by means of a questionnaire administered to the course participants. Their evaluation of activities included in the questionnaire led to the identification of their learning style, applying the VARK learning style model. The predominant read/write learning style is a very satisfactory finding as reading and writing skills are necessary prerequisites for university students' high proficiency, especially in ESP learning where students meet with difficult and unfamiliar lexis, many times, ahead of the subject-matter acquisition.

Nonetheless, no learning style should be adopted in isolation either by the student or the teacher. A comparison of the VAK/VARK with, for instance, Kolb's learning style model would be beneficial in bringing forth an analysis of learning styles from which both learning and teaching strategies could be implied. Further and more detailed research of the learning styles stemming from detailed analyses of learners' individual differences and the implementation of their impact into the development of learning strategies, would present both the learners and the language instructors with valuable findings that could be adopted into a teaching process.

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EFFICIENCY AND RELEVANCE OF TEACHING METHODS IN MANAGERIAL EDUCATION

[1]✉Eva Jarosova, [2]Hana Lorencova, [3]Katerina Pubalova

[1]Department of Managerial Psychology and Sociology, Faculty of Business Administration, University of Economics, Prague, nám. Winstona Churchilla 4, Praha 3, 130 67, Czech Republic, +420 224 09 8332, eva.jarosova2@vse.cz

[2]Department of Managerial Psychology and Sociology, Faculty of Business Administration, University of Economics, Prague, Czech Republic

[3]Department of Managerial Psychology and Sociology, Faculty of Business Administration, University of Economics, Prague, Czech Republic

Abstract

Managerial education should be topically relevant in terms of its content as well as the teaching methods used. Managerial education should entail, among other things, the development of its participants' leadership competencies. The teaching methods used should correspond with the strategy of learner-centred teaching that focuses attention on the participants' learning process and their active involvement in class. It's also desirable to know whether the participants find the methods used in specific managerial education programmes useful for understanding the concepts of leadership as well as for leadership skills development. The paper presents the results of the analysis of the responses to these questions in a sample of 54 Czech managers – participants in the MBA programme and of lifelong learning programmes. The data was acquired based on written or electronically submitted questions. The results show that the respondents most valued the methods that activate them throughout the course, enable them to develop their skills, and get feedback.

Keywords

Managerial education, leadership skills, learner-centred teaching, teaching methods

Introduction

Managerial education and development takes place in formal programmes outside of the workplace as well as in informal training opportunities at work in a managerial position. Managers learn or adopt knowledge and skills that will allow them to carry out or improve their current or future professional roles (Sadler-Smith, 2006: 2). Studying for an MBA or in short-term lifelong learning courses are examples of formal programmes. The teaching methods used in them have gone through certain changes that can be described briefly as a shift from teacher-centred to learner-centred teaching.

The beginnings of this change in managerial education and development are connected to the criticism of traditional methods of teaching aimed primarily at handing over „ready-made" knowledge, and not at the skills so urgently necessary. These methods have predominated in management preparation (especially in academia). In an effort to place greater emphasis on developing managerial skills and get closer to managers' needs, approaches such as the model of experiential learning (also known as Kolb's learning cycle) have gradually been advanced since the 1980s. It's connected not only to the humanistic psychology of Carl Rogers and the intellectual legacy of other psychologists (John Dewey and Jean Piaget), but also to the ideas about adult education described in Malcolm Knowles's work (1980). It was primarily an effort to overcome the academic

model and compensate for the shortcomings of the traditional approach to managerial education, in which the individual is more or less a passive object (Bedrnová, Jarošová and Nový, 2012).

Learner-centred teaching focuses on the participants' learning process. The teacher's role is not to transmit knowledge from the instructor to the students, but to facilitate their learning. The emphasis is on using and communicating knowledge effectively to address enduring and emerging issues and problems in real-life contexts (Huba and Freed, 2000). This „facilitative" style of teaching encompasses creating an inspiring and psychologically safe environment, in which learners explore the subject by themselves as well as in peer groups. This teaching style works best when learners already have prior knowledge of the subject as well as experience or existing skills (Beevers and Rea, 2010).

It's very important for managerial education to respect its participants' actual learning needs and provide them with learning opportunities that are clearly linked to their everyday work. Managers approach education (similarly to adult learners) in a more utilitarian way than students or undergraduate students. Teaching methods in managerial education should motivate participants to engage continuously in the learning process as a whole person (Hoover et al., 2010). They also should enable participants of the education programme to build upon their experience, reflect on it, and add theoretical background that will make them more effective in their managerial work.

Managerial education also focuses on developing leadership competencies and skills. Although management and leadership are different in many ways (Kotter, 1996), they also overlap. At the level of the individual this means that managers are expected to provide leadership and to acquire leadership knowledge, skills, and abilities, i.e. competencies (Day and Dragoni, 2015). For organizations, competent leaders are one of the basic requirements of their survival in the turbulent conditions of the modern world. The topic of leadership is thus an integral part of managerial education.

People in managerial positions tend to evaluate their leadership behaviour higher than when it's judged by their subordinates (see, for example, Mehdinezhad and Sardarzahi, 2015). Teaching methods in managerial education should thus provide participating managers with the opportunity not only to understand theoretical concepts and to develop specific leadership skills, but also to gain valuable feedback on their leadership behaviours, to self-reflect and develop self-awareness and self-development (Waddock and Lozano, 2013).

This situation, as it is described, raises questions on the methods used in management programmes for leaders' development and their frequency, relevance and effectiveness. With regard to learner-centred focus, an important criterion of the evaluation of the teaching methods applied is the managerial education participants' own perception and assessment of those methods. Therefore, the objective of the presented study is to seek answers to the following questions: How frequently are particular methods used in managerial education (MBA programmes and short-term lifelong learning courses /LLP)? To what extent do the participants in managerial education programmes (MBA programmes and short-term lifelong learning courses /LLP) consider specific teaching methods useful for conceptual understanding of leadership? To what extent do the participants in managerial education programmes (MBA programmes and short-term lifelong learning courses /LLP) consider specific teaching methods useful for leadership skills development?

Materials and Methods

The data used for this paper was collected within the Norway funds project (NF-CZ07-

ICP-1-0302014) on the basis of a questionnaire survey that took place in the spring of 2015. The respondents were the participants of managerial education courses (MBA and lifelong learning courses) from both partner institutes involved in the project, i.e. the University of Economics, Prague (VŠE, CZ) and Sogn og Fjordane University College (NO). The collected results for both countries were first published at the EGPA Annual Conference in August, 2015 (Bukve, et al., 2015). For the purposes of this paper, only data for the Czech Republic was used, which were the answers of the participants of the LLP and MBA programmes and courses that are taught at the International School of Business and Management (ISBM) of the Faculty of Business Administration VŠE. LLP courses are one-offs and tailored to their participants' needs (as part of company training) and are one semester long. The length of study in the MBA programme is 2.5 years (a total of 90 ECTS).

We approach the above raised questions by means of a survey design. Before elaborating the survey, we identified 14 different teaching methods used in the programmes under study. The list of methods is adapted from Daniel Jenkins's list of instructional strategies (Jenkins, 2013), taking into account the methods with relevance to programmes under study. An appendix, which contained the definitions of all the relevant teaching methods, was attached to the questionnaire in order to prevent misunderstandings.

Respondents were asked about how often the teaching methods were used in their programme, and how useful they found the methods for different purposes. In this paper, we analysed its usefulness for conceptual understanding of leadership and developing leadership skills. The students filled out the questionnaires online (based on a link sent to them) or on paper, always after completing a course or a part of the programme devoted to leadership.

The overall number of completed questionnaires for the CZ was 54 (the response rate was 55%), of those 60.67% were women and 30.48% men. Fifty-five percent of the questionnaires were returned. Most of the respondents were participants in lifelong learning programmes (66.6%), others were students of MBA programme (33.3%).

Descriptive statistical characteristics were calculated in the statistical analysis of the collected surveys (mean, standard deviation and minimal and maximal values, with the first two being shown in the next part). Welch's method of multiple mean comparison (Welch's ANOVA) was used to assess the significance of observed differences in method frequency and perceived effectiveness.

Results

The frequency of the various methods used in teaching

The respondents were asked to report the frequency of use of each teaching method from the prepared list using the rating scale of 1 to 4 (1 = never, 2 = rarely, 3 = sometimes, 4 = often). The results are presented in Table 1.

The respondents described discussions in small groups (3.50), larger groups (3.35), and feedback (3.35) as the methods most frequently used in their type of training.

Method	Mean	Sd
Small Group Discussion	3.50	0.86
Large Group Discussion	3.35	0.91
Feedback	3.35	0.87
Interactive Lectures	3.26	0.96
Simulations, Model Situations	3.22	0.88
Case studies	3.19	0.97
Lectures	3.07	0.99
Role Playing	3.02	0.98
Self-Assessment Questionnaires	2.98	0.94
Oral Presentation	2.69	1.04
Reflective methods	2.46	1.00
Exams, knowledge test	2.43	1.34
Short Written Exercise	2.30	0.96
Research Projects	1.74	0.94

Welch ANOVA $p<0.00000$

Table 1: Frequency of the methods used in teaching, 2015 (source: own research)

The results for specific methods in the frequency of their use are significant ($p<0,0000$). The results of the survey of the frequency of the various types of teaching methods used in MBA and lifelong learning programmes can be considered very encouraging (see Tab. 1). It can be said that traditional teaching methods such as lectures (3.07), exams, knowledge test (2.43), and short written exercise (2.30) are techniques that are less frequently used compared to learner-centred interactive methods such as small/large group discussion (3.50/3.35), case studies (3.19), and interactive lectures. Due to the target group of learners one can appreciate the emphasis on sharing and exchanging experience, especially through discussion, but even on relatively often used tailored preparative activating methods, such as simulation (3.22), role play (3.02), and case studies (3.19).

The further development of the effective use of teaching methods can be undertaken in the field of so-called reflective methods that can, especially for students with a lot of experience, significantly contribute to their further personal development. This is also supported by not omitting to give feedback on activities carried out during full-time study as well as on homework tasks.

The usefulness of the methods for conceptual understanding of leadership

Respondents were asked to evaluate the usefulness of specific teaching methods for conceptual understanding of leadership. They were provided with a five-level scale (from 1 = useless to 5 = very useful). See Table 2 for the results.

The respondents of our research have designated the so-called experience-based methods as the most useful for conceptual understanding of leadership. These are especially feedback (4.52), simulations and model situations (4.50), small group discussion (4.33) and case studies (4.33). Short written exercises (2.94) and exams and knowledge tests (2.67) were seen as least useful for conceptual understanding of leadership.

Method	Mean	Sd
Feedback	4.52	0.72
Simulations, Model Situations	4.50	0.67
Small Group Discussion	4.33	0.75
Case studies	4.33	0.80
Role Playing	4.19	0.95
Interactive Lectures	4.11	0.82
Oral Presentation	4.07	0.87
Large Group Discussion	3.96	0.89
Self-Assessment Questionnaires	3.80	0.96
Reflective methods	3.76	1.1
Lectures	3.59	1.11
Research Projects	3.07	1.18
Short Written Exercise	2.94	1.11
Exams, knowledge test	2.67	1.21

Welch ANOVA $p<0.00001$

Table 2: The usefulness of teaching methods for conceptual understanding of leadership, 2015 (source: own research)

There are significant differences among the represented methods in the assessment of usefulness for conceptual understanding of leadership ($p<0.00001$).

Small group discussion (4.33) and oral presentation (4.07) seem to be useful for conceptual understanding of leadership, i.e. methods that include sharing experience, but also interactive lectures (4.11), that fittingly combine the instructor's contribution with a discussion and the experience and opinions of students and case studies (4.33)

Research projects (3.07), seldom used in this type of study programme, can be judged as useful. In contrast, the least useful according to the respondents are the exams and knowledge testing methods.

The usefulness of the methods for leadership skills development

Respondents were asked to evaluate the usefulness of teaching methods for leadership skills development. They were provided with a five-level scale (from 1 = useless to 5 = very useful). See Table 3 for the results.

On terms of leadership skills development, the respondents of our research find feedback (4.72), simulations, model situations (4.48) and small group discussion (4.44) most useful. Research projects (3.04), short written exercise (3.00) and exams, knowledge tests (2.85) were seen as least useful for leadership skills development.

Method	Mean	Sd
Feedback	4.72	0.60
Simulations, Model Situations	4.48	0.75
Small Group Discussion	4.44	0.74
Case studies	4.22	0.77
Role Playing	4.19	0.95
Interactive Lectures	4.17	0.99
Large Group Discussion	4.13	0.93
Oral Presentation	4.11	0.98
Self-Assessment Questionnaires	4.04	0.95
Lectures	3.74	0.94
Reflective methods	3.70	1.02
Research Projects	3.04	1.22
Short Written Exercise	3.00	1.26
Exams, knowledge test	2.85	1.25

Welch ANOVA $p<0.00001$

Table 3: The usefulness of teaching methods for leadership skills development, 2015 (source: own research)

There are significant differences among the represented methods in the assessment of usefulness for leadership skills development ($p<0.00001$).

Knowledge level is an important basis for further development of managers, but the focal point of the instruction is gradually shifting to the level of skills. It's not enough just to „know" or „memorize", but it's necessary to know how to use and apply, i.e. acquire a wide spectrum of skills (social, managerial, and others). For example, the concept of versatile leadership (Pavlica, Jarošová and Kaiser, 2015) places an emphasis on managers' need to adopt various different, even contradictory, but mutually complementary skills together with a versatile, wide-ranging application in practice.

Discussion

Limitations of this study may be perceived in the fact that the respondents of the survey were MBA and lifelong learning courses participants coming from one educational institution only, so the results can't be seen as representative. Also only the participants, not the course instructors, were asked to fill in the survey. However, as the methods used in the research are established on already executed research studies from abroad, it is possible to discuss the results in their context. The studies mentioned are those of Allen and Hartmann (2009) and Jenkins (2013). Both are inspired (as does our study) by Conger's four approaches to leadership development (personal growth, conceptual understanding, feedback and skill building), which were combined with different sources of learning commonly found in leadership development activities.

In the Allen and Hartmann study, the respondents were undergraduates who were asked to share their opinion on the way they would like to learn about leadership. The students showed a preference for developmental activities where the primary learning objective was individual personal growth and skill building. Jenkins's study brings an overview of leadership programmes from educators´ perspective. 303 leadership instructors from USA, teaching in-class academic credit-bearing undergraduate leadership courses, were asked to participate. The instructors showed a preference for instructional strategies that emphasized class discussion, forms of conceptual understanding and personal

growth. On the other hand, they seldom used skill-building instructional strategies or traditional assessment. These results indicate that even leadership educators, although giving less attention to skill development, give a significance to in-class interaction and communication in leadership development programmes and do not overestimate traditional ways of assessment, such as tests.

Conclusion

The results of the survey have confirmed the trends in the educational area introduced in the introduction of this article, especially the limitation of traditional „teacher-oriented" teaching, and strengthening the use of modern „learner-oriented" teaching methods. The results also suggest that it is useful to consider the effectiveness and relevance of selected teaching methods in relation to their purpose (e.g. conceptual understanding or skill development) while designing managerial training programmes.

Respondents of the research, MBA and LLP course students, have found the methods that keep them active over the course of the training and enable them to develop their understanding of leadership concepts and skills through sharing experiences and discussion, getting feedback, solving various problem situations through role play and simulations or case studies to be the most useful. This target group have found the methods from the group of exams and testing knowledge, such as exams, knowledge test, short written exercise or traditional lectures least useful.

All of these methods have the potential to be used more intensively in teaching. This entails greater demands on the instructor, the level of his or her preparation, on the ability to adapt the content and type of activities directly to the target group and to time planning. Using these teaching methods places an emphasis on creating the right atmosphere in the group to support the active participation of all education programme participants, including providing and accepting feedback.

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STATE OF THE ART OF LOGISTIC AND TRANSPORT EDUCATION IN THE CZECH REPUBLIC

[1]✉Petr Jirsak, [2]Lenka Krsnakova, [3]Veronika Cervinska, [4]Jitka Jirsakova

[1]Department of Logistics, Faculty of Business Administration, Economic University in Prague, W. Churchilla sq. 1938/4, Prague, 130 67, Czech Republic, petr.jirsak@vse.cz

[2]Department of Logistics, Faculty of Business Administration, University of Economics, Prague, Czech Republic

[3]Department of Logistics, Faculty of Business Administration, University of Economics, Prague, Czech Republic

[4]Insitut of Education and Communication, Czech University of Life Science, Prague, Czech Republic

Abstract

This paper is focused on analyzing supply of current tertiary logistics and transport education in the Czech Republic. The authors of this paper want to discover focus and a structure of logistic tertiary education in the Czech Republic. State of the art of current education is researched by content analysis conducted on syllabi of logistic and transport programs and courses. Their findings are compared with the BestLog reference model as it is well recognized and it represents business requirements. Results indicate that traditional focus still prevails and uncover gap that should be reduced by changes of logistic and transport program curriculums. Focal tertiary institutions are mainly technical, economics and management schools. The research outcome should help parametrization of transport and logistics programs for better adherence to current and future business requirements.

Key words

Competences, logistics, tertiary education, transport

Introduction

Logistics discipline has experienced substantial evolution throughout the recent forty years due to globalization and changes in force of competitiveness of businesses. That has induced changes in scope of activities and their organization within a logistics discipline so it has to adapt Mass, Lean, Agile, Resilient and Green initiatives. Endeavour to disengage practitioners and academics from traditional perception of Logistics as a transportation and inventory management oriented discipline resulted in formulation of a new term Supply Chain Management. It encompasses organization of material, financial, information and knowledge flows across a supply chain of a focal company. However, both terms are used interchangeably and there is not standardized definition of them valid world widely. Unclear definition of the discipline scope leads to lack of clarity in body of knowledge that should be mastered by individuals within profession (Dooley, 2009).

Such progress in the discipline has also influenced the requirements on qualification that organizations expect from their job applicants including fresh graduates. They are demanded to have a broader range of both traditional and emerging logistics and supply chain skills (Fawcett, Rutner, 2013). Concurrent logistics encompasses large scope of processes for instance demand planning, procurements and supply planning,

replenishment, production planning, organization of flows in production process, customer order competition, warehousing, value added services, distribution, transportation etc.. So, logistics is responsible for organization of major flows: physical, information, financial and knowledge (Ayers, 2006).

Furthermore, logistic performance is a consequence of mutual harmonization of used technology (transportation, manipulation, identification, data processing and sharing), processes and people regarding customer needs and efficiency for the company. Therefore, logistics and supply chain managers need a holistic, cross-functional understanding of value-added systems (Davis and Spekman, 2003; Rossetti and Dooley, 2010). Importantly, success on such marketplace requires broader range of traditional and emerging logistic and supply chain skills (Fawcett, Rutner, 2014). However, current supply chain managers are usually of different origin in terms of their previous experience before their entering supply chain position e.g. IT, Procurement, Finance, Transportation etc. (Mangan and Christopher, 2005).

Concerning above mentioned, logistics covers wide range of activities and need manual workers, managers across all levels and specialist of different fields to meet customer demand on today market. Thus, companies have to firstly organize continuous knowledge management and also very carefully assess knowledge and capabilities of their new applicants. Secondly, logistics education has to be well established across levels: vocational level, bachelor level, master level and executive level. Nonetheless, this paper is focused on tertiary education and so the paper concentrates mainly on bachelor and master education program. Many universities have embedded supply chain management into their curriculum across the world (Rutner and Fawcett (2005).

However, many are still struggling to redesign their curriculum to reflect logistics as cross functional integration discipline and adhere to current job market demand (Wong, 2014). There has to be close cooperation between universities and business (Van Hoek et al., 2011).

One of the initiation that can mitigate the gap between logistics education supply and demand is the logistics curriculum formulated by BestLog (The European Logistics Best practice project). It is divided into nine areas: business functions, personal skills, scientific basics and tools, general management skills, logistics operation, logistics planning, logistics concept and tools, logistics support, specific areas of application (BestLog, 2007) Detail content of competences are shown in table 1.

Business functions	Scientific Basics and Tools	Personal Skills
Controlling / Cost Management	Economics	Intercultural Competence
Financial Management	Geography	Leadership
HR-Management	Management Techniques and tools	Languages: Chinese, English, French, Russian, Spanish
IT & Communication	Mathematics / Statistics	Presentation skills
Marketing	Organization Theory	Social Competence / Team play
Project Management	Quantitative Modelling / Operations Research	
General Management Concepts	**Logistics Operation**	**Logistics Concepts and Tools**
Change Management	Inventory Management	Supply Chain Management
Cooperation Management	Warehouse Management	Cooperation in Logistics and SCM
Innovation Management	Transport Management Road / Truck cargo, Air Cargo, Rail Cargo, Ship / Rivers/Sea Cargo, Intermodal Cargo	Global / International / Euro Logistics
International Management	Packaging Management	e-Logistics
Knowledge Management	Waste Management	Operation Research in Logistics
Quality Management	Sourcing & Procurement Logistics Management	Simulation Tools in Logistics
Risk Management	Production Logistics Management	Transportation Economics and Policy
Service Management	Distribution Logistics Management	Logistics Infrastructure Economics and policy
Strategic Management		Legislation, Law and Contracts in Logistics
		Logistics and Ecological Environment
Logistics Support	**Logistics Planning**	**Specific Areas of application**
Customs and Insurance	Logistics / Supply Chain Strategy	Trade / Retail Logistics
Logistics Controlling / Cost Management	Logistics Network Design	Industrial Logistics
Logistics equipment / Engineering	Tactical Scheduling / Forecasting	Logistics Service Provider
Dangerous Goods Management	Operative Planning and Control	Seaport / Inner Harbour Logistics
Logistics IT - Systems		Maritime Logistics
Logistics / SCM Consulting		Airport logistics
Marketing for Logistics Services		City Logistics
Logistics Safety & Security		health care / Hospital Logistics
Logistics Service Quality Management		Food Logistics
Telematics and Auto ID - Systems		Spare Parts Logistics
		Passenger Logistics

Table 1: BestLog curriculum, (source: BestLog (2009))

The BestLog curriculum framework is used as a reference model in this research. It is compared with contemporary structure and content of logistic and transport tertiary education in the Czech Republic. The BestLog framework is well recognized in Europe and represents business requirements on logistic education. The hereinafter method is used to answer the research question: Is the Czech logistic and transport tertiary education properly established?
Authors search the answer for this question based on the following propositions: there are both comprehensive bachelor and master program and courses dedicated to logistic and transport; programs are evenly distributed between bachelor and master program; programs are evenly distributed among transport and logistics; logistic and transport tertiary education is compliant with the BestLog reference model.

Materials and methods

Research description

The research question is answered by the following procedure. Firstly, authors analyse logistics tertiary education by selection of tertiary education institutions that provide some logistic or transport education regardless the specialization. Hence, all programs and courses with transport or logistics in its name are covered. Authors set the list of institutions based on the report of tertiary institutions published by Institute for Information in Education (UIV, 2016). Then, selected tertiary institutions are analysed regarding provision of comprehensive logistics and transport education program or individual courses either in bachelor or master program. Next step is the content analysis made among the selected tertiary institutions with provision of comprehensive logistic or/and transport program. 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). The criteria of content analysis are formulated on the BestLog recommendations (see table 1). BestLog is a widely recognized European consortium of universities and companies financed by European Commission. BestLog objective is to identify best practices in Logistics and provide their dissemination. Moreover, it analyses logistics job market and education. Therefore, authors uses that as a reference model. BestLog is represented by members of 27 EU countries and some non-EU countries such as Switzerland, Norway, Russia and Turkey.

Analysis of tertiary logistics education

There are 69 tertiary institutions registered in Institute for Information in Education (UIV, 2016) without consideration of different faculties in each institution. However, various logistic and transport programs and courses could be provided at faculties of the one institution. Therefore, authors recognize institutions on the level of faculties of which there are 194 registered in Institute for Information in Education (UIV, 2016). The content analysis is conducted based on the following procedure:

1. Is any logistic or transport education provided by a tertiary institution?
   a) yes
   b) no

2. Is any logistic or transport education provided by a faculty?
   a) yes
   b) no
3. What is the form of the education?
   a) Comprehensive program Bc/Msc
   b) Individual course(s)
4. What is the main focus of the program?
   a) Transport
   b) Logistics
   c) Transport and logistics
5. What are the courses of comprehensive programs focused on?
   a) Business functions
   b) Scientific basics and tools
   c) Personal skills
   d) General Management Concept
   e) Logistics Operation
   f) Logistics Concepts
   g) Logistics Support
   h) Logistics Planning
   i) Specific area of application

Programs and their courses´ specialization is analysed based on syllabi being published on web pages of university or faculty.

Results and discussion

Authors identify 22 tertiary institutions providing logistic or/and transport education in the Czech Republic. Breaking it down to the faculty level, there are 32 faculties which offer logistic or transport education. There is an offer of 15 bachelor programs and 19 master programs. Two faculties offer logistics and transport education on Bc level but not on Msc level. In addition to that, 4 faculties offer logistic and transport education on Msc but not on Bc level. Majority of faculties focus with their individual courses or programs on transportation (19), minority on logistics (16) and only 7 are complex and contain both. Content analysis is conducted by using abbreviation characterizing program focus. The abbreviations are mentioned hereinafter. Comprehensive programs which have transport and/or logistics in their name but with focus on construction of building or engineering of vehicles or machinery used in transport or logistics are excluded. The reason is that their focus is on engineering not transport or logistics itself. Thus, 37 comprehensive transport and/or logistics programs are identified out of which 19 are of transport orientation, 10 of logistics and 8 content both transport and logistics. Less than half of the program (15) are technically oriented out of which 12 are of transport and 3 of logistics focus.

TS - technical university
NTS - non-technical university
Bc -bachelor program
Msc - master program
T - transport
L - logistics
TL - transport and logistics
TO - technically oriented program
NTO - non-technically oriented program

Detail results of the content analysis is shown below by using BestLog logistic and transport education reference model.

Business functions

Controlling/cost management - TS 1, NTS 1, Bc 0, Msc 2, T 1, L 0, TL 1, TO 0, NTO 2
Financial management - TS 7, NTS 10, Bc 12, Msc 5, T 8, L 7, TL 2, TO 1, NTO 16
HR management - TS 6, NTS 2, Bc 1, Msc 7, T 4, L 1, TL 3, TO 3, NTO 5
IT and communication - TS 24, NTS 8, Bc 18, Msc 14, T 16, L 9, TL 7, TO 12, NTO 20
Marketing - TS 6, NTS 6, Bc 10, Msc 2, T 9, L 2, TL 1, TO 3, NTO 9
Project management - TS 5, NTS 3, Bc 4, Msc 4, T 3, L 2, TL 3, TO 1, NTO 7

Scientific basic tools

Economics - TS 5, NTS 8, Bc 11, Msc 2, T 5, L 5, TL 3, TO 3, NTO 10
Geography - TS 6, NTS 2, Bc 8, Msc 0, T 6, L 0, TL 2, TO 3, NTO 5
Management techniques and tools - TS 14, NTS 9, Bc 16, Msc 7, T 11, L 7, TL 5, TO 5, NTO 18
Mathematics / Statistics - TS 21, NTS 10, Bc 16, Msc 15, T 15, L 10, TL 6, TO 11, NTO 20
Organization Theory – 0
Quantitative Modelling / Operations Research - TS 20, NTS 5, Bc 14, Msc 11, T 12, L 5, TL 8, TO 10, NTO 15

Personal Skills

Intercultural competences - TS 0, NTS 2, Bc 1, Msc 1, T 2, L 0, TL 0, technically oriented program 0, non-technically oriented program 2
Leadership - TS 0, NTS 1, Bc 0, Msc 1, T 0, L 0, TL 1, TO 0, NTO 1
Languages – all
Presentation skills - TS 1, NTS 1, Bc 1, Msc 1, T 2, L 0, TL 0, TO 1, NTO 1
Social Competence / Team play - TS 1, NTS 0, Bc 0, Msc 1, T 1, L 0, TL 0, TO 1, NTO 1

General Management Concepts

Change management 0
Cooperation management 0
Innovation management - TS 0, NTS 1, Bc 0, Msc 1, T 0, L 1, TL 0, TO 0, NTO 1
International management – 0
Knowledge management – 0
Quality management - TS 7, NTS 2, Bc 4, Msc 5, T 3, L 3, TL 2, TO 4, NTO 5
Risk management - TS 8, NTS 2, Bc 4, Msc 6, T 7, L 2, TL 1, TO 3, NTO 7
Service management - TS 0, NTS 1, Bc 0, Msc 1, T 0, L 0, TL 1, TO 0, NTO 1
Strategic management - TS 1, NTS 2, Bc 0, Msc 3, T 1, L 0, TL 2, TO 1, NTO 2

Logistics operation

Logistic operation - TS 9, NTS 6, Bc 12, Msc 3, T 4, L 6, TL 5, TO 4, NTO 11
Inventory management - TS 1, NTS 1, Bc 0, Msc 2, T 0, L 0, TL 2, TO 0, NTO 2
Warehouse management - TS 2, NTS 1, Bc 2, Msc 1, T 0, L 1, TL 2, TO 2, NTO 1
Transport Management Road/Truck cargo, Air Cargo, Rail Cargo, Ship/Rivers/Sea Cargo, Intermodal Cargo - TS 16, NTS 5, Bc 14, Msc 7, T 14, logistics 1, TL 6, TO 8, NTO 13
Packaging Management - TS 1, NTS 3, Bc 2, Msc 2, T 2, L 1, TL 1, TO 0, NTO 4
Waste Management – 0

Sourcing & Procurement Logistics Management - TS 0, NTS 4, Bc 1, Msc 3, T 0, L 2, TL 2, TO 0, NTO 4
Production Logistics Management - TS 2, NTS 3, Bc 1, Msc 4, T 0, L 4, TL 1, TO 0, NTO 5
Distribution Logistics Management - TS 1, NTS 2, Bc 1, Msc 2, T 1, L 1, TL 1, TO 0, NTO 3

Logistics Concepts and Tools

Supply Chain Management - TS 5, NTS 1, Bc 0, Msc 6, T 2, L 3, TL 1, TO 2, NTO 4
Cooperation in Logistics and SCM – 0
Global / International / Euro Logistics - TS 3, NTS 1, Bc 2, Msc 2, T 1, L 1, TL 2, TO 3, NTO 1
e-Logistics – 0
Operation Research in Logistics - TS 14, NTS 2, Bc 11, Msc 5, T 7, L 3, TL 6, TO 5, NTO 11
Simulation Tools in Logistics - TS 7, NTS 4, Bc 5, Msc 6, T 3, L 5, TL 3, TO 4, NTO 7
Transportation Economics and Policy - TS 3, NTS 0, Bc 1, Msc 2, T 1, L 0, TL 2, TO 1, NTO 2
Logistics Infrastructure Economics and policy - TS 5, NTS 2, Bc 4, Msc 3, T 5, L 0, TL 2, TO 4, NTO 2
Legislation, Law and Contracts in Logistics - TS 8, NTS 5, Bc 9, Msc 4, T 7, L 3, TL 3, TO 1, NTO 12
Logistics and Ecological Environment - TS 10, NTS 6, Bc 7, Msc 9, T 8, L 6, TL 2, TO 5, NTO 11
Logistics support - TS 3, NTS 0, Bc 2, Msc 1, T 2, L 1, TL 0, TO 2, NTO 1
Logistics Controlling / Cost Management - TS 1, NTS 0, Bc 0, Msc 1, T 1, L 0, TL 0, TO 0, NTO 1
Logistics equipment / Engineering – 0
Dangerous Goods Management - TS 0, NTS 1, Bc 0, Msc 1, T 0, L 0, TL 1, TO 0, NTO 1
Logistics IT – Systems - TS 7, NTS 1, Bc 5, Msc 3, T 7, L 0, TL 1, TO 5, NTO 3
Logistics / SCM Consulting – 0
Marketing for Logistics Services – 0
Logistics Safety & Security - TS 4, NTS 0, Bc 2, Msc 2, T 2, L 2, TL 0, TO 2, NTO 2
Logistics Service Quality Management - TS 1, NTS 0, Bc 0, Msc 1, T 1, L 0, TL 0, TO 1, NTO 0
Telematics and Auto ID – Systems - TS 5, NTS 1, Bc 4, Msc 2, T 5, L 0, TL 1, TO 4, NTO 2

Logistics planning

Logistics / Supply Chain Strategy - TS 0, NTS 2, Bc 0, Msc 2, T 0, L 0, TL 2, TO 0, NTO 2
Logistics Network Design - TS 3, NTS 1, Bc 2, Msc 2, T 3, L 0, TL 1, TO 1, NTO 3
Tactical Scheduling / Forecasting - TS 1, NTS 1, Bc 0, Msc 2, T 0, L 0, TL 2, TO 0, NTO 2
Operative Planning and Control - TS 5, NTS 2, Bc 4, Msc 3, T 3, L 2, TL 2, TO 3, NTO 4

Specific area of logistics

Trade / Retail Logistics - TS 1, NTS 0, Bc 0, Msc 1, T 0, L 1, TL 0, TO 0, NTO 1
Industrial Logistics – 0
Logistics Service Provider - TS 1, NTS 2, Bc 1, Msc 2, T 1, L 1, TL 1, TO 0, NTO 3
Seaport / Inner Harbour Logistics – 0
Maritime Logistics - TS 0, NTS 1, Bc 0, Msc 1, T 0, L 0, TL 1, TO 0, NTO 1
Airport logistics - TS 0, NTS 3, Bc 1, Msc 2, T 2, L 0, TL 1, TO 0, NTO 3
City Logistics - TS 5, NTS 0, Bc 4, Msc 1, T 1, L 1, TL 3, TO, NTO 3
Health care / Hospital Logistics – 0
Food Logistics – 0
Spare parts Logistics - 0
Passenger Logistics - TS 2, NTS 1, Bc, Msc 2, T 2, L 0, TL 1, TO 1, NTO 2

Authors summarize findings of their propositions in the table 2.

Proposition	Result
There are comprehensive programs and courses dedicated to logistics and/or transport	yes (37)
Programs are evenly distributed between Bc and Msc programs	prevalence of Msc (20/17)
Programs are evenly distributed between logistics and transport	prevalence of transport (21/16)
Programs are compliant with BestLog reference model	poor coverage - spotted orientation

Table 2: Results (source: own source)

Aforementioned results confirm that Czech logistic and transport education lacks focus on soft personal skills: leadership, presentation skills and intercultural competences. Furthermore, business functions particularly: controlling, HR management and project management are also commonly not part of the comprehensive transport and logistic programs. Unlike to scientific basics which are frequently part of both logistics and transport programs. In addition to that, general management concepts are not embedded in the programs especially change management, cooperation management, international management and knowledge management. Moreover, there is a short of courses dedicated to logistic support such as logistic controlling, customs and insurance and dangerous goods management. Additionally, specific areas of logistic and transport application e.g. trade/retail logistics, industrial logistics, logistic service providers and maritime transport are not sufficiently represented in the programs as well. The authors´ findings show that the logistic and transport tertiary education is already established in the Czech Republic in terms of number of education program and courses. The study programs are provided by 32 faculties, however, 15 out of 37 programs are of technical insular orientation. Moreover, even non-technical programs don´t have full range coverage of all logistic and transport areas that are demanded by business sector. These areas are for instance defined by BestLog (BestLog, 2009). The outcomes of this research indicate that current logistic and transport education program curriculums should be supplemented with soft skills and alternative applications of logistics and transport. Authors are aware of the research limitation, particularly those related with the web oriented research. Authors haven't realized interview with supervisors of the study programs to uncover differences between program and course syllabi and the real content of the education. Furthermore, the content

analysis of syllabise is not focused on insular transport or/and logistic courses but only on those involved in comprehensive programs. Thus, elective courses might contain some of the areas missing in the programs. Additionally, the BestLog framework is tailored for European perspective as it was formulated on business and academic organizations mainly across EU. Therefore, authors will organize semi structured interviews with HR companies specializing in supplying production, trading and service companies with logistic specialists and managers. Nonetheless, the output of research presented here provide basic for further research.

Conclusion

Results gained by the content analysis of the transport or/and logistic programs at the tertiary Czech institutions show that focus on traditional logistic and transport areas still prevails. However, business complain about insufficient knowledge of soft skills and complex view of today graduates. There are 37 university programs at 32 Faculties specialised in logistics and transport and majority of them is focused on transportation. Less than half of programs is of technical orientation. Nonetheless, there is significant gap in soft managerial skills and cross functional orientation. Mathematics and operation research courses are well represented within logistics and transport programs. Therefore, it could be concluded that the logistics and transport programs are established in tertiary education in the Czech Republic, however, they haven't meet requirements defining by BestLog and in the introduction part of this paper. The presented outcome can help outline future necessary changes in logistic and transport curriculums to reinforce qualification of supply chain labour either from logistics or transport. Authors are aware of the limitation being specified in the result and discussion part. These limitations will be reduced by the subsequent steps of the research.

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TEMPORARY INTERNATIONAL STUDENT MOBILITY IN EUROPE

Mikulas Josek

Department of Psychology, Faculty of Economics and Management, Czech University of Life Sciences Prague, Kamýcká 129, Praha 6 - Suchdol, 165 21, Czech Republic, josek@pef.czu.cz

Abstract

This article deals with international student mobility and its connections to economic benefits. The data were obtained from an extensive questionnaire survey among students from Europe (ESNsurvey). High willingness of students to relocate for work was observed. A sample of students after returning from a study abroad (n = 11 916) were significantly more willing to migrate when compared with a control group with no mobility experience (n = 9 387). The length of a study abroad also proved to be an important aspect, because students after a two-semester stay seem to be more willing to migrate to work abroad compared to those after one semester. The estimated work abroad locations of graduates were explored. Overall, students without a study abroad experience show a greater tendency to stay after their studies in their home country and students with a study abroad experience tend to subsequently migrate mainly within Europe.

Keywords

Erasmus Programme, international student mobility, migration, study abroad

Introduction

King and Ruiz-Gelices (2003) surveyed international students about the added value of studying in a foreign country. The top positively assessed benefits were foreign language improvement, overall personal development, knowledge and understanding of the host country and the opportunity to gain new perspectives on their home country. Apart from receiving a number of benefits during their stay, international students also give back some "added value" to their host countries. This paper explores the willingness of students to migrate abroad and the potential benefits of this migration from an economic perspective. Different countries have a different approach to international student mobility. Anglophonic countries such as the United Kingdom, United States or Australia represent popular study abroad destinations already for many years and take advantage of their popularity by requiring high tuition fees from international students. However, these countries have also started to recognize the benefits for their home universities, businesses and economies that rise from sending students abroad (Brooks and Waters, 2011: 2). Therefore, they support exchange programmes and international partnerships between universities. On the contrary, traditional sending countries like China and India are beginning to invest in higher education institutions and to promote the quality of their domestic education system with a clear aim to increase their attractiveness on the field of international education. Overall, the number of international mobile students continues to rise, and in 2012 it has reached the milestone of 4,5 million of international students in one year (OECD, 2014: 342).

Within the European Union (EU), international student mobility has become a tool for supporting the strategic objectives of Europe 2020 (European Commission, 2014). Through mobility programmes, bilateral agreements and education policies, the EU aims to foster its position as a centre of excellence in education and training and thus raise the

number of highly skilled graduates within the EU labour market. Teichler (2009) described how certain European measures like the Bologna Process were key for facilitating intra-European mobility and enabled the development of internationalisation of European higher education in Europe. Additionally, these measures aim to create a "European Identity", facilitate cross-cultural encounters and help in overcoming national stereotypes. In this sense the benefits of international student mobility have a social, cultural, political and also economic dimension.

Education policies play an important role in international student mobility, because they are often connected with the economic objectives of the countries. Many of the policies adopted among the EU countries in the past years supported international student migration and facilitated the study and work abroad flows. However, even the fundamental EU right to move freely around Europe in order to study or work might now be under a threat due to the escalation of the situation after the terrorist attacks in Paris and Brussels during an already tense immigration crisis. Policy makers shouldn't neglect the added value that international student mobility has for Europe and should not take a stricter path in the evolution of policies regulating migration flows, which might affect international students.

University students represent a very mobile segment of our population. Apart from migrating within their home countries (usually to bigger cities with universities), students also migrate abroad to either pursue a part of their studies in a different country (called credit or temporary mobility) or to obtain a full degree from a foreign university (called degree mobility). The study abroad experience frequently triggers subsequent migration to work abroad. University graduates who were educated in an international setting and who learned skills that allow them to communicate across cultures and languages are an important asset of the European labour market. They are more prone to become part of a labour force that makes the labour market flexible. Wiers-Jenssen (2008) state that mobile students search for and gain work abroad more often than non-mobile students, and add that mobile students also tend to choose jobs with a more international content. King and Ruiz-Gelices (2003) compared students with a year abroad experience and students without any mobility experience and recognize that having a previous study abroad experience allows a person to better envisage working abroad in the future. In this sense, a study year in a different country can be regarded as a stepping-stone for a career abroad. Parey and Waldinger (2010) confirmed this relationship by finding a causal effect between studying abroad via the Erasmus programme and subsequent international labour market mobility. This study proved that studying abroad increases an individual's probability of working in a foreign country by about 15 percentage points.

It is very difficult to quantify the economic costs and benefits of international students in Europe, because of the diverse approach of EU member states. Host countries spend finances on providing places to study for international students. Tuition fees paid by international students can cover these costs. However, the size of tuition fees largely differs among EU member states and also among students coming from different countries (non-EU citizens tend to pay more) (Münch and Hoch, 2013).

International students also spend money on their accommodation, living expenses, and leisure and travel activities, which positively affect a host country's economy and can be transferred to the macro level as income taxes from newly created jobs.

There is limited information available on participation of international students in the labour market of their host country during their stay. They mainly work in low-skilled sectors and only as a way of gaining additional income (European Migration Network, 2013). After students graduate and begin working full-time, the economic

impact obviously becomes larger and the host countries benefit from direct taxation of the graduates income and from social insurance contributions. However, whether the graduates remain working in the host country is subject to migration policies and to the country of origin of the international student. Citizens of the EU can benefit from the basic economic freedom to move freely around Europe in order to study or work. This is vital for the EU labour market, because it allows the EU to stay competitive with other popular study/work abroad destinations such as USA, Canada or Australia. Students as third-country nationals (non-EU citizens) are in a more complicated situation. Although the principle directive is to allow access to study/work, the conditions to work abroad for third-country nationals substantially differ between the member states (Council Directive 2004/114/EC, 2004) making it even more difficult to quantify the income taxes and social security contributions from mobile students on a European scale. Despite the variability of study tuition fees, living costs, work-permits, education policies or visa issues within Europe, the aggregate effect of international student mobility on host countries is positive (Münch and Hoch, 2013).

Generally, data regarding mobility students apply to so called degree students, who study in order to obtain a full degree at the host university, because these data are relatively accessible through traditional graduate surveys. There is not much information about the effect of credit mobility on students' decisions regarding subsequent migration to work abroad.

This article is based on data from a student research called ESNsurvey 2016 and aims to determine the role of shorter student mobility (i.e. credit or temporary mobility) in affecting students' willingness to migrate abroad for work. It also explores students potential future work destinations while taking into account whether they have a study abroad experience or not.

Materials and methods

Data collection

The data used in this article were collected through an online questionnaire entitled "ESNsurvey 2016 Questionnaire" placed at www.esn.org/esnsurvey/2016. This link was distributed through local associations of the largest student network in Europe - Erasmus Student Network (ESN). Its approximately 500 branches located at different universities around Europe shared the link to the questionnaire among students. Thanks to cooperation with the European Commission and other institutional partners in the field of higher education, the questionnaire reached even to universities outside the ESN network. The way of administration and distribution of this questionnaire does not allow calculating the return rate. The data collection period lasted from 16th of October 2015 to 8th of January 2016.

ESNsurvey is the largest European research project carried out solely by volunteers. The project has been running since 2005 every year with a different topic. This year is already the 11th edition and the research topic is "International-friendliness of universities". A publication with the findings is released every year (named ESNsurvey Report). The author of this article is the research coordinator for the 2016 edition. The position involves preparing the research design and creating the questionnaire, it allows the coordinator to use the data collected for own publishing and academic purposes.

Two questionnaires were designed to target two main groups of students; 1) students who have completed a short-term study abroad (one to two semesters), and 2) students

who have no experience with a study or work stay abroad. The main questionnaire for homecoming students contained 65 questions, and was filled in by 11,916 students. The second questionnaire for local students contained 29 questions and was completed by 9,387 students. Although a large part of the questions of the two questionnaires varied, many were designed for comparison. This article will deal with the corresponding parts, which are a) demographic variables (gender, age, country of origin, field of study, the perceived level of family income and level of education) and b) migration variables (length of study abroad, the perceived willingness to work abroad and the estimated location of work after completing their studies). The migration variables explore the likelihood of first or subsequent migration (depending on the group).

Characteristics of the sample

Table 1 divides the total number of respondents (n = 21,303) by not/having completed a study abroad. The predominance of female respondents corresponds to a general trend in social science research when using the questionnaire method. The similarity in sample size, average age and level of education support the comparability of these two groups of respondents. 95% of respondents come from countries of the European Economic Area.

	Students WITH a study abroad experience	Students WITHOUT a study abroad experience
Number of respondents (n)	11,916 (56%)	9,387 (44%)
Gender ratio female:male	66:33	67:33
Average age	23 years	22 years
Education ratio: Bachlor:Master	74:26	78:22

Source: Own calculations of ESNsurvey2016 data

Table 1: Sample characteristics

Data analysis

A statistical analysis will verify if homecoming students are more willing to migrate abroad than students without a study abroad experience. The sample of students with no study abroad experiences will, therefore, be used as a control group. Whether there is a difference in the willingness to move abroad for work between students with and students without a study abroad experience will be tested by using statistical tests with help of the SPSS software. The Chi-square test will be used to reject the null hypothesis that there is no such difference. Whether the length of the study abroad period has an effect on the willingness to move abroad will be tested by a two independent samples *t*-test. Subsequently, descriptive statistics will be used to describe students' estimated location/ destination of work after completion of their studies. The results will be interpreted in the context of student mobility in Europe.

Results

Table 2 shows that both groups of participants in this study respond very positively to the question: "*Would you be willing to migrate abroad for work / in order to pursue your career?*"" Nevertheless, students with an abroad experience seem more convinced. The Chi-square test rejected the null hypothesis that there is no statistically significant difference in the willingness or unwillingness to move abroad for work among students with an experience and students without an experience of studying abroad. The null hypothesis was rejected on the level of significance less than 0.0005. This means that there is a statistically significant relationship between having a study abroad experience and the

being more willing to migrate abroad for work. The strength of this relationship was measured by Phi at 0.11, which corresponds to a small to moderate strength. A previous study abroad experience thus has a small to moderate influence on the willingness to work abroad after graduation.

Question: *"Would you be willing to migrate abroad for work / in order to pursue your career?"*	Yes	No
Students WITH a study abroad experience.	11 124 (93%)	792 (7%)
Students WITHOUT a study abroad experience	8 103 (86%)	1284 (14%)

Source: Own calculations of ESNsurvey2016 data

Table 2: Willingness to migrate abroad for work

In the next step of the analysis, the length of a study abroad was divided into one and two semesters. A *t*-test for two independent samples was applied. This test rejected the null hypothesis that there is no difference in the willingness or unwillingness to move abroad to work among the students who were abroad one or two semesters. For $t(11,124) = 4.324$ the *p*-value was less than 0.0005. Students with a longer experience from abroad tend to be more willing to subsequently migrate to work abroad.

The results on estimated work location show an interesting pattern. Students answered the question: "*Where do you think you will work after your studies?*" Students who returned from abroad were given an additional option b) "*In the country where I studied abroad*". Table 3 shows the distribution of selected options by groups and Graph 1 displays percentage comparisons. It is important to mention that students could select multiple answers for this multiple-choice question. Hence the figures don't show the actual number of students, but the frequency of that choice being selected, in other words, what percentage of the total number of the group (WITH or WITHOUT) selected the option.

The group of students with an experience from abroad indicated Europe as the most expected work destination after their studies. Additionally, every fourth student with a study abroad experience expects to work in his/her study-abroad-country after graduation. In contrast, for students without a study abroad experience, the most common answer was they would remain in their home country. However, it is quite evident that none of the groups exclude the idea to migrate for work abroad after graduation.

Question: *"Where do you think you will work after your studies?"*	a) In my home country	b) In the country where I studied abroad	c) I will move somewhere in Europe	d) I will move outside of Europe	e) I'm not sure yet
Students WITH a study abroad experience	4 191 (35%)	3 040 (26%)	6 263 (53%)	2 883 (24%)	3 466 (29%)
Students WITHOUT a study abroad experience	4 009 (43%)	-	3 937 (42%)	2 979 (32%)	2 477 (26%)

Source: Own calculations of ESNsurvey2016 data

Table 3: Estimated location of work after graduation

Since many students selected multiple choices as their answer, the data was in a further analysis limited to respondents who selected only one option, in hope of selecting rather convinced students. This step revealed that only 6% of students with a study abroad experience selected solely the country of their study abroad as their expected future

location of work. Other results were more or less in line with the overall results; 20% of students without the experience compared with 13% of students with the experience would remain in their home country after graduation. Homecoming students tend to choose the option of migrating elsewhere in Europe slightly more often (18%) than non-mobile students (15%).

Discussion

As in other studies related to cross-border mobility of students (eg. King and Ruiz-Gelices, 2003, Parey and Waldiger, 2010, Wiers-Jenssen, 2008), students are generally very mobile and open to the idea to move abroad to work. However, students with a study abroad experience prove to be more prepared and more susceptible to subsequent migration. This research has supported these claims and, thanks to a control sample of non-mobile students, more or less verified that even short-term student mobility can stimulate the willingness to migrate abroad. Even for short-term student mobility, the difference between one and two semesters abroad seems significant. Students with a longer experience from abroad demonstrate to be more willing to migrate.

According to King and Ruiz-Gelices (2003) students with a year long study abroad experience are almost twice as prone to migrate abroad and three times as prone to settle abroad than students without a study abroad experience. Homecoming students applied for a job abroad more often and more than half of those who applied did so in the country where they studied abroad. Therefore, the findings of this study might be a little surprising, because only 26% of students in the researched sample indicated that they would return to the country of their study exchange after graduation. However, King and Ruiz-Gelices (2003) worked with data from students who have studied a whole programme abroad and received a diploma of the visiting university. These degree students have, therefore, studied abroad longer than our sample of credit students, which rather confirms the positive effect of a longer study period abroad, which leads to a higher willingness to move abroad to work.

Contrary to the findings of King and Ruiz-Gelices (2003), the current sample didn't show a strong tendency to return to their study-abroad-country after completing their studies. Only one out of four students included this possibility among their reply and only 6% of them chose this option exclusively. Europe was the most commonly chosen option for expected labour migration. A longer mobility period generally leads to creating stronger ties with the host country, as successful interaction with host students comes with time (Volet and Jones, 2012). Therefore, credit mobility students might not be as attached to the study-abroad-country as degree students, making them willing to migrate in the future, but not necessarily linked to country of their previous experience.

Conclusion

The article aimed to explore the role of a short-term study abroad experience in students' decision to migrate abroad for work and in their expected work destinations. The connection of international student mobility and economic benefits as well as the relationship between studying abroad and subsequent work abroad migration were clarified by a review of previous research in the field of international student mobility. This research paper revealed a remarkable willingness of students to move abroad to work. As expected, students with a previous experience of studying abroad are more prone to such migration. Contrary to other research in this area, the focus was on credit mobility, which proved that not only the experience itself, but also the length of the experience

plays an important role. Students who have spent two semesters abroad seem to be more willing to migrate to work abroad than students with just a one-semester long experience. In this sense even credit mobility, a relatively short period abroad, can serve as a tool for increasing subsequent labour market mobility. Specific economic benefits stemming from such migration differ among the EU member states due to the variability of approaches to migration.

The estimated locations of work after graduation seem to be a rather hypothetical indicator, since students often indicated more than one possibility. This suggests that they are considering migrating abroad for work, but they don't have a clearly chosen destination. Still, it can be stated that students without a study abroad experience have a greater tendency to remain in their home country after their studies and that students with a study abroad experience tend to subsequently migrate within Europe. Apparently, supporting student mobility programmes inside a particular region should lead to greater labour market mobility inside that region. Although cross-border student mobility programmes (the most common one in Europe being the Erasmus+) can be considered as a tool for creating a mobile workforce in Europe, it is not a rule that student's would prefer their study-abroad-country as their subsequent work abroad destination.

One could argue about the representativeness of the sample, on the one hand the questionnaire was distributed through a network of students interested in cross-border cooperation and in the topic of international students. On the other hand, a large amount of data that allow interpreting the results on a European scale was successfully collected. The concept of student mobility flows would definitely deserve more attention of researchers. A number of economic factors can influence the decision students' make about whether or not to move abroad for work. Due to the diverse approaches, the economic aspects could be studied on a bilateral basis (from country of origin to destination of studies) and here the role of scholarships (by size), cost of living in the host country, student's family income or geographic distance of the two locations could be explored to determine their role in the migration flow. Nevertheless, student mobility flows activate a number of chain effects, which go beyond the economic dimension and which occur on different levels. A high quality mobility experience should enable individuals to acquire intercultural competences, institutions to benefit from the culturally diverse environment and the society to be enriched through mutual understanding and social cohesion.

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PROJECT LEARNING FOCUSED ON THE ISSUE OF LOAN PRODUCTS

[1]✉Martin Kazda, [2]Vladimira Petraskova, [3]Premysl Rosa

[1]Faculty of Education, University of South Bohemia in České Budějovice, Jeronýmova 10, České Budějovice, 371 15, Česká republika, martinmatik12@gmail.com

[2]Faculty of Education, University of South Bohemia in České Budějovice, Czech republic

[3]Faculty of Education, University of South Bohemia in České Budějovice, Czech republic

Abstract

In the past years, the issue of financial literacy has become an integral part of teaching at primary and secondary schools. For achieving of an appropriate level of financial literacy it is necessary to acquire the relevant knowledge and skills that can be improved by means of appropriately selected teaching methods. One of the methods is project learning. The article familiarizes the readers with the results of research including the implementation of project learning focused on the improvement of knowledge in one field of financial literacy, i.e. in the field of loan products. Data for research was obtained using two didactic tests, before and after the project, which were rated by the rules listed in the article. Results indicate that project learning has a positive effect on financial literacy.

Keywords

Computer aided teaching, financial literacy, loan products, project learning

Introduction

Since the 1990s, when the financial market in the Czech Republic changed considerably, a number of households have gradually been facing problems with their debts, which has negatively affected our society and economic development. A considerable part of the population succumbs to the temptation to raise a loan by means of which it is possible to get a lot of money very easily. However, as indicated by the results of research carried out for the Ministry of Finance by the company STEM/MARK (2010), most of these people are not aware of the considerable hazards involved with this „expensive„ money. Due to aggressive marketing, these households rapidly increase debt. The total estimated sum borrowed by them from companies offering "hazardous loans" amounts to up to CZK 30 billion of an aggregate borrowed amount of CZK 310 billion.

One of the preventative instruments in the struggle against the growing debt of the households is the financial education of people of all age groups to assist them in assuming responsibility for the financial security of themselves and their families. In the last years, the schools have been paying increased attention to financial literacy. The failure of our secondary school pupils to solve complex inter-subject tasks (this category can also include tasks in the field of financial literacy) in particular results from their inability to apply acquired knowledge in practice. Thus, they justifiably consider mathematics the science out of touch with life. The main goal of teaching has been increasing to get students to pass the tests. As indicated in the paper by Hejný and Kuřina (2009), such formally "mastered" mathematics is inapplicable and it does not completely develop the cognitive abilities and mechanical memory of the pupils.

One of the possible alternatives is a research-oriented teaching based on the pupil's

discovery process itself, the initiator and supporter being the teacher, but this is a time-consuming intellectual process. However, if the process is properly designed and efficiently implemented in practice, it can contribute to the personal and cognitive development of the pupil as well as the teacher.

This article proposes and verifies one of the possible forms of financial literacy teaching implementation at secondary schools by means of project preparation. The teaching is based on the requirements drafted in the document "Financial literacy standards" (2012) that define the target state of financial literacy level for secondary education as well as on the methodical recommendations of the Research Institute of Education in Prague as stated in the paper written by Hesová (2012).

Interdisciplinary and inter-subject relations and financial literacy

The basic curriculum documents of the Czech educational system at the state level are framework educational programmes for particular degrees and types of schools (primary schools, grammar schools, trade school etc.) that specify the requirements for education as stated in the *National Educational Programme* (*White Book*) (Ministry of Education, Youth and Sports of the Czech Republic, 2001). These framework educational programmes define binding frameworks for particular stages of school education by determining binding educational content, i.e. expected outputs and subject matters. The framework educational programmes do not specify particular subjects. They only use the categories as the field of education and the branch of education. Sometimes the branch of education is identical to the field of education (e.g. *Mathematics and its application* or *Human and the world of labour* are fields of education as well as branches of education) and at other times the field of education is divided into multiple branches (e.g. the field of education *Human and nature* consists of branches of *Physics*, *Chemistry*, *Biology*, *Geography* and *Geology*). In addition, the school educational programmes can integrate particular spheres, complexes and topics of various educational branches from the framework educational programmes into particular subjects or groups of subjects in order to support interdisciplinary, possibly inter-subject relations as much as possible (Research Institute of Education, 2007: 12). One of the topics of these relations is the topic of financial literacy which forms the links between the branches of education *Mathematics and its application*, *Human and society*, *Human and the world of labour* and *Computer science and information and communication technologies* that are also reflected in the school educational programmes concerning the relations between appropriate subjects. In studying of the school educational programmes of various schools we encounter various approaches to defining the subjects constituting the school teaching plan.

Research examination executed by one of the authors of this article, whose results can be found in the paper written by Kazda (2013), has detected that the subject matter concerning financial education at most secondary schools is still divided into the subjects Mathematics, Essentials of Social Sciences (Civics) and Economics. A fourth of the schools teach the subject matter concerning financial literacy standards as a separate subject. The project referred to in the article was verified at the school where financial literacy is not implemented as a separate subject. Thus this is a possible alternative, by means of which the subject matter required can be made accessible to the pupils.

Materials and Methods

The main research goal was the evaluation of project learning efficiency in the familiarization of secondary school pupils with the issue of loan products. For this

purpose, a didactic test was used in order to detect the level of knowledge of the pupils in this field. The pupils were subject to the didactic test at the beginning and at the end of project learning.
Before commencement of the project, the pupils were subject to a didactic test that included 10 questions concerning the issue of loan products; 8 questions were of an open nature and 2 questions were of a closed nature (the possibility of choice from pre-set answers). The purpose of the test specification was to detect the initial knowledge of the pupils. In addition, didactic test was used for final analysis of project learning efficiency. The didactic test specification can be found in Annex 1 to this article.
The test was followed by an introductory lesson where the pupils were familiarized with project learning, its specification and goals. In addition, the pupils were in brief familiarized with the issue of loan products. This initial information was to be helpful for the prompt orientation of the pupils, in particular in the first stages of project learning.

Research goal

The research question, asked by the authors of the article, was as follows: *Can project learning contribute to the acquisition of knowledge and skills in the field of loan products?*

Sample to be examined

Project learning was executed at one type of secondary school, i.e. grammar school, with the total participation of 49 pupils of the 1st and 2nd class.

Project

The project topic was focused on loan products and specified as follows:
"Detection of the most advantageous loan that will provide the funds for the purchase of a selected product (goods or service) chosen by the pupils"
The project was implemented in the form of a long-term project, lasting two months and divided into particular stages. Duration of the stages of project learning corresponded with their intensity. Within project learning implementation, the pupils worked in groups. The pupils were allowed to form groups (teams) from different classes (1st class and 2nd class). 21 teams were formed, i.e. 3 four-member teams, 7 three-member teams, 5 two-member teams and 6 pupils worked separately. One pair consisted of the pupils from different classes. The others preferred the work in class teams. The project integrated the branches of education *Mathematics and its application*, *Human and society*, *Human and the world of labour*, *Computer science and information and communication technologies* according to the framework educational programme and appropriate subjects according to a specific school educational programme. In the past years, information and communication technologies have become an integral part of the teaching process, as stated e.g. in the papers by Binterová and Tlustý (2013) or Hašek and Petrášková (2014).
For project learning implementation, the following methodical procedure was selected: *goal determination*, *solution plan preparation*, *plan implementation*, *executed project evaluation*.

Project goal

The main project goal *"Loan products"* was to enable the pupils to familiarize themselves better with the issue in question. In concrete terms, they were to learn to compare the loan offers of banking and nonbanking institutions and to select the most advantageous option to them in a specific situation. At the same time, the pupils were to be aware of the risks

related to the loans and to learn to recognize warning indications of hazardous loans. They were to verify the information acquired by means of reliable sources.

Solution plan preparation (by means of brainstorming)

By means of the brainstorming method, particular issues of the project solution plan were drafted:

- Detection of the types of loans used for procurement of goods.
- Detection, what entity can lend us the funds for procurement of consumer goods or real estate.
- Detection of the conditions offered by particular entities. A visit to the entities and verification of the information acquired, if possible.
- Comparison of the products offered. Evaluation of their pros and cons.
- Selection of a loan product with regard to particular needs and justification of the choice.
- Processing, presentation and justification of the information acquired.

Executed project evaluation

The project learning evaluation was based on the results of the didactic test, the monitoring of continuous work of particular teams, the final presentations of the pupils and an online questionnaire related to project learning specification and implementation. Total executed project evaluation is stated in the paper by Pech et al. (2015). This article is only focused on project learning evaluation based on the didactic test.

The data was processed by software *R*. For testing of statistical significance of "knowledge shift", so-called marginal homogeneity test has been used that was designed by Stuart (1955) and Maxwell (1970).

The hypotheses:

H_0: The results of the didactic test do not dependent on the fact whether the test was assigned at the beginning of project learning or at the end of project learning.

against

H_1: $\neg H_0$.

Results

In order to verify alternative hypothesis, the test results were rated according to the rules as follows:

- Question 1: for each stated characteristic of the consumer loan, the pupil gained 1 point, maximum 4 points. The pupil gained 4 points if he/she stated 4 and more characteristics.
- Question 2: unjustified correct answer – 1 point, justified correct answer - 2 points.
- Question 3: for each stated charge related to the consumer loan, the pupil gained 1 point, maximum 4 points. The pupil gained 4 points if he/she stated 4 and more charges.
- Question 4: unjustified correct answer – 1 point, justified correct answer - 2 points.
- Question 5: for each stated unfair practice of the consumer loan market, the pupil gained 1 point, maximum 4 points. The pupil gained 4 points if he/she stated 4 and more unfair practices.
- Question 6: instalment sale definition – 1 point, instalment sale characteristic - 1 point.
- Question 7: for the stating of one potential hazard in the use of credit card, the pupil

gained 1 point, maximum 4 points. The pupil gained 4 points if he/she stated 4 and more hazards.

- Question 8: for the stating of one possibility of how to raise a nonbank loan, the pupil gained 1 point, maximum 4 points. The pupil gained 4 points if he/she stated 4 and more possibilities. For the stating of one drawback of a nonbank loan, the pupil gained 1 point, maximum 4 points. The pupil gained 4 points if he/she stated 4 and more drawbacks.
- Question 9: for the stating of one conformity, one possible difference between a conventional mortgage and an American mortgage, the pupil gained 1 point, maximum 4 points. The pupil gained 4 points if he/she stated 4 and more conformities, possible differences.
- Question 10: for the drafting of one rule, the pupil gained 1 point, maximum 4 points. The pupil gained 4 points if he/she stated 4 and more rules.

In the didactic test, the pupil could gain a maximum number of 38 points.
For Stuart test, four categories were selected:
Category 1: the pupil gained points within the range 0 – 8.
Category 2: the pupil gained points within the range 9 – 17.
Category 3: the pupil gained points within the range 18 – 26.
Category 4: the pupil gained points within the range 27 – 38.
To verify the null-hypothesis, the Stuart test was used according to the methodology described in the paper by Anděl, J. (1985). The results are stated in Tab. 1.

Category		After				
		1 (0 – 8)	2 (9 – 17)	3 (18 – 26)	4 (27 – 38)	sum
Before	1 (0 – 8)	1	20	19	2	42
	2 (9 -17)	0	2	4	1	7
	3 (18-26)	0	0	0	0	0
	4 (27 - 38)	0	0	0	0	0
	sum	1	22	23	3	49
$\chi^2 = 45{,}687$, p = 0,0000						

Table 1: Table changes (source: own calculation)

As p–value is 0.00000, i.e. it is less than 0.05, we rejected the null-hypothesis at the 0.05 significance level. In other words, there was a statistically significant knowledge shift in the field of loan products.

Discussion

After the completion of the first test (the test specified before commencement of the project), the pupils were subject to a controlled interview. At the beginning of the project, most pupils did not know the basic terms concerning loan products. Some pupils stated that they had encountered the terms thanks to mass media advertising but they could not explain them. A number of pupils pointed out the necessity of knowing this information as they were aware that they would surely need it in the future. At the same time, the pupils in a class started to discuss spontaneously the necessary and unnecessary knowledge learnt at school. Thus, this didactic test also became a motivational tool of the project. Already at this stage some pupils demanded correct answers that, however, at this stage were not provided and the pupils had to acquire the necessary information by means of their work on the project. The interviews revealed in the fact that three pupils had already

encountered financial literacy teaching in primary school, which also became evident in the didactic test but they were not able to apply the knowledge. Most of them stated that nobody had spoken with them about the loans and their latent hazards. The pupils stated that they had heard snippets of information from their acquaintances, family members and mass media.

In the didactic test specified at the beginning of project learning (in figure 1 marked "Before"), most pupils answered as follows: I do not know, I do not understand, I do not know the term specified. However, if we compare frequencies of these types of answers with the results of the test specified at end of project learning (in chart 1 marked "After"), we can detect that at the end of project learning these answers were considerably fewer.

After completion of the 2nd test, the pupils were again subject to a controlled interview. Based on the controlled interview and the results of the didactic test at the end of project learning, the following findings were made:

1. The pupil remembers the terms with which he/she has worked during project learning most frequently.
2. The pupil forgets the formally provided information with which he/she does not work.
3. Project learning can motivate the pupil to a more thorough understanding of the term or effect.
4. Thanks to project learning, the pupil has gained a more rational insight into the issue of loan products.
5. During project learning, the pupil has become familiarized in more detail with the conditions and risks of loan products.

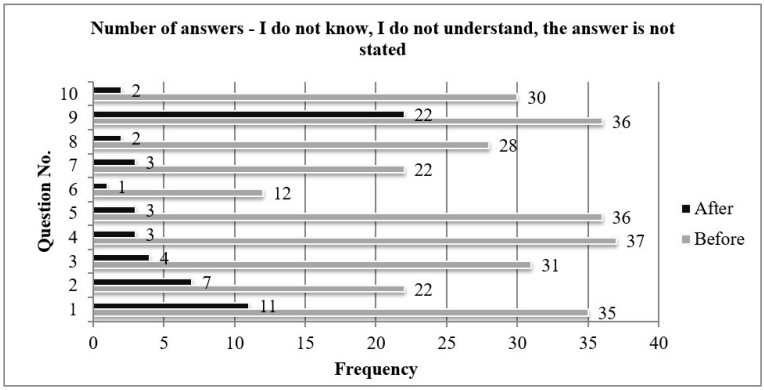

Figure 1: Frequencies of answers: I do not know, I do not understand, the answer is not stated (source: own calculation)

The above-mentioned results correspond with Valenta's statement (1993) claiming that project learning will give pupil the experience needed for everyday life, if its topic and content are close to daily life and usable as common practice.

Conclusion

Within project learning implementation, the pupil improves the skill of working without the teacher's assistance. The pupil learns to organize his/her work by preparation of a time schedule according to needs and upon agreement with the other members of his/her work group. In addition, the pupil himself/herself searches for efficient strategies

resulting in a solution to the problem. The pupil detects multiple possible options and thus he/she acquires the applicable skills in practice. In project learning, the pupil utilizes acquired knowledge and skills in the work together with information and communication technologies; this mainly pertains to the skills to utilize the technologies for the collection of necessary information, its analysis and critical evaluation. The authors of this article have come to the conclusion that within project learning the pupils and their teachers not only acquire required knowledge on a selected issue, but they also acquire other valuable experience applicable in their further studies and jobs. Thus project learning surely complies with the concept of research-oriented teaching.

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Appendix 1 – Didactic test

1. State the most commonly used characteristics of consumer loans based on which the consumer loans can be compared.
2. Select and justify the most advantageous loan to the client from the following
   - Loan A with interest rate 8.9 % p.a.
   - Loan B with interest rate 8.9 % p.m.
3. State examples of the charges that are usually related to a consumer loan.
4. The values of the annual percentage rate /APR/ indicator and interest rates are stated in the percentage. By means of an inequality sign, compare both values and justify your decision.
5. State other unfair practices on the consumer loan market which we could encounter.
6. What do you imagine by an instalment sale? (State brief characteristics).
7. Presently, one of the favourite tools for a prompt loan is a credit card. State its latent potential hazards.
8. What further possibilities are there to raise prompt funds other than from banking institutions? State latent drawbacks of these loans.
9. State similarities and differences between a conventional mortgage and an American mortgage.
10. Try to draft the rules to be followed in order to prevent very unpleasant situations resulting from some loans.

ANALYSIS OF THE DIFFERENCES BETWEEN RESULTS OF TEST VARIANTS

Jindrich Klufa

Department of Mathematics, Faculty of Informatics and Statistics, University of Economics, W.Churchill Sq.4, Prague, 13067, Czech Republic, +420 224 094 244, klufa@vse.cz

Abstract

The paper contains an analysis of the differences of number of points in the test in mathematics between test variants, which were used in the entrance examinations at the Faculty of Business Administration at University of Economics in Prague in 2015. The differences may arise due to the varying difficulty of variants for students, but also because of the different level of knowledge of students who write these variants. This problem we shall study in present paper. The aim of this paper is to study dependence of the results of entrance examinations in mathematics on test variants. The results obtained will be used for further improvement of the admission process at University of Economics.

Keywords

Entrance examinations, test variants, mathematics, statistical methods

Introduction

Students of the Faculty of Business Administration are accepted to study on the basis of tests in mathematics and language tests. 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 (Klůfa, 2012), (Zhao, 2006), (Klůfa, 2013), (Premadasa, 1993), (Klůfa, 2015b). The tests in mathematics have 10 questions for 5 points and 5 questions for 10 points, i.e. 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,...,90, 95, 100. Test variants in mathematics are generated from a database created by the Department of Mathematics. This database is divided into groups, e.g. goniometric equations, sequences etc. From the selected groups is generated a question. Finally, the generated variants are chosen which are used for entrance examinations. The effort is to choose variants, which are equally difficult for students.

The aim of this paper is to analyse the differences of number of points in the test in mathematics between test variants, which were used in the entrance examinations at the Faculty of Business Administration in 2015. Similar problems are solved in Brožová and Rydval (2013), Hrubý (2013), Kaspříková (2012), Mošna (2013), Klůfa (2015c), Kubanová and Linda (2012), Coufal and Tobíšek (2015), Otavová and Sýkorová (2014). The differences may arise due to the varying difficulty of variants, but also because of the different level of knowledge of students who write these variants. This problem we shall study in present paper. The results obtained will be used to further improve of the preparation of test variants in 2016.

Material and Methods

The analysed data are the results of the entrance examinations of 1514 students in mathematics at the Faculty of Business Administration in 2015. Six test variants, denoted

A0, A8, A9, B0, B4, B6, were used for the entrance examinations in mathematics at the Faculty of Business Administration in 2015, other test variants were not used at this faculty.
On the other hand, the Department of Mathematics organizes preparatory courses for entrance examinations in mathematics. The results of one randomly selected parallel class (17 students) of these courses in 2016 will be analysed in this paper as well.
For study the differences of number of points in the test in mathematics between 2 test variants we shall use paired t test. Statistic t is

$$t = \frac{\overline{d}}{s_d}\sqrt{n}, \tag{1}$$

where $d_i = x_i - y_i$, and x_i, y_i is number of points in the test in mathematics of a student i in 1st and 2nd test variant, $\overline{d}$ is average of values d_i, s_d is standard deviation, n is sample size ($n = 17$). When

$$|t| > t_\alpha(n-1), \tag{2}$$

where $t_\alpha(n-1)$ is critical value of student t distribution with $(n-1)$ degrees of freedom, the hypothesis "mean number of points in 2 test variants is the same" is rejected at significance level α.
For comparison of 6 test variants at the Faculty of Business Administration in 2015 we shall use ANOVA and Scheffé's method. We shall verify the validity of the null hypothesis: mean number of points in test variants A0, A8, A9, B0, B4, B6 is the same. When the test statistic (Rao, 1973)

$$F > F_\alpha(s-1, n-s), \tag{3}$$

where $F_\alpha(s-1, n-s)$ is critical value of Fischer-Snedecor distribution with $(s-1)$ and $(n-s)$ degrees of freedom, the hypothesis is rejected at significance level α. In our case is $s = 6$ (number of variants) and $n = 1514$ (sample size for ANOVA).

Results and Discussion

Differences between the test variants

Now we shall compare distributions of number of points in the test in mathematics in test variants A0, A8, A9, B0, B4, B6 - see Fig.1 and Tab. 1.

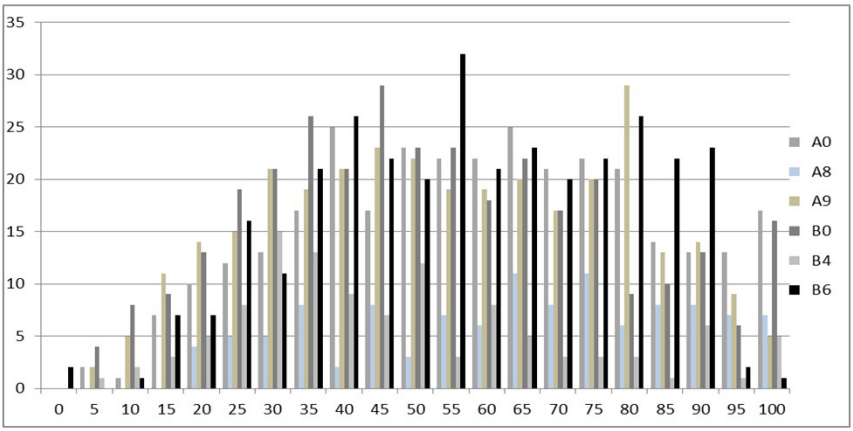

Fig. 1: Distribution of number of points in test in mathematics in 2015 – test variants A0, A8, A9, B0, B4, B6 (histogram) (source: own calculation)

Test variant	Frequency n_i	Average number of points	Variance
A0	317	59.23	543.94
A8	114	64.17	540.23
A9	318	54.61	559.70
B0	327	52.54	584.03
B4	113	47.92	544.97
B6	325	57.31	462.71

Tab. 1: Distribution of number of points in test – test variants A0, A8, A9, B0, B4, B6 (source: own calculation)

We shall test null hypothesis "the differences between average number of points in test variants A0, A8, A9, B0, B4, B6 in Tab. 1 are not statistically significant".

To verify the validity of the hypothesis we use ANOVA. In the first step we verify assumption of this method by Bartlett's test. The hypothesis "variance of number of points in test variants A0, A8, A9, B0, B4, B6 is the same" is not rejected at 1% significance level, assumption of ANOVA can be considered to have been met.

Source of variability	Sum of Squares	Degrees of freedom	Fraction	F	P value	F crit
Test variants	23365.02	5	4673.00	8.68	3.99E-08	2.22
Rezidual	811706.13	1508	538.27			
Sum	835071.15	1513				

Tab. 2: Results of ANOVA (source: own calculation)

Results of ANOVA we got with MS Excel (Marek, 2013) – see Tab. 2. Since

$$F = 8.68 > 2.22,$$

the null hypothesis is rejected at 5% significance level. There are some differences between the test variants, the differences between average number of points in test variants A0, A8, A9, B0, B4, B6 in Tab. 1 are statistically significant.

Finally we shall study which pairs of averages differ significantly. We use Scheffé's method (Anděl, 1978). Pairs of averages differ significantly if absolute value of difference in averages exceeds critical value

$$\sqrt{\left(\frac{1}{n_i}+\frac{1}{n_j}\right)\ x\ 5\ x\ 538.27\ x\ 2.22} \tag{4}$$

where 538.27 is the rezidual variance and 2.22 is the critical value from Tab. 2.

Test variant	A0	A8	A9	B0	B4	B6
A0		4.94	4.62	6.69	11.31*	1.92
A8			9.56*	11.63*	16.25*	6.86
A9				2.07	6.69	2.70
B0					4.62	4.77
B4						9.39*
B6						

**Significant difference for α=0.05 (Scheffé's method)*

Tab. 3: Absolute value of differences between average number of points in test variants A0, A8, A9, B0, B4, B6 (source: own calculation)

From Tab. 3 it is seen that a significant difference is at 5% significant level between A0 and B4, A8 and A9, A8 and B0, A8 and B4, B4 and B6. All other pairs of averages are not significantly different. Greatest significant difference is between the test variants A8 and B4.

Difference between A8 and B4

Significant differences between test variants may arise due to the varying difficulty of variants for students, but also because of the different level of knowledge of students who write these variants. Therefore we shall now study results of the same group of students – see results of 17 students in preparatory course for entrance examinations in 2016 in Tab. 4.

Student	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A8	100	60	70	35	40	25	40	60	55	45	60	55	45	70	45	55	80
B4	95	45	80	20	35	20	45	50	50	50	55	60	45	80	40	40	85
d_i	5	15	-10	15	5	5	-5	10	5	-5	5	-5	0	-10	5	15	-5

Tab. 4: Number of points in mathematics in test variants A8 and B4 (source: own calculation)

From Tab. 4 we have average number of points in mathematics in test variants A8 $\bar{x}_{A8} = 55.29$ and average number of points in mathematics in test variants B4 $\bar{x}_{B4} = 52.65$.

Now we shall test null hypothesis "the difference between these average number of points in test variants A8, B4 is not statistically significant".

We have two results for the same student. It means that the samples in Tab.4 are not independent. Therefore, to verify the validity of the hypothesis we use paired t test.

According to (1) we have

$$t = 1.31$$

Critical value of t distribution for 16 degrees of freedom and significance level $\alpha = 0.05$ is $t_{0.05}(16) = 2.12$. Since

$$|t| < 2.12,$$

the null hypothesis is not rejected at 5% significance level. Because $t_{0.20}(16) = 1.34$, this hypothesis is not rejected also at 20% significance level. The difference between average number of points in test variants A8 and B4 in preparatory course for entrance examinations in 2016 is not statistically significant.

Discussion

From results of this paper it followes that the difference between average number of points in mathematics in test variants A8 and B4 in entrance exams in 2015 is statistical significant – see also second row of Tab. 5. Therefore, we ask whether these test variants are equally difficult for students.

Test variant	A8	B4
2 different groups of students in entrance exams in 2015	$\bar{x}_{A8} = 64.17$	$\bar{x}_{B4} = 47.92$
1 group of students in preparatory course in 2016	$\bar{x}_{A8} = 55.29$	$\bar{x}_{B4} = 52.65$

Tab. 5: Average number of points in mathematics (source: own calculation)

For the same group of students in preparatory course in 2016 the difference between average number of points in mathematics in test variants A8 and B4 is not statistical significant – see also third row of Tab. 5. It means that the difference between test variants A8 and B4 in entrance exams in 2015 could be caused by other factors, e. g. by the different level of knowledge of students who wrote these variants in entrance exams in 2015.

Entrance exams in mathematics at the University of Defence with similar problems are analysed in Hošková-Majerová and Račková (2010) - examples in mathematics with the same level of difficulty. The aim of this paper was a little different. Similar problem as in this paper was solved in Klůfa (2015a). On the basis of test of independence in contingency table it follows that results of entrance examinations do not depend on the test variants, i.e. the analogous result as in present paper.

Conclusion

The differences between average number of points in mathematics in test variants A0, A8, A9, B0, B4, B6, which were used for the entrance examinations in mathematics at the Faculty of Business Administration in 2015, are statistically significant. The differences may arise due to the varying difficulty of variants, but also because of the different level of knowledge of students who write these variants. From results of this paper it follows that these significant differences between tests variants may arise due to different level of knowledge of the students who write these variants. On the other hand, the difficulty

of test variants for students is poorly measured. Other results, which will be obtained in project "Entrance exams practice" in 2016, will be analysed in following paper.
Significant changes in test variants in mathematics in the coming years are not needed. But increase the homogeneity test variants would be very useful. Therefore the database created by the Department of Mathematics will be further modified - the database will be expanded and divided into more of the groups.

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ABILITIES OF ECONOMIC SUBJECTS' TEACHERS AND THEIR IMPACT ON STUDENTS' MOTIVATION

[1]✉Kristyna Krejcova, [2]Katerina Berkova

[1]Department of Economic Teaching Methodology, Faculty of Finance and Accounting, University of Economics, Prague, nám. W. Churchilla 4, Prague 3, 130 67, Czech Republic, +420 224 095 123, kristyna.krejcova@vse.cz

[2]Department of Economic Teaching Methodology, Faculty of Finance and Accounting, University of Economics, Prague, Czech Republic

Abstract

Motivation is one of the most important issues in education that can significantly support efficiency of educational process. Our paper focuses on the motivational influence of a teacher of Economics on students from the second and third years at secondary business schools. In the research, the impact of teachers' skills (communication and presentation skills, exposition of curriculum, ability to develop thinking and expertise) on the students' motivation was quantified. Data analysis proved that students of Economics subject are most motivated by teachers' expertise. This finding should support teachers of economic subjects to enrich their expertise and to use more activating methods to support intrinsic motivation of their students.

Keywords

Economic teaching, expertise, motivation, secondary business school, teacher's abilities

Introduction

Motivation can be defined as summarization of strengths that energize and organize behavior and experiencing of an individual with a goal to change current unsatisfied situation or to reach something positive (Plháková, 2003: 319). In the field of education, motivation can be described as one of the crucial influences that determine effectivity and fruitfulness of educational process. Without motivation there will be no study result (Fontana, 2014: 153). Many educational systems use various forms of external motivational incentives. Nevertheless, a student can gradually improve his/her ability to motivate himself /herself without dependence on external sources of motivation (Čáp, Mareš, 2001: 506).

In a structure of motivation, two important dimensions are generally described. Intrinsic motivation is driven by interest or enjoyment in a task without any external pressure or reward. External rewards can even impair the intrinsic motivation. 'Students are likely to be intrinsically motivated if they: Attribute their educational results to factors under their own control (e.g., the effort expended), believe they can be effective agents in reaching desired goals (i.e. the results are not determined by luck), are interested in mastering a topic, rather than just rote-learning to achieve good grades' (Tohidi, Jabbari, 2012: 820). When the intrinsic motivation in learning process is not sufficient, teachers obviously use external motivation (rewards or punishments, grades, competition etc.) According to the self-determination theory, external motivation can be modified into intrinsic motivation under certain circumstances, particularly if the task corresponds with values and beliefs of an individual and helps to fulfil his/her psychological needs (Tohidi, Jabbari, 2012: 820). Some issues of motivation in education process can be related to the issues of work

motivation, because parents mediate children their interests, values and attitudes towards responsibilities. Kolman, Chýlová and Selby (2012) try to systematize current theories of work motivation. They identified five clusters of work motivation ideologies: man as a machine, man as an organism, man as a social being, protestant ethic and humanistic. They stated that these clusters are culturally determined and also age-specific. Analyzing population in Czech Republic, they found out that 'respondents who are older, less educated and live on the country margins understand performance on the job in a different way than their younger, more educated and living in the central part of the country counterparts. These two kinds of respondents differ mainly in their experience on the job. The younger ones believe that to produce on a job will bring rewards to them. The others do not believe it is so' (Kolman, Chýlová, Selby, 2012: 96). These attitudes can influence motivation of children and students in Czech Republic.

Motivation in education process is also age-specific and can significantly change during the school attendance. Vostrá Vydrová, Jindrová and Dömeová (2012) analyze motivation of distance students. They observe higher motivation of adult students. Often they need to reach university degree to keep or improve their work position, successful termination of their studies can be also more important for their private social status. These factors lead to more intensive self-study and higher responsibility in comparison with regular students (Vostrá Vydrová, Jindrová, Dömeová, 2012: 40).

Except age-specific issues in motivation, gender differences determinate motivation structure as well. Pacáková (2013) observes motivational responses of university students on various motivational actions (credit test as a part of final exam grade, decrease of possible tries for credit test and possibility to pass the exam on the basis of well-done credit test). To the possibility to pass the exam on the basis of well-done credit test the author concludes that 'it looks like if it is highly motivating rather for boys than girls. Analysis of interaction between school year and gender showed that at the end of the observed period, especially in winter term, boys catch up girls, though girls are generally of better results' (Pacáková, 2013: 305). At this point, the author estimates that some motivational actions are not suitable for students who are unable to accomplish requirements because of insufficient general learning potential, despite their motivation is high.

Ferreira, Cardosob and Abrantesc (2011) investigate interaction between a negative sense of school belonging and intrinsic motivation and their impact on perceived learning. With the sample of 1986 high school student, they proved that a negative sense of school belonging negatively affects intrinsic motivation and also perceived learning. The author conclude that higher intrinsic motivation leads to more positive self-view in learning and to more positive attitude towards their field of study (Ferreira, Cardosob, and Abrantesc, 2011: 1712-1713). Similar findings can be found in study of Popa (2015) that analyzes impact of motivational factors (self-efficacy, locus of control and interest in subject) and regulated learning's influence on the level of school performance at middle school students. According to their results, 'academic performance increases if the person aware of his purpose, controls, regulates and directs his impulses, follows the rules, prefers careful planning and demonstrates perseverance in achieving success' (Popa, 2015: 2552).

Motivation of a student is significantly determined by personality of a teacher. Teacher's quality affects his personality characteristics – qualification level, scope, form and quality of teacher's training, specialization, age, professional experience, ethnicity, verbal skills and attitudes (Windham, 1988). The ideal teacher disposes resilience, adaptability, the ability to absorb new knowledge, social empathy and communication skills (Dytrtová, Krhutová, 2009: 15). The main determinant of the educational process is the teacher's

personality and using of teaching methods. Appropriate use of teaching methods causes a positive effect on teaching. A research of Hausmannová (2015: 76) with 1733 students of business academies confirmed that students perceive the subject Economics as important – at the second position (at the first position was the subject English) and as favorite – from 16 subjects the third position (Berková, 2015). The main reason is the importance of the subject Economics and its practical application.

Students with lack of motivation or demotivated ones are not interested in the process of solving problems, but they are only interested in the result (Boekaerts, 2004). The most important stimulus for motivation is experiencing successes and failures (Elliot, 1999). Study success is related to the used teaching methods. As evident from the several empirical researches, in teaching economic subjects traditional teaching methods are still dominating being supplemented by problem-solving teaching methods. This finding is confirmed by e.g. research, which was conducted in 2003 and focused on 200 students of business schools in the Czech Republic (Králová, 2009). It was proved that in teaching of Economics verbal reproduction prevails. The least represented activating methods were discussions, economic games, staging methods and independent students' work. The new research proves that there is a causal link between the length of teaching experience and applied teaching methods. The longer experience the teacher has the less sophisticated activating methods supporting economic thinking are used. A change occurs by teachers with teaching experience of less than 10 years (Berková, Králová, 2015: 42).

The objective of our article is to analyze motivational influence of a teacher of the subject Economics on students from the second and third years at secondary business schools. The subject of the research is to quantify the impact of teachers' skills – communication and presentation skills, exposition of curriculum, ability of developing thinking and expertise of teachers – on the students´ motivation. Following hypothesis is subject to empirical verification:

The null hypothesis (H_0): Monitored skills of teachers do not influence motivation students of the subject Economics.

An alternative hypothesis (H_1): Motivation of students of the subject Economics is influenced by at least one of the teachers' examined skills.

In Materials and Methods, we describe our research sample, the structure of used questionnaire and methods of statistical analysis. In sections Results and Discussion, we present our findings and their comparison with other relevant researches within the field of our study and we formulate issues for subsequent research.

Materials and Methods

The research was conducted in 2015 at 3 business schools in the Czech Republic. These schools were chosen by reason of their different methods that support students' economic thinking in the economic subjects. Development of economic thinking is main sphere of the authors' survey. The different between these schools helped to get the relevant sample based on the deliberate choice. The survey involved 368 students from the second and third years of studies at secondary business schools out of which 277 students were used for the data analysis (Tab. 1). The research involved 221 girls (ie. 79.8%) and 56 boys (ie. 20.2%).

Parameters	2nd year		3rd year		Total	
	Absolutely	Relatively	Absolutely	Relatively	Absol.	Relat.
Premise	170	x	198	x	368	x
Return	124	72.9%	153	77.3%	277	75.3%

Tab. 1: Research Sample (source: own calculation)

For data collection the method of questioning technique was used. Students filled questionnaires to find their attitudes to evaluate the motivational potential (i.e. analytic approach to evaluate personality of the teacher). Students assigned points 1-5 to each teacher's ability (the higher the point value, the better the teacher's ability to motivate students to the subject). It was also possible to assign zero (i.e. student cannot assess the monitored ability). Teacher's personality evaluation was monitored in five categories, each containing files describing the ability of teachers (Tab. 2).

Category	Number of Files	Files
Communication Skills	6	pronunciation, interest, pace and melody, keeping attention, paying attention, listening
Presentation Skills	4	examples of real life situations, good actor, eye contact, dealing with stage fright
Exposition of Curriculum	3	practical meaning of the curriculum, adopting unconventional ideas, explanations of mistakes
Ability of Developing Thinking	2	interest in developing a task, leading to thinking
Expertise	1	answer factually correct and consistently to all questions

Tab. 2: Description of Categories and Files of Examined Abilities (source: authors)

Data were processed and analyzed with the support of NCSS statistical program (version 2007). Verification of null hypothesis was performed base on non-parametric Kruskal-Wallis test at 5% significance. Data were analyzed based on the method One-Way Analysis of Variance that compares mean value of files. The importance of differences between the monitored skills are evaluated via paired comparison test (modification Tukey´s multiple comparison method). The using Tukey-Kramer Multiple-Comparison test identifies the conclusive differences between the surveyed factors.

Results

Null hypothesis H_0 is rejected at the 5% level of significance ($P < 0.01$). The influence of at least one of the teachers´ surveyed ability to motivate the student is conclusive (Tab. 3).

DF	Chi-Squaer	Prob Level (P)	Decision (0.05)
4	78.54279	0.000000	Reject H_0

Tab. 3: Proven dependence – Kruskal-Wallis test (source: authors)

The importance of differences between the monitored skills is proved by Tukey-Kramer test (Tab. 4).

Monitored Skill	Mean	Differences between skills
Communication Skill	0.7176173	Ability of Developing Thinking; Exposition of Curriculum; Expertise
Presentation Skill	0.7350181	Expertise
Exposition of Curriculum	0.7761011	Communication Skill; Expertise
Ability of Developing Thinking	0.7729242	Communication Skill; Expertise
Expertise	0.8310469	Communication Skill; Presentation Skill; Ability of Developing Thinking; Exposition of Curriculum

Tab. 4: Tukey-Kramer test – analysis of differences (source: authors)

Differences between skills are graphically depicted in a box diagram via exploratory analyzes (Fig. 1).

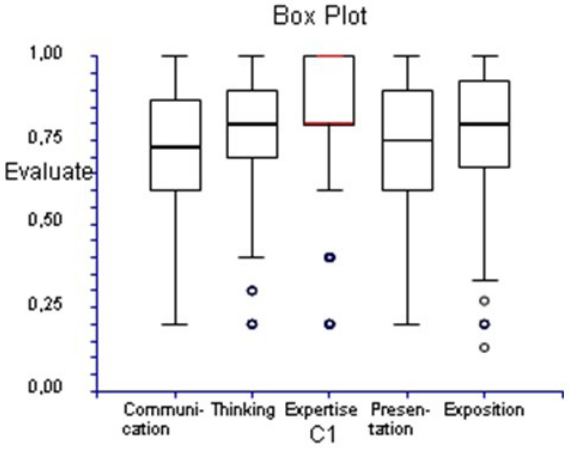

Figure 1: Exploratory Analysis of Differences

In our research focused on 277 students from the second and third years of studies at secondary business schools, paired comparison proved that in the subject Economics students are most motivated by teachers' expertise. This ability is significantly different from other monitored teachers' skills. Significant differences were found between presentation and communication skills; ability of exposition of curriculum, ability of developing thinking and presentation skills. It is proven that if a teacher will sufficiently use their presentation skill (i.e. examples of real life situations, good actor, eye contact, dealing with stage fright) the students' motivation will not be to increased via inclusion of communication skill (i.e. pronunciation, interest, pace and melody, keeping attention, paying attention, listening). It follows that the combination of more abilities do not causes positive effect. It is proven that if a teacher will sufficiently explain a curriculum (i.e. practical meaning of the curriculum, adopting unconventional ideas, explanations of mistakes) the students' motivation will not be to increased via inclusion of presentation skill and ability of developing thinking.

Discussion

Results of our research proved that students' motivation in the subject Economics is most

influenced by the teachers' expertise. According to the self-determination theory (Tohidi, Jabbari, 2012), this finding could support motivation of teachers to develop and enrich their expertise in their pre-gradual education and in life-long education as well, because they need their expertise not only to gain their master degree or certificate from a course, but above all to transmit knowledges and to support the intrinsic motivation of their students by means of their expertise.

Kolman, Chýlová and Selby (2012) suppose that structure of motivation is culture-specific. The preference of teachers' expertise in our study can be related to the ideology of motivation that Kolman, Chýlová and Selby (2012: 95) called the protestant ethic (the value is attached to hard work that is necessarily connected with acquisition of knowledges and expertise). In the context of research of Vostrá Vydrová, Jindrová and Dömeová (2012) that emphasize age-specific factors of motivation, we should consider relativity of our findings. By younger students, communication and presentation skills could be more important than expertise of a teacher; by older students, motivation could be more affected by ability to develop thinking. This hypothesis comes out of the mechanisms of cognitive development (Sternberg, Williams, 2010) and should be verified by subsequent research.

The preference of teachers' expertise can be also determined by the perceived importance of subject Economics. In the research of Hausmannová (2015: 76), students evaluated the importance of subjects at secondary business schools with Economics on the second position next to English.

The subject Economics supports effective application of curriculum to practical situation. The solving of practical situations requires a high expertise of teachers. In this context, it is necessary to change teaching methods and to apply more problematic and activating methods in the teaching. These methods allow students to see progress, not only the finished result. Such methods are motivating (Boekaerts, 2004). The traditional teaching methods are still dominant (Králová, 2009; Berková, Králová, 2015). Those methods are not so motivating for students.

Conclusion

Motivation is one of the most important issues in education that can significantly support effectivity of educational process. Motivation of students has specific structure and is determined by age, culture, personality and other specific factors. Personality of a teacher significantly affects motivation of students. Our study with 277 participants from secondary business schools proved that the expertise of a teacher has the highest motivational potential for students in subject Economics. Analysis of current state and results of our research indicate that the teachers of economic subjects should have use problem teaching methods, analysis and solving problem.

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EXPERIMENTAL RESEARCH TEST DEVELOPMENT FOR BUSINESS ENGLISH COURSES

[1]Lenka Kucirkova, [2]✉Martina Jarkovska

[1]Department of Languages, Faculty of Economics and Management, Czech University of Life Sciences Prague

[2]Department of Languages, Faculty of Economics and Management, Czech University of Life Sciences Prague, Kamýcká 129, Prague 6, 165 21, Czech Republic, +420 224 382 838, jarkovska@pef.czu.cz

Abstract

Experimental research studies the effects of specified and controlled treatments given to students in groups and it attempts to understand the differences between the groups in a pre-determined environment - the classroom. It deals with testing hypotheses, controlling variables and both internal and external validity in order to demonstrate the relationship between or within the researched groups unambiguously. Therefore the demonstration of validity and reliability of the tests employed for the purpose of the experimental research is significant.

The paper sets out to describe such test development within an experimental research conducted among the university students of Business English courses. First the method of research sample selection and control and experiment group creation is focused on. The paper then goes on to explain the individual steps in the actual test development and the both the validity and reliability of the test is verified.

Keywords

Control group, experimental research, quazi-experiment, post-test, pre-test

Introduction

As Seliger and Shohamy (1990) state, experimental research is concerned with studies of the effects of specified and controlled treatments given to students in groups. It aims to understand differences between or within groups of learners under manipulated environments; it requires a strict control of conditions enabling interpretations with a low factor of error (Phakiti, 2015). Experimental research designs have a lot of variations, depending on the specific conditions under which the research is conducted. In deductive research assumptions are made and cause-and-effect relationships or the co-occurrence of phenomena are being predicted. Predictions are supported by designing an investigation, collecting data, and statistically examining the results (Seliger and Shohamy, 1990). The experimental research is concerned with testing hypotheses, with problems of the control of variables, internal and external validity because of the need to demonstrate a relationship unambiguously (Seliger and Shohamy, 1990).

Campbell and Stanley (in Seliger and Shohamy, 1990: 148) refer to an experimental research conducted under standard school conditions as ‘’quazi-experimental’’ design ‘’constructed from situations which already exist in the real world, and are probably more representative of conditions found in educational contexts’’. Quasi-experimental research designs, like experimental designs, also test hypotheses (White and Sabarwal, 2014). In a true experiment, however, participants are randomly assigned to either the treatment or the control group, whereas they are not assigned randomly in a quazi-experiment

(Nunan, 1992). Quazi-experimental designs are commonly employed in the evaluation of educational programmes where random assignment is not possible or practical (Gribbons and Herman, 1997).

The objective of the research was to find out the influence of e-learning on the students' results after completing a full-time e-learning course in comparison with the face-to-face instruction (Kučírková, Kučera and Vostrá Vydrová, 2012). The research was aimed at examining whether the e-learning method of Business English is as effective as the face-to-face instruction, i.e. whether there are no statistically significant differences between the results of students completing the e-learning course and the face-to-face course (Kučera and Kučírková, 2015). At the same time, the statistically significant differences between the pre-tests and the post-tests within individual groups were examined, i.e. whether the students improved their skills and vocabulary (Kučírková, Kučera and Vostrá Vydrová, 2014).

Based on the conducted research, the aim of the paper is to describe the method of test development in a quazi-experimental, empirical research conducted within the Czech University of Life Sciences Prague and analyse the validity and reliability of the tests in the quazi-experimental research. The next section describes the selection of research sample and formation of two groups, an experimental and control group. Later the actual test development is focused on and discussed.

Materials and Methods

The population was represented by students of the Czech University of Life Sciences Prague within the bachelor studies who enrolled into B1 courses according to the Common European Framework of Reference for Languages. 3,082 students of all forms of studies, i.e., full-time students, distance students and students of lifelong education, were enrolled into English B1 in the winter term of the academic year 2012/2013. The research sample of 107 students was represented by full-time students of B1 level who enrolled into the subject of Business English. In the pre-research there was one experimental and one control group. In the study proper there were two experimental groups and two control groups. They were considered as one experimental group and one control group for the purposes of the research because in order to gather enough subjects for experimental research, it is possible to pool the results of more classes (Seliger and Shohamy, 1990, Pelikán, 2007). Four pieces of paper with days and time of the lessons were put in the hat and two pieces of paper were chosen by drawing lots. However, after drawing the lots, the first piece of paper had to be put back into the hat in order not to increase the probability of choice while decreasing the number of items (Pelikán, 2007). So, while enrolling into the lessons, the students did not know what day and what time the e-learning method will be used. Thus they were not more motivated and influenced by the so called Hawthorne effect (Seliger and Shohamy, 1990, Pelikán, 2007, Gavora, 1996).

The students were given computer-based tests before they started a course and after completing the course. Their language levels in the skills of reading, listening, writing, translating, as well as in vocabulary and grammar were assessed. The tests were conducted under the supervision of the teacher and required the students to answer questions in a given time limit of 90 minutes, as stipulated for regular lessons of Business English, without reference to books or other people.

The treatment is a controlled and intentional exposure of groups to a language teaching method, specially constructed for the experiment (Seliger and Shohamy, 1990). In the research, it was the e-learning method in the Moodle learning management system. The

treatment is an independent variable in the research whereas measurement is a dependent variable in the research. It refers to how the effects of the treatment will be evaluated or observed (Seliger and Shohamy, 1990). It is represented by language pre-tests and post-tests as the main research instruments.

Results and Discussion

The testing cycle has several stages that are illustrated in Figure1 (Manual for Language Test Development and Examining, 2011: 18). The basic testing cycle was accommodated for purpose of the research as some phases are necessary for some contexts only.

Assembling tests

The aim of the assembling tests phase was to construct tests and to produce test materials. The test construction stage involved balancing a number of different aspects, such as test content (subject-matter) and item difficulty so that the test met the required specification - number and type of items to be included (Manual for Language Test Development and Examining, 2011:26). The number of items was sufficient to cover the necessary content and to provide reliable information about students' abilities and, of course, there were some practical limits on the test length given by the time of 90 minutes as mentioned above. The item types included multiple choice for listening, reading, translation and vocabulary testing and true/false also for listening comprehension in pre-tests. True/false is the procedure that requires students to determine whether a statement is correct or incorrect. It is often based on the text or an oral stimulus (Seliger and Shohamy, 1990). Multiple choice is the technique that requires students to select a correct answer from a number of alternatives, usually based on the text or another stimulus that precedes it. Other possible types of techniques were used for practising during seminars within the term and were not used in the final test. Multiple choice (a-d) was considered sufficient to check the knowledge. The final test consisted of the following parts: listening (15 items), reading comprehension (specialist text + 5 items), specialist terminology (25 items), translation (10 items). The total number of items was 55. Productive writing, which was also included, is described below in the section on Marking. There were 2 tested groups (experimental and control), that is why only 1 test variant was used. The tests were proof-read by two experienced colleagues of Business English and verified and checked for the quality by trying them out in the pre-research, on the basis of which they were modified where necessary. This was important for the validity. Test reading and listening materials were checked for their length, suitability of topic and level of language. This helped to identify such faults as typing errors, unclear instructions, incorrect keys or where more than one correct answer was possible. Feedback from colleagues included suggestions on how the item might be changed. It was important that items had been reviewed by someone other than the author. The items were also answered by ourselves without looking at the answer key, as if taking the test, and this helped us to identify items with more than one possible correct answer, or items which were difficult or unclear.

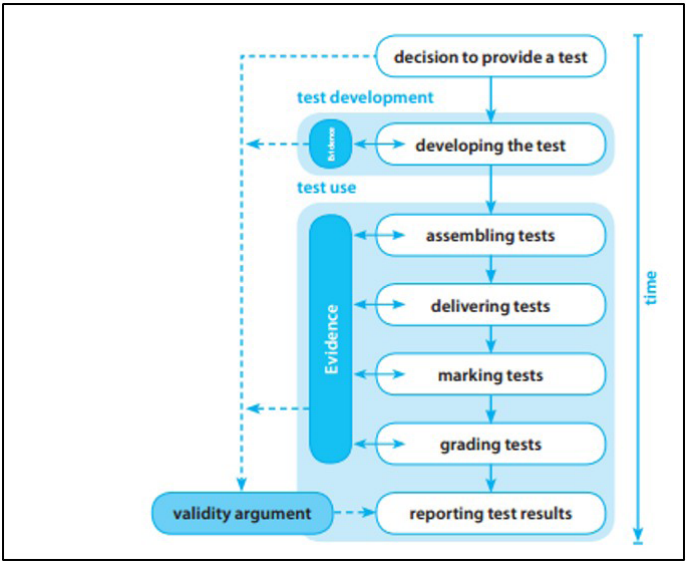

Figure 1: The testing cycle (Source: Manual for Language Test Development and Examining, 2018: 18)

Administering tests

The venue for the tests was the computer classroom where regular classes took place, so that the features such as accessibility, size of the room (ability to accommodate the number of the students required, internal acoustics for listening etc.) were fit for the purpose of testing. As far as registering for the tests was concerned, the list of students in the class and personal knowledge of them was sufficient. Registration was carried out by students' logins into the computer. The students were told the venue and the time of the tests in preceding lessons. Before the beginning of the tests, instructions were given to students about how to behave during the lessons. This included information about unauthorised materials and about dictionaries that were not allowed to be used. The tests started with listening comprehension, the audio was played twice which took about 20 minutes in total. Then the students could concentrate on other tasks in the order they had wanted.

Marking

Machine marking was the most useful as the multiple choice and true/false items were of types that did not require any human judgement, and a large number of tests had to be marked. The results of the tests in reading comprehension, listening comprehension, vocabulary and translation were machine marked in percentage in Moodle LMS. With computer-based testing, the reliability in marking was high. Productive writing cannot be machine marked. For reporting test results in writing we used band descriptors specific to this particular skill. They are analytical descriptors for marking writing by Weir (in Dudley-Evans and St John, 2005: 219) and they are recommended for their reliability and breaking each feature down (relevance and adequacy of content, compositional organisation, cohesion, adequacy of vocabulary, grammar, mechanical accuracy - punctuation, spelling). The use of descriptors is vital for standardising because fair results

can be provided only through standardisation of marking through the use of band descriptors to mark results. It was helpful to use tried and tested descriptors as they were developed and proved by those who invested time and expertise in them. This avoids the case when each individual teacher would mark according to his/her own perspective (Dudley-Evans and St John, 2005). In using these bands, the students were assigned writing to a band and then to points within the band (maximum was 10.5 points). Finally, the results were recounted for percentage results. The benefits of band descriptors were greater fairness and standardisation so that we could mark more accurately and consistently. They reduced the variation inherent in the subjectivity of human judgement (Manual for Language Test Development and Examining, 2011). This increased the reliability in marking that was also enhanced as there was only one test rater. The tests fit into the current system of studies in terms of curriculum objectives because they also served as credit tests with 60% for a pass.

Reliability of tests

For a valid interpretation of test results, scores must have acceptable reliability. Reliability provides information on whether the research instrument (data collection procedure) is consistent, reliable and accurate (Gavora, 2000, Seliger and Shohamy, 1990, Pelikán, 2007, Manual for Language Test Development and Examining, 2011). A good way of confirming reliability is to find out to what extent the research instrument is consistent, i.e., to what extent its items are homogenous and whether they are related to one another and measure the same thing (Seliger and Shohamy, 1990). It is calculated statistically by means of Cronbach's Alpha (Gavora, 2000, Brown, 1997). The reason for its use is its unambiguity, understandability and its implementation of the calculation procedure in most statistical programmes. Reliability is expressed as Cronbach's Alpha coefficient ranging from 0.00 to 1.00. In the case that the coefficient reaches the value of 1.00, the interpretation is that the data are not influenced by the chance at all. Cronbach's alpha coefficient in the top third of the range, i.e. from 0.7 to 1.00, is considered acceptable, the data are not influenced by the chance. The higher the coefficient, the more reliable the procedure is (Manual for Language Test Development and Examining, 2011, Seliger and Shohamy, 1990, Brown, 1998). In order to increase the reliability of the research instrument in the study proper, the data collection instrument used in the pre-research was lengthened by adding more items, and the items that caused the problem were removed (comprehension questions in reading). It was measured to what extent the research instruments were consistent, i.e. to what extent their elements are homogeneous. The higher the homogeneity, the higher the reliability of the research instrument (Gavora, 2000). The reliability of the pre-tests and the post-tests was calculated mathematically by means of Cronbach's alpha coefficient.

Experimental group

Cronbach's alpha coefficient was calculated with the following variables:

Pre-testEx_Listening Pre-testEx_Vocabulary Pre-testEx_Reading Pre-testEx_Translation Pre-testEx_Writing Pre-testEx_Total

Cronbach's alpha value of the experimental group pre-test is shown in Table 1:

Cronbach's Alpha	N of Items
0.752	6

Table 1: Reliability statistics (Source: Author´s own research)

Cronbach's alpha value of 0.752 indicates the high consistency and reliability of the pre-test of the experimental group. The constructed model ANOVA with Cochran´s Test is statistically conclusive.

Cronbach's alpha coefficient was calculated with the following variables:

Post-testEx_Listening Post-testEx_Vocabulary Post-testEx_Reading Post-testEx_Translation Post-testEx_Writing Post-testEx_Total

Cronbach's alpha value of the experimental group post-test is shown in Table 2:

Cronbach's Alpha	N of Items
0.746	6

Table 2: Reliability statistics (Source: Author´s own research)

Cronbach's alpha value of 0.746 indicates high consistency and reliability also as far as the post-test of the experimental group is concerned.

Control group:

Cronbach's alpha coefficient was calculated with the following variables:

Pre-testCo_Listening Pre-testCo_Vocabulary Pre-testCo_Reading Pre-testCo_Translation Pre-testCo_Writing Pre-testCo_Total

Cronbach's alpha value of the control group pre-test is shown in Table 3:

Cronbach's Alpha	N of Items
0.745	6

Table 3: Reliability statistics (Source: Author´s own research)

Cronbach's alpha value of 0.745 indicates high consistency and reliability as far as the pre-test of the control group is concerned.

Cronbach's alpha coefficient was calculated with the following variables:

Post-testCo_Listening Post-testCo_Vocabulary Post-testCo_Reading Post-testCo_Translation Post-testCo_Writing Post-testCo_Total

Cronbach's alpha value of the control group post-test is shown in Table 4:

Cronbach's Alpha	N of Items
0.749	6

Table 4: Reliability Statistics (Source: Author´s own research)

Cronbach's alpha value of 0.749 indicates high consistency and reliability as far as the pre-test of the control group is concerned.

The calculation proves that the research instruments (tests) are consistent, i.e., the items are homogeneous. Cronbach's alpha value exceeded 0.7 in all measured cases (in all pre- and post-tests with both the experimental and the control groups). The homogeneity of items is high, the reliability of the research instruments (tests) is also high.

Reliability is in close relation to the test validity. To be valid, the test must have a high rate of reliability (Manual for Language Test Development and Examining, 2011: 16, Pelikán, 2007: 68) Based on statistical measurements and on the efforts at the beginning of the research to minimise the breach of the validity we dare state that the tests are reliable and also valid.

The tests, particularly pre-tests, were based on the following opinion of Dudley-Evans and St John (2005: 221) in the chapter on in-house test development: ‘’… we also say for tests: make use of what is available, adapt and modify it”. Dudley-Evans and St John (2005: 214) suggest the use of public examination tests as they are standardised and ‘’demonstrate current thinking and provide valuable examples for in-house test

development" and accuracy of marking as well; validity and reliability are also promoted and ensured. The tests are computer-based, all of them refer to a phenomenon that has become increasingly used in English language teaching recently (Dudeney and Hockly, 2005). The tests measured the mastery of the syllabus and the performance of students on a number of target language tasks. Bachman, Lynch and Mason (1995) stress correspondence between test tasks and test performance to non-test language use for content relevance and reliability of scores derived from test performance. From the tests we could deduct which skills and language means require most attention in the lessons, or how much focus should be given to, for example, vocabulary development.

Conclusion

The aim of the paper was to describe the development of the tests in experimental, empirical research while confirming the test validity and reliability. The tests are important for a comparable measure of 2 groups of students and also for feedback on learning for future lessons and for suggestions for further research. As standardised tests do not reflect what has been taught or learnt, our own post-tests were developed in which students' knowledge of specialist business English was examined**.** The form of multiple choice was selected in the final research; thus, marking was more objective than in the pre-research where reading was tested in the form of open-ended comprehension check. In this way the reliability of the test has been increased. One way by which the reliability of the test can be increased is through changing items that cause the problem, or another way is through lengthening the data collection instrument by adding more items**.** It was important because of the content validity of the test as the objective was to cover the content of specialist terminology in more detail. The test content must be a good representation of the material which the students learnt during the year. The statistical measurement is more precise in this case.

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THE THEORETICAL FRAMEWORK FOR VOLUNTARY IC DISCLOSURE AT CZECH UNIVERSITIES

[1]✉Katerina Kuralova, [2]Klara Margarisova, [3]Lucie Kvasnickova Stanislavska

[1]Department of Management, Faculty of Economics and Management, Czech University of Life Sciences Prague, Kamýcká 129, Prague 6 - Suchdol, 165 21, Czech Republic, kuralova@pef.czu.cz

[2]Department of Management, Faculty of Economics and Management, Czech University of Life Sciences Prague, Czech Republic

[3]Department of Management, Faculty of Economics and Management, Czech University of Life Sciences Prague, Czech Republic

Abstract

In today's knowledge society, intellectual capital (IC) is seen as essential for value creation in private sector as well as in public sector, such as universities. Universities' inputs and outputs are predominantly intangibles, thus higher education institutions are considered an ideal framework for the implementation of the ideas associated to IC concept. This research is based on the integrated theoretical framework for voluntary IC disclosure proposed by selected authors who recommend its application in further research investigating IC reporting practices in a particular country or industry. This paper aims to verify three premises of given integrated theoretical framework for voluntary IC disclosure in the field of public higher education in the Czech Republic and tries to demonstrate the importance of IC reporting practices which besides shows the efficiency and responsibility of a given subject.

Keywords

Annual report, intellectual capital disclosure, knowledge society, theories, universities

Introduction

Intellectual capital in public sector in the knowledge society

In the last decade, there has been a growing interest in applying an IC approach in universities (Leitner, 2004, Sánchez and Rivera, 2009,Wu et al, 2012). If the knowledge society is characterized by production, transmission and dissemination of knowledge, universities are unique in these processes (European Commission, 2003). According to Leitner and Warden (2004) the importance of IC approaches in the field of higher education is due to their outputs and inputs that is knowledge. This knowledge universities produce by research as well as through education and universities` key resources are their teachers, researchers, university staff, students etc. with all their relations and routines, which is largely intangible. European Commission (2006: 4) defines IC as ´a combination of intangible resources and activities that enable the organization to transform a collection of material, financial and human resources in a system capable of value creation´. When referred to a university, the IC is used to cover all the institution's non-tangible assets, including processes, capacity for innovation, patents, the tacit knowledge of its members and their abilities, talents and skills, the recognition of society, its network

of collaborators and contacts, etc. IC components are variously divided, however, the tripartite classification (human, structural and relational capital) is conclusively the most widely accepted by expert authors (Leitner, 2004; Ramírez et al., 2007; Sánchez et al., 2009; Bezhani, 2010; Bodnár et al., 2010; Secundo et al., 2010).

Theoretical traditions for voluntary IC disclosure

In IC research there could be find different theories serve to explain the voluntary IC disclosure (An et al, 2011).

Agency theory

According to Marek (2007) agency theory deals with the agency relationship. The two parties have an agency relationship when they collaborate and engage with each other, so that one party (the principal) delegates decisions and/or work on the other party (the agent) as to act on his behalf (Eisenhardt, 1989; Rungtusanatham et al., 2007). According to An et al. (2011) the agency problems arise when both the principal and the agent are trying to maximize their own interests which are not aligned and information asymmetry is one of the key factor leading to agency problems. IC is in the period of the knowledge economy the key factor in the value creation of the company and information about IC is highly desired by shareholders and investors in their decision-making processes. However, most of the IC information are made only on a voluntary basis (An et al., 2011). If you combine both concepts (agency theory and voluntary IC disclosure), it is apparent that the voluntary IC disclosure could reduce information asymmetry between the principals and the agents (An et al., 2011).

Stakeholder theory

Stakeholder theory is based on the assumption that the final results of any organization's activities should take into account the benefits accruing to all stakeholders (Freeman, 1984). According to Deegan (2009) all stakeholders have the right to the information about how they are affected by the organization, even if they do not use such information, or are not the decision makers, who have a direct effect on the existence of given organization. Guthrie et al. (2006) state that organizations should choose the way of voluntary IC reporting, social and environmental performance over the mandatory requirements of the various standards and regulations.

According to the stakeholder theory the organizations should be from the strategic point of view responsible for its stakeholders. Information disclosure is seen as an important mean to fulfill its commitment to accountability (An et al., 2011). The relationship between voluntary IC reporting and stakeholder theory lies in the fact that IC is considered as the key to the success and competitiveness in the knowledge economy, thus these information is increasingly requested by stakeholders (Yi, Davey, 2010). It can be assumed that the voluntary IC reporting can contribute to reducing the information asymmetry between the organizations and stakeholders and thereby contributing to improve relations.

Signaling theory

Signaling theory deals with how to resolve problems arising from information asymmetry in any social setting. It suggests that information asymmetry should be reduced, if the party owning more information transmits signals to other stakeholders (An et al., 2011).

According to signaling theory, organizations with high quality should signal its excellence towards the external environment because that would stakeholders reconsider the

perceived value of the organization, and then make decisions that could be beneficial to the organization (Whiting, Miller, 2008). IC reporting could be a very effective tool for signaling own excellent quality and future value creation. Especially for organizations with high IC value, the voluntary disclosure of this information can be considered an appropriate and effective tool to demonstrate own quality and differentiate ourselves from competitors (Guthrie, Petty, 2000).

Legitimacy theory

Legitimacy theory is another theory about the relationship between organization and society as a whole. Organizations must constantly strive to ensure its activities falling within the limits and norms of society, so that it is perceived as "legitimate" by various stakeholders (Deegan, Samkin, 2009; Guthrie et al., 2006). According to An et al. (2011) if the organization expects to be considered as legitimate by the society in which operates, it should align its operations and activities with social system of norms, values, beliefs and definitions, if not, the organization may lose the status of legitimacy, which could endanger its continued existence in society.

Given the importance of IC for sustainable development and efficiency of the organization, IC information is increasingly requested by various stakeholders (Vergauwen, Alem, 2005). It is therefore essential that organizations publish own IC on a voluntary basis, or at least as part of the annual reports in order to be evident that they meet the expectations of society as a whole or that they divert the attention of those groups (eg. media, etc.), which could have the negative impact of the organization (Deegan, 2009).

The integrated theoretical framework for voluntary IC disclosure

An et al. (2011:579) investigated interactions of above mentioned theories and they formulated three key premises of voluntary IC disclosure: (1) `to reduce information asymmetry between the management of an organization and various stakeholders in the society`, (2) `to discharge accountability to various stakeholders` and (3) `to signal organizational legitimacy and excellence (or superior quality) to the society`.

This paper aims to verify three premises of chosen integrated theoretical framework for voluntary IC disclosure through operationalization of agency theory, stakeholder theory, signaling theory and legitimacy theory in the context of public higher education in the Czech Republic.

The paper has five further sections. First, the Materials and methods section offers procedural research steps including description of realized interviews. Second, the Results interpret the outputs of interviews in relations to the theories and premises of the framework. Third, the Discussion is provided and fourth, the Conclusion summarizes the paper in relations to the paper`s aim. Fifth, References are enclosed.

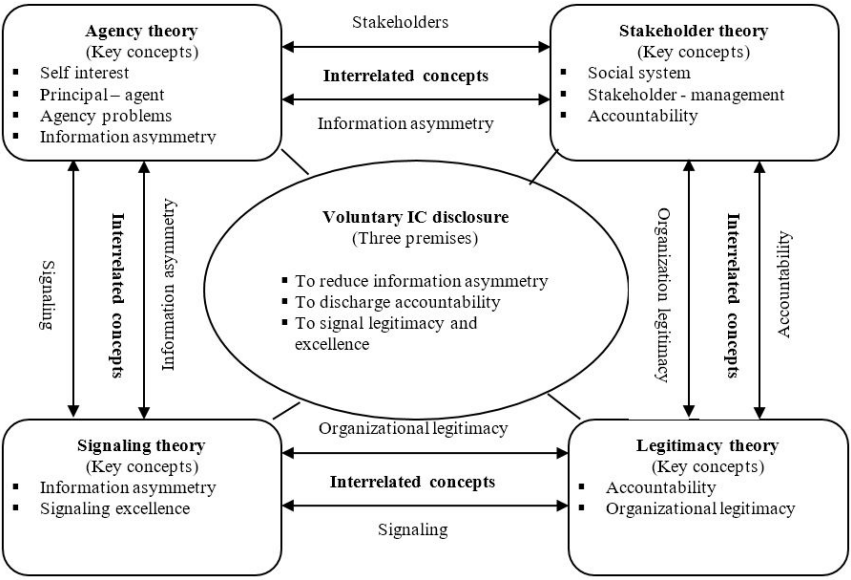

Figure 1: The integrated theoretical framework (source: An et al., 2011:580)

Materials and Methods

The research approach was inspired by the research process recommended by Tharenou et al. (2007), Creswell (2009) and Malátek and Polonský (1998). The initial step was to develop research questions, as well as finding a theory or default framework. The starting point of the research was a theoretical framework of An et al. (2011). This study is based on authors' theoretical framework for voluntary IC disclosure and especially formulated recommendations for further research. The review of papers in the field of IC reporting in higher education followed. Based on previous steps were set research aims and the direction of the data collection and analysis was determined. In the next phase, research design was chosen, which led to answering the research aims (Tharenou et al., 2007; Creswell, 2009). The qualitative data analysis has been implemented through semi-structured interviews with representatives of public universities, who are responsible for the creation of university annual report. 26 potential respondents from all public universities in the Czech Republic were deliberately chosen, the criteria were the responsibility of the person behind the creation of annual report. The interview was conducted in accordance with the principles set by Pergler et al. (1969) and Malátek and Polonský (1998).

Results

2 bursars, 9 vice-deans, 7 heads of departments, 2 chancellors, 1 spokesperson, 2 secretariats of rector and vice-rector, 1 employee of marketing department, 1 project manager and 1 administrative employee from department for development and external relations) are responsible for annual reports creations at Czech public universities. Out of 26 possible respondents there were 9 available.

Agency theory

The respondents were asked to identify the principal-agent relationships in the field of Czech public higher education. All respondents most often chose ministry-public university relationship. In this regard, the Ministry of Education, Youth and Sport (Ministry) is the principal who delegates tasks or decisions to the agent that represents public universities represented by the rector. Other agency relationships were identified: management of university-faculty, administrative board-university, rector-deans, rector-vice-deans and others. One of the respondents emphasized the fact that public university is a very specific institution, where it is difficult to clearly determine the role of agent and the principal in comparison with the private sector. Two respondents stated that there are situations where one entity represents the role of the agent and the principal at the same time, which confirms the theory.

Respondents were asked whether among identified principals and agents exists an information asymmetry in the environment of the Czech public universities, which causes, under the agency theory, the existence of a conflict between the goals of agents and the principals as the fact that each party acts primarily in their own interest. The respondents' answers were not clear, but prevails the positive opinion on the existence of information asymmetry. Respondents confirmed the existence of information asymmetry between the Ministry and public universities, but stressed that in the context of public universities would not exist, because these parties would have the same interests. There were also mentioned factors such as the individual characteristics, which affect the negotiations of the principals and agents, which may have an impact on the existence of an information asymmetry.

According to the integrated theoretical framework of An et al. (2011), one of the motives why organizations should voluntarily disclose IC information is the fact that IC report could reduce an information asymmetry between the organization and its environment. Given the fact, that none of the Czech public universities publish separate IC report, but current annual reports contain IC information, the respondents were asked whether the annual report reduces information asymmetry between the university and its stakeholders. Affirmative answers prevailed again, according to which annual report reduces information asymmetry primarily between the principal (Ministry) and the agent (public university).

One of the respondents stated that the Ministry issued the framework for university annual report, which dictates its requirements for disclosure of certain information. The framework corresponds to the Ministry information need and universities through creation and submission these annual reports thus meet the information need of the Ministry and reduce information asymmetry. Other respondent also responded positively and agreed with the statement that university annual report is a tool that reduces information asymmetry between both the principals and the agents; on the other hand, the respondent mentions the fact that there may be some distortions. Some of the answers sounded in a positive sense, but some doubt was clear.

Stakeholder theory

Respondents answered the question of how public universities can meet the information needs of the stakeholders. Different answers were obtained. Tools that can satisfy the information needs of stakeholders are as follows: university annual report, social networks, strategic plan and its updates, websites, printed materials, advertising in the media, Alumni, journals, magazines for public relations, promotional leaflets and brochures in

Czech and English language, education fairs, performing school officials and students in the media, publicly operated art creation, participation in festivals, contact with secondary schools, attending meetings on university policy etc. The list of possible ways to satisfy the information need of stakeholders according to the respondents is quite rich, various tools of public relations were presented. Very often the respondents emphasized the role and influence of social networks and media. Respondents also emphasized the necessity of choosing the appropriate media to meet the information needs of specific stakeholders. From such a statement implies an important fact, that it is necessary first to identify university stakeholders, then explore their information needs a and then chose a suitable instrument to satisfy these information needs in an appropriate way.

According to An et al. (2011), organizations should disclose IC information as they discharge accountability to stakeholders. The validity of this assumption was verified in the filed of higher education in the country. Respondents were asked whether they considered current annual report an important instrument to fulfill its obligation of accountability to the stakeholders. Respondents consider annual report an important source of information and the majority agreed with the statement that it is an important tool to fulfill the obligation of accountability to the stakeholders. One respondent stated that annual report primarily meets the information needs of the principal, which represents the Ministry. Respondents therefore questioned the significance of annual report for other stakeholders than the Ministry.

Signaling theory

An et al. (2011) set the assumption that each organization should indicate its quality and excellence to the society as whole. To verify this assumption in terms of Czech public universities the respondents were asked whether public universities should signal their quality in order to reduce information asymmetry between them and their social environment. All respondents responded positively. One of the respondents separated the term of quality of the uniqueness and specificity.

In relation to signaling theory, respondents were asked one more question, which examined the opinion of the respondents whether they consider the annual report an effective tool, which can indicate its quality and excellence that point to future value creation of an institution and to distinguish themselves from competing universities and other institutions. In response to this question prevailed rather doubt over such a meaning of annual report, but also were recorded positive answers, where respondents mentioned that individual annual report since they pursue the same framework set by Ministry are comparable and thus offers space for comparison. Despite the fact that annual reports are based on the mandatory framework, public universities have the option of voluntary adding extra information, which can differentiate them from other universities, but a critical factor is voluntariness. One respondent stated that annual report contains enough information to express the quality of public universities.

Legitimacy theory

Legitimacy theory is the last of the four theories contained in the authors An et al. (2011) framework. After introducing the theory the respondents were asked questions to verify the importance of legitimacy of public universities in the country.

Respondents were asked whether in the environment of public universities is necessary that public universities have acted to align their operations and activities with a social built system of norms, values, beliefs and definitions. Respondents expressed the same opinion

confirming. Respondents also said that annual reports used to confirm the legitimacy meet the expectations of stakeholders, while it depends on what stakeholders demand, further, that the academic environment is a reflection of the state of society and vice versa. According to the legitimacy theory it is essential for organizations to disclose information about their intangible resources and processes on a voluntary basis so that it was evident that they meet the expectations of society as a whole. Opinion on this statement in relation to public universities was also investigated and respondents confirmed this statement.

Discussion

There were identified the principal-agent relationships in the area of Czech public universities, most respondents identified the Ministry as the principal and the agent as a public university. Most respondents confirmed the existence of information asymmetry between agents and principals in higher education sector. University annual report is a document that contains information that is required by the Ministry, thus reflecting their information needs. It can be stated that annual report is a tool for reducing information asymmetry between these agents and principals in higher education sector.

According to respondents, the annual report is an important source of information, primarily for Ministry as one of the stakeholder. Annual report is a tool to discharge accountability towards the stakeholders, but the question is whether other stakeholders use this source of information. Most respondents doubt about this fact. Public universities would discharge accountability with their surroundings. Annual report is the source of such information, but for stakeholders such as students, applicants, parents etc. respondents recommend to select the most appropriate tools than annual report.

Most respondents agreed on the importance of signaling own quality and exceptionality toward its environment. Public universities should therefore towards the society signal their quality, uniqueness, excellence, but through appropriate instruments, since the annual report as a document through which you can signal own uniqueness and quality of the respondents disagree. Annual reports are treated more as a formal matter, however they provide many sources of information that prove the quality of public universities. The third premise of signaling organizational legitimacy and excellence to the society was confirmed.

Conclusion

This study was based on the integrated theoretical framework for voluntary IC disclosure supposed by An et al. (2011). First, the IC concept in public sector in the knowledge society was introduced, followed by brief introduction of agency theory, stakeholder theory, signaling theory and legitimacy theory. The theories were characterized in relation to the IC concept. The theoretical framework was transferred to the practical level of public higher education in the Czech Republic. The theories and premises of the framework were verified through semi-structured interviews with respondents from management of Czech public universities. The premises for voluntary IC disclosure in public higher education in the Czech Republic were verified. It can be stated that public universities in the Czech Republic should disclose IC in order to reduce information asymmetry, to discharge accountability and signal quality, excellence and legitimacy towards stakeholders and society as a whole, because it shows on their sustainability, efficiency and responsibility. Current university annual reports have the potential to fulfill these requirements as they contain information corresponding to the character of IC, but this reports are primarily perceived as a purely formal document and to its creation is so accessed. Expansion of the

annual report with IC information is a question of voluntariness, to which the respondents were rather negative.

However, the fact that stakeholder will have access to the type of information, such as IC that is important for proper decisions. Creating IC reports with all its indispensable necessities brings undoubtedly several internal and external benefits (Kuralová et al, 2014). The significance of management, measurement and reporting of IC in the period of the knowledge society has been demonstrated in many studies, but the readiness and willingness of the Czech public universities is doubtful. Further research in this area is desirable.

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STUDY ON THE USE OF ELECTRONIC COMPLEX FOR PROMOTING STUDENTS' INDEPENDENT ACTIVITY

[1]Galiya Kydyrbayeva, [2]Nazym Zhanatbekova, [3]Nurzhan Ualiev, [4]✉Raushan Zhexembayeva

[1]Department of Informatics and Method of Informatics teaching, Faculty of Physics and Mathematics, Zhetysu state university after named I.Zhansugurov

[2]Department of Informatics and Method of Informatics teaching, Faculty of Physics and Mathematics, Zhetysu state university after named I.Zhansugurov, Republic of Kazakhstan

[3]Centre for the Development of Information Systems and Electronic Administration, Zhetysu state university after named I.Zhansugurov, Republic of Kazakhstan

[4]Department of Informatics and Method of Informatics teaching, Faculty of Physics and Mathematics, Zhetysu state university after named I.Zhansugurov, 220 Zheltoksan street, Taldykorgan city, Republic of Kazakhstan, +77 077 601 407, rau@mail.ru

Abstract

This article discusses the possibilities of e-learning as a way of activation of independent work of students. Also we present a model of readiness of students for independent activity based on the development of cognitive interest, monitoring system for independent cognitive activity, criteria for evaluation of formation of cognitive activity, as well as the problems of formation of individual's readiness for the different activities. Taking into consideration the emphasized personal characteristics of students' readiness for independent activity we developed the methods of using e-learning complex. The distinguishing features of the e-training complex are: dynamics, interactivity, flexibility, openness, multi-functionality. In support of this method we developed a computer e-learning system. To assess the effectiveness of the complex experimental work with three groups of students was carried out. As a result of the experiment it is clearly seen the significant increase in the number of students who accomplished the task on constructive and creative level, in the average marks of academic performance under experimental learning.

Keywords

Electronic educational complex, informatization of education system, independent activity, method of using electronic educational complex, testing students' readiness level

Introduction

In the conditions of social informatization, the role and importance of modern education system and human capital as the criteria of social development are increasing. In turn, changes in the social relations system influence education and require its mobility and adequate response to challenges of new historical stage of transition to information society. Higher education focuses on forming specialist's personality, who would be ready for continuous self-education, independent search for new information and self-development throughout life, increasing their ability to adapt in changing conditions of social production and competitiveness in the labor market.

Ways of improving students' training for active educational and cognitive activity and

independent acquisition of new knowledge are of great importance under these conditions. At the same time "State program of education development in the Republic of Kazakhstan for 2011-2020" states that the educational processes developed in the educational institutions of the Republic under the conditions of education methodology, structure and content, are insufficient for forming competitive specialist (Ministry of Education and Science RK, 2010).

Informatization of education system, transition to a new paradigm, based on modern information and communication technologies (ICT) can provide training of graduates to meet modern requirements.

Introduction of information and communication technologies in educational process of universities promotes students' independent cognitive activity, and computer science becomes one of the major scientific disciplines in higher education.

A fundamental element of higher education is information and technological environment with developing architecture of educational space, i.e. the main emphasis should be on creating technically equipped educational environment, including large amount of information in the educational environment with flexible and adaptable organizational structure which is optimal in terms of the efficient use of study time.

Some authors consider that a relationship exists between total communication competency (the sum of presentation, discussion, and activity of tested students and their theoretical knowledge) (Hricova and Pcolinska, 2015).

Also, analyzing Beshenkov S. A. E. S. Bidaybekova, V. Grinshkun, J. A. Karaev, N. N. Moiseev, D. S. and Baigazinova, G. K. Nurmukhambetov, A. E. Sagimbaeva, K. M. Baigusheva, J. R. Orynbaeva's researches, we concluded that in the process of teaching computer science we need constant updating of versions of the studied ICT aids, use of new user environments and programming systems. With this regard, it is possible to determine, from our point of view, one of the most important problems in the field of education. The training system must provide the level that would allow students to adapt quickly to innovations in ICT in their future careers.

Materials and Methods

In this regard, there is a need to develop and implement electronic educational complexes in the educational process.

There is a certain experience of creating electronic educational complexes in the Republic of Kazakhstan. So, in line with the researches, conducted by the scientists of G.K. Nurgaliyeva's scientific school, a functional model of electronic methodological system in methods of teaching mathematics, electronic research system as information technology resource for developing research activities, electronic program "Monitoring of professional education" are developed (Nurgalieva, 2011).

Based on the analysis of developed and implemented electronic educational resources of Kazakhstan scientists we came to the conclusion that electronic educational complexes allow:

- to create conditions for exercising students' individual and self-educational activity, self-study, self-development, self-improvement, self-education, self-realization;
- to apply full range of modern ICT possibilities in the process of implementing various educational activities, including registration, collection, storage, processing of information, interactive dialogue;
- to use the possibilities of multimedia technologies, hypertext and hypermedia

systems in the educational process;
- to objectively diagnose and evaluate students' intellectual abilities and their level of knowledge, abilities, skills, training level, to objectively evaluate the effectiveness of training in accordance with requirements of state educational standards;
- to manage teaching process adequately to each student's intellectual level, level of his/her knowledge, skills, motivation peculiarities;
- to create the basis for constant and immediate communication between teachers, students and parents, aimed at increasing teaching effectiveness.

When developing the model of students' readiness for independent activity, we relied on the research of development levels of cognitive interest (Shchukina, 1998), monitoring systems of independent cognitive activity (Ussova, 1980), criteria of forming cognitive activity (Sadykova, 2003), the introduction of eLearning methodologies into teaching that stress the social aspects of learning (Dlouha, 2009) and also problems of forming individual readiness for various activities (Odnossum, 2006), etc.

During research to achieve the goals of research, the following methods were used:
- scientific methods of theoretical research (analysis, synthesis, formalization, modeling, classification, generalization and systematization). Analysis of the psychological and pedagogical, methodological, philosophical and technical literature related to the research problem.
- methods of empirical research (pedagogical observations, tests, questionnaires, interviews, pedagogical experiment).
- method of group assessment and methods of mathematical statistics. Pedagogical experiment and analysis of experimental data using mathematical statistics were carried out.

Results and Discussion

A number of studies devoted to the problems of activization of independent activity of students, including the conditions of informatization of education: the development of methods of application of information technology as a means to enhance students' independent work explored by S.Temurov (Temurov, 2012), development of methods of the organization of independent work of students in learning science conducted by Odnossum L.(Odnossum L.,2006), etc.

However, on the one hand, these studies do not exhaust all the possible ways of development of independent informative activity of pupils on the basis of modern information and communication technology training, on the other hand, the emergence of new educational software such as e-learning systems objectively requires scientific study of the organization independent cognitive activity of pupils on the basis of their use.

Thus, in actual practice, on the one hand, we have developed real conditions for the active use of e-learning systems in the practice of teaching, on the other hand, insufficiently developed scientifically based methods of their use in the independent activity of students. This contradiction has given rise to the problem of the study, which needs to develop a methodology for the use of e-learning systems in the independent activity of students.

All these broad pedagogical opportunities create favorable conditions for promoting students' independent activity.

Having based on studied works of scientists such as B.P. Yessipov, Zh.A. Karayeva, M.A. Kussainova, P.I. Pidkasistiy and O.I. Sadykova, we identified that self-activities and independent cognitive activities are interrelated and interdependent. Indeed, students' independent activity is a focused cognitive activity, controlled by students, necessary for

improving education and occurring during intensive formation of student's personality, growth of self-consciousness, in determining the vocation and life plans. In this case, a student (himself or with the help of a teacher) defines educational purpose, content of cognitive activity, volume and ways of organizing his work.

Readiness is a primary fundamental condition for successful achievement of any activity (Odnossum, 2006). We believe that readiness is an integrative personal formation, holistic complex, which includes motivational, informative and operational characteristics. Students' readiness for independent activity, in our opinions, comprises three interconnected structural components with quality features and parameters:

- motivational component, expressing students' motives, interests, aspirations and needs of independent cognitive activity;
- content-related component which combines a set of knowledge about the nature of independent activities, methods and techniques and conscious attitude to it;
- operational component, comprising a set of abilities and skills of independent cognitive activity.

Data of criteria and indicative characteristics allowed us to distinguish three levels of students' readiness for independent cognitive activity: copying and reproducing, productive and interpretive, constructive and creative.

In order to encourage students to accomplish independent cognitive activity we require, above all, motivation. The most common motivations for students to do independent cognitive activity are socially important motives, associated with the implementing of ideals and students' life plans. They provide independent cognitive activity with necessary stability, purposefulness, regularity and enhance the level of students' readiness to carry out independent cognitive activity. From psychological and pedagogical literature we know that key characteristics requirements are power, frequency of occurrence, ways of meeting needs and subject content. These characteristics are used as indicators of motivational criterion.

So, copying and reproducing level is determined by wide, but not defined and sustained, motives of independent activity (curiosity, interest in the subject and to everything around him), elementary, not very persistent, often unconscious interest in new facts and phenomena. Students are characterized by aspiration to reproduce knowledge in a given sample

Leading motives in the productive interpretive level of students' readiness for independent activity are growth of self-consciousness, awareness as members of society, prepared to take a certain place after leaving a university, conscious desire for developing cognitive skills, need for implementing all the components of cognition, etc.

Students with a constructive and creative level of readiness have strong interest in the subject, establish causal relationships, reveal patterns, establish common principles of phenomena; they want not only to understand deeply the essence of studied phenomena and their interrelations, but also find a new way of learning.

Content-related criterion for defining the level of students' readiness for independent activity is characterized by the following indicators.

Copying and reproducing level suggests a lack of conscious relationship to independent activity, misunderstanding its significance, ignorance of techniques and methods of independent activity, so knowledge, gained by students on their own, is local in nature, not combined with other, without any systematization.

The productive and interpretive level of readiness includes awareness of independent activity as a means of implementing ideals, decisions of vital personal plans, improving

knowledge about the techniques of independent work, awareness of importance of rational organizing independent work: problem statement, determining means of its implementation, amount of work, intensification methods, etc.

Constructive and creative level within content-related criterion is characterized by awareness of socio-economic significance of obtained knowledge; detection and correction of knowledge lack, inaccuracies in action; formation of adequate ideas about their abilities; assimilation of working methods on self-control and self-esteem.

Students with the lowest copying and reproducing level of readiness are characterized by mastering the most elementary cognitive skills: completing exercises by example or mechanical reproduction of textbook pages. They do not set certain goals for their activities consciously, and therefore, they do not choose means for their implementation, organization of independent activity is spontaneous, reference to other sources of educational information is accidental, not purposeful and episodic. Tasks are performed by literal, not transformative use of example, without justification of action sequences. Students with this level do not study much, they memorize what educational literature and teachers tell them.

The productive and interpretive level was observed in students who already organize their own activity purposefully. They are distinguished by a higher level of cognitive skills in the performance of their individual tasks, finding supplementary sources of information; tasks are performed correctly, actions are justified; however, they offer their traditional solutions.

And, finally, the highest level, or constructive and creative level, is characterized by mastering skills in determining the goals of self-education, assessing their abilities and adjusting their tasks according to them; skills to build up their own activity more efficiently. This level also requires problem-solving search in the process of cognitive and practical activities, transferring previously learned knowledge and skills in a new situation; finding out new functions of a familiar object, alternative solutions to problems and (or) method of their solution; combination of previously learned ways of action (solutions) in a new way; construction of original solution in the presence of other individual ways. Provided tasks are performed correctly, all actions are justified, non-traditional decisions or alternative solutions are proposed.

Developed criteria-indicators do not exhaust the variety of personal characteristics of students' readiness for independent activity, but in the context of research problems they are the most significant.

Thus, for promoting students' independent cognitive activity it is necessary to create such conditions under which all the above mentioned readiness levels for independent activity are formed.

Taking into account the selected personal characteristics of students' readiness for independent activity, we have developed the method of using electronic educational complex in students' independent activity.

This electronic complex developed on its own, without additional financial costs as well as the main reason for the development of the electronic complex is focused on the specifics of the educational environment of our university. Usually, implementation and operation of LMS contain hidden costs, unclear user environments, bulky developer and administration manuals, and limitations with regard to interoperability, integration, localization, and bandwidth requirements (Cavus, 2013). LMS such as Moodle or Blackboard are very complex and robust software with many functionalities (Zahraa et al, 2013). However, site-level group functionality (hereinafter - the "study groups") is not

provided in none of mentioned programs. Without site-level group it is very difficult to manage students from different specialties. To organize and manage the learning process of our university, e-learning system should be focused on the priority use of study groups. We developed electronic educational complex in Informatics which is based on the technology "client-server" and has two modules: administrator's module and client's module

Client's module consists of the following units: "Training", "Information", "Registration", "Help". System users, teachers and students, have the access to client's module.

"Training" unit includes all the theoretical materials, assignments to for practical work, individual assignments, questions of pilot tests, etc. With the help of this unit, students study theoretical materials, retrieve and review materials, receive and carry out practical and individual assignments and pass control tests.

"Information" unit allows to get information about academic calendar, open a register of grades. Students can see their results of completed individual tasks, pass individual tasks, use chat services, send messages and change their login details. Teachers receive, verify and comment students' individual and practical tasks, consult students and are allowed to register students' data.

Administrator's module allows to create sections for users to update information, assign a password and control teachers and students' access to sections.

All information is stored and updated on the web-server like Apache in tables of an automated MySQL database. The proposed structure can be "enlarged" by other units in the educational process if it is necessary.Distinctive features of electronic educational complex are dynamics (timely updating of educational information in the subject); interactivity (consulting, chat, forum); flexibility (multiple choice assignments, tests); openness (summary statement); multifunctionality (academic calendar, syllabus, assistance).

Methodology of using electronic educational complex in students' independent activity includes methods and teaching techniques, providing for organization of self-study process from goals to results.

For carrying out of experimental work on testing the technique of using electronic educational complex, three groups of students, including two experimental groups (39 and 36 students) and one control group (51 students), were formed. These groups were approximately equal in their academic performance and in their initial level of readiness for this activity.

In determining the level of students' readiness for independent activity, each level has certain points in accordance with developed theoretical model of readiness. Each level was also correlated with the degree of mastering theoretical knowledge in subjects, which was detected via testing. Copying and reproducing level is 2.0 to 3.0 points, the number of correct answers to test questions is below 60%. Productive and interpreting level is 3.1 - 4.0 points, number of correct answers in test questions is from 61% to 89 %. Constructive and creative level is 4.1-5.0 points, i.e. over 90% of correct answers on test questions.

The results of testing students' readiness level for independent activity before conducting the forming experiment are presented in the table 1.

Level of readiness	Control group			Experimental group-1			Experimental group-2		
	Number of students	%	C	Number of students	%	C	Number of students	%	C
1	35	68.6	0.250	27	69.2	0.246	25	69.4	0.255
2	16	31.4		12	30.8		11	30.6	
3	0	0.0		0	0.0		0	0.0	

Note: 1 – copying and reproducing level of readiness for independent activity;
2 – productive and interpretive level of readiness for independent activity;
3 – constructive and creative level of readiness for independent activity;
% - number of students in percent;
C - coefficient of the level of readiness for independent activity in the whole group

Tab. 1: Comparative data on levels of readiness for independent activity of experimental and control group students before the forming experiment, 2015-2016 (own calculation)

Coefficient in the table 1 is coefficient of the level of readiness for independent activity in the whole group, which is calculated by the formula:

$$X = 1/n * \sum_{i=1}^{n} x[i], \quad (1)$$

x [i] - assessment of student i, n - the number of students in the group.
Coefficient of level students readiness for self-employment is calculated according to the formula:

$$K_{(\acute{y},\grave{o})} = 1/x[0] * N * \sum_{i=1}^{0} x[i] * n[i], \quad (2)$$

where x [i] – variant of level, x [0] - the maximum value of variant level, [i] - the number of students from the i -th level of readiness, of n - the number of students performing work.
During the experiment we have conducted two comprehensive “measuring” of students’ readiness for independent cognitive activity. Teachers and teacher-methodologists were experts. To eliminate randomness in the results and to trace the dynamics of the studied readiness levels throughout the experimental work, we conducted three control works: first and second work included test questions of midterm examination, designed for a specific level of activity; and the third - individual assignments, including theoretical and practical part.

Group	First control work		Third control work	
	X	C	X	C
Control group	3.73	0.621	3.98	0.678
Experimental group -1	3.92	0.630	4.17	0.758
Experimental group -2	3.94	0.638	4.33	0.833

X – average point of achievement level. C – coefficient of the level of students’ readiness to independent activity.

Tab. 2: Comparative picture of experimental and control groups’ progress during the period of educational experiment, 2015-2016 (own calculation)

	Copying and reproducing level		Reproductive and interpretive level		Constructive and creative level	
	Beginning of the experiment	End of the experiment	Beginning of the experiment	End of the experiment	Beginning of the experiment	End of the experiment
Control group	68.6	19.6	31.4	62.7	0.0	17.6
Experimental group-1	69.2	12.8	30.8	56.4	0.0	30.8
Experimental group -2	69.4	5.5	30.6	55.5	0.0	38.8

Tab. 3: Dynamics of the levels of college students' readiness for independent activity, 2015-2016 (own calculation)

Comparing the results in the table 3, we can note the positive changes in the levels of students' readiness for independent activity. The obtained data show that the results in the experimental groups are significantly higher than in the control group. If the number of students with constructive and creative level increased by 17.6% in the control group, these indicators in the experimental groups are 30.8 % and 38.8 % respectively. The number of students with copying and reproducing level of readiness in the experimental groups decreased by 56.4% and 63.9%, while in the control group - only by 49%.

Conclusion

Thus, we concluded that the use of electronic educational complexes promotes students' independent work, because:

1. Number of students who work on constructive and creative level increased.
2. In the experimental study average marks of students' progress increased.
3. Level ratio of students' readiness for independent activities in groups with electronic training complex is significantly higher than in groups, using traditional forms.

However, many questions remain to be examined. These issues will be addressed in future research.

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TALENTED STUDENTS AND THEIR FAMILY BACKGROUND

[1]✉Hana Lipovska, [2]Jakub Fischer

[1]Department of Economics, Faculty of Economics and Administration, Masaryk University, Lipová 41a, Brno, 602 00, Czech Republic, lipovska.hana@seznam.cz

[2]Department of Economic Statistics, Faculty of Informatics and Statistics, University of Economics, Prague, Czech Republic

Abstract

The economic growth and well-being of the nation increasingly depends on the human capital. The level of the human capital is influenced by the intergenerational transmission. The aim of this paper is to examine the transmission within the group of very talented students. We try to identify who the talented students are, which background they did come from and how the family background influenced them. For fulfilling the aim, we conducted unique survey among the most successful and talented students at secondary schools in the Czech Republic, especially in the South Moravian Region. According to the survey results, most of the talented students came from the complete highly educated families with tradition in their field of interest and long positive attitudes toward accumulating the knowledge. Contrarily, the role of the teachers in the support and guidance is negligible. Our results confirm that there is a clear evidence of human capital intergenerational transmission as well as vertical immobility. For the future economic growth there must be offered a helping hand for the talented children with less educated family background.

Keywords

Human capital, intergenerational transmission, responsibility in education, Talent 2016 survey, talented students

Introduction

The economic growth as well as well-being of the nation depends increasingly on the human capital (e.g. Benos and Karagiannis 2016). As Callard-Szulgit (2012: 19) mentions, the promise of our future is especially the human capital of the gifted students. However, if we study the background of the most talented and gifted personalities, we often find that there is high level of accumulated human capital across the generations (e.g. Yang and Qiu 2016). Parents with higher education levels have children with higher education levels (Black et al. 2003). Parental educational level also affects the lifelong learning of adults (Fischer and Lipovská, 2013a). The crucial question is, if the highly gifted students came from families with the high accumulated level of education as well as from the families with the lower (or even the lowest) education level or, on the contrary, if the gifted children from the poorer and less educated families hit the glass ceiling and do not have enough chances to further cultivate their human capital.

If the intergenerational transmission mechanism of the human capital worked strongly among the gifted children and their families, it should be the school and teachers, who distinguish the student's potential and help to cultivate his or her talent. Recent Czech schooling policy supports especially disadvantaged children and children with learning disabilities. Characteristically, in the Decree no. 103/2014 Coll. amending Decree no. 73/2005 Coll., on the education of children, pupils and students with special educational

needs and exceptionally gifted, just two sections are devoted to the exceptionally gifted, while ten sections deal with the disadvantaged students.

According to the Czech School Inspection Report only one third of all Czech schools clearly identify their gifted and talented students. Moreover, the work with such students is not systematic, it mostly consist just of the participation at competitions, as the schools are not motivated to take care of gifted children (Entler et al. 2008). Matějů (2006) claims that even the grammar schools "does not act as an instrument of upward educational mobility", but – on the contrary – their just promote the "intergenerational reproduction of educational inequality".

As Ermisch, Pronzato (2010), Sewel, Shah (1968) or Fischer, Lipovská (2013b) mention, there is the sex-dependency in the intergenerational transmission mechanism. Similarly there is a consensus that children from complete families do better than their counterparts from divorced families (e.g. Pavlát 2011).

The aim of this paper is to identify who the talented students are and from which background they did come. To do this we conducted unique survey among the most successful and talented students in the Czech Republic (and especially in the South Moravian Region, which has consistent program for co-operation with talented students since 2003). The rest of the paper is organized as follows. We introduce the survey and data we used. Then the results of our analysis are presented. Firstly we analyse the intergenerational transmission mechanism from the grandparents to the parents of talented students, as well as their working status. Secondly we explore, who has the greatest effect on the talented students, who brought them to their field of interest and who supports them. Finally the self-estimation of the talented students is examined.

Materials and Methods

Our research is based on unique dataset Talent 2016. This survey was conducted from 24th January to 31st January 2016 among highly talented students in the Czech Republic. On-line questionnaire was sent to two groups of respondents:

i. All current and former participants of the Support for Talented High School Students (PPNS) managed by the South Moravian Centre for International Mobility (JCMM). These students or former participants enrolled to the program either because of the outstanding results at national or international level of student's competition, or according to the assessment in educational and psychological consulting.
ii. All participant of national round of Students Professional Activities in 2015 (almost 300 respondents). These students are winners of regional levels, which mean that they were able to write during their secondary education professional thesis on the scientific topics. On-line questionnaires were distributed via the National Institute for Further Education.

Both groups overlapped in certain range as some of the successful Student Profession Activities Competition are participants at JCMM PPNS program. Totally 213 questionnaires were fully filled and therefore filed to the final dataset.

For comparison with the Czech standard education and occupation structure the results of Population and Housing Census 2011 were used. These data are available from the Czech Statistical Office official database. Similarly as Fischer, Lipovská (2013b) we distinguished students with blue-collars parents and white-collars parents according to the ISCO-08 classification (see Table 1).

white-collars workers		blue-collars workers	
0	armed forces occupations	6	Skilled agricultural, forestry and fishery workers
1	managers	7	Craft and related trades workers
2	professionals	8	Plant and machine operators, and assemblers
3	technicians and associated professionals	9	Elementary occupations
4	clerical support workers		
5	service and sales workers		

Table 1: International Standard Classification of Occupations. White and blue collars workers distinction

Students were further asked to describe their subjectively greatest success. These verbal descriptions were subsequently classified according to the Table 2.

categories		success level
minor success	1.	personal
	2.	local
	3.	regional
major success	4.	national
	5.	international

Table 2: Classification of respondents' successes

Results and Discussion

In this section we firstly examined the human-capital background of the talented students in terms of the educational level of parents and grandparents as well as the field of their studies. Secondly we discuss the self-estimation of talented students and their own explanation of their success. In our dataset 60% of respondents were talented male students, 40% talented female students. Most of respondents (60%) studied at eight-year grammar school (85% of them having tertiary educated parents), 22% studied at four-year grammar school (70% of them having tertiary educated parents) and only 18% at other type of secondary schools (only 26% of them having tertiary educated parents). More than one third of respondents gained the major (national or international) success (35% of students). Those basic statistics are in line with the assumption postulated by Matějů (2006), as there is really just the accumulation, not the transmission of the human capital at the Czech grammar schools. In accordance with Pavlát (2011) most of the talented students (88%) grew up in the complete families with both parents.

Human capital background

As figure 1 clearly shows, the gifted students came from highly educated families. Nearly one half (49%) of all respondents comes from families where both parents have the university degree, 71% come from families where at least one of the parents have the university degree. Moreover, 39% of talented students come from the teacher's families. According to the Population and Housing Census 2011, only 17% of all economically active Czech citizens have the tertiary education. Apparently, the intergenerational transmission mechanism works among talented-students families in the same way as described by Becker (1993).

If mother has the university degree, her father had the degree in 57% cases and her mother

in 33% cases, at least one of her parents had the degree in 75% cases. On the other hand, if the mother did not get university degree, her mother studied the university just in 8% of cases and her father just in 18% of cases. Nevertheless, 77% of these mothers reached an upper secondary education.

This transmission mechanism is slightly weaker in the father's families, where the education of mothers from the father side is the same as in case of mothers, but fathers are significantly less educated (only 48% had a degree). At least one of his parents had the degree in 70% cases. On the other hand, if the father did not get university degree, his mother studied the university just in 4% of cases and his father just in 9% of cases. Those results are in line with the sex-dependency as described in Fischer, Lipovská (2013) or Ermisch, Pronzato (2010).

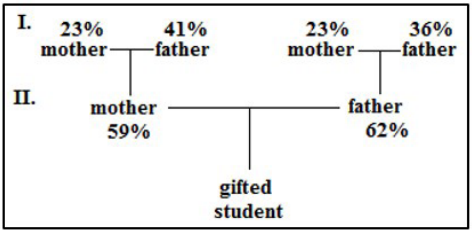

Figure 1: Ratio of the gifted students' family members, who got university degree (source: own calculation)

According to the results of Population and Housing Census 2011, 64% of economically active citizens work at the white-collars occupations. This ratio is significantly higher for the families of talented students: 94% of mothers and 82% of fathers are white-collars workers.

If we restrict our dataset just to those respondents, who study or studied at university, we find, that a fifth of talented students major in the same field as their mothers, one third major in the same field as their fathers and one half has the same professional orientation as at least one of the family members (including the grandparents). As table 3 clearly shows, there is strong relation between the field of fathers and grandfather as well as between mothers and grandmothers. Significantly high number of talented male students inherited their field from their fathers. On the other hand the relationship between the field of talented female students and field of their parents is somewhat weaker.

		mother	father
Talented student	female-student	20%	18%
	male-student	22%	43%
Talented student's parents	talented student's mother	33%	10%
	talented student's father	8%	25%

Table 3: After who did the talented students and their parents inherited the field of interest?

When asked who brought them to the field in which they excel, most of the talented students (68%) claims, that their find their way themselves.[1] Most often this was the response of students whose parents lacked the tertiary education (78% chosen the option *"I've found this field on my own"*) against students from tertiary educated families (57%). Great deal of students also mentioned that they were brought to their field by family members. This impact is stronger especially if the parents have tertiary education. As table 4 shows, parents with

1 Respondents could select multiple options.

tertiary education brought talented students to their field twice more often. Again, there is a strong sex-dependency: talented female-students were influenced more often by their mothers (28%) than male-students (15%), on the contrary talented male-students were influenced more often by their fathers (38%) than the female-students (25%). Only 8% of students stated, that their field selection was influenced by their elementary school teacher and 18% by their high school teacher. What is more, there is no evidence, that the teachers would influence talented students from the lower-educated families more than talented students from higher-educated families. Those results are in line with the findings of Czech School Inspection (Entler et al. 2008).

	Mother	Father
tertiary education	25%	40%
lower than tertiary education	13%	19%

Table 4: Parental influence on the field selection according to their level of education

Self-estimation and cause of success

More than half of talented students consider themselves as above-average during their secondary education (57%) as well as during their primary education (52%). However, while 76% of talented male-students consider themselves as above average, the same is valid just for 45% of talented female students. This finding confirms existence of female confidence gap among the top professionals as described e. g. in Sarsons and Xu (2015). Similarly students from higher educated families estimated themselves better than students from lower-educated families (61% as compared with 48% student from lower-educated families).

Most of the talented students explain their success by their interest in the field (69%) and diligence (54%).[2] On the other hand just 29% of them explained their success by the support of their teachers (in contrary to 42% of talented students who mentioned the importance of their parental support).

As figure 2 clearly depicts, the interest in field is the most often explanation of the male-students success (75%), while the female-students highlights especially their endurance (67%). Talented students who reached the major success on the national or international level mention especially their diligence (77% of them) and endurance (59% of them).

There are large differences between the success-factors consideration among the talented students from the lower and higher educated families. While 58% of talented students from higher-educated families stressed their talent, only 27% of talented students from the lower-educated families considered talent as an important factor. Similarly, talented students from the higher-educated families mentioned importance of their parental support more often than students from lower-educated families (48% in comparison to 29%). On the other hand, students from the lower-educated families find their diligence as more important than students from the higher-educated families (56% in comparison to 46%) and their stressed also the importance of the field interest (74% in comparison to 67% of talented students from the higher-educated families).

The greatest differences in the success explanation might be observed between the talented students from the families with both tertiary-educated parents and families with none of the tertiary educated parents. Talented students from the lowest-educated families extraordinary stress the role of their family support (91% of them in comparison to only 49% of students from the families with the highest human capital level). Compared to that,

2 Respondents could select multiple options.

talented students from the highest educated families extremely highlighted the effect of their talent (62% in comparison to only 27% of students from the families with the lowest human capital level, see figure 3). This is in line with Winner (1997:185) who says that "There are poor and undereducated families who value education and achievement, just as there are many upper-income families, who do not provide enriching environments, ale allow their children to spend the bulk of their time in front of the television or at the mall."

Conclusion

Talented students are the most promising and most important part of our future human capital stock. However, there is still a profound ignorance of their family background, influences as well as the effect of schooling on their development and professional orientation.

In our study we offered original findings based on our own survey Talent 2016. We intend to conduct this survey every five years to monitor the changes in the structure of the Czech talent pool. This paper provides clear evidence of human capital intergenerational transmission as well as vertical immobility. Most of the talented students came from the complete highly educated families with tradition in their field of interest and long positive attitudes toward accumulating the knowledge. On the other hand, the role of teachers in the support and guidance is negligible.

The family effect as well as the sex-dependency is incontestable. For the future economic growth and Czech well-being there must be offered a helping hand even for the so far unused talent pool of children with the less educated background as no country all over the world can afford to waste its valuable talent.

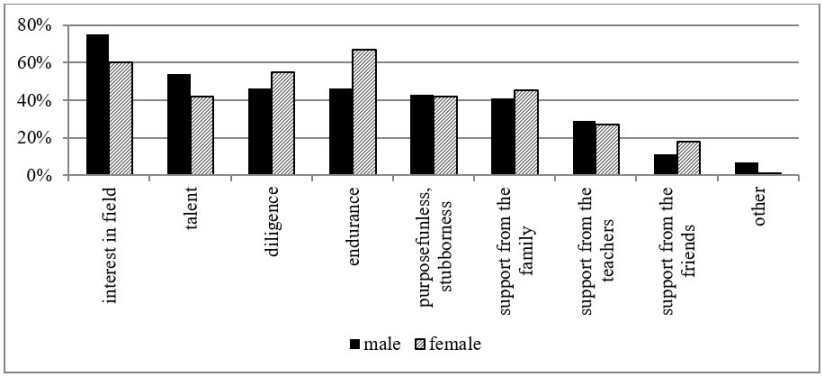

Figure 2: What do you consider to be the main reason for your success? (Respondents by gender)

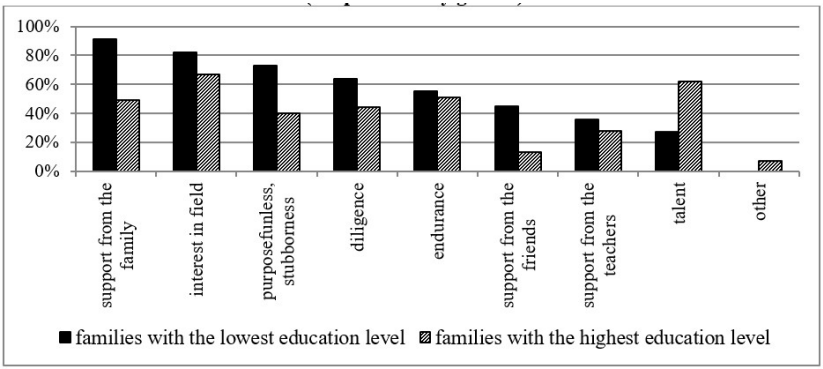

Figure 3: What do you consider to be the main reason for your success? (Respondents by educational level of their families)

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WOLFRAM|ALPHA IN EDUCATION

[1]✉Renata Majovska, [2]Barbara Majovska

[1]Department of Mathematical methods in Economics, Faculty of Economics, VŠB – Technical University of Ostrava, Sokolska 33, Ostrava, 701 21, Czech Republic, renata.majovska@vsb.cz

[2]Faculty of Law, Charles University in Prague, Czech Republic

Abstract

There are many problems in mathematical education at faculties of economics. Scientists who deal with methods of teaching mathematics solve problems concerning primary and secondary schools. In this paper we describe appropriate integration of the online tool Wolfram|Alpha in mathematical lessons. We consider the inclusion of open source programs in mathematical lessons as an effective tool which enables students to achieve a higher level of knowledge and to overcome their difficulties with learning. We conducted research in which we compared results of two groups in a pre-credit test. One group attended extra special lessons in which the teacher helped them to use Wolfram|Alpha. To evaluate the teaching experiment we use the Two-Proportion z -test.

Keywords

Mathematics, online tool, p -value, Wolfram|Alpha, z -test

Introduction

The integration the information and communication technologies (ICT) into mathematical education has increasing trend. It has become an inevitable and irreversible reality and new learning methods which use ICT help students to overcome their difficulties with mathematics and present mathematics as a powerful tool of problem solving in the real world. Information and communication technologies offer new dimensions in the mathematical education. We can use a wide spectrum of mathematical software, online calculators and the Learning Management Systems (LMS). The implementation of modern information and communication technologies into education brings many advantages (Friedrich, 2016: 78). Quality education helps students to assert in their future professions. It depends not only on the quality but also on steadiness and competence to use the obtained knowledge. Therefore teachers have a difficult and sophisticated role. They should prepare modern lectures using new tools which increase imagination, creativity and simplify mathematical education. Information and communication technologies are the connecting element between a sophisticated mathematical theory and its applicability in the real world and current practice (Baszova, 2015: 17). Information and communication technologies enable students to approach education more actively. They can work in a heuristic way (Kunter, 2013: 64). The utilization of modern technologies in lectures represents a new approach to education. New extensive researches show that the involvement of computers in mathematical education provides much more advantages than disadvantages (Luu and Freeman, 2011: 1072, De Witte, Haelermans and Rogge, 2014: 314). In spite of these results computers cannot replace the person of the teacher in the educational process.

When teachers talk about mathematical education two questions always arise. “What do we teach?” and “How do we teach?” It is true that these two questions are very important. But there is the third fundamental question. “How do students learn?” In many ways this is the more difficult question. It could be very hard for teachers of mathematics to imagine the thought of mathematical beginners and especially when students do not study mathematics as the main and profiling subject.

Students at the Faculty of Economics at VŠB–Technical University of Ostrava unfortunately have their mathematical lessons in a classical classroom without computer support. But a small part of teachers of the Department of Mathematical Methods in Economics has encouraged students to use modern technologies, mathematical programs, online calculators and applets for many years (Majovska, 2013: 390). We started with Computer Algebra Systems (CAS) such as Maxima, Scilab in the year 2008. But these programs were complicated for students and only a small part of them used these CAS. In 2008 we prepared a set of applets using the open source program Compass and Ruler. We use this program in calculus very successfully. In the year 2010 our faculty bought the licence of the program Mathematica. It was an important step to a higher level. But only a small part of students started to use this program.

We could suppose that information and communication technologies are common for young people and therefore they can be implemented in the learning process. But it is not quite true. We have observed that students have problems with using mathematical programs or online calculators. We carried out a statistical enquiry in the academic years 2011/2012 and 2014/2015 (Majovska, 2014: 402), (Majovska, 2015: 341). Among other conclusions we found out that students have problems with the correct notation of the functions or formulas when they were using a mathematical program. Therefore we chose the efficient online computational tool Wolfram|Alpha and we have been encouraging students to use it since the academic year 2014/2015. Moreover, we prepared a clear manual which makes this program easy to use.

In this paper, in the section Materials and Method, we present the online tool Wolfram|Alpha and the Manual which we created so as the students can use the program more easily. Further we describe our research and the statistical methods which we used to show that Wolfram|Alpha and Manual help students to overcome their troubles with mathematics. In the section Results and Discussion, we show statistical results and we discuss them. In the last section, Conclusion, we summarize our result and we give some recommendations.

Materials and Methods

We have tried to raise the level of students’ knowledge and their mathematical literacy for many years. We have recommended to students to use open source programs. During the last two years our effort has been concentrated on Wolfram|Alpha. In order to help students to overcome their initial difficulties with using this tool we prepared the clear and brief manual which helps students to write the script of mathematical functions and formulas or any commands properly.

Wolfram|Alpha

This tool is characterized as the computational knowledge engine which generates output by doing computations from its own internal knowledge base. It gives us free access to broad computational resources. The free Wolfram|Alpha service is only available for ad hoc, personal, non-commercial use. Wolfram|Alpha LLC is continually working to improve and expand this product, creating new algorithms for computation, linguistic

analysis, data comprehension and computational aesthetics to provide smart and attractive results. Wolfram|Alpha wants to provide the broadest possible free public access to advanced computation and rich sources of data.

We can start with Wolfram|Alpha by watching Stephen Wolfram's introduction screencast available from https://www.wolfram.com/broadcast/, browsing the web pages *Examples by Topic* (Fig. 1), or just type something that we want to compute or know into the input field (Fig. 2).

Figure 1: Examples by Topic, 2016 (source: 2016 Wolfram|Alpha LLC-A Wolfram Research Company)

Figure 2: Input field, 2016 (source: 2016 Wolfram|Alpha LLC-A Wolfram Research Company)

We have observed that only a small part of students uses Wolfram|Alpha or another online calculator for problem solving and doing exercises. We have found that they are not able to write down the instructions into the search box properly in spite of the fact that the script of any mathematical formulas is very easy and intuitive. Students can make a mistake in the command and the tool manages with it. For example, the student can write "derivat" or "differentiation" instead of "derivative" and the software provides correct result with the advice how to enter the notation correctly next time. We wanted to help the students to overcome the reluctance to use Wolfram|Alpha and therefore we prepared a brief guide how to use it. Our students can find many examples with precise notations of formulas, functions, commands etc. in this guide. Every example includes the command and the link to Wolfram|Alpha setting where the solution is immediately displayed (Fig. 3).

Find the local extremes of the function $y = x \cdot e^{\frac{-x^2}{2}}$ (note: the function values in extremes are calculated, the graph of function is drawn):	
local extrema of x*exp(-x^2/2)	*online evaluation*

Figure 3: The part of Wolfram|Alpha Manual, 2015 (source: author)

In the web interface of Wolfram|Alpha students can edit the notation from the Manual and adjust it to other exercises.

Research organization

We conducted the research in the academic years 2014/2015 and 2015/2016. We compared the students' results from two student groups in the pre-credit test. They could check their knowledge before the credit test. We did not expect that they would prepare quite thoroughly. The first group (215 students) wrote the pre-credit exam at the end of the winter term in the year 2014/2015. These students could use any open source program or online calculator during the winter term but only optionally without permanent stimulation. The second group (161 students) wrote the credit exam in the end of winter term in the year 2015/2016. These students were encouraged to use open source programs, especially Wolfram|Alpha, and they had the manual at their disposal during the winter term. In accordance with our experience and assumptions we formulated one alternative hypothesis:

H1: Appropriate integration of the online tool Wolfram|Alpha in mathematical lessons enables students to achieve a higher level of knowledge and to overcome their difficulties in mathematics.

In this article we present a comparison of the results of two groups by gender. Students from both groups solved seven tasks in which they should find the domain of the function, draw two graphs of the function of one real variable (quadratic and exponential), find the limit of the function, examine intervals of the monotonicity of the function, intervals of concavity and convexity, and solve one matrix equation. The students had access to the internet and were informed about the possibility to use any online calculators, computer programs and applets during writing the test in both groups.
The results of both groups were compared using statistical methods. Each task was scored with 0 or 1 points. The students obtained 1 point if they solved the task correctly or with a small error. Each student could get from 0 to 7 points. To describe the results of both groups the counts and percentages for each task were calculated. As both samples are independent we used the Two-Proportion z -test. The z -test is used to measure the difference between two proportions (Peck, Olsen and Devore, 2008: 176).

Results and Discussion

As we have mentioned, 215 students took part in the first pre-credit test, including 91 males and 124 females. In the second pre-credit test there were 161 students, 67 males and 94 females. The results of each task (number of successful students) at the end of the winter term 2014/2015 (the first group) are shown in Table 1. Similarly, the results of the second group who wrote the pre-credit test at the end of the winter term 2015/2016 are given in Table 2. We did not compare the results according the gender. Using a simple comparison of these tables we can see that there is a significant increase in the success in all the tasks. This observation is consistent with the hypothesis H1 that open source programs, online calculators and other ICT enable students to overcome difficulties in mathematics and the obtained knowledge is more permanent.

Task	Together
domain of function	25 (11.6 %)
graph of quadratic function	28 (13 %)
graph of exponential function	18 (8.3 %)
limit of function	26 (12.1 %)
intervals of the monotonicity	18 (8.3 %)
interval of concavity, convexity	15 (7 %)
matrix equation	11 (5.1%)

Table 1: Results of the first group, 2014 (source: own calculation)

Task	Together
domain of function	72 (44.7%)
graph of quadratic function	95 (59%)
graph of exponential function	78 (48.4%)
limit of function	65 (40.4%)
intervals of the monotonicity	84 (52.2%)
interval of concavity, convexity	81 (50.3%)
matrix equation	112 (69.6%)

Table 2: Results of the second group, 2014 (source: own calculation)

Each sample includes at least 10 successes and 10 failures, which is the assumption to use the Moivre-Laplace Central Limit Theorem for approximation Binomial distribution by normal distribution. The lowest number of successes in the case of the 1st sample (7^{th} task) is 11. The null hypothesis $H_0 : \pi_1 = \pi_2$ means that the success in both groups is the same. The alternative hypothesis $H_1 : \pi_1 < \pi_2$ means that the second group is more successful (where π_1 and π_2 are expected (population) proportions in the first and the second group).

Auxiliary calculations and explanation:

Pooled sample proportion p (where p_1 and p_2 are objected sample proportions in the first and second group, n_1 and n_2 are sizes of both samples – number of values):

$$p = \frac{p_1 n_1 + p_2 n_2}{n_1 + n_2} \tag{1}$$

Standard error SE of the sampling distribution difference between proportions:

$$SE = \sqrt{p(1-p)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)} \tag{2}$$

Test statistic z (z -score, random variable with standardized normal distribution):

$$z = \frac{p_1 - p_2}{SE} \tag{3}$$

Significance z (the p -value is the probability of observing a sample statistic as extreme as the test statistic). It is calculated or left-sided alternative hypothesis.

$$\text{Sig } z = \Phi(z) \tag{4}$$

It is quite clear from Table 1 and Table 2 that the second group who used Wolfram|Alpha regularly achieved better results in the pre-credit test. As an example of z -test we chose the fourth task (limit of function) of the smallest differences between sample proportions. The MS Excel spreadsheet was used for calculations.

Pooled sample proportion p :

$$p = \frac{p_1 n_1 + p_2 n_2}{n_1 + n_2} = \frac{0{,}121 \cdot 215 + 0{,}404 \cdot 161}{215 + 161} = 0{,}242 \tag{5}$$

Standard error SE :

$$SE = \sqrt{p(1-p)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)} = \sqrt{0{,}242 \cdot 0{,}758\left(\frac{1}{215} + \frac{1}{161}\right)} = 0{,}045 \tag{6}$$

Test statistic z :

$$z = \frac{p_1 - p_2}{SE} = \frac{0{,}121 - 0{,}404}{0{,}045} = -6{,}29 \tag{7}$$

Significance z (p -value):

$$\text{Sig}\, z = \Phi(-6{,}29) = 0{,}000... \tag{8}$$

The result (p -value) presents the probability less than 0,001. It means that the null hypothesis H_0 is rejected at the "standard" level of significance $\alpha = 0{,}05$ but also $\alpha = 0{,}001$ (extremely significant). We accept the alternative hypothesis that the second group was more successful in the fourth task.

Conclusion

Appropriate integration of modern forms of teaching methods including computer programs, online calculator, applets etc. is a frequently discussed topic at universities. It could seem that it is quite common to use ICT in subjects in which we use quantitative methods (Fiala, 2014: 110, Fiala, 2015: 104). But many mathematical teachers refuse this and prefer classical teaching without computer support. These teachers do not consider the fact that mathematics should prepare students to other subjects based on quantitative methods. They do not keep in mind that many researches confirm that information and communication technologies help to improve the education and make it more attractive. In this paper we present our experiences with using the computational knowledge engine Wolfram|Alpha in mathematical courses. We confirmed in our research that students accept appropriate integration of new methods, and as a result, they improve their mathematical knowledge.

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IS EDUCATION THE GATEWAY TO HIGHER WAGES?

[1]Lubos Marek, [2]✉Petr Doucek

[1]Department of Statistics and Probability, Faculty of Informatics and Statistics, University of Economics, Prague, Czech Republic

[2]Department of Systems Analysis, Faculty of Informatics and Statistics, University of Economics, Prague, W. Churchill Sq. 1938/4, Prague 3, 130 67, Czech Republic, +420 224 095 475, doucek@vse.cz

Abstract

The aim of this article is to analyze wages received depending on the level of education. We have data on wages from the Czech economy for the years 2000-2014. This is the data for the entire Czech Republic broken down by educational levels. The data are divided into six categories according to these levels: elementary, secondary vocational, secondary, bachelor, master's and PhD. For each category we have basic statistical characteristics: mean, median, quartiles (25% and 75% quantile), the first and last decile (10% and 90% quantile), and rate variability (standard deviation and coefficient of variation).

We also have working hours - data are tracked for the second quarter of the calendar year because just in this quarter, the working hours are most stable in the long term which guarantees the data can be compared. Because the data are in the form of time series, we will be interested not only in the comparison of different characteristics but also in their development in time. We will also be interested in the redistribution rate in each group. To compare it we will calculate the Gini Index. Results show positive impact of education level on average wage and we did not confirm the research question about "increasing education equality grows in line with average wages" in this article.

Keywords

Level of Education, Gini index, Wages by Level of Education

Introduction

Among regularly examined characteristics of economic development of virtually every state is tracking time series of the development of income individuals (Bartosová, and Longford, 2014) or families (Malá, 2015), wages or salaries. A number of works have been examining the wage issue in the recent period from different perspectives. One of the areas where we analyze wages is the sector of information and communication technologies (ICT) (Maryska, Doucek and Nedomová, 2015; Nedomova and Doucek, 2015; Doucek, Nedomová and Maryska, 2015). In addition to general research on wages in ICT, one can find analyses of various aspects, such as inequality of wages by gender (Nedomova and Doucek, 2015). The general development of wages in the Czech economy is dealt with by (Hanclová, 2006; Marek, 2010; Marek, 2013), for example. The **aim of this article is to analyze wages received depending on the level of education**. When analyzing wage equality in the individual categories we formulated a "**Research questions**". The first one was: '**With increasing education equality grows in line with average wages. (RQ1)**' and the second one was: "**The level of education has a positive impact on average wage**" **(RQ2).** This article offers a somewhat different perspective on wages as it analyzes wages in the Czech economy according to educational levels. Besides development of

wage amounts in time we examined the equality in wage distribution according to attained educational levels.

Methodology

We performed the entire analysis in the program MS Excel. We did the basic comparisons in the form of tables and graphs. To construct wage characteristics we employed the basic statistical functions. The data are observed over years 2000-2014, therefore data are in the form of time series. The data development in time is shown in graphs.

We have a yearly time series whose values are always given for the second quarter of the calendar year. Reported values of individual characteristics therefore do not represent a direct data for the year - this is information related to the second quarter. This means that the values may differ from officially referred statistics for the entire year. However, the differences are minimal, as we discovered during our investigation. The second quarter was selected because of the comparability of working time – in this quarter the working times are in the long term very stable, which ensures the comparability of data over time. The source of the data is the firm Trexima, Ltd. (Trexima, 2016), which conducts statistical surveys for the Ministry of Labour and Social Affairs and the Czech Statistical Office – see sample file ISPV (ISPV, 2016) – Information system on average earnings.

The data set consists of data for the entire Czech Republic divided according to the level of education. The data are divided into six groups according to levels of education: elementary, secondary vocational schools (secondary vocational), secondary, bachelor's, master's and doctoral. For each data group we have basic statistical characteristics: mean, median, quartiles (25% and 75% quantile), first and last decile (10% and 90% quantile) and variability rate (standard deviation and variation coefficient). In addition to these characteristics, we also have a table of interval frequency distribution - the absolute numbers are presented in wage intervals of 500, which provides the possibility of a very detailed analysis of the data. We can therefore construct empirical frequency distribution, which, as we say below (Figure 2 and Table 3) has a very interesting course. We used the frequency distribution table to construct wage division polygons which are an empirical opposite of probability distribution (Hindls, Hronová and Seger, 2003). For inequality measurement, we used the Gini index approach (Gini, 1912). Gini index measures the extent to which the distribution of income (or, in some cases, consumption expenditure) among individuals or households within an economy deviates from a perfectly equal distribution. A Lorenz curve plots the cumulative percentages of total income received against the cumulative number of recipients, starting with the poorest individual or household. The Gini index measures the area between the Lorenz curve (Gini, 1912) and a hypothetical line of absolute equality, expressed as a percentage of the maximum area under the line. Thus a Gini index of 0 represents perfect equality, while an index of 1 implies perfect inequality (Worldbank, 2016).

Data analysis - Results

Average Wages

First, let us look at the development of the average wage for the whole Czech Republic regardless of education, and for each of its levels. Each time series in the graph from top to bottom corresponds to the description in the legend.

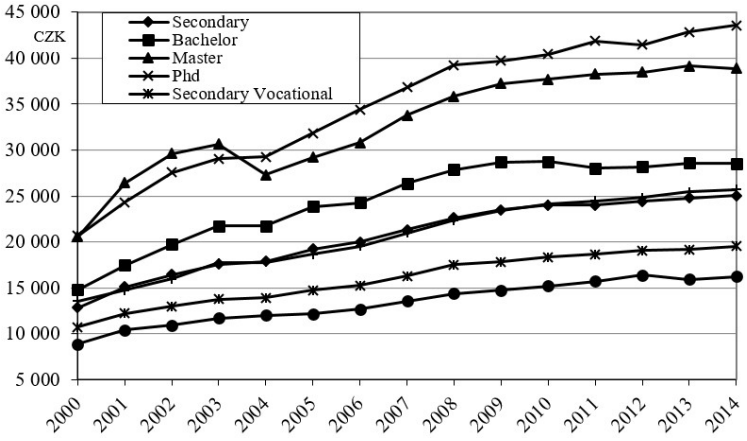

Figure 1: Development of Average Wage in the Czech Economy by Educational Level

Figure 1 shows the following facts:

- average wages rise in line with educational levels (**positive answer to RQ2**),
- average wages rose in time in all categories until 2010, then their rise slowed down or in some years they declined slightly – these fluctuations are best seen in the bachelor's category,
- it is evident that the average wage for entire Czech Republic almost equals the average in the secondary education category. The differences are relatively small, on the order of tens or several hundreds of crowns,
- average wage in the categories 'master' and 'PhD' is markedly higher than the average for entire Czech Republic,
- master's average wage is CZK 38,891, but if a master holds a PhD, the average wage rises to CZK 43,544.

Because we analyzed data behaviour in time, we interspersed the data for the elementary and doctoral category a linear trend function (according to the determination index, the straight line was best). Growth in GDP and overall auspicious development of the economy in 2015 and 2016 indicate that actual growth in wages may be faster than an analytical linear trend would suggest. This is despite the fact that in the last few years the average wage grew slowly, was sluggish or slightly declined in some categories.

Quantiles

The quantile characteristics would be very similar although the values would be on other levels. This is evident from the following table presenting some quantile rates for 2014. The symbols have these meanings: D1 – 10% quantile, Q1 - 25% quantile, median - 50% quantile, Q3 - 75% quantile, D9 - 90% quantile.

	D1	Q1	Median	Q3	D9
Elementary education	9,431	11,393	15,106	19,663	24,438
Secondary vocational	11,041	14,078	18,399	23,559	29,355
Secondary education	14,277	18,200	22,618	28,596	36,253
Bachelor's education	16,517	20,235	25,201	32,058	41,225
Master's education	20,053	23,381	29,431	42,706	64,417
PhD	22,025	26,808	35,710	49,731	71,239
Czech Republic	12,570	16,821	22,074	28,794	39,182

Table 1: Wage Quantile Rates – Year 2014 in CZK

Table 1 shows some following facts:

- just like the average, the quantile characteristics for elementary education and secondary vocational differ significantly. The values are markedly lower in all cases than the other categories,
- values of the quantile rates rise in line with the level of education,
- 25 % masters (without PhD) have a wage higher than CZK 42,706, 25% masters with PhD have a wage higher than CZK 49,731,
- our calculations (we performed the calculations from tables of absolute frequency distribution, which are not included as they are too voluminous) indicate that the average for the Czech Republic (CZK 25,728) is approx. 66% quantile, yet the median (50% quantile) in the categories master (CZK 29,421) and PhD (CZK 35,710) exceeds this value markedly.
- it is not difficult to calculate that for entire Czech Republic a wage lower than the average is received by 66% of employees; in the elementary category it is 91.5%, in the category secondary vocational 80.5%, in the category secondary 63.1%, in the category Bachelor it is 50.6%, in the category master 37.5% and in the category PhD a mere 21.7%. If we look at these figures from the other side, this means 78.3% in the category PhD have a wage above the average for the Czech Republic,
- the lower quartile (Q1) on the level PhD is higher than the bachelors' median (a quarter of employees with PhD receive a wage lower than CZK 26,808, while one half of employees with bachelor's education have a wage lower than CZK 25,201).

We could continue with such comparisons but an observant reader can easily get the picture using the data in the tables.

Wage Division Polygons

We used the frequency distribution table to construct wage division polygons which are an empirical opposite of probability distribution (Hindls, Hronová and Seger, 2003). Figure 2 shows frequency polygons for each educational level for the year 2014. Figure 2 shows clearly that the categories differ markedly in the basic characteristics. The wage distribution position is completely different, as is its variability, slope and pointedness. The fact that the curves are not smooth is due to us working with empirical frequencies and not with a model. The data could be naturally modelled with a theoretical probability distribution (Marek, Vrabec, 2013), but it is not the subject of this article. The individual educational levels are clearly defined. It can be seen that:

- lowest position rate (estimated as arithmetical mean) shows elementary education. Distribution shifts to the right with its growing level,
- elementary education has lowest variability, PhD highest. This means that on the PhD level are the biggest differences in wages,

- elementary education has biggest pointedness, with rising level pointedness declines,
- elementary education least sloped, slope increases with rising educational level,
- tail of a distribution (incomes over CZK 100,000) is very prominent on the levels master and PhD, in elementary education the average wage hardly exceeds the value of CZK 100,000.

Since the average wage values over CZK 100,000 are mainly in the categories master and PhD (they are very similar), let us look at the polygon in the PhD category over 15 years. Figure 2 shows clearly that empirical frequency distribution changes over time its position, variability, inclination and pointedness. It is the same after all in all the education categories. What is completely different is the great rise in wages over CZK 100,000. If at the beginning of the monitoring of these wages (in the category scientific qualification) it was a mere 0.47%, in 2014 it was already 3.77%. It is plain that the percentage of high wages will continue to increase and the other characteristics will follow suit. The comparison in Table 2 shows how the situation changed in all the categories over time.

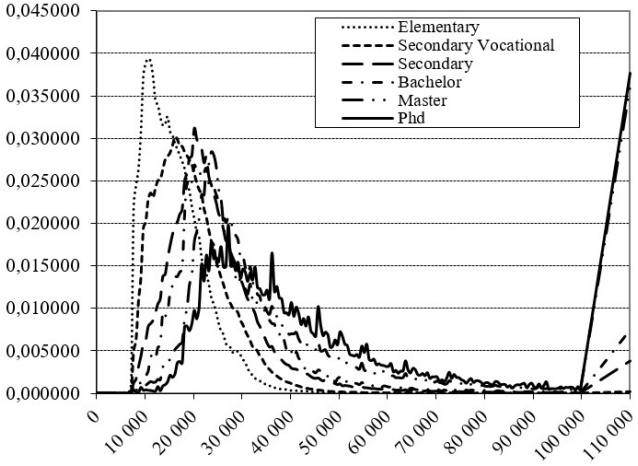

Figure 2: Frequency Polygons by Educational Level for 2014

Educational category	Percentage of wages over CZK 100,000	
	2000	2014
Elementary education	0.00	0.00
Secondary vocational	0.00	0.02
Secondary education	0.03	0.04
Bachelor's education	0.43	0.74
Master's education	0.77	3.62
PhD	0.47	3.77

Table 2: Changes in Tail of Distribution in Wages CZK 100,000 in Percentage Points

Figure 3 shows frequency polygons for the PhD level. When all the years were included the graph was difficult to read (the data overlapped), we chose for the purposes of illustration the years 2000, 2004, 2008, and 2014. They show sufficiently how on the PhD level the frequency distribution contour changes over time. It is similar in the other categories with one difference: incomes over CZK 100, 000 have a much lower frequency (or zero frequency as in elementary education).

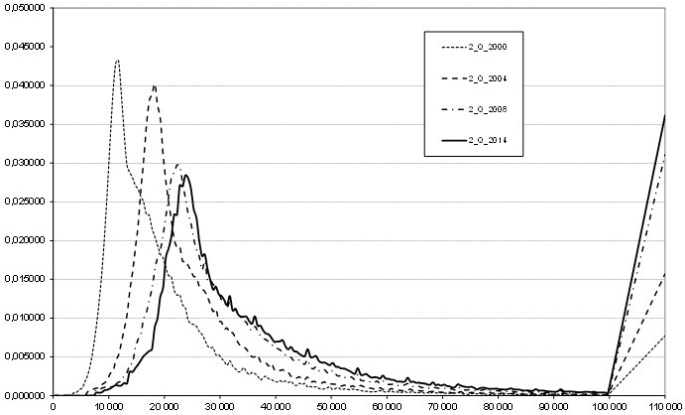

Figure 3: Wage Polygons for Master's Level of Education in 2000 - 2014

Gini Indexes by educational category

Wage inequality between categories of workers by attained level of education is another view of the wages in the Czech economy. We assessed it with Gini Indexes whose values for each category are shown in Table 3.

Year	Elementary education	Secondary vocational	Secondary education	Bachelor's education	Master's education	PhD
2000	0.206	0.198	0.220	0.310	0.312	0.254
2001	0.200	0.191	0.215	0.259	0.312	0.254
2002	0.200	0.189	0.214	0.268	0.302	0.269
2003	0.191	0.185	0.205	0.249	0.303	0.264
2004	0.196	0.190	0.197	0.204	0.297	0.257
2005	0.196	0.196	0.207	0.212	0.274	0.247
2006	0.201	0.198	0.210	0.214	0.267	0.252
2007	0.199	0.197	0.215	0.229	0.271	0.256
2008	0.204	0.202	0.217	0.227	0.278	0.260
2009	0.204	0.195	0.213	0.227	0.283	0.261
2010	0.195	0.195	0.212	0.227	0.280	0.261
2011	0.202	0.195	0.215	0.218	0.281	0.259
2012	0.202	0.199	0.215	0.221	0.282	0.266
2013	0.205	0.203	0.220	0.224	0.284	0.267
2014	0.208	0.206	0.220	0.226	0.284	0.263

Table 3: Evolution of Gini Index for the Reference Levels of Education in 2000 – 2014

Note on Table 3: Value of Gini Index for entire Czech economy was 0.255 in 2014.

Answers to this research question are shown in Table 3. We identified greatest equality in the category secondary vocational and elementary education. The reason for it is that professions in these two categories are relatively consistent from the point of view of wages - lower wages for employees without managerial positions. Here the Gini Index only exceeded the value of 0.2 after 2012. The Gini Index values for secondary education are insignificantly higher – 0.22 in 2014. On these three levels the Gini Index value decreased until 2003 and hence distribution of wages was more equitable. Since this year inequality in wage distribution has been gradually increasing although the approximation

line slope is very low (elementary education 0.0004 with a dependency of only 0.1588, secondary vocational education 0.008 with a dependency of 0.4669). Evolution of the Gini Index of average wages for secondary education and a fall in the index still continued in 2004, but since that year the dynamic was greater. In the three educational categories the values of the Gini Index at the beginning and end of the period under review do not much differ (elementary education 2000 - 0.206, 2014 - 0.208; secondary vocational education 2000 - 0.198, 2014 - 0.206; secondary education 2000 - 0.220, 2014 - 0.220).
On the master's level the value of the Gini Index was 0.226 in 2014, although the history of its evolution was much more dramatic. Until 2004 the bachelor's position was forming in the Czech market and there were very few of them and they held master's posts, or they were graduates from foreign universities with company management. This is why the index values begin in 2000 on the master's level and since then this position sought its place until a greater number of bachelors appeared in the Czech market and they assured the corresponding values of the Gini Index – minimally since 2004 but steadily increasing to the value of 0.226.
Next in line by the size of the Gini Index is the master's level. The value of the index evolved from 0.254 in 200 to 0.263 in 2014. The highest value of the Gini Index and hence lowest equality in the distribution of wages is on the level of master's education. This educational category is the only one where the index decreased in the period under review (0.312 in 2000, 0.284 in 2014). The inequality by these jobs is caused by relative large share of masters in upper and top management positions. The lot of them are employees with wage higher than 100,000 CZK – see Figure 3. The decreased in the Gini Index before 2006 indicates a certain diversification of experts in this educational category and their more even distribution in income groups. Therefore, the **answer to our research (RQ1) question is negative**.

Conclusion

Our conclusion is definitive: Higher education really entails a higher wage. The differences are quite considerable. If we consider the order from the lowest education to the highest and compare two adjacent categories, we see the sharpest difference between the bachelor's and master's category, and between the secondary and secondary vocational. This confirms the widely known fact that there is a huge difference between the three educational levels - elementary (together with secondary vocational), secondary school and university (master and PhD). Differences are also in the first and third category. Concerning the relation between average wages in each group and the total average, wages in the elementary category and secondary vocational differ sharply; the secondary category is roughly equal to the total national average (differences on the order of hundreds of crowns) and university education clearly occasions much higher than average.
Gini Indexes and evolution of their values indicate that most equal wage distribution is in elementary and secondary vocational education. Inequality increased in line with rising educational level. The highest degree of inequality in wage distribution is the master's level which exceeds the PhD level. The value of the PhD level is almost identical to the Gini Index value for entire Czech economy.
If we make a comparison in time, we will see that wages either increased or stagnated for 15 years (in the last 3 years). The growth tempo changed, however, and it was lower in the last years than in the preceding years. During 15 years the wage distribution changed the basic characteristics – position on the 'x' axis shifted to the right (average wage grew), variability increased (this means differences between wages as such increased), the slope

decreased (this means the distribution is flatter as it broadened) and pointedness increased (differences between wages are greater, and high wages distant from the mean increase). Wages in excess of CZK 100,000 increase in frequency markedly in time; these high wages are 'pushed' up by the group with university education.
The definitive conclusion is therefore: **Invest in your education, it pays off!**

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[1]✉Klara Margarisova, [2]Katerina Kuralova,
[3]Lucie Kvasnickova Stanislavska

[1]Department of Management, Faculty of Economics and Management, Czech University of Life Sciences Prague, Kamýcká 129, Prague 6 - Suchdol, 165 21, Czech Republic, +420 224 382 254, margarisova@pef.czu.cz

[2]Department of Management, Faculty of Economics and Management, Czech University of Life Sciences Prague, Czech Republic

[3]Department of Management, Faculty of Economics and Management, Czech University of Life Sciences Prague, Czech Republic

Abstract

In recent years the importance of sharing knowledge increases. This paper discusses the area of knowledge acquisition and sharing. The article deals with knowledge sharing strategies within selected companies in the Czech Republic. The main objective is to identify the approaches of those companies to knowledge sharing. In the theoretical part importance of knowledge and their sharing is highlighted. The paper focuses on methods of employees‘ knowledge development and on used knowledge sharing strategies. Presented conclusions are based on questionnaire survey among almost 200 managers of Czech companies of selected CZ-NACE sections (Information and communication companies, Finance and insurance and Professional, scientific and technical activities).

Keywords

Knowledge, Tacit knowledge, Knowledge sharing, Strategy, Employee training and development

Introduction

In knowledge age an organization is one that learns, remembers, and acts based on the best available knowledge (Dalkir, 2005).

Although knowledge is described as the only asset that isn´t consume by use and is understood as the only meaningful economic resource in the knowledge society (Drucker, 1993), there are many barriers that prevent knowledge sharing (Riege, 2005, Drucker, 1993). And also many organizations are unable to function as knowledge based organizations, because they suffer from learning disabilities (Senge, 1990).

Knowledge management is the deliberate and systematic coordination of an organization´s people, technology, processes, and organizational structure in order to add value through reuse and innovation. One possible way to achieve this is by creating, sharing and applying knowledge (Dalkir, 2005).

Knowledge is becoming an important resource that affects the performance of an organization if it can be shared, spread and used at the enterprise level (Lahti and Beyerlein, 2000). Riege (2005) considers the process of sharing knowledge one of the cornerstones of knowledge strategy of many businesses.

McDermott (1999) states that sharing of knowledge takes place between a person whose knowledge is being shared and another person with which he or she is sharing the

knowledge by means of his or hers thinking and understanding to help the other person understand his or her situation. The person who shares and distributes knowledge should be aware of the purpose for which the knowledge is being shared and used and whether there is a need of sharing this knowledge on the part of the person receiving it. I.e. whether it will be really used and applied afterwards.

Sharing of knowledge differs from the transfer of knowledge. Transfer of knowledge includes both sharing of knowledge on the part of the sender and its reception and subsequent application on the part of the receiver. It is rather used to describe the "movement" of knowledge between organization units or between different organizations rather than between individuals (Szulanski, Cappetta and Jensen, 2004).

Riege (2005) believes that the greatest importance lies in sharing tacit knowledge, the bearers of which are the company employees. Since, as opposed to other intangible resources, they are not covered by the right of ownership of the enterprise. Nonaka and Takeuchi (1995) state that sharing of tacit knowledge between a number of individuals from different environments with different perspective and motivation enables the formation of new knowledge.

Various approaches to knowledge sharing strategies could be found. For case of the research four of them derived from the paper of authors Chen, Sandhu and Jain (2009) were used:

- *Communities of practice* - groups of people who do some sort of work together to help each other by sharing tips, ideas and best practices.
- *Knowledge networks* - a more formal and structured team based collaboration that focuses on domains of knowledge that are critical to the organization which is part of their standardized job
- *Retrospect* - an in-depth discussion that happens after completion of an event, project or an activity to basically capture lessons learnt during the entire activity. At the end of the session, a documented review of the project process is created.
- *Storytelling* - a story telling session whereby the person who attends an event or training session is given the opportunity to disseminate the information/knowledge gained to others within the organization.

The main objective of this study is to identify the approaches of selected Czech companies to acquire and share knowledge. In the backdrop of this, the presented research study aims to determine the importance of sharing knowledge for creation of competitive advantage of an organization and methods used to spread explicit and especially tacit knowledge among employees. To achieve these objectives secondary as well as primary data will be used.

Materials and Methods

A survey of the MEDIAN s.r.o. agency showed that to do their job successfully, in the commercial sphere, employees in the finance, information and communication technology, management and marketing spheres employee have to continually improve and educate. Based on the above definition of population, the survey aimed at executives of organizations in these three fields. More specifically, it were the employees of companies sorted by CZ-NACE into the following three categories. SECTION J - Information and communication companies, SECTION K - Finance and insurance and SECTION M - Professional, scientific and technical activities. Another criterion for the selection of respondents was the size of the organization, determined by the number of employees. Only organizations with ten or more employees took part in the survey. Those respondents

that work in a company for less than three months were excluded from the survey. This was to avoid distortions caused by lack of knowledge of the environment. Questionnaires were submitted by 196 respondents working on an executive positions, which represents a return rate of 11.4 %. Questionnaires (18) which failed to meet the above criteria were excluded.

The most of respondents were males (69.7%), women were less than a third (30.3%) of the sample. The most respondents were in the age group 35-44 years (33.1%), followed by the category 25-34 (29.7%) and by the category of 45-54 years (20%). Less represented were in age categories 55 or older (14.3%) and the age category under 25 years (2.9%). Among respondents dominate university graduates (69.9%) followed by respondents with high school graduates (21.6%). The rest of the sample consists of respondents with higher professional education (6.8%), secondary school (1.1%) and primary education (0.6%) absolvents.

In the sample dominated by those who are employed in organizations for more than 5 years (69.1%). Almost a quarter of respondents (23.6%) stated length of employment from 1 year to 5 years and only 7.3% from 3 months to 1 year. Survey respondents most often occupy a position at the lower management level (57.5%). Almost a quarter (23.5%) of the respondents work at the position of middle management and 19% at top management positions.

Results

Employee training and development methods

Respondents were asked about the methods used in their organizations for training and further development of the employees. In the list of various methods respondents were offered a balanced ratio of conventional methods (attendance at conferences, lectures, workshops, case studies, assignment of tasks) and methods (mentoring, couching, consulting, learning one from another, sharing of experience in the form of stories – were chosen based on Mládková, 2005) with stronger potential of transfer of implicit and particularly tacit knowledge.

As shows Fig. 1 from the conventional methods respondents most frequently opted for assignment of tasks (75.8%), followed by attendance at conferences (53.4%), workshops (52.2%), lectures (42.1%) and the least frequent possibility - using case studies (25.8%).

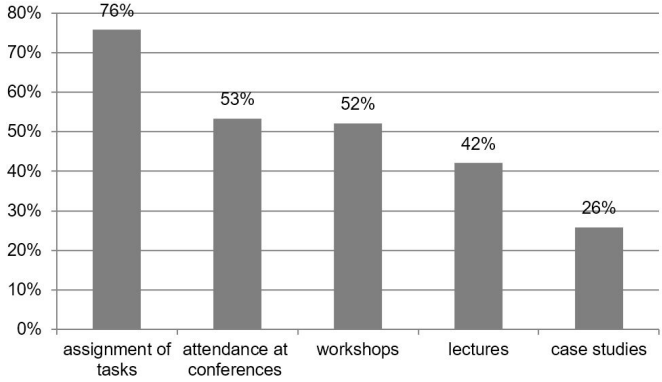

Figure 1: Application of traditional methods

From the Fig. 2 it is clear that for the methods of transferring tacit knowledge, respondents most frequently opted for learning one from another by means of sharing knowledge (77.5%), followed by consulting (73.6%). A significantly smaller number of respondents opted for the possibility of coaching (37.6%), mentoring (25.8%) and sharing of experience in the form of stories (23%).

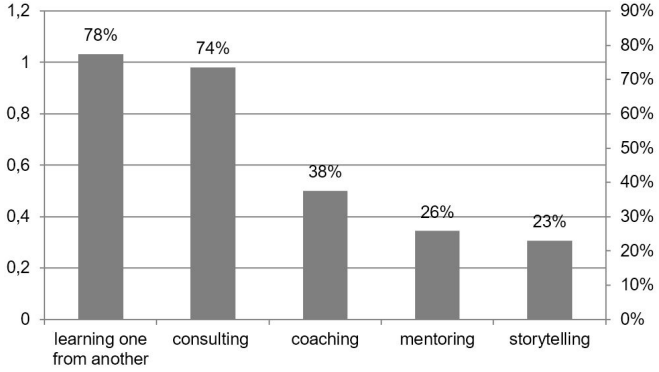

Figure 2: Application of methods enabling the transfer of tacit knowledge

The most frequent of all methods was learning one from another by means of sharing knowledge, which is a method suitable for the transfer of implicit as well as tacit knowledge.

Nearly half (48.9%) of respondents believe that: "Learning process has mostly a social nature, that means that is takes place in interaction with other people rather than individually." Only 10.7% disagree with this statement. This supports high frequency of certain methods (Learning one from another, consulting) that enable sharing of tacit knowledge, i.e. those that can be transferred only in direct interaction.

Knowledge sharing strategy

Just under 14% (13.5%) of respondents declared that their organization has no strategy for sharing knowledge. This indicates that great importance is attributed to knowledge and it's sharing in the surveyed fields.

This is supported by the result of another question aimed at the impact of sharing knowledge on competitive advantage of an organization. More than 70% of respondents (71.3%) believe that sharing of knowledge between employees forms the foundations of creating a competitive advantage. A similar number of respondents (68.5%) thinks that it is worth changing some factors in an organization to bring improvement in the area of sharing of knowledge.

As far as the specific strategy for sharing of knowledge is concerned, respondents were given four basic alternatives derived from the work of Chen, Sandhu and Jain (2009). Respondents had also the choice to add another possibility, which however remained unused. The results are shown in Fig. 3.

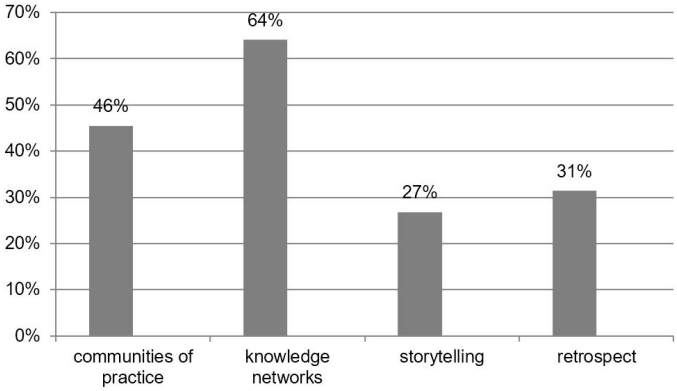

Figure 3: Knowledge sharing strategy – Frequency of use of different tools

Most participants (64%) responded that the strategy for sharing of knowledge in their organization is based on supporting the creation and operation of formalized groups, which are based on team work and focus on the specific field of knowledge crucial for the company.

The second most frequently used tool (46%) are mostly informal groups of people sharing a similar type of work and helping each other by sharing tips, ideas and best practices, i.e. communities of practice as defined e.g. by Wenger, McDermott and Snyder (2002).

A significantly smaller amount of respondents opted for the possibility of retrospect discussions (31%) that follow after finishing an event, project or activity and lead to capturing experience. Even low amount (27%) chosen option of meetings based on storytelling, through which a person who visited an event, training or conference has the opportunity to spread the obtained information and knowledge among other employees.

The highest number of respondents (41%) claimed that the strategy for knowledge sharing of their organization is based on one of the tools above. A significant number (30.3%) of respondents however used a combination of two of the tools. A combination of more than two tools is less frequent (10.7% - 3 tools, 4.5% - 4 tools).

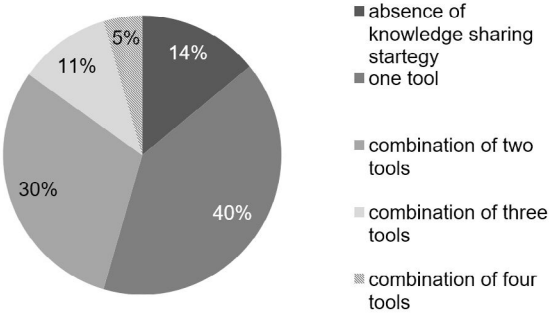

Figure 4: Knowledge sharing strategy – Diversity of tools

Discussion

In comparison with the results of similar survey (Margarisová, Kuralová and Kvasničková Stanislavská, 2014) conducted in the field of higher education, where high need to

continually improve and educate could be also expected, some differences could be found. Frequency of the answers showed that universities are mainly concerned about transferring explicit knowledge. Only 1 out of the 5 most frequent options (consulting) has higher potential for a transfer of tacit knowledge. In the case of selected companies from the commercial sphere, the ratio is 2:3 in favor of the traditional methods. But the methods with higher potential to spread tacit knowledge reached the first and third highest frequency (Fig. 1 and 2).

In both cases the majority of the respondents (82.35% - universities and 71.3% - commercial sphere) stated that knowledge sharing is one of the key elements for the creation of competitive advantage.

Only one respondent (5.9%) stated that the university does not have a strategy for knowledge sharing. In commercial sphere it was more than twice as many, but still only 13.5% (Fig. 4).

Conclusion

The results show that companies are aware of the importance of knowledge. The most of respondents believe that knowledge sharing is crucial for creation of competitive advantage.

They use wide range of methods for employee training and development as well as various tools for knowledge sharing and dissemination. Results show that the organization of the surveyed industries use traditional methods as well as methods which enables sharing of tacit knowledge, especially learning one from another and consulting.

There is room for improvement could be found in using of certain tools for knowledge sharing. Only a small amount of respondents stated that their organization uses retrospect and storytelling. However, both of these tools can be very useful. Retrospect discussions allow to learn from own mistakes or vice versa identify best practices and spread them among employees. They could help to prevent making the same mistakes or seeking for solution that is already found. On the other hand storytelling allows disseminate new knowledge and techniques.

Based on these findings, future research will be focused on the area of tacit knowledge sharing within the selected companies.

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RICH-MEDIA USED AT SECONDARY SCHOOLS AS RESULT OF MERLINGO PROJECT SWOT ANALYSIS

Ivo Martinik

Department of Applied Informatics, Faculty of Economics, VŠB-Technical University of Ostrava, Sokolská třída 33, Ostrava, 701 21, Czech Republic, +420 597 322 235, ivo.martinik@vsb.cz

Abstract

The term *rich-media* is a synonym for the digital interactive multimedia. The MERLINGO project (*MEdia-rich Repository of LearnING Objects*) is designed for the management of the central repository of the learning objects based on the rich-media technologies. Although the IT technologies penetration reaches the world standard within the Czech universities and the secondary schools, the exploitation of the eLearning technologies including the rich-media in everyday teaching and learning is far behind expectations. This was changed at the selected secondary schools that participated in the project "Clever helpers for teaching - using ICT in a simple and creative way". Based on the SWOT analysis of the MERLINGO project and the earlier pilot project at one of them, the Slavonic Grammar School in Olomouc, new approach to rich-media based recording of presentations has been introduced, including completely symmetric asynchronous communication channels between teachers, students and their parents. The article presents the main results of the project.

Keywords

Asynchronous communication, EduArt, MERLINGO, SWOT analysis, secondary schools, rich-media

Introduction

One of the burning questions at majority of universities and secondary schools in the Czech Republic is maintaining and increasing the teaching process quality at the permanently growing interest in studies. Using of eLearning technologies generally has been of a great assistance while addressing the stated issue however it is obvious, that conventional eLearning text study resources cannot fully substitute direct or indirect interactions of teachers with their students. The complex rich-media visualization of the tutorial presentation thus becomes the absolute need for the overall transfer of the taught content from teacher to students (Martiník, 2012).

The term *rich-media* is a synonym for the digital interactive multimedia. Rich-media includes audio, video, or other elements that encourage users to interact with the content. Rich-media are being often used for the support of synchronous and asynchronous type of bidirectional communication, through which it is possible to share and transfer the digital content and communicate interactively in the real time. The characteristic feature of the rich-media technologies is their support of dynamics of changes and accessibility on-line or on-demand. An example can be complex ads that is updated during broadcast and can elicit user response in real time, or a record of teachers' presentation accessible in the virtual university environment jointly with the synchronized slide show, which the student can interactively work with. Currently, there are several theories dealing with various aspects of the rich-media implementation, such as *Media Richness Theory* (Daft and Lengel, 1986), *Media Naturalness Theory* (Kock et al, 2008) and *Social*

Presence Theory (Short, Williams and Christie, 1976). MERLINGO project (*MEdia-rich Repository of LearnING Objects*) is designed for the management of the central repository of the learning objects based on the rich-media technologies accessible within the Czech national academic computer network CESNET2 (MERLINGO, 2016).

It can be seen at the present time, that the growing popularity of mobile multi-media devices and general availability of internet services allows communication between providers and receivers not in direct, but in asynchronous way. So this is an actual field of research (Borup, West and Graham, 2013) in the areas of asynchronous videoconferencing (Tang et al, 2012) and Human-Computer Interaction, massively invested by companies such as Apple, Microsoft, Polycom, Phillips, etc.

Although the information and communication technologies (ICT) penetration reaches the world standard within the within the Czech universities and the secondary schools, the exploitation of the new eLearning technologies including the rich-media technologies in everyday teaching and learning is far behind expectations. This was changed at the selected secondary schools that participated in the project "Clever helpers for teaching - using ICT in a simple and creative way" that was directed together by the University of Ostrava and the VŠB-Technical University of Ostrava. Based on the SWOT analysis of the MERLINGO project (Martiník, 2012) and the earlier pilot project at one of them, the Slavonic Grammar School in Olomouc, new approach to rich-media based recording of presentations has been introduced, including completely symmetric asynchronous communication channels between teachers, students and their parents. The article presents the main results of the project obtained at the Slavonic Grammar School in Olomouc where the progressive programming system *EduArt* (EduArt, 2016) featuring unique characteristics in the area of rich-media recordings and the new asynchronous communication possibilities.

Material and Methods

SWOT analysis

SWOT analysis is an acronym for Strengths (characteristics of the business, or project team that give it an advantage over others), Weaknesses (characteristics that place the business or project at a disadvantage relative to others), Opportunities (elements that the business or project could exploit to its advantage), and Threats (elements in the environment that could cause trouble for the business or project). It is a structured planning method that evaluates these four elements of a project or a business venture (Armstrong, 1996). SWOT analysis can be carried out for a company, product, place, industry, or person. Identification of SWOTs is important because they can inform later steps in planning to achieve the objective.

Rich-media based programming system *EduArt* and its properties

EduArt (***Edu****cation* ***Art***) is a new progressive software product designed for the working with the rich-media, realization of asynchronous communication and recordings and their publishing on-line or on-demand. As opposed to similar commercially available products, this programming system can be installed and used on any device (including mobile devices) using the *Microsoft Windows* operating system. *EduArt* software can record and synchronise video and audio (from camera and microphone) with a presentation shown on the screen of a given device (using any programming system for the presentation purposes, for example *MS PowerPoint*, or a visualizer, an electronic board, a tablet, and

other devices connected to the computer with installed *EduArt* programming system via standard input interface) and at the same time it creates the metadata content of your presentation. There are synchronously recorded all the individual channels in their original distinction (i.e., audio, video, images and metadata) in the resulting output. This is how *EduArt* differs from any competitive rich-media products which record (compress) the whole presentation into one video channel. Individual images (slides) of the presentation are recorded in native resolution of the graphic card of applied computer and stored in JPG format. Next revolutionary feature of the *EduArt* system is the capability of scanning more displays of a given device. It means that for example on a primary display the course of the presentation recording can be controlled while on the second display the presentation can be displayed and sensed.

The resulting presentation recording can be then transmitted to the viewer/listener as a webcast (on-line) or as an on-demand recording that can be then accessed anytime, anywhere, in accordance with the end user needs and available options. On-demand recordings of the presentations can be exported to a web server (Internet, Intranet) or stored on a variety of storage media (CD/DVD/BD, flash disks, external drives) and then used for the asynchronous communication purposes.

Records created using the *EduArt* programming system can be viewed/played on any computer or other device that uses a web browser. The viewer can play presentations in the sequence in which they were recorded or use the option to fast-forward or to replay as needed, using the video control or thumbnails of captured slides, thereby repeating a sequence or viewing only the sections that interest him or her. All the channels (video, slides and audio) continually remain synchronised. Also other metadata can be included in the presentation such as references/URL links, which take the viewer to other, related resources on the Internet (e.g. textbooks, biographies, manuals). *EduArt* programming system is also applied in the area of adaptation of rich-media learning objects for the students with special needs.

Results and Discussion

MERLINGO project implementation was launched in 2007 and the following SWOT analysis of this project (based on its previous SWOT analysis (Martiník, 2013)) was performed in the last year:

Strengths:

- availability of the central repository of the learning objects (MERLINGO, 2016) based on the rich-media technologies within the national academic computer network CESNET2,
- relatively well equipment by ICT technologies at the secondary schools in the Czech Republic,
- verifiable improvement of the study results of the students in the context of the availability of the presentation recordings and their accessibility on-line or on-demand,
- significant financial, personal and time cost reduction joined with the creation and management of rich-media learning objects,
- enrichment of the teaching process mainly by combined and distant form,
- establishment of conditions for collaboration with other universities and the secondary schools during implementation of the project,
- support for recording of the presentations in locations which are not equipped with

a necessary infrastructure (camera and microphone systems, sound, mixing device, etc.),
- a possibility to outfit each teaching staff with their own mobile recording that could be used for preparation and publishing of a lecture at times, when such staff is outside their work place, on business trips, conferences, etc.,
- full mobility for asynchronous communication support of the *EduArt* programming system and its Czech localization.

Weaknesses:
- rich-media technologies are not integrated into the teaching process at the secondary schools,
- study materials in the form of recordings of teaching staff presentations at the secondary schools are not adapted for the students with special needs,
- relatively high purchase price of individual recording systems and the necessity of annual payment for programming support to supplier,
- limited possibility of editing and modifications (e.g., edition, post-production) of records of lectures which could be done by teaching staff without technical assistance and on a mobile device.

Opportunities:
- so far unused possibility of collaboration with the secondary schools at the Czech Republic in the area of the rich-media technologies effective use and a sufficient integration in the teaching process by teachers of the secondary schools,
- a possibility of increasing the competencies of secondary school teaching staff at ICT integration in the teaching process,
- a possibility of increasing the teaching process level at the secondary schools,
- a possibility of supporting of asynchronous communication realization between teachers and students at the secondary schools via recordings of presentations realized with the support of mobile devices,
- a possibility of mobilization of students in the teaching process at the secondary schools,
- a possibility of support of students with special needs at the secondary schools via rich-media technologies usage,
- a possibility of development continuation of the existing programming system *EduArt* determined for the recordings on the basis of rich-media technologies, that can be used on the mobile devices and its control is user-friendly and simple even for the teachers and students at the secondary schools.

Threats:
- difficulty with further funding of the MERLINGO project activities in the present economic situation of the Czech Republic,
- termination of the commercial firms whose products are used in the frame of the MERLINGO portal services (like Accordent Technologies),
- concerns of the teachers that streaming presentations may encourage absenteeism on their lectures,
- aversion (or lack of interest) of the teachers at the secondary schools to the recording of lectures realization,
- decline of commercial firms whose products and technologies are used at the support of teachers and students at the secondary schools,
- high degree of dependence on the unique knowledge of the system administrators

at the secondary schools during the realization and publication of the presentation recordings based on the rich-media technologies.

SWOT analysis of the MERLINGO project determines its future development and its project investigators´ chose the **MIN-MAX** strategy (i.e., minimization of weaknesses and maximization of opportunities). The following strategic goals were defined in the area of rich-media technologies:

- beginning all the necessary activities of collaboration with the selected secondary schools in the area of the rich-media technologies effective use and a sufficient integration in the teaching process by teachers of these chosen secondary schools,
- continuation of the development of the existing *EduArt* programming system determined for the recordings on the basis of the rich-media technologies, that can be used on the mobile devices by the teachers and students at the secondary schools,
- supporting for the asynchronous communication realization between the teachers and the students at the secondary schools via recordings of presentations realized via the *EduArt* programming system.

Currently, one of the key tasks for the MERLINGO project investigators is a pilot implementation of rich-media technologies in the educational process at six selected secondary schools which has been running already for several months within the project of "Clever helpers for teaching - using ICT in a simple and creative way".

For many years already, secondary schools in the Czech Republic are relatively well equipped by ICT. However, it has not been reflected yet in their effective use and a sufficient integration in the teaching process by teachers. Therefore, the above stated project objectives mainly involved realization of educational courses for teaching, managing and ICT staff of partner secondary schools. In that sense, rich-media technology implementation can have an irreplaceable task mainly at increasing the teaching process level, support of asynchronous communication realization between teachers and students, mobilization of students in the teaching process and last, but not least, support of students with special needs. At present, the *EduArt* programming system has been already implemented within the project at six secondary schools: Slavonic Grammar School in Olomouc, Grammar School Hello in Ostrava-Poruba, Olga Havlová Grammar School in Ostrava-Poruba, Information Technology High School in Frýdek-Místek, Secondary Vocational School of Třinec Steelworks and Secondary Technical School in Šumperk. All listed secondary schools are using for storage the rich-media recordings made by them at the central repository MERLINGO.

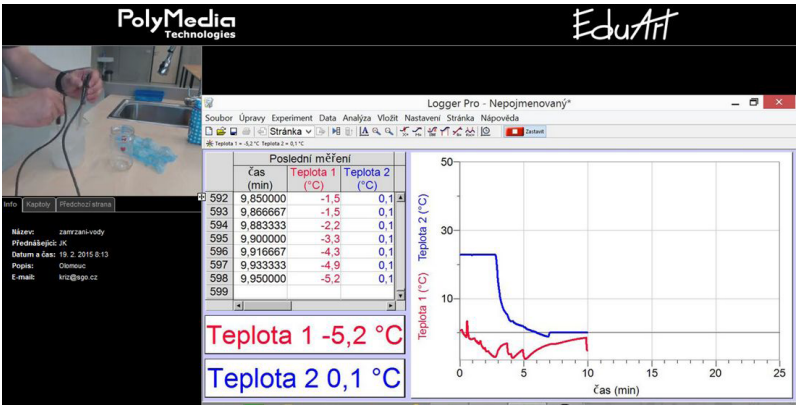

Figure 1: MERLINGO rich-media recording from physics lesson at secondary school

The following significant results in this area were achieved at Slavonic Grammar School in Olomouc:

- A group of 10 teachers is dealing with the *EduArt* programming system implementation in the teaching process. They are actively making recordings of their teaching lessons and we can say that over 300 lessons in the subjects of mathematics, physics, chemistry, German language, Spanish language, history, social sciences and the corresponding optional subjects were recorded during the last 12 months of using of the *EduArt* programming system by the teachers.
- All the recorded lessons are available in the on-demand mode by all students of relevant subjects who can go over the topic they did not fully comprehend again, or they can play back the recording from the time when they were absent, for example when they were ill.
- In total 10 mobile cameras are available for teachers that can be used by them in different lecture rooms at the Grammar School. In a specialized lecture room of physics an independent camera system has been installed including next infrastructure elements needed for making recording of presentations and their publicising in the environment of web browsers.
- Various forms of asynchronous communication of teachers with students were initiated. Certain teachers started pilot recordings of their procedure when correcting written exams via the *EduArt* programming system (see Fig. 2) (SGO, 2016). Then, those are available for particular students and they can immediately check the teacher´s objectivity at their assessment.
- Additionally, the asynchronous communication is also used in the so called pre-learning process, whereby the students have records of the selected topics presentations of the taught subjects for their disposal in advance. Hence, they can study them in detail coming to the particular lesson already equipped with information about the given topic.
- Asynchronous communication is also used in the process of the active involvement of students of this Grammar School at the recording of their individual presentations especially during the defenses of their annual works in the present time. Currently, *EduArt* software is actively used by more than 400 students of this Grammar School for the educational and also asynchronous communication purposes.

A detailed comparison of the mathematics knowledge level in students of 5 year at 8-year Slavonic Grammar School in Olomouc was carried out by their teachers. The criterion was the study results of two selected classes while students of one class had recordings of all mathematics lessons available. These students could utilize all the possibilities of the asynchronous communication on the basis of the rich-media technology, but the students of the other class had no access to those technologies. In a long run, the students by whom rich- media in the learning process were fully used showed minimally 0.5 better marking compared to the other group. Regarding selected areas of algebra (mainly the issue of solving an equation expressed as a fraction and with absolute values) there was almost 1 rating difference between those two groups in favour of the students using actively rich-media in the learning process.

Figure 2: Correcting written exams via the programming system *EduArt*

Conclusion

Generally it can be stated that implementation of the rich-media technologies at selected secondary schools significantly contribute to mobilizing students at the learning process. Through realized recordings of teaching lessons the students can both repeat the theme, and understand it better, which has obviously a positive impact on the overall level of their knowledge and improvement of their study results. Moreover, due to realization of recordings and their asynchronous availability, the mutual communication between students and teachers is significantly enriched. Hence, asynchronous communication becomes an excellent tool for the support of inclusive education as it enables access to the educational process from multiple points, various time and any number of repetition. Bearing in mind the level of school and student outfit with multimedia tools (tablets, notebooks), nothing stops it from its immediate frontal implementation. Finally it can be stated that rich-media technology implementation at secondary school environment is a pilot activity not only at the level of secondary schools in the Czech Republic, but also within the EU.

Next pilot activities realized or prepared as a part of the MERLINGO project mainly involve:

- pilot design and implementation of a mobile version of the *EduArt* programming system for the mobile platforms with the *Android* and *iOS* operating systems that will preserve the most of the original *EduArt* properties for the devices with *MS Windows* operating system,
- pilot design and implementation of the programming environment designed for the

recording, publishing and managing of asynchronous videoconferences,
- automated transcription of spoken text of the lecture recorded by the recording and assistance service into the written text and its availability on-demand and intended mainly for the students with the hearing disability.

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EXPLORING INTERACTIVE WHITEBOARDS IMPACT ON PEDAGOGICAL COMPETENCES DEVELOPMENT

[1]Liliana Mata, [2]Gabriel Lazar, [3]✉Iuliana Lazar

[1]Department for Teacher's Training, Faculty of Sciences, "Vasile Alecsandri" University of Bacau, Romania

[2]Doctoral School in Environmental Engineering, Faculty of Engineering, "Vasile Alecsandri" University of Bacau, Bacau, Romania

[3]Department in Chemical and Food Engineering, Faculty of Engineering, "Vasile Alecsandri" University of Bacau, Marasesti Str., 157, Bacau, 600115 Romania, +40 234 542 411, ilazar@ub.ro

Abstract

The study presents an educational experiment investigating the impact of interactive whiteboards on the development of pedagogical competencies of primary and pre-school teachers. Students with different ages were randomly divided into two equal groups: first group participated in the interactive teaching training learning program and the second received the traditional teacher training program. The use of the interactive whiteboard on development of pedagogical competencies at pre-service teachers influenced the development level of pedagogical skills differently for young and mature students. The results of the comparative analysis on school performances showed that young students with the same initial knowledge obtained significantly higher post-test results than the adults. The young students from the experimental group got better results in terms of the development level of pedagogical skills compared to the students from the control group. For mature students development level of pedagogical skills did not depend on the training means used.

Keywords

ANCOVA, interactive whiteboards, pedagogical competencies, pre-service teachers, primary and pre-school education

Introduction

The use of modern technologies with a pedagogical purpose is a way of running teaching-learning activities (Kim, Kim, Lee, Spector and DeMeester, 2013: 76) with innovative teaching and current tools. The interactive whiteboard (IWB) (Mata, Lazar and Lazar, 2016: 278) is a modern technological tool which can be successfully used in the education process in order to increase or improve various skills needed for a future teacher (Davies, Jindal-Snape, Digby, Howe, Collier and Hay, 2014: 34). The IWB's pedagogical role is increasingly emphasized both in terms of improving students' achievement (Chen, Chiang and Lin, 2013: 173, Hennessy, Deaney, Ruthven and Winterbottom, 2007: 283), but also in the optimal teachers' training (Campbell and Kent, 2010: 447, Minor, Losike-Sedimo, Reglin and Royster, 2013: 1, Winkler, 2011). It is obvious that technology itself could not help increase students' performance if teachers could not create a learning environment which stimulates students to be active, it is based on cooperation (Dobber, Akkerman, Verloop and Vermunt, 2012: 609) and on taking responsibility in the learning process (Smeets and Mooij, 2001: 403). Only by using modern information and communication

technologies (ICT), students who are trained for the teaching profession can be adapted to the new generation of pupils.
In the Romanian education system, a teaching position can be obtained only through a national exam which is assessing the development of the future teachers' pedagogical skills. As a result of the educational reform implementation, since 2012, the emphasis was moved on applying pedagogical concepts and not on reproducing them as done in previous examinations. After the change, the results were very poor, for example, in 2013, the average of the results for teachers who applied to get a job in primary education was 6.36, while the average for teachers who applied to get a job in pre-school education was 5.21. This constitutes a major risk for the effective professional integration of future teachers of Primary and Preschool Education Pedagogy (PPEP).
Given the urgent and concrete need for teachers' pedagogical training (Postareff, Lindblom-Ylänne and Nevgi, 2007: 557) in line with the current technological requirements, an experimental approach is proposed for the development of pedagogical skills for students attending Primary and Preschool Education Pedagogy (PPEP) by using IWB.
The *research objective* aimed at measuring the impact of IWB use on the pedagogical skills development level, as a result of the implementation of the interactive initial training program for PPEP teachers. The specific hypotheses stated for the study were: 1: The development level of pedagogical skills will be significantly influenced by the teaching method; 2: The development level of pedagogical skills will be significantly influenced by the students' age; 3: There is a significant interaction effect between the teaching method and the students' age, which influences the development level of pedagogical skills in different ways for *young* and for *mature* students.

RESEARCH METHODOLOGY

Participants

The experimental study was conducted during academic year 2013-2014. The research group consisted of 40 students specializing in Primary and Preschool Education Pedagogy (PPEP). Initially, 40 students grouped according to their age into *young* (19-35 years old - 29 students) and *mature* (36-52 years old - 11 students) were selected as a study sample. To meet the objectives of the study, but also to validate it, students were randomly divided into two equal groups: *experimental group* was made up of students who participated in the interactive teaching training learning program and *control group* was made up of the students who received the traditional teacher training program.

Research Variables

For this study, the independent variables were the *teaching method* and *age*, and the dependent variable was *student achievement post-test scores*. Only significant results (at the 0.05 threshold) were validated (Chang, 2001: 147). The dependent variable was represented by the *development level of pedagogical skills*, and the independent variables were represented by the *research group* (experimental/control); the *age* (young students - 19-35 years old / mature students – 36-52 years old).

Research Methods and Procedure

The main method used was the pedagogic experiment (Smith, Higgins, Wall and Miller, 2005: 91) with repeated measures (test-post-test). The application of the experiment has involved three work stages for the experimental group:

1. Assessment of the initial level of the development of students' pedagogical skills - was conducted in October 2013 and consisted of applying the test to assess the level of pedagogical skills development, to students from both *experimental* and *control* group. Student's groups were homogeneous as level of education and age;
2. IWB integration in the initial interactive training program for the students belonging to the *experimental* group in order to improve their pedagogical skills - took place from November 2013 to May 2014. The pedagogical training of the *experimental* group consisted of the use of interactive teaching strategies containing collaborative teaching and learning methods, the interactive whiteboard as a teaching means and group and pair organization forms. For the *control* group, the program was based on the use of traditional teaching strategies consisting of traditional teaching and learning methods, traditional means and forms of organization which are predominantly frontal and sometimes individual;
3. Final evaluation of the pedagogical skills development level - was conducted in June 2014 and consisted on application of the test to assess the level of pedagogical skills development in order to determine the impact of IWB use on the outcomes of the students from the experimental group compared to those from the control group.

The identification test of the pedagogical skills development level in the initial and final evaluation phase was constructed by using the framework developed and validated in previous research (Mata, 2014: 341). The items were formulated in each category and subcategory of pedagogical skills (Figure 1, Appendix 1).

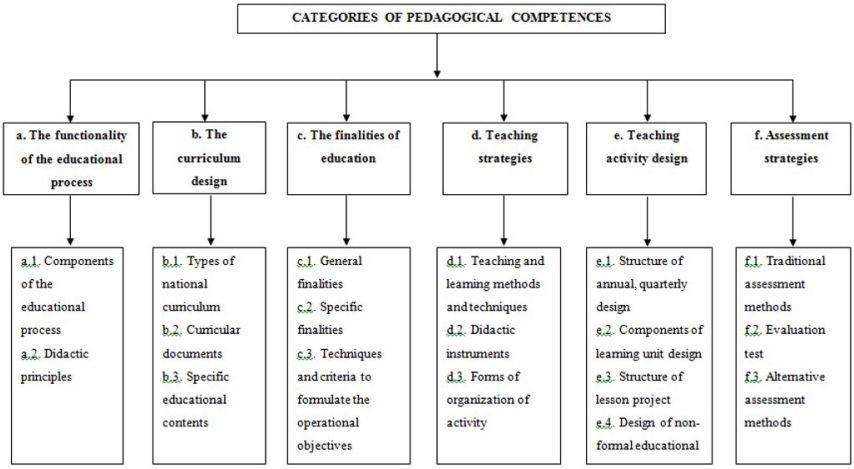

Figure 1. The structure of pedagogical competences; 2013-2014; source: (Mata, 2014: 341)

To solve the items, the students started from a 1st grade specific competence: 1.4 from *the curriculum for the ROMANIAN LANGUAGE COMMUNICATION subject. Preparatory grade, 1st and 2nd grade* (MENCS, 2013). The specific competence was chosen from the curriculum for the ROMANIAN LANGUAGE COMMUNICATION subject, because at the national examination for obtaining a teaching position, primary school teachers are evaluated in terms of the pedagogical skills development in this discipline.

The Wilcoxon test

All students were initially applied the pre-test and finally the post-test. Thus, the initial

knowledge level (EI) and the final one (EF) were quantified. To check if both the initial level of knowledge and the final one differ between the two groups under investigation, we applied the nonparametric Wilcoxon test for naturally related, small size samples. The Wilcoxon test results (z-scores = -0.444, *Sig.* = 0.657) indicated that there is no significant difference between the median students achievement pre-test scores of both groups. However, post-test results are different. Therefore, the Wilcoxon test results (z-scores = -3.318, *Sig.* = 0.001) indicated that there is a significant difference between the median students achievement post-test scores of both groups. ANCOVA factorial method was applied for a thorough statistical analysis.

ANCOVA method

An analytical comparison of two teaching methods was used to analyse students' achievement in pedagogy. From this perspective, the present study is a quantitative experimental research. Therefore, a factorial ANCOVA with a pre-test-post-test randomized group design method has been used. The conditions that must be met in order to apply the factor analysis were checked in the initial statistical processing. This confirmed a linear dependence between the covariate (also called control variable) given by the initial level of knowledge and the dependent variable, as well as homogeneity of the regression slopes for the covariate.

The use of this analysis of covariance allowed the study of the effects of two independent variables (the *teaching method*/training TM (interactive/classic), and *age* A (young/mature)), as well as the interaction effects of independent variables on the dependent variable (*students achievement post-test scores* EF). The covariate is *student's achievement pre-test scores* EI. The condition of normality for the distribution of EI and EF scores was satisfied.

Results

The objective of this study was to analyse the effect of using interactive teaching, of the resident environment and age on the performance of Pedagogy students after adjusting values according to the EI covariable. The result of the Levene F-test rejected the hypothesis of inhomogeneity between groups. Table 1 summarizes the main indicators of ANCOVA factor analysis.

For each of the sources of variance, Table 1 gives the sum of squares (calculated by Type III method), the degrees of freedom (*df*), Mean Square, F-test values and the thresholds of significance (*Sig.*). The overall effect (F = 10.769, *Sig.* = 0.000) of the use of the *interactive teaching method*, of the *resident environment* and of the *age*, which was specified on Corrected Model line (Table 1) was statistically significant in our study, under the control of the covariate. Among the main factors (independent variables *TM*, and *age*) only *age* had a significant effect on the "students' achievement post-test scores *EF*" dependent variable. For this factor, the observed power was average (Observed Power = 0.622). The interaction *TM*Age* also showed a statistically significant effect on the "students achievement post-test scores *EF*" dependent variable, the observed power was average (Observed Power = 0.573). The "students achievement pre-test scores *EI*" covariate variable also had a statistically significant effect on the "students achievement post-test scores *EF*" dependent variable, the observed power having a very high value (Observed Power = 0.999). We calculated the averages of the two experimental conditions associated to the *age* independent variable in the absence of covariate (Table 2a) and its presence (Table 2b).

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
Corrected Model	235.168[a]	13	18.090	10.769	.000	.843	139.995	1.000
Intercept	4.472	1	4.472	2.662	.115	.093	2.662	.349
TM	.023	1	.023	.014	.907	.001	.014	.051
Age	9.336	1	9.336	5.558	.026	.176	5.558	.622
EI	46.209	1	46.209	27.508	.000	.514	27.508	.999
TM* Age*EI	11.385	6	1.898	1.130	.373	.207	6.778	.363
TM*Age	8.334	1	8.334	4.961	.035	.160	4.961	.573
TM*EI	1.759	1	1.759	1.047	.316	.039	1.047	.167
Error	43.676	26	1.680					
Total	3042.750	40						
Corrected Total	278.844	39						

a. *R Squared =.843 (Adjusted R Squared =.765)*

b. *Computed using alpha =.05*

Table 1. The main table of ANCOVA factor method. Test of Between-Subject Effects for dependent variable: *final results***; 2013-2014;** *source: own calculation*

As the effect of the *age* variable was significant it is proven that under the conditions of the same initial knowledge score *EI*, young students had significantly higher performance compared to mature ones (Table 2b). We noted that the difference between the two age groups in terms of students' achievement pre-test scores *EI* was higher when comparing the results of students with the same level of initial knowledge (the situation of the adjusted averages from Table 2b).

The size of the effect for the age variable calculated on the basis of the standardized difference between averages as a result of ANCOVA factor analysis (F = 5.558, df = 26) was: r=0.420. Thus, we can say that age had an average effect on students achievement post-test scores EF while maintaining student's achievement pre-test scores EI constant.

a			95% Confidence Interval	
Age group	Mean Square	Std. Deviation	Lower Bound	Upper Bound
young	8.417	0.416	7.572	9.262
mature	8.152	0.763	6.6	9.704

b			95% Confidence Interval	
Age group	Mean Square	Std. Deviation	Lower Bound	Upper Bound
young	8.761*	.292	8.161	9.361
mature	7.386*	.765	5.815	8.957

**Covariates appearing in the model are evaluated at the following values: Initial results = 6.03.*

Table 2 Variance analysis for the effect of the independent variable (age) on the dependent variable (students achievement post-test scores) in the absence of the covariate (a) and in its presence (b); 2013-2014; *source: own calculation*

In addition, it can be seen that there was a significant interaction effect (Table 1) (F(1.26)

= 4.961, *Sig.* < 0.05), meaning that the use of IWB influences the development of pedagogical skills in young and mature students in different ways.
The simple effect of the *teaching method* variable for young students was statistically significant. Statistically significant differences between the performance of young and mature students showed that young students' results (Mean Square = 10.42, Std. Deviation = 1.820) are superior to those of mature students (Mean Square = 6.53, Std. Deviation = 1.586).

(a) Age group = young										
		F[a]	Sig.[a]	t[b]	df[b]	Sig. (2-tailed)[b]	Mean Difference[b]	Std. Error Difference[b]	95% Confidence Interval of the Difference[b]	
									Lower	Upper
Final results	Equal variances assumed	.340	.564	6.119	27	.000	3.887	.635	2.584	5.191
	Equal variances not assumed			5.971	21.674	.000	3.887	.651	2.536	5.239
(b) Age group = mature										
		F[a]	Sig.[a]	t[b]	df[b]	Sig. (2-tailed)[b]	Mean Difference[b]	Std. Error Difference[b]	95% Confidence Interval of the Difference[b]	
									Lower	Upper
Final results	Equal variances assumed	.388	.549	.956	9	.364	1.979	2.070	-2.703	6.662
	Equal variances not assumed			1.075	4.662	.335	1.979	1.840	-2.857	6.815

a. *Levene's Test for Equality of Variances*
b. *t-test for Equality of Mea*ns

Table 3 Independent Samples Test for "the teaching method/ training" variable for young (a) and mature students (b); 2013-2014; *source: own calculation*

ANCOVA factorial analysis results showed that in terms of school performance benchmarking, young students with the same initial knowledge obtain significantly higher post-test results than the adults. For mature students, the simple effect of *teaching method* variable was not statistically significant (Table 3b).

Discussions and Conclusions

In terms of methodology, the results of the experimental study we carried out revealed a high post-test level of pedagogical skills development obtained by *young* students from the experimental group unlike that obtained by *mature* students. At the same time, research results indicated the presence of a significant interaction effect between students' *age* and *training means/ teaching method*, which influenced the development level of pedagogical skills for young and mature students in different ways. Regarding the type of the research group, there were no significant differences between the post-test results obtained by the students from the experimental group and the control group, as it results

from other experimental studies, too (Akbaş and Pektaş, 2011: 1, Ertan, Yücel, Kara and Karabiyik, 2010: 23, Norouzi, Mohammadi and Madani, 2014: 99, Riska, 2010). The results demonstrated the responsiveness of young students to new technologies, due to the development of pedagogical skills in the interactive training program, unlike mature students who registered lower post-test scores, which showed how difficult it was for them to adapt to the use of new technologies, as Picciotto (Picciotto, 2012: 250), underlined teachers' resistance to using them. Therefore, there is a need for the training of mature teachers to develop their professional skills by using modern technologies.

Pedagogical approaches related to the initial teacher training by using new technologies is one of the main directions of improving professional skills in a close relationship to the requirements of knowledge society and the needs of the younger generation of students. The continuous and systematic carrying out of such interactive training programs contributes to the development and successful integration of future PPEP teachers in their professional activity.

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Appendix 1. Identification test of pedagogical skills development level

1. Receiving oral messages in familiar communication contexts

1.4. Expressing interest in receiving oral messages in familiar communication contexts (Clasa I)

- oral formulation of questions or requests for the understanding of the oral message;

- role playing such as speaker-listener, using finger puppets, hand puppets, masks etc.;

- asking comprehension questions after listening stories and and short stories read, recorded or told by adults / children;

- issuing predictions about the course of events from a listened text;

- activities like „News of the day" („What I did yesterday"), where children listen to stories / events recounted by children or adults *(the curriculum for the ROMANIAN LANGUAGE COMMUNICATION subject. Preparatory grade, 1st and 2nd grade, 2013*)

Categories of pedagogical skills	Items		Score
	Initial Evaluation	Final Evaluation	
a. ensuring the functioning of the educational process	Exemplify the compliance to the intuition principle in the illustrated activity / learning situation	Exemplify the compliance to the conscious and active learning in the illustrated activity / learning situation.	2 points
b. curriculum design	Specify the types of content (knowledge / skills / values / attitudes / behaviours) which are involved in creating specific competence.	Explain the relationship between the general competence, the specific competences in the selected sequence and content chosen for the construction of the learning activity.	2 points
c. formulating educational goals	State two operational objectives derived from the competence selected from the curriculum.	State two operational objectives derived from the above mentioned competence.	2 points
d. selecting teaching strategies	Design a teaching strategy consisting of organization methods, means and forms suitable for the activity / learning situation.	Design a teaching strategy consisting of organization methods, means and forms suitable for the activity / learning situation.	2 points
e. drafting teaching design documents	Name the lesson stage corresponding to the learning activity which was designed.	Name the lesson stage corresponding to the learning activity which was designed.	2 points
f. carrying out school evaluation	Design two objective items to assess the content corresponding to the specific competence.	Design two semiobjective items to assess the content corresponding to the specific competence.	2 points
			12 points

EFFICIENCY IN TEACHING MATHEMATICS: ENGAGING STUDENTS THROUGH ELECTRONIC VOTING

[1]✉Marketa Matulova, [2]Petra Siruckova

[1]Department of Applied Mathematics and Computer Science, FEA, Masaryk University, Lipová 41a, Brno, 602 00, Czech Republic, +420 549 495 984, Marketa.Matulova@econ.muni.cz

[2]Department of Applied Mathematics and Computer Science, FEA, Masaryk University, Czech Republic

Abstract

Science, Technology, Engineering and Math (STEM) subjects are usually not very popular among students, which can be caused by their high failure rate. These subjects are often perceived as too difficult and useless. Active learning, in which students are engaged with their learning through discussion, reflection or collaboration (as opposed to passive listening and notetaking) has proved to have significant potential for improving understanding and study outcomes in STEM disciplines. We try to integrate some elements of active learning to our subjects and this paper evaluates the effect of their application on study results in the course Statistics 2.

Keywords

Active learning, classroom voting, computer labs, mathematics, statistics, support centre

Introduction

Too many young people are still limiting their career options by not taking exams in subjects like maths and the sciences and those who take, very often fail in the exams. The social discussion on the topic is long-lasting in the Czech Republic, the date of introducing obligatory secondary school-leaving exam on mathematics is incessantly postponed. It seems to be a serious problem also in other countries. In the UK during the period 1990 – 2010 educational institutions publicly acknowledged that they had recruited many students onto mathematically demanding courses for which the students were not well-prepared, which is known as „the Matematics Problem“. Advisory Committee on Mathematics Education in UK states:„Garants of many university courses are placed in an impossible position. They cannot require an appropriate level of mathematics of their applicants and hope to fill their places, and in many cases they are unable to design courses with the level of quantitative demand that would be appropriate for their disciplines.” (ACME, 2011) Also in the United States President’s Council of Advisors on Science and Technology report in 2012 calls for an additional one million STEM majors in the next decade requiring a 33% increase from the current annual total (Freeman et al., 2014).

Numerous studies proved that a significantly greater number of students fail STEM courses that are taught lecture-style than in classes incorporating so-called active learning expecting them to participate in discussions and problem-solving. Comprehensive analysis comparing lecturing to active learning in undergraduate education was performed by Freeman et al. (2014). Their findings were based on 225 studies of undergraduate education across all of the STEM areas. They found that 55 percent more students fail lecture-based courses than classes with at least some active learning. Kernel density plots of failure rates under active learning and under lecturing together with mean failure rates under each classroom type (21.8% and 33.8%) can be seen on Figure 1.

We focus especially on mathematics and statistics courses for future engineers of economy, because this study is motivated by our experience from the Faculty of Economics and Administration of Masaryk University (ESF MU). The paper is organized as follows. The active learning elements used in our courses are described in the next chapter. We briefly introduce the basic concepts of classroom voting, autocorrection exercises and math support centres. Study results of students taught innovatively are analyzed in the third chapter. The overview of advantages and disadvantages of technology application in the lessons is given in the discussion. Conclusions are summarized in the last chapter.

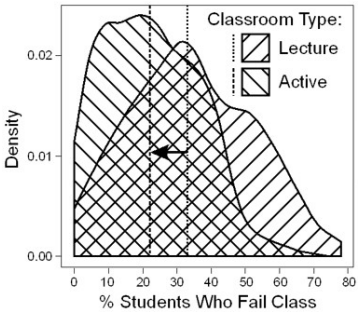

Fig. 1: Kernel densities of failure rates, mean= vertical line (source: Freeman et al. 2014)

Materials and Methods

We give no single definition of active learning approaches, they may include many different ways of teaching. Our main concern is set on classroom voting and the use of autocorrection exercises supported by math and stats help centre.

Classroom voting

We started to use the classroom response system in 2014, our first experience is described in our previous work (Matulová, 2015). Classroom voting is an innovative and very useful method in teaching as it allows to use the "ask, don't tell" pedagogy. After stating the question the teacher can give time for thinking and peer discussion. Responses are collected afterwards, often by means of some electronic clickers. Our way of response collection is based on sending answers via web browser with the aid of free multiplatform system Socrative. It is available for all web-browsers on iOS, Android, Kindle or Windows, so it is accessible for all educational technology settings. Features of the Socrative system are described in more detail in Dervan (2014). There are many other classroom response systems, for reference on VotApedia see Dunn et al. (2012), system OnlineTED is described by Kühbeck, Engelhardt and Sarikas (2014), we can mention also the SMILE system by Seol, Sharp, and Kim (2011).

Response collection should be followed by discussion where students should justify the correctness of their answer and explain it to their peers. Pioneer of the concept Erik Mazur recommends double round voting (Watkins and Mazur, 2013). Students are motivated to formulate their ideas and express their own way of reasoning, which is very important for the development of understanding, particularly in STEM disciplines. The voting concept enables to include also weak students that are not confident enough to present their ideas in front of the class (those students are often stressed by traditional way of teaching based on calling on individuals and it may be the reason why they dislike STEM subjects).

Immediate feedback is of a 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.

Autocorrection exercises

Obligatory homeworks integrated in the Information System of Masaryk University (IS MU) are used as autocorrection exercise. The design consists of 3 blocks of practical tasks with different timing through the semester. The answers are collected by the ROPOT (acronym for Revision Opinion POll and Testing) application. The Information System allows to create question sets, which may comprise questions of numerous types, with the aid of special forms. It is possible to combine questions contained in different question sets within the same ROPOT application.

Using several question sets within the same ROPOT application is helpful mainly in the situations where each of question sets targets a certain area and the test should contain questions a certain number of which comes from a certain set. Within this environment we can ensure that different quizes of the same type and difficulty would be generated for individual students. The option of this setting is that they work under equal conditions, but they cannot easily cheat by copying answers of their classmates.

The System saves the answers and evaluates them automatically. Teachers can browse students' answers either in IS MU or they can export them to XML format, which may be subsequently utilized for further processing. The system generates the list of those who have worked with the ROPOT application and saves their scores in a notebook in IS MU. After saving the answers, the students can have the keys to display the errors. They may open and work with this kind of material during certain period of time. We decided to allow students to fill the form in a ROPOT application repeatedly. This guards against the danger of technical problems (Internet connection dropping, computer freezing, etc.) and either it gives them the opportunity to revise their computations if their answers are wrong. However some students may still find it difficult to solve the tasks and need a help, which may be provided by our math and stats support centre (established in February 2016). The tutors in the centre would not work on the exercise instead of students but are there to help them if they get stuck, so even weak students can manage to solve the problems by themselves.

The practice of Mathematics Support Centres

Many higher educational institutions all over the world have established some kind of support centre in order to ease difficulties that a significant number of students have with mathematics, particularly in the first years of their studies. Perking et al. (2013) assess the number of universities in United Kingdom offering this additional support and he shows that the number grows rapidly (46 in 2001, 66 in 2004 and 88 in 2012). In most of the institutions the support is represented mainly by the existence of drop-in centre. Our newly established centre at ESF MU is to our knowledge the first institution of this kind in the ČR. Experienced tutors (both teachers and older students) will be available for 5 hours every working day in the room located near the school canteen. We hope that many students will find the help useful and we would be able to gain funds for the future run of the centre.

Matthews et al. (2013) provide review of scientific literature on Mathematics Support Centres and mention many papers demonstrating MSC usage and activity or showing the impact of MSCs on students, staff and the institution. Mac an Bhaird et al. (2009) report that MSC has a positive effect on the grades of the students who attend the centre. Unlike

other authors they find it particularly beneficial to students with weak mathematical backgrounds. Pell and Croft (2008) also give evidence that giving support has improved the pass rate of their students by 3%. On the other hand they show that majority of those attending were not students who were in danger of failing. Many frequent users of their centre were quite competent and simply wanted to do better.

Statistical evaluation of impact of active learning on study results

Relevant data were collected in the course Statistics 2 during the spring semester of the year 2015. The main analytical methods of processing the data included t-test, f-test, and Kolmogorov-Smirnov test. A two-sample t-test examines whether means of independent samples from two normal distributions are different and is commonly used when the variances are unknown. The F-test is used to check if the variances of the populations are equal, which is the assumption of standard form of two-sample t-test (if the condition is not satisfied, Welch t-test should be used instead). The Kolmogorov–Smirnov test (K–S test) is a nonparametric test that can be used for a comparison of a sample distribution with a reference probability distribution. In the special case of testing for normality, samples are standardized and compared with a standard normal distribution. The test is based on the K–S statistic quantifying a distance between the empirical cumulative distribution function and the reference function. All computations were performed using the statistical software package Statistica, the usage of the methods is described in more detail on http://www.statsoft.com/Textbook.

Results and Discussion

Evidence of the active learning importance in the course Statistics 2

The course Statistics 2 is taught at ESF MU under new conception from the year 2010, when we managed to schedule instructions to the computer labs and that allowed us to teach the course more practically-oriented. According to the course syllabus, participants of the course should be able to understand and explain the basics of statistical inference, use the basic testing procedures and to operate the statistical software Statistica. There are two hours of theoretical lectures and two hours of computer seminar sessions a week. The course pre-requisites are set as essential knowledge of calculus and probability (courses Mathematics and Statistics 1). In the first run of the course obligatory semestral project was a part of the assessment, but it was very time-consuming to correct all the projects and give feedback, so we have reduced credit requirements to active participation at seminars. Unfortunately this proved to be insufficiently motivating for continuous preparation and lead to a quite high failure rate, because students moved their study effort just before exam.

That is why another innovation has been introduced into the teaching in the year 2015 for a pilot group of 71 students. The instruction of the pilot group is based on the classroom voting. We expect students in this group to be more thinking and engaged during the classes (rather than automatically clicking according to the projector). The class in the pilot is organized as follows: there is a list of tasks to be done during the instructions. Questions are prepared beforehand on Socrative Teacher Website and they are usually of type “short answer” or “multiple choice”. All students vote at the same time and voting is followed by discussion. Voting is obligatory, but the answers are not graded. Quizzes are not anonymous, students use their University Identification Number (UIN) for login.

This setting facilitates the administration of answers and monitoring students' activity in the course.

In the last year, 307 students enrolled in the course Statistics 2, but only 296 students attended the lessons and attempted to finish the course. They were divided into 12 seminary groups of approximately 24 students. The majority of students (nine seminary groups, total of 225 people) had traditional lessons and 71 students (three seminary groups) were taught interactively with classroom voting. We analysed their final grades to find out whether study results are better under the new way of teaching. Final grades are derived from the scores of the written final test divided into two parts (theory and practise) with the total score in the range 0-100 points. In order to succeed in the test, it is necessary to gain at least 50 points. The resit is possible, but we wanted to evaluate the impact of instructions on the students, so we analysed only the results of their first trial.

The mean score of students taught traditionally was $m_1 = 42.92$, whereas for students taught interactively it was $m_2 = 47.76$. Boxplot of the scores is given on Figure 2. Two sample t-test was performed in order to show whether the results are significantly better in the first group. Normality of the samples was checked by Kolmogorov-Smirnov test and the equality of dispersions by F-test. The p-value of one-sided t-test was 0.048, so we rejected null hypothesis of the means equality $(\mu_1 = \mu_2)$ in favour of the alternative $(\mu_1 < \mu_2)$ on the level $\alpha = 0.05$. The limit of 50 points was achived by 79 members of the first group and 30 members of the other one. (if the score was be the only one credit requirement, that would mean failure rates 65.4%, resp. 58.8%).

Comparison of our results to findings of other authors

Technology plays increasingly significant role in the implementation of active learning. Excelent examples of technology-based activities in educational process are given by Oldknow (2009). Our experience is in line with his findings that technology can significantly help to make mathematics more exciting, relevant and challenging to young learners.

The pros of technology-based teaching are listed already in our previous work (Matulová, 2015). Other advantages specific for the Statistics course are connected with the usage of statistical software and real data. With the aid of voting technology, students can collect data instantly and applying methods on their own data is very motivating (the example of graph based on datafile made by responses to the question "How much do you have in cash?" is given in the Figure 3). The effect of the introduction of classroom voting on study outcomes confirms the findings of Freeman et al. (2014), but our results are not so significant. The failure rates expressed by the percentage of students not achieving the prescribed limit in the first run of final test differs in the traditional and active-learning group (65.4% vs. 58.8%). This is not as much convincing as 33.8% vs. 21.8% in Freeman's study. However the test scores are significantly higher in the active-learning group (by 4.84 out of 100 points on average). Our estimates of failure rates may seem too high, but they were computed before the resit term.

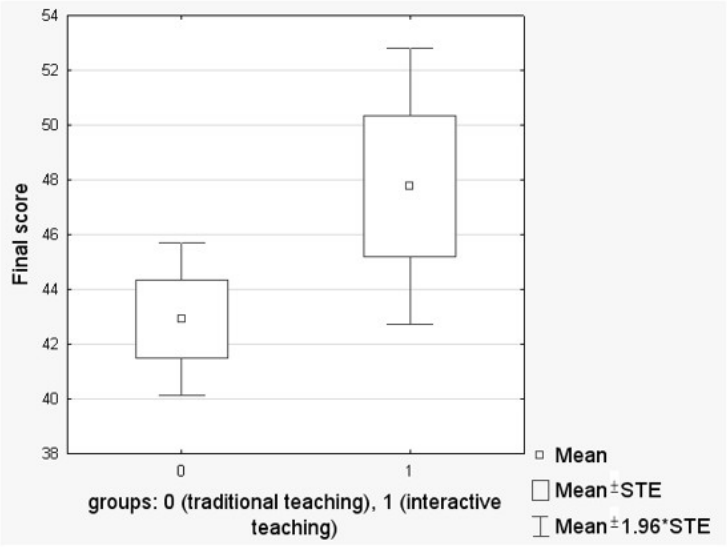

Fig. 2: Boxplot of the study results in Statistics 2 in 2015 (source: own calculation)

However there are also some significant pitfalls, some of them (such as less time for performing other activities during the lesson) are mentioned by Dervan (2014). We would add some others connected with the necessity to schedule lessons in the computer labs. Big issue in most of the labs is the room layout. The desktops are lined up in narrow rows and the tables are fixed to the floor due to the wiring, so the layout is not adjustable. This situation is a barrier for the effective group work and is also very limiting for tutor's possibility of going around and answering questions, showing software workflow, etc. Some computer labs are equipped with magnetic white boards only, the text on the board is hardly visible from the back rows, because the markers writing is too thin for the large room. Computers and the air conditioning make noise, the acoustics of the lab is very poor. Maybe the main problem is that students can be distracted from the teaching-learning process in the lab and get off task to browse the internet, communicate with their friends, etc. We may conclude by confirming results of the study (Gebre et al., 2015) examining students' and teachers' perceptions on the role of computers in the teaching. The benefit of technology application for supporting students in mathematical and statistical courses differs according to many variables: the students and their previous knowledge, the task and its complexity, the topic, the class context, the kind of technology used, the way how teacher uses technology, etc.

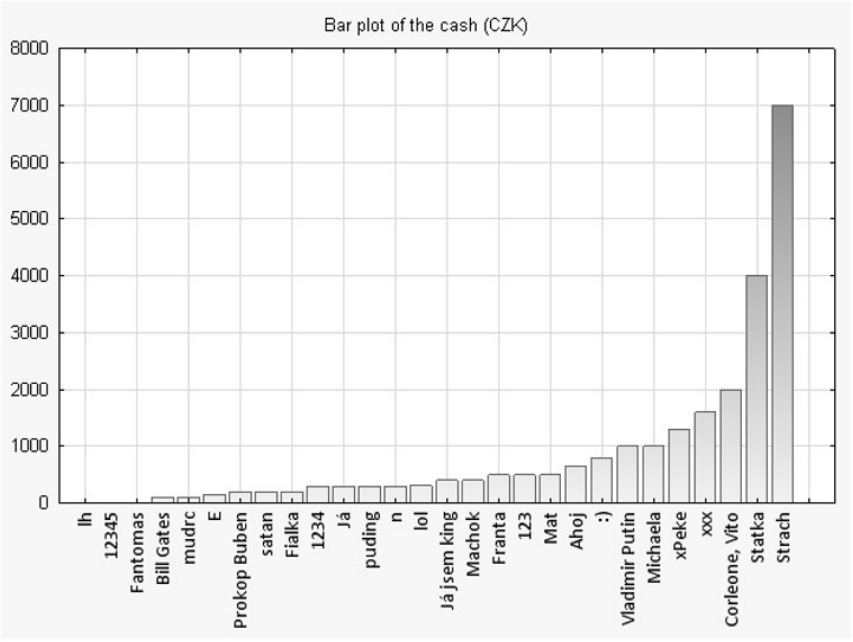

Fig. 3: Bar plot of data collected in the lesson (source: own calculation)

Conclusion

To teach mathematical and statistical subjects for future engineers of economy is a challenging task. STEM courses in general are usually perceived as too difficult and useless, which is often caused by low level of understanding and high failure rate in exams. According to vast literature on this topic, bad outcomes may be improved by means of active learning. We try to gradually adopt the elements of active approach in our courses. In the academic year 2014/2015 classroom voting was introduced in some courses, this year we add online homework exercises, called ROPOTs and we offer students free math and stats support in a new drop-in centre. We have conducted a case study to verify if the innovations have positive effect on study outcomes. Students were divided in two groups educated using traditional and interactive approach. Scores of the final test were compared and students of the second group were 4.84 points better on average. Higher test scores of the group using classroom voting were interpreted as the result of efficient and enhanced teaching. The benefit of ROPOT exercises and support delivered by the new drop-in centre should be evaluated in the future, there is not enough data available yet.

Acknowledgements

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INTERNET AND SCHOOL DISRUPTION

[1]✉Eva Milkova, [2]Petra Kalibova, [3]Simona Pekarkova

[1]Department of Informatics, Faculty of Science, University of Hradec Králové, Rokitanského 62, Hradec Králové, 500 03, Czech Republic, eva.milkova@uhk.cz

[2]Faculty of Education, University of Hradec Králové, Czech Republic

[3]Faculty of Education, University of Hradec Králové, Czech Republic

Abstract

The 21st century as a digital era has brought technologies, which have a great impact on everyday life. The internet has become an indispensable part of a modern man´s life, mainly then for adolescents from the reason of reduced level of parental control, free internet access and the use of such media for the purpose of education. Although the internet is understood as a crucial part of contemporary life and education, we can also trace an increase of its negative usage from students' side within lesson. Within the ICT in Education doctoral study programme there is prepared a dissertation work focused on a long-term research concerning internet use, internet abuse and internet addiction of adolescents. A part of the research is devoted to school disruption. In the paper we present achieved research results concerning this social aspect.

Keywords

Internet addiction, school disruption

Introduction

It is often being spoken about implementation of information and communication technologies (ICT) in education process mainly in the connection with their advantages. Many researches about the use of ICT have reconfirmed similar outcomes concerning motivation for learning. ICT might have a positive impact on enhancing motivation and better performances. (Mackinnon and Vibert, 2002, Widenska, 2014). The similar results were obtained in a comparative study between classrooms with and without the use of computers, students from classrooms with computers reported to have participated more, to be more interested in learning, and to be more motivated to perform well (Trimmel and Backmann, 2004). The findings also corresponded with results uncovered by Fitch (2004) and Stephens (2005) when notebook use in their research revealed enhancement in class and engagement.

However, we also very often come across with discussions that refer to a negative impact of Internet use as well as negative usage of ICT by students within a lesson (cf. O´Bannon and Thomas, 2015).

The doctoral dissertation work being pursued within a doctoral study program - ICT in Education, deals with a research focused on three social aspects which enter into education process of adolescents: internet use, internet abuse and internet addiction. The questionnaire treats with 44 statements. In the paper of (Kalibova and Milkova, 2016) we present results achieved from answers to 16 statements focused on internet addictive behaviour of secondary school youth in the Czech Republic. These are then discussed in the context of foreign experts´ study researches that have been published in recent years.

The questionnaire statements concerning internet abuse by adolescents can be divided

partly into statements focused on cheating and plagiarism, and partly into statements focused on school disruption.
In the paper we introduce research statements connected with questions focused on adolescents school disruption. They are then discussed in relationship with internet addiction.

School Disruption

Mobile phone seems to be the most accessible technology used during lessons. O´Bannon and Thomas (2014) states that, even though mobile phones (and modern technologies in general) have the aim to improve lessons at schools and help students to gain so called competences of 21st century, in many classrooms is the use of mobile phones banned mainly from the reason of lesson disruption or abuse of these technologies in the educational process. The research results, where the authors dealt with the use of mobile phones in a school classroom, show that students make the greatest use of mobile phones during lessons in order to connect to internet, watch videos and listen to music. Newly described phenomenon also stems from deliberate use of the internet access to private purpose during work or lectures. They are described as cyberloafing or cyberslacking in foreign literature (cf. Akbulut et al, 2016). Akbulut et al (2016) states that if students are allowed to use modern technologies in classrooms it is then very difficult to distinguish and to prove what it student´s purpose is for. Yilmaz et al (2015) says that cyberloafing was originally described only in the context of work environment, namely it was defined as counterproductive work behaviour. Up to the connection with increasing cases of school disruption by the ICT use we also start to talk about this phenomenon in the school classroom environment.
In the work of Akbulut et al (2016) the authors also include, for instance, sending and receiving emails, text messages, browsing on web sites, communication in chat rooms or via social networks, other activities on social networks, online shopping, downloading and playing games into cyberfloafing. These activities have been divided into five basic activity groups:

- Sharing – publishing statuses on social network, commenting on the content of social network, communication via social network
- Shopping –shopping online, online auctions, internet banking
- Real-time updating – publication of actual information on social networks
- Accessing online content – listening to music, watching videos
- Gaming – playing games, betting

Internet Addiction

Foreign literature has to deal with certain conceptual variability and even uncertainties, where besides internet addiction there is excessive use of the internet, pathological use of the internet, problematic use of the internet or risky internet use being used (cf. Lee and Cheung, 2014).
Even though no unified labelling of these phenomena exists, Chang and Law (2008) state that it is generally conceptualized as "compulsive behaviour associated with the internet use, which lead towards significant issues in everyday life." (Kalibova and Milkova, 2016)

Materials and Methods

A dissertation work prepared within the *ICT in Education,* doctoral study programme, is focused on a long-term research concerning internet use and its abuse in education of

secondary school, including the issue of internet addiction. The part of this research dealing with questions focused on school disruption of adolescents will be further introduced.

Research Methodology

The questionnaire that is of own construction contains 44 statements, 16 of them devoted to the internet addiction (factor F1 – see below).

The anonymous questionnaire was distributed in a paper version face to face. Each question was answered according to the Lickert scale (1 = never ever, 2 = almost never, 3 = sometimes, 4 = almost always, 5 = always).

Obtained data were subjected to factor analysis. Program NCSS was used. Three factors were generated (questionnaire reliability: Cronbach alpha = 0.86), which we marked as F1 *Tendency to internet addiction*, F2 *Internet – study aid* and F3 *Internet abuse*.

In the paper of (Kalibova and Milkova, 2016) achieved research results concerning internet addiction are described. Using table 1 (mean M, standard deviation SD) let us mentioned at least the achieved order of statements according to mean M, M > 2.5.

Statement	M	SD
When I connect to internet and it is being loaded, I feel excited.	3.50	1.02
It happens to me, that due to internet I miss something important (e.g. a meeting, keeping a promise).	3.09	1.09
It happens to me, that I procrastinate learning for later due to internet.	2.83	1.14
When doing homework or writing an essay "I borrow" a ready-made text from internet and I use it in my work.	2.79	1.18
I conceal the things that I do on internet at home.	2.69	1.2
When I am online, I lose the track of time.	2.68	1.15
Even though I have other responsibilities, I postpone them due to the internet.	2.61	1.17

Tab. 1: Order statements about Tendency to internet addiction according to mean M, M > 2.5

Among the questions of factor F3 there are three questions focused on school disruption of adolescents:

- Question **A**: I receive and send emails during lessons
- Question **B**: I surf on internet during lessons
- Question **C**: During lessons I communicate on social network

Research Sample

Within our research we paid attention to the group of adolescents who attend secondary schools in the Czech Republic. There were 1542 respondents at the age from 15 up to 23 years (average age M=16.99, standard deviation SD = 4.28), 647 boys and 895 girls, 106 students from vocational schools, 697 students from secondary vocational schools and 739 students from grammar schools.

Research Results and Discussion

From the 1542 answers the following means were achieved.

	Question **A**	Question **B**	Question **C**
all respondents	2.90	2.62	2.59
boys	2.79	2.66	2.60
girls	3.05	2.58	2.59

Based on D´Agostino Kurtosis test it was found that all monitored data has normal distribution and thus we could use F tests for statistical survey of mutual dependence of individual factors.
In accordance with above mentioned means, statistical results concerning interdependence of questions A, B and C according to gender have shown that a significant difference can be seen only in question A, i.e. girls send and receive emails during lessons more often than boys. Obviously, such conclusion matches natural talkative women's behaviour.
On other hand, using statistical results coming out from the research we find out that men indicated significantly higher tendency to internet abuse. From this result then follows that men indicated significantly higher tendency to cheating and plagiarism, whereas tendency to school disruption is comparable with women.
In table 2 there are introduced the results of the statistical survey of interdependence of questions A, B and C according to factor F1 - *Tendency to internet addiction* ($p<0.01$).

Questions	A	B	C
Tendency to internet addiction	0.34	0.37	0.22

Tab. 2: Relations among questions and tendencies to internet addiction

We can claim from the results: The higher tendency of school disruption by means of internet usage, the higher tendency to internet addiction.
In the paper of (Kalibova and Milkova, 2016) we claim that statistical results of the research concerning factor F1 show that men indicate significantly higher tendency to internet addiction ($p < 0.05$), which is in accordance with results given in table 2 as well as with the discussion above. This fact can be caused by generally recognized gender differences in some fields of information and communication technology use, for example in differences of activities done on the internet, in the fact that men spend more time online then women, or with the fact that men work with modern technologies far more confidently and more intuitively than women (cf. Alpaslan et al, 2015, Sipal and Bayhan, 2010).
Finally, let us introduce research results concerning questions focused on school disruption of adolescents according to core subjects that are represented by Czech language and Maths. The subjects devoted to mother tongue as well as to mathematics belong to the fundamental subjects taught at secondary schools. Mother tongue shows cultural and social maturity and mathematics shows a level of logical thinking.
Tab. 2: Relations among questions and Czech language and Maths evaluation
In table 3 there are the results of the statistical survey of interdependence of questions A, B and C according to Czech language and Maths (**$p<0.01$, *$p<0.05$).

questions	A	B	C
Czech language	0.066*	0.15**	0.12**
Mathematics	0.089**	0.14**	0.15**

Tab. 3: Relations among questions and Czech language and Maths evaluation

From the achieved results we can claim: The higher tendency of school disruption by means of internet usage, the worse evaluation of the Czech language (Mathematics resp.). This fact supports our opinion that students with worse evaluation are inattentive on one hand, and on other hand they rely far too much on information achieved from the internet and aren't willing to think as deeply as necessary about the explained subject matter.

Conclusion and Future Work

According Timiraos (2002) negative usage of internet starts early and grows mostly in fifth and sixth grade. He argues that there is a progression over time. When this aspect is overlooked by schools as a not important matter there is a high probability that this behaviour become a part of student's moral norm. Students acquire new habitual behaviour, include it in their own morality and will repeat the same behaviour later, during their next studies.

Sometimes also teacher's behaviour causes an increasing trend in disruption by means of internet. Students need to feel that teacher is engaged in their work and try to improve their skills. They are apparently more likely to "play with internet" if their teacher does not seem to carry about their work and their assignment.

In the paper we focused on the issue of school disruption in connection with internet addiction. The goal of our research was to explore and evaluate possible coherence between these two issues. According to the research outcomes we can state that there is existing direct proportionality. We can claim from the results: The higher tendency of school disruption by means of internet usage, the higher tendency to internet addiction.

Furthermore, we examined the obtained data according to fundamental subjects that are represented by Czech language and Mathematics. On the base of the achieved results we can claim not only: The higher tendency of school disruption by means of internet usage, the worse evaluation of the Czech language, but also: The higher tendency of school disruption by means of internet usage, the worse evaluation of the Mathematics.

Our aim in the future is to pay attention on this research among university students.

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HOW STUDENTS WORK WITH KNOWLEDGE. SURVEY FROM THE UNIVERSITY OF ECONOMICS PRAGUE

Ludmila Mladkova

Department of Management, Faculty of Business Administration, University of Economics Prague, W. Churchilla 4, Prague 3, 130 00, mladkova@vse.cz

Abstract

The paper discusses results of a survey on work with knowledge we did among students of the University of Economics in Prague. The objective of the survey was to identify how students learn, which processes they use to create new knowledge and whether their styles of work with knowledge are compatible with their personality traits and the way how we organise our courses. We find this topic important as everyday work with students indicate that their learning habits change. This probably happens due to the specifics of generation Z that creates majority of our students these days. The survey was done during the second half of February 2016. We interviewed 128 students from 4 faculties.

Keywords

Explicit knowledge, learning habits, SECI model, tacit knowledge, VARK

Introduction

The paper discusses results of a survey on work with knowledge we did among students of the University of Economics in Prague. We wanted to find out how generation Z students, who grew up with modern ICT technologies, work with knowledge. The survey results are discussed in this paper.

There are disagreements about the time of birth of generation Z (Jaleniauskieneand and Juceviciene, 2015). For example Schroer (2015) writes that generation Z are people born between 1995-2012. Geck (2007) sees generation Z as people born in or after 1990. Roland (2008) calls generation Z a Google generation and sees them as a generation of people born after 1993. Posnick-Goodwin (2010) date generation Z to 1990s and the early 2000s. Still we can assume that students who now study at bachelor and master programs at our universities belong to generation Z. Some authors think that generation Z people are specific as they grew in a world influenced by ICT technologies dominated by the Internet. From infancy, these people grew up in an environment surrounded by and using graphical web browsers, laptops, cell phones, instant messenger services, broadband, wireless, video games. Today's high-speed digital devices enable them to always be connected to the Internet, their friends, and others. This connectivity permits them to communicate and collaborate in real- time regardless of physical location; to access a wealth of diverse information, including vast digital collections (Geck, 2007). Some consider members of Generation Z to be smarter, more self-directed, and more able to quickly process information than previous generations; but there is one thing they may not be-team players (Igel and Urquhart, 2012). Generation Z are 'digital natives'– the first generation born into an already-digital world (Gross, 2008:8). On the other hand some authors argue that in a real sense, we are all Google generation now: the demographics of internet and media consumption are rapidly eroding this presumed generational difference Rowlands, Nicholas, Williams, Huntington, and Fieldhouse (2008).

Knowledge can be defined in many ways. For example, Tobin (1996) understands

knowledge as information plus intuition and experience. Woolf and Merriam (1990) see knowledge as organised information used for problem solving. Turban (1992) writes that knowledge is information that is organised and analysed to become legible and usable for problem solution and decision making. Nonaka and Takeuchi (1995) define knowledge as justified true belief. Knowledge includes two dimensions, explicit and tacit one. Explicit knowledge is encoded in organisational formal models, rules, documents, drawings, products, services, facilities, systems, and processes and is easily communicated externally (Vail, 1999, Al-Ghassani, Kamara, Anumba, Chimay and Carrillo, 2006: 516-524). Tacit knowledge is stored in peoples' brains as mental models, experiences, and skills and is difficult to communicate externally (Vail, 1999). Brinkley (2008) thinks that what distinguishes knowledge from information is the way in which knowledge empowers actors with the capacity for intellectual or physical activity.

Students use three processes when work with knowledge. It is acquisition, creation and sharing. Knowledge acquisition can be explored by VARK model (Fleming and Baume 2006). VARK model works with four learning styles; V means visual, A means auditory (aural), R means read/write (tactile) style and K kinaesthetic style. Exploitation of VARK model for study of student knowledge acquisition can be found for example in Prithishkumar and Michael (2014, 183), Peyman et al (2014, GC01), Leung et al (2014, 113) and Ganesh and Ratnakar (2014, 26). The process of knowledge creation and sharing is described by different authors differently. Individual knowledge creation is explained by Ackoff (1989) by 5 category approach, in the SECI model (Nonaka and Takeuchi, 1995), the model of Ba (Nonaka and Konno, 1998) and the model of knowledge assets (Nonaka, Toyama and Konno, 2000).

For the purpose of our survey and this paper, we understand information as equal to explicit knowledge and we work with SECI model. SECI is the model of four processes of knowledge creation and sharing; socialization, externalization, combination and internalization. Socialisation is the process of sharing tacit knowledge through shared experience. To acquire tacit knowledge, people have to share the same experience through joint activities or stories. Externalisation is a process of articulating tacit knowledge as explicit knowledge. It creates new, explicit concepts from tacit knowledge. Combination is a creation of new explicit knowledge from existing explicit knowledge. Combination is the process of connecting discrete elements of explicit knowledge into a set of explicit knowledge that is more complex and systematic than any of its parts. Internalisation is the process of embodying explicit knowledge as tacit knowledge. It is related to learning-by-doing. (Kelemen, 2010).

Problematic on how generation Z people acquire, create and share knowledge offers many questions. This is our first study in the field and we purposefully targeted it to our students and limited the objective of the survey. It is to find out how our students work with knowledge.

The survey consists of two parts, a review of existing literature and the empirical survey. The methodology used for the review of the literature was as usual for this type of theoretical research. The empirical research is a quantitative survey based on a questionnaire. Objective, thesis and methodology is discussed in chapter Materials and Methods, than results are published. Discussion and conclusions end the paper.

Materials and Methods

This section of the paper discusses objectives and methodology of the survey. The objective of the survey was to find out how our students work with knowledge. Three

aspects of work with knowledge were researched; acquisition, creation and sharing. We did not create hypothesis, just simple thesis. The thesis is that the way how our students work with knowledge is in conflict with orientation of academic environment on work with written material.

The survey consists of two parts, a review of existing literature and the empirical survey. The methodology used for the review of the literature was as usual for this type of theoretical research. We collected, described and evaluated different approaches and different ideas on relevant topics, e.g. generation Z, knowledge, knowledge acquisition, creation and sharing. Methods used for the review of the literature include typical methods of theoretical work; e.g. methods that allow interlinking separate pieces of knowledge like analysis and synthesis, comparison, induction, deduction, abstraction, generalisation and critical thinking.

The empirical research is a quantitative survey based on a questionnaire. Majority of questions were constructed as closed questions. Respondents chose from given options or evaluate given options on the Likert 1-5 scale. The Likert scale options are as follows: 1 - factor is poor, 2 - factor is under average, 3 - factor is average, 4 - factor is over average and 5 - factor is excellent. One question was an open question.

The questionnaire started with questions on data of the respondent; age, nationality, gender and education. Open question on learning habits followed. Then four questions on knowledge creation and sharing explored the use of tacit and explicit knowledge. SECI model was used as foundation for two questions on knowledge creation. Respondents evaluated their preference of individual SECI processes on the Liker scale. Other two questions were simple choice questions that explored preference of tacit or explicit knowledge in knowledge creation and sharing.

Finally respondents fill in a VARK questionnaire via which we researched knowledge acquisition. It was adopted from VARK (2016). Respondents completed the survey without the supervision of researchers. Questions were constructed so that they did not indicate what may be a “correct answer”.

The respondents of our survey were students of the University of Economics Prague. In total, we had 128 respondents. We gave the questionnaire to three groups of students, all of them in our management courses. One group was created by BA students from the Faculty of Informatics and Statistics (F4) (45 respondents), one group of BA students from the Faculty of Finance and Accounting (F1) and Faculty of International Relations (F2) (55 respondents). Last group were MA students of the Faculty of Business Administration (F3) (25 respondents). The characteristic of respondents is in table 1.

Percentages are rounded off in the whole paper. The author of this article does not provide any statistical analysis due to the way the research was conducted; it has no relevant meaning.

		Number	%
Gender	Female	59	46
	Male	68	53
Age	- 25	123	96
	26 -	5	4
Education	Secondary school	90	70
	University (Bc.)	38	30
Program and faculty	BA program F4	45	35
	BA program Finance F1, F2	55	43
	MA program F3	25	20
Nationality	Czech	83	65
	Other	45	35
Total respondents		128	100

Table 1: Characteristics of Respondents, 2016

Results

The part of the research focused on knowledge creation and sharing covered three topics. First we examined how the respondents create knowledge using the SECI process during the learning. Second we examined how the respondent share knowledge through SECI process and help other people learn. We wanted to know which of processes is the most popular as individual processes use different tools and require different pedagogical approaches. The third part of knowledge creation survey enquired which dimension of knowledge respondents prefer in both creation and sharing.

The results of the survey concerning preference of individual SECI processes in knowledge creation and sharing are in table 2.

Activity	SECI process	Total points	Average
Knowledge creation	Codification	461	3,6
	Internalization	393	3,1
	Socialization	379	3,0
	Externalization	442	3,5
Knowledge sharing	Codification	262	2,0
	Internalization	471	3,7
	Socialization	349	2,7
	Externalization	483	3,8

Table 2: Preference of individual SECI processes in knowledge creation and sharing, 2016

Codification is the SECI process most popular for knowledge creation; externalization and internalization were the most common for knowledge sharing.

The results of the survey concerning preference of explicit and tacit knowledge are in table 3.

Activity	Dimension of knowledge	Total	%
Knowledge creation	Explicit	86	67
	Tacit	49	38
Sharing	Explicit	20	16
	Tacit	112	88

Table 3: Preference of knowledge dimension, 2016

In knowledge creation, explicit knowledge was reported as preferred; it was tacit knowledge for knowledge sharing.

Knowledge acquisition was researched by the VARK questionnaire. Results of the survey are in table 4. To evaluate the VARK type of the student, we use the basic type with the highest score. If more basic types achieved the same score, they make combination. Table 4 informs about basic types and combinations we identified and about the scoring of individual types.

Combination	Nb.	%
A	40	31
AK	5	4
AR	7	5
ARK	4	3
K	41	32
R	8	6
RK	9	7
V	8	6
VAK	3	2
VK	3	2
Type total		
V	14	11
A	59	46
R	28	22
K	65	51

Table 4: VARK analysis, 2016

VARK analysis identified that 41 % of interviewed students are kinaesthetic and 40 % of interviewed students are aural (e.g. their basic types are kinaesthetic and aural). Other possibilities and combinations got much lower scores. When looking at total appearance of individual basic types (separate and in combinations), the mostly common type is a kinaesthetic type – 51% of respondents had this type in their profile and aural type – 46 % of respondents. The lowest score got the visual type.

Students were asked one open question on what are their learning habits. Answers to this question were compared to their VARK type. Results are in table 5.

VARK type x learning habits	Nb.	% from 128	% from 83
Compatibility	57	45	69
Not compatible	26	20	31
Incorrect or no answer	45	35	

Table 5: VARK type x learning habits of students, 2016

65 % (83 students) of students out of all respondents answered the open question on

their learning habits in a way that it was possible to compare it with their results of VARK questionnaire. In this group of 83 students, 69 % of students have learning habits compatible with their VARK type and 31% have learning habits that are not compatible with their VARK type.

Discussion

Results of our survey are difficult to compare to results of past researches due to the specific orientation of our survey. The survey is an original survey, not the repetition of previous surveys. Still, some works on similar topics can be found. As for SECI, Nonaka, Byosiere, Borucki, and Konno (1994) found out when researching knowledge creation of managers that in contemporary organizations, enhanced organizational performance is frequently attributed to the conversion of explicit knowledge. This result is similar to preference of interviewed students to create new knowledge by codification and externalization. Becerra-Fernandez and Sabherwal. (2001) highlight the fact that in different situation different SECI processes are most appropriate which fully corresponds with our findings that our respondents prefer different SECI processes for knowledge creation and different for knowledge sharing. Our findings that our respondents prefer to create new knowledge using explicit dimension but they prefer tacit knowledge when sharing also support Becerra-Fernandez and Sabherwal. (2001) findings.

As for knowledge acquisition, Fleming (1995) argues that VARK methodology helps overcome the predisposition of many educators to treat all students in a similar way. This is a reason why we initiated our research, e.g. our ideas are compatible. He also discusses compatibility of different learning types with tertiary education system and feels sorry for the kinaesthetics as problem based teaching is so rare in tertiary education. The majority of our students turned out to be kinaesthetic and aural. We are aware of problem listed by Fleming (1995) and plan to adjust our pedagogical methods to this fact. Slater, Lujan and DiCarlo (2007) also highlight that VARK tool can be used as a catalyst for reflection and discussion and that students should use the information to adjust study habits to correspond to their individual learning strengths. We checked the compatibility of learning habits of students with their VARK questionnaire results. Students were informed about their results and instructed how to use them. Slater, Lujan and DiCarlo (2007), Riley and Fearing (2009) and Alkhasawneh, Mrayyan, Docherty, Alashram, and Yousef (2008) state that majority of respondent of thein researches had multimodal learning preferences. Our survey arrived to different results; 63% our respondents had single mode learning preference.

Conclusion

The paper discusses results of the survey on work with knowledge. Respondents were students of the University of Economics Prague. The objective of the survey was to learn how our students work with knowledge. Three aspects of work of knowledge were researched; knowledge acquisition, creation and sharing. The thesis of the survey was that the way how our students work with knowledge is in conflict with orientation of academic environment on work with written material.

The survey showed that our respondents prefer to create new knowledge by codification and externalization. As for knowledge sharing, interviewed students preferred externalization and internalization and codification got the lowest evaluation. Socialization turned out to be unpopular process of both knowledge creation and sharing. As for the preference of knowledge dimensions, our respondents prefer create new knowledge using explicit

dimension and share knowledge using tacit knowledge. VARK analysis focused on knowledge acquisition identified that majority of interviewed students are kinaesthetic or aural (e.g. their basic types are kinaesthetic and aural). Together with type combinations, kinaesthetic and aural styles got the highest score. The results of the survey call for the change of the pedagogical methods to more interactive ones.

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AUTHENTIC VS. TRANSLATED MATERIALS AND TEXTBOOKS IN CLIL IN MATHEMATICS

Hana Moraova

Department of Pedagogy, Faculty of Education, Charles University in Prague, Magdalény Rettigové 4, Praha 1, 116 39, Czech Republic, hana.moraova@pedf.cuni.cz

Abstract

The paper focuses on the issue of the use of authentic mathematics textbooks vs. translated materials as a source of tasks and problems when teaching mathematics through CLIL (Content and Language Integrated Learning, i.e. partly in a non-mother tongue) on primary and lower secondary school level. It is a part of a larger research project in which the author analyses non-mathematical contents of mathematics textbooks and other learning materials. The research question asked in this paper is: What are the pros and cons of using authentic and translated materials when teaching mathematics in a non-mother language. The uncovered pros and cons are illustrated on problems posed by teachers in L2, of problems from an authentic textbook designed for L1 learners and of problems from a CLIL textbook. The paper is of interest both to teacher trainers working in the CLIL environment and to pre- and in-service teachers who are planning to use the CLIL method in their lessons.

Keywords

Textbook analysis, CLIL, authentic textbooks, non-mathematical content

Introduction

CLIL (Content and language integrated learning) has over the past years drawn a lot of attention of policy makers, educators, researchers and the general teaching public and is becoming increasingly more and more popular in many European (as well as non-European) countries. 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 village". Without any doubt if a graduate of a school is to be employable in the future, they will have to be able to communicate in at least one (but probably more) foreign languages. Moreover, if education is to be an open internationalized system and if mobility is desired already at the stage of training – at least 20% of higher education graduates and 6% of 18-34 year-olds with an initial vocational qualification should have spent some time studying or training abroad (Education and Training 2020, 2015), the learners' command of a foreign language is a must. Language learning and language acquisition are thus one of the areas that are seen as EU priority (Education and Training 2020, 2015; Rethinking Education, 2012). At the same time schools are becoming an increasingly multicultural environment where in some countries and regions the number of non-native speakers surpasses the number of native speakers. Teachers then face the reality of teaching pupils with limited language, with other school experience, knowledge and culture.

The Czech Republic has responded to the EU objective of supporting language education in more ways. It has amended the Framework Education Programme for Elementary Education starting from the 2013/2014 school year on the basis of the Common European Framework of Reference for Languages. Incorporation of another foreign language as

a mandatory field of study from the 8th grade at the latest is a fundamental change. (ET 2020 National Report Questionnaire, 2012)

Another trend that can be observed already on primary school level in Czech schools is introduction and use of 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.

It is not difficult for schools including primary schools to introduce CLIL as no special approval of the Ministry of Education of the Czech Republic is needed and also no language requirements on the teachers are defined and the decision about who is going to be teaching CLIL subjects if they are in School Education Programme are up to the head of the school (unlike in case of bilingual education where the teacher's command of the language of instruction must be on C1 level). However, the introduction of CLIL into Czech school reality opens some issues that must be paid attention to. It is not easy to find teachers willing to use the methodology and it is even more difficult for teachers willing to teach CLIL to plan their lessons as planning in CLIL is much more demanding and materials are harder to get.

In this paper the author compares various sources of teaching materials that can be used in teaching mathematics through CLIL. The objective of the paper is to show the potential advantages and drawbacks of using problems from authentic English textbooks, a CLIL mathematics textbook developed especially for Czech learners and of translating and posing own problems and thus map an area relevant for teacher training and teaching practice. The hypothesis is that a CLIL teacher will always have to subject the selected materials to careful analysis, find the possible obstacles and modify the materials accordingly.

Theoretical background

When the school decides to implement CLIL in their lessons, there are a number of decisions to be taken. What subjects will it be introduced to? Who will be teaching CLIL lessons and what qualifications does the teacher have? What materials will the teacher use when planning and conducting their lessons? How to plan a lesson in which the pupils will simultaneously improve their language competence and knowledge and competences in target language? As (Moraová and Novotná, 2014) show it is possible to plan a lesson that meets the language and content needs of learners of mathematics, but a lot of attention must be paid to the selection of materials. The materials need language as well as content adaptations.

The selected materials must ensure that 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.

This means the teacher must subject any teaching material to a very careful analysis to see the possible obstacles. Especially language obstacles primary and lower secondary school pupils may come across were partially analysed by Novotná, Moraová and Hofmannová (2003) where the authors focused on comparison of a set of English textbooks used at a Czech lower secondary school and the language that pupils learning from this textbook may have mastered and on the demands of authentic mathematics textbooks on non-native speakers of mathematics. The authors also pointed at the cultural differences between cultures of L1 and L2 and pointed out that these may become an additional obstacle in learning mathematics. Doing mathematics is culture, our expectations of what it means to be doing mathematics and how this can be done is culture (Rezat and Sträßer, 2012). And this culture is different in L2 country and in the Czech Republic and will affect the course of the lesson and learners' activity. As Meany and Lange (2013) point out learners whose culture is different from culture of mathematics done at school may underperform as they are not able to apply their intuitive knowledge of mathematics done at home to mathematics done in a different cultural context at school. It is true that, as Jeřábek, Prokýšek and Bambousek (2014) point out, the world presented to learners at school is not reality but augmented reality enriched to better illustrate the teaching objectives, still even this augmented reality is rooted in a culture. The teacher thus must analyse the materials not only from the linguistic point of view but also with respect to the cultural artefacts in the assignments. The teacher must guarantee that no mathematics knowledge and competence will be lost due to culture.

The question we ask and the objective of this study therefore is to find out what areas CLIL mathematics teachers should pay attention to when they use problems posed by themselves, use authentic textbooks or use materials designed for Czech CLIL mathematics learners and what the advantages of each are.

Materials and Methods

The design of this study is qualitative. Currently the number of researches on materials used in CLIL is rather limited (in the Czech Republic more attention to is paid by e.g. Novotná, Hadj Moussová and Hofmannová, 2001, abroad in Italy by (Favilli, Maffei and Peroni, 2013) and Finland by (Jäppinen, (2005)). Thus the aim of the study is to cast light on an area that is underdeveloped, to provide its description, which corresponds to the definition of qualitative research (Průcha, Walterová and Mareš, J., 1995) and open a new direction in research. The author conducts a content analysis of three types of materials that can be used in a CLIL mathematics lesson. The author analyses problems from the three different sources, namely vocabulary items and grammar structures used and cultural background of the problems. In the analysis the author keeps record of items that are problematic and may cause difficulty in CLIL mathematics lessons. Then she groups the possible obstacles into larger categories in which she draws conclusions. For the objective of this study, it is important that they are examples of three types of materials used in CLIL lessons:

1. problems posed by pre-service teachers of mathematics during their course (15 activities),
2. problems from an authentic English textbook written for English 4th graders (1 textbook with learning materials for one year, hundreds of tasks and problems),
3. problems from a textbook developed for Czech teachers and pupils who teach and learn mathematics through CLIL (1 textbook).

The findings from the analysis of problems is supplemented by pre and in-service teachers' opinions from semi-structured interviews with pre-service teachers conducted after their microteaching and with in-service teachers. She points at the possible problems the materials might bring into a CLIL mathematics lesson.

Results

Problems posed by teachers in L2

(Moraová, 2014) conducted a study with Czech pre-service teachers and the type of problems they pose to see how close problems they pose are to textbook problems and concluded that the posed problems are very stereotypical and very textbook-like. This in a way means that if a teacher poses their own problem, it is very likely to match the expectations of the learners and is likely to correspond to their image of what it means to be doing mathematics properly. However, there are dangers to be aware of.

For this part of the study, problems posed by 36 teacher trainees in a compulsory CLIL seminar for future mathematics teachers on Faculty of Education, Charles University were used (in academic years 2014-2015 and 2015-2016). In the seminar the trainees were asked to find and adapt or pose a problem that could be used in a CLIL lesson and to conduct peer microteaching to get hands-on experience with the approach. It was quite surprising to see that majority of the trainees actually worked with materials that they had translated rather than using authentic resources.

The following is an example of a problem posed by a B2 level teacher trainee, who decided to pose a problem on her own rather than to adapt an existing authentic problem (see figure 1). Despite her fluent English, she did not avoid making mistakes in English that actually block the chance of the solvers to succeed. Apart from grammatical mistakes (using *there is* and hyphen instead of the correct *there are thirty five students,* using *at least one tasks* instead of *at least one task*) that do not block understanding, the trainee made a serious language mistake in the last sentence of the first paragraph. By the sentence *three students didn't solve either first or second exercise* she wanted to say that *they solved neither the first nor the second exercise,* which came out in the following discussion of results. Her formulation meant a different thing than was expected as the result. This showed the trainees how tricky it was to be using problems that are posed by themselves, non-native speakers.

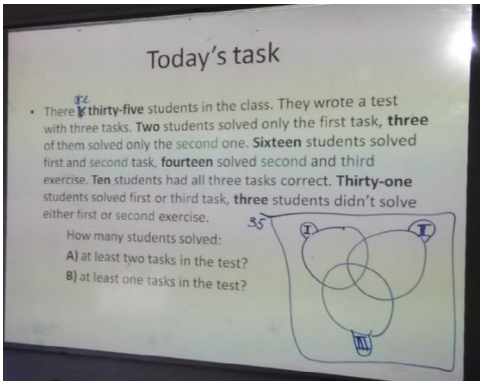

Figure 1: A problem posed by a trainee

Similar mistakes could be come across in the work of other trainees as well. E.g. a trainee who posed a sequence of combinatory problems struggling with quantifiers whose wrong use resulted in ambiguous or unclear assignments. If they want to avoid these difficulties it seems teachers will be safer if they use authentic materials formulated by native-speakers. However, this may also be tricky because of problems described in the following section. The interviews conducted after the micro-teaching showed that these teacher trainees wanted to pose and translate problems of their own because they wanted to have materials tailor-made for their learners, that are based on Czech textbook and Czech curriculum. They did not like authentic materials as too general, not addressed specifically for their learners. The advantages of posing their own problems are that they fit the curriculum as well as the cultural background of the learners. However, as the analysis shows, the disadvantage clearly is the language handicap and possible problems caused by not sufficient level of language used in the assignment.

Problems from authentic textbooks

Text analysis of a textbook for native English speakers – 4th graders (Pearce, 2002) shows some interesting facts. On the one hand the analysis shows that the language of mathematics itself is quite universal and all the tasks that require from the learners to do calculations use a very simple language in the assignment. Of course learners will have to get used to English signs for multiplying and dividing but calculations themselves are assigned in a very transparent way (*Write the answer, Complete, Fill in*). This will not be an obstacle for L2 learners.

The difficulties for learners come as soon as we come to word problems and additional difficulties for teachers when they compare the curriculum for Year 4 with Czech curriculum. E.g. English 4th graders already work with fractions and decimal numbers, which are not known to Czech learners at this stage. In language the textbook uses the passive, the present perfect, in the non-mathematical cultural content e.g. unusual sports such as *netball*, foods, e.g. *smarties*, everyday objects, *e.g. crate* and many others. All these will have to be paid attention to by the teacher and if possible replaced by more familiar objects. Of course L2 learners should develop their language skills and vocabulary knowledge, but in a scope that does not surpass their potential within one lesson.

Very interesting for native speakers are problems in which they are asked to *Make up a story to much each number sentence (e.g. 25x3=75).* These will be extremely difficult for L2 learners as they require them to understand the mathematics in the equation as well as be able to formulate a situation in English. Similarly difficult will be problems that use a lot of terminology, *e.g. Find three examples to illustrate that halfway between any two multiples of 6 is a multiple of 3.* These are problems that develop reasoning and thinking which is much more difficult in L2 than in L1.

In-service teachers involved in CLIL often report that they must plan lessons very carefully, work with authentic materials very flexibly, select only bit and pieces and sometimes adapt the cultural background of the tasks to make them more easily accessible. The scope of the paper unfortunately does not allow to present a detailed analysis. For more findings about the obstacles in use of authentic textbooks see (Novotná and Moraová, 2005).

Thus the advantages of using authentic materials is high quality of the used language, the disadvantage may be not corresponding mathematical content, unfamiliar cultural setting and different practices of doing things in mathematics.

Problems for a Czech textbook for teaching Mathematics through CLIL

A team of authors lead by E. Seidlová (2015) have currently developed and published with the support of an EU project (ŠKOLA BEZ HRANIC (CZ.1.07/1.1.00/55.0011) a set of two textbooks designed for A1 and A2 learners of English who want to be doing mathematics through CLIL. The fact that this is set of books was designed for Czech market allowed the learners to use L1 as well as L2 in the book. There are for examples translation of key terms into Czech and exercises especially designed to allow learners to practice this new vocabulary. The authors put in the title of the textbook "Maths and English" and it very well captures the fact that a lot of attention is paid to language itself, which could never be the case of an authentic textbook. There are e.g. longer reading texts and general non-mathematical contents whose aim is development of communication and language skills. As the textbook was designed for use in Czech schools, it also tries to answer the needs of Framework Education Programme for Elementary Education, namely it includes one of the defined cross-curricular subjects in each of the 13 included topics.

The setting of the 13 topics is often in the English-speaking world (8 of the 15 topics – e.g. shopping in Oxford Street, football stadium in Chelsea, Flying to South Africa, Kruger National Park, New York Knicks vs. Chicago Bulls, New York at night) but also in the Ancient world (Greece, Egypt, pyramids, ancient wonder of the world). But the setting of a topic into Oxford does not exclude Czech cultural background, use of CZK and Czech leaflet.

Each unit has an obvious language goal. There are reading texts, listening exercises, questions that support communication. But what about mathematical content? Who is the book actually designed for? The mathematical topics addressed in the textbook are the rule of three, units of length, time and capacity and the concept of a unit per hour, introduction to angles and graphs (but more or less only terminology is provided), the Pythagoras theorem, the pyramid, the concepts of the mean, the mode and the median, the concept of congruent triangles. There are fewer than 30 mathematical problems for learners to solve (the exact number of problems depends on the definition of what a mathematical problem is; is e.g. matching of a term to its definition a mathematical problem? Even if we define it as one, it certainly does not develop the ability to apply mathematics for solution of problems and does not develop higher order thinking skills as requested by Coyle in his 4 Cs').

The course book (Seidlová et al, 2015) is a very nice example of how language can be developed with mathematics at the background but is not an example of a material that would enable learners to build solid and firm knowledge of mathematics and its use. Much more mathematics, mathematics problems and problem solving would have to be included. The advantage of this book is its language and communicative focus, the drawback is lack of mathematics, mathematics in a very fragmented form building no real curriculum. The book can be a good guide to CLIL teachers of mathematics how to get more language in the lesson but cannot be regarded as a fully-fledged textbook of mathematics.

Conclusions

An answer to the question of what materials should teachers use when teaching mathematics to CLIL does not have a simple answer. The above presented analysis shows that each of the three sources of mathematics has its pros and cons. The decision to pose their own problems may result in wrong use of grammar structure and terminology and

may result in misunderstanding and confusion. On the other hand even a CLIL teacher must expect to be facing situations in which they will have to be flexible and be able to pose simple problems to illustrate a point which is not clear and was not anticipated in a priori analysis.

Use of authentic materials and problems from textbooks for English children will require adaptations – in terms of language used, cultural artefacts, teaching strategies but also mathematical content. If nothing else, looking for the topics to be covered in a particular school year with respect to the particular School Education Programme will be necessary. Clearly, comparison of authentic and translated materials shows that from linguistic point of view authentic materials should be used to avoid mistakes and ambiguity in the assignments. However, they need to be selected carefully and adapted and modified with respect to the needs of Czech pupils, Czech curricula and Czech pupils' knowledge of English. If a CLIL textbook is to be developed for Czech market, it will have to be much more anchored in mathematics curriculum than the existing textbook, which really only suggests possibilities.

Thus it can be concluded that both pre- and in-service teacher should be provided with the needed training for CLIL and should be taught how to search for adequate materials and how to adapt them in a way from which their learners will gain most profit.

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HOW PROGRESSIVE TESTING INFLUENCE STUDENT RESULTS OF FINAL ORAL EXAM

[1]Tomas Moravec, [2]✉Jan Pastorcak, [3]Petr Stepanek, [4]Petr Valenta

[1]Department of Business and European Laws, Faculty of International Relations, University of Economics in Prague, Czech Republic

[2]Department of Business and European Laws, Faculty of International Relations, University of Economics in Prague, sqw. W. Churchill 4, 130 67, Prague 3, Czech Republic, jan.pastorcak@gmail.com

[3]Department of Business and European Laws, Faculty of International Relations, University of Economics in Prague, Czech Republic

[4]Department of Business and European Laws, Faculty of International Relations, University of Economics in Prague, Czech Republic

Abstract

The main purpose of this research is to reveal the causes which influence the exam results of students in the obligatory one semester course 'The Basics of Law' at the University of Economics, Prague (UEP). The paper analyses data from computerised progress tests during the examined period of 2008-2016. It consists of two computerised tests at the middle of and at the end of each semester. After both the tests are passed, students must pass the final oral exam, which is required for completion of the course. The data research discovered the correlation between the student results, the form of progressive testing and the structure of the computerized tests. In accordance with the paper's conclusion, test questions should be regularly modified or the structure of computerised test changed to ensure better student preparation for tests and the oral exam. Students then pass the course with better knowledge. The authors confirmed this correlation by statistical methods in their other research.

Keywords

Computerised test, final oral exam, knowledge of students, lectures, progressive testing, teaching methods

Introduction

This paper is a continuation of the research which was published in an article called 'The impact of the progress testing of students on their results at final exam' (Moravec, Štěpánek, Valenta, 2015) and uses the same methods and hypothesis as this article. The aim of this paper is to continue in this research by using new data from the academic years 2014/2015 and 2015/2016 and confirm its previous conclusions concerning the course 'The Basics of Law'. The course lasts one semester and belongs among the compulsory courses of the first year of study at the UEP. Each student should pass the course by the end of the first academic year. The total number of students is about 2000 per year. Therefore, the students from some faculties attend the course during the winter semester and the students from rest of the faculties during the summer semester. For the purposes of the paper, we set the research period as an academic year. This period involves the results of all students from each faculty and is comparable with other periods. The time

capacity of the course for daily attendance is, in total, 130 hours. This amount contains participation in lectures, preparation for lectures and 2 computerised tests and preparation for the final oral exam. Each of these teaching methods has its own time schedule as you can see in Table 1.

Type of teaching method	Daily attendance
Participation in lectures	52 h
Preparation for lectures	24 h
Preparation for tests	10 h
Preparation for final oral exam	44 h
Total	130 h

Table 1: Learning activities, teaching methods and workload (source: UEP dataset)

The topics lectured within the course could be divided into two parts, the basics of law and business law. The first part provides students with basic knowledge and terminology of law, theory of law and state and the basics of private and civil law. The second part is focused on the basics of business law, especially on company law, contract law and dispute resolution. Each of these parts is finished by a test which consists of lectured themes of the course. The total time allowance for participation in lectures is set at 52 hours, which is equivalent to 13 weeks during the semester.

The aim of the course is to provide students with a comprehensive view on law for economic purposes. After the course is successfully completed, students are able to define the basic terms in the field of theory of law, identify the applicable legal provisions governing the status of businessmen and their mutual relations, determine the differences between the types of business companies and identify the conditions for pursuing business in the Czech Republic.

The Department of Business and European Laws UEP (responsible for the lecturing and examination of the course) uses a system of progressive testing during the semester. It means that students must pass two computerised tests and only after that are they allowed to go to the final oral exam afterwards. The aim of this kind of testing is to ensure ongoing preparation for lectures and better student results of the final oral exam. This system consists of two computerised tests; one is mid-semester and contains matters of basics of law, the second contains matters of business law and is performed at the end of the semester. The precondition for entering the final oral exam is passing these two tests, which means achieving at least 50% of points from each test. The data obtained in the computerised tests are processed and examined by statistical and other scientific methods for improvement of the course. The next chapters of this paper also examine changes in the structure of the tests and changes in automatised selection of test questions. These changes were influenced by changes in Czech legislation and by research results of the previous years.

Materials and Methods

The paper is based on methodology used in Moravec, Štěpánek, Valenta (2015). Furthermore, authors examined the data for previous periods in another study (Moravec, Pastorčák, Štěpánek, Valenta, 2015). They proved the same dependency between the new test variants and student results of the final exam by using correlation and Pearson's chi-squared test.

The research also builds on a number of other studies dealing with the evaluation of students in general and improvements in examinations implemented by the introduction

of automated systems. The proposed models and analyses are mostly based on the study of description and influences of computerised systems on creating, applying and tabulating surveys and paper instruments in an automatised way (Viciana et al., 2013), the role of multimedia in education and testing the students (Dindar et al., 2013), the connection between the teaching methods and testing (Rudman, 1989), modern electronic versions of testing (Horovčák, Stehlíková, 2007), mathematical and statistical research of multiple-choice testing as an objective tool for examination at UEP (Klůfa, 2013 and 2015).

Determination of research questions and prerequisites

The main aim of the paper is to analyse the available data from the computerised system of testing and the effect of introducing the progress testing on the knowledge of students. For this purpose the essay discusses the following research questions (RQ).

RQ1: Does the introduction of continuous progressive testing have a positive influence on the knowledge of students and their evaluation at the final exam?

At the same time, we presume that students slowly share questions from the tests after their finishing and that the question base is gradually spread among the students. To confirm this presumption we will set a representative sample of questions and examine the correctness of answers to them over time. In this context we pose the following research question:

RQ2: How does the correctness of answers to a certain sample of questions change over time?

In our view, to keep the constant level of knowledge of students and thus constant average results achieved by them at their final exam, it is necessary to continuously modify the question base and add a certain amount of new questions to the whole question base each year. To analyse this issue, the following research question is discussed:

RQ3: What amount of questions is it necessary to modify to ensure an equal level of knowledge of students?

Based on the previous results of research, the Department of Business and European Laws UEP decided to make some changes in structure and select test questions to respond the amendments in Czech legislation and to changes in the allocated number of lectured hours for some topics. To analyse this issue another question is discussed:

RQ4: What is the impact of changes in structure and selection of test questions on student results? We would like to confirm that the change of structure of the test has a similar impact to the updating and replacement of the test questions.

The impact of the introduction of progressive testing

In 2008 a new system of progressive computerised testing for the obligatory course 'The Basics of Law' was introduced. During the period of 2008-2016 data were collected on all student results from these computerised tests. The overall knowledge of students is verified during the final oral exam at the end of the course. Students can be classified with 4 values of grades from 1 to 4 according to their knowledge as can be seen in Table 2.

Grade	Overall knowledge
1	Excellent (90 - 100%)
2	Very good (75 - 89%)
3	Good (60 - 74%)
4	Insufficient (0 - 59%)

Table 2: The grades students can obtain at the final oral exam (source: UEP dataset)

To pass the exam it is required to achieve at least grade 3. Table 3 analyses and examines the achieved average results (grades) during the examined period. The average grades which are shown in the second row were calculated as the arithmetic average of all grades received by all students at the final oral exam. The last row shows the differences of average grades compared to the previous period.

Academic year	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16
Average grade	2.43	2.24	2.04	2.21	2.23	2.11	1.98	2.20
Average grade change	N/A	0.19	0.20	-0.17	-0.02	0.13	0.13	-0.22

Table 3: Average result of students, 2008-2016 (source: own elaboration, UEP dataset)

As indicated in Table 3, we can see that the average results (grades) of students had improved from an average grade of 2.43 in the academic year 2008/2009 to 2.24 in the year 2009/2010. This trend also continued in 2010/2011, when students achieved an average grade of 2.04. The computerised testing system was introduced in the academic year 2008/2009. After this introduction there was a phase of system debugging and checking until the academic year 2010/2011 when the system went into full operation. Therefore we can conclude two years after the introduction of computerised progressive testing the average grades improved approximately by 0.2 points every year. It is also important to note that in the years mentioned above, the testing systems were developed and the number of questions was increased.

If the average grades in the following years are analysed, the results can be seen to oscillate, especially in the academic year 2011/2012, when the average results got worse by 0.17 points compared to the previous year. This trend was eliminated in the next academic year 2012/2013, when the results were almost the same as in previous period. The average grade in the academic year 2013/2014 was 2.11, which is 0.13 points better than the previous year. We concluded in the previous research that these changes (movements) are caused by changing the number of testing questions in the database. In the academic year 2014/2015 an attempt was made to change the structure of the test, on the condition that the number of testing questions in the database remained the same. For the year 2015/2016 the test structure and database structure remained the same. The change in average grade is similar to the year 2011/2012. In the academic year 2011/2012 the questions were unchanged and therefore we concluded that the change of structure of the test has a similar effect to changing 50% of the questions in the test. Table 3 displays that the average grade in every academic year, after the introduction of computerised progressive testing of students, and the average results of students are better than in the school year 2008/2009 when the computerised system of testing was starting and the progress testing had no relevance at all in this year. The summarized data of average grades before the year 2008, which would be necessary for further analysis, are unfortunately not available.

On the basis of the research results, we can answer RQ1 and conclude that the introduction of continuous progressive testing has a positive influence on the knowledge of students and their evaluation at the final exam. Testing is a very important part of teaching methodology and helps students to learn and remember more content and reduce test anxiety. Testing can be used to diagnose what individual students know and test results are useful tools for measuring the effectiveness of instruction and learning (Rudman, 1989). The changes in structure and selection of test questions have no influence on the trend of improvement of average grades in the academic year 2014/2015, as can be seen the Table 3. There was a change in this trend in the winter semester of year 2015/2016 due to factors discussed in the following sections.

Changes in correctness of answers over time

In the research twelve different questions (Q1-Q12) were selected, representing different areas of the course 'The Basics of Law' for examination and analysis of the correctness of answers of students in the examined period as can be seen in Table 4. The correctness is displayed as a percentage of correct answers. The data concerning the correctness of answers have been fully available since the academic year 2010/2011. A positive linear trend indicates that correctness of answers to particular questions increases. On the other hand, a negative linear trend indicates a decrease in correctness of answers.

The study presumes that one of the reasons why the average results of students began to oscillate in the last three years is the fact that the question base is gradually spread among students, especially through social networks, shared databases, smart phone applications and other arrangements for information sharing. In preparation for progress tests, students therefore rely more on questions which are available to them and underestimate their preparation through deep study. This has a negative impact on their results at the final exam afterwards (Moravec, Štěpánek, Valenta, 2015).

Academic year	10/11	11/12	12/13	13/14	14/15	15/16	Linear trend
Q1	29.93	45.74	68.94	54.59	50.32	26.32	-0.53
Q2	43.11	32.58	25.40	42.62	14.29	24.24	-3.77
Q3	31.73	39.67	39.64	57.92	82.39	86.52	12.01
Q4	77.15	76.20	77.02	77.50	87.42	91.04	2.96
Q5	60.85	70.47	71.98	91.78	93.33	97.22	7.72
Q6	47.78	61.35	54.10	60.93	63.23	65.52	2.89
Q7	32.24	32.07	31.42	29.79	69.73	69.30	8.48
Q8	54.28	68.09	76.82	75.13	91.51	93.33	7.54
Q9	57.31	59.51	62.84	75.53	83.40	78.85	5.49
Q10	12.81	17.07	17.98	14.77	40.97	42.19	6.16
Q11	31.54	42.59	35.06	31.56	79.41	77.38	9.61
Q12	45.26	49.46	72.25	73.50	70.49	64.44	4.58
Average	43.66	49.56	52.79	57.13	68.87	68.03	5.26

Table 4: Correctness of answers of students, 2010-2016 (source: own elaboration, UEP dataset)

Table 4 displays that, with the exception of questions Q1 and Q2, there is a positive linear trend. The reason why the linear trend is negative for Q1 is a change in the structure of the test and the number of selections for this question during the period. There was also an added question of similar wording. There is also new legislation for Q2, which caused this question to be more complicated. When thoroughly analysing the results, it can be seen that in 10 questions the linear trend is higher than plus two, which means that considerable growth of correctness was recorded for these questions. For example, we can point at Q8, where the correctness continuously grows from 54.28 % in the school year 2010/2011 to 93.33 % in the year 2015/2016. Only for Q2 is the linear trend below minus one, which means that only for one examined question was a significant drop of correctness of answers recorded. This will be the basis for further analysis of the wording of the question and its possible exclusion from the test or its alteration. After summarization the average linear trend is 5.26. This trend is increasing in comparison to the previous study for the period 2008-2014, when it was 4.36. We can answer research question RQ2 that correctness of answers to particular questions changes positively in time. This conclusion also confirms the previous study (Moravec, Štěpánek, Valenta, 2015b: 85). It is also

evident that the question base of our test is gradually spread among students. We can confirm the statement that describes the increasing role of multimedia in education, but in this case it is unfavourable to our system of testing students. As was mentioned above in the year 2014/2015, the structure of the database of testing questions was completely changed. The most important questions, divided into 6 groups, were created. These groups are represented in the test three times, firstly as questions with one correct answer, secondly as questions with more correct answers and thirdly as written questions. This leads to a greater frequency of questions in the test and a greater increase in correctness of answers. Parts of questions were included in residual questions and this led to a lower frequency of questions in the test. An example is question Q1, when the result was a decrease in the correctness of answers.

Updating the question base

The research has found that if the same level of knowledge of students is to be maintained over time, a change to the question base is regularly needed. Verification of this hypothesis is provided in Table 5, which displays the impact of the number of added questions on the average grade in the examined periods.

Academic year	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16
Average grade change	N/A	0.19	0.20	-0.17	-0.02	0.13	0.13	-0.22
No. of questions	80	326	620	620	629	850	817	817
No. of added questions	80	246	294	0	9	221	-33	0
Share of new questions	N/A	75.46%	47.42%	0.00%	1.43%	26.00%	-4.04%	0%

Table 5: Number of added questions, 2008-2016 (source: own elaboration, UEP dataset)

The initial base of questions consisted of 80 questions in the academic year 2008/2009 and was continuously extended in the following years until the number 817, in the academic year 2014/2015. The majority of the new questions were added in years 2009/2010 and 2010/2011. This was caused by the formation of a new question base in the first years after the introduction of the new system. It is evident that adding 246 new questions in 2009/2010 caused an improvement of the average results. The same trend continued in 2010/2011. When the question base remained the same in 2011/2012, the average grade declined. The same persisted in the following academic year. The hypothesis that the new added questions caused better student results is confirmed in the academic year 2013/2014. After the addition of 221 new questions the average grades improved. The essential assumption for this phenomenon is the announcement to the students that the test base would be modified. In connection with the recodification of private law, 33 questions were removed in 2014/2015. These reasons have also forced changes in the structure of the test and method of questions selection. Students were informed about these changes during the lectures. Therefore, they had enough time to react to these changes and their results in 2014/2015 improved. In accordance with RQ4, we can conclude that changes in structure and selection of test questions led to better student results. Because no new questions were added in 2015/2016, the results deteriorated.

This analysis therefore proves that it is necessary to modify a certain amount of questions regularly to keep the pressure on students to study and not to rely on the historical information from their predecessors. By further processing of available data, we would like to quantify what amount of the question base it is necessary to add or modify each year to ensure consistent knowledge of students at the final oral exam, which means

achieving zero change of the average grade between the two following years. For this purpose we will construct a simple linear regression in Figure 1.

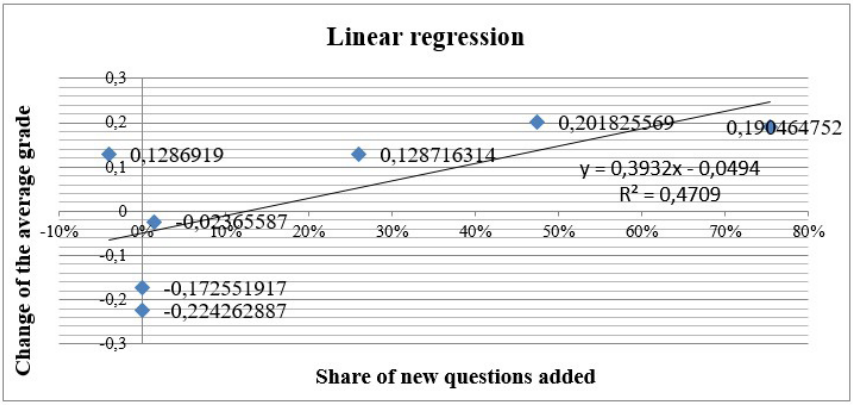

Figure 1: Linear regression of change of the average grade and the change of the amount of new questions (source: own calculation)

Figure 1 displays a simple linear regression of dependence of change of the average grade on the change of the amount of new questions. Previous research containing data from the period 2008-2014 shows positive statistical dependence, which implies that to achieve zero change of the average grade of students it is theoretically necessary to modify 14.83 % of the question base (Moravec, Štěpánek, Valenta, 2015). The data collected in the following period 2014-2016 complement previous research on the impact of the changes in the structure of the tests, when the number in the question base remained the same. In such a situation the trend continues with the difference that for achievement of zero change of the average grade, it is necessary to modify a lower percentage of questions. In answer to questions RQ3 and RQ4, we can state that to ensure an equal level of knowledge of students it is necessary to modify 12.56 % of questions in the progress tests database.

The study has some limitations, which have to be mentioned. First, it is the change of content, when the development of legislation occurs. Due to numerous amendments, it is necessary to change the content of lectures and test questions from time to time. In the case of recodification of private law, it was also necessary to change the structure of some topics. These changes can slightly distort the results of the research and it is necessary to perform further analysis of these impacts. The computerised system designated to testing of students is continuously developed and new tools and functions could be added which could also influence the data, e.g. new structure of the test, algorithm change in the system. To ensure clearer results and a less complicated process of analysing results, there should be a defined number of examined questions from the question base and, when needed, old questions should be simply replaced by new ones. Despite the mentioned limitations, the computerised system of testing is very helpful for both sides, teachers and also for students. All impacts and obtained data must be deeply analysed and examined.

Conclusion

In previous chapters we have analysed and answered all four research questions set at the beginning of the paper. In accordance with other studies we can conclude that progress testing forces students to prepare themselves for the final exam continuously during the

semester. Students can, for purposes of preparation for the computerised test, use the practise test in their information system at home. The results of the sharp tests are available for students immediately after finishing the test and give the students appropriate quick information on the level of their knowledge and students can modify the methods of their preparation for the final exam in due time. The computerised method of testing is useful because it provides lecturers with important feedback about the state of student knowledge and also helps to identify problematic lectures or parts of the course, misleading questions, differences among particular lecturers, etc. This method is also more preferred by students and helps save costs and the time academic staffs spend correcting written tests.

It is also important to mention the similar effects updating and replacing questions have compared to the changing of the structure of the computerised test. We also analysed the impact of the change in structure of the computerised test and frequency of represented questions in the test and concluded that a higher frequency of questions leads to an increase in the correctness of answers and that a lower frequency leads to a decrease in the correctness of answers. It is evident that selected questions should still be regularly analysed and investigated. Based on the results of their analysis, the Department of Business and European Laws UEP should take every necessary corrective action. The study has confirmed the results of previous studies, which consider progressive testing as a useful tool in the whole process of education.

Acknowledgements

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PSYCHOPHYSIOLOGICAL WORKLOAD DURING LOG BUCKING BY TIMBER HARVESTER

[1]Pavel Natov, [2]Jiri Dvorak, [3]✉Ludmila Natovova

[1]Department of Forestry Technologies and Constructions, Faculty of Forestry and Wood Sciences, Czech University of Life Sciences Prague, Czech Republic

[2]Department of Forestry Technologies and Constructions, Faculty of Forestry and Wood Sciences, Czech University of Life Sciences Prague, Czech Republic

[3]Department of Psychology, Faculty of Economics and Management, Czech University of Life Sciences Prague, Kamýcká 129, Praha 6 - Suchdol, 165 21, Czech Republic, natovova@pef.czu.cz

Abstract

In this study we aim to assess the measurement of workload in students/operators of log bucking from the methodological sight. To analyze the workload, a multicase study research design has been conducted from April 2013. This paper presents the results of a single case study and the main aim of this paper is to evaluate the whole research design. Data were collected in April 2013 from a college student of forest harvesting. We used psychodiagnostical tools (testing of awareness, vigilance and personality characteristics) and Biofeedback 2000 X-pert tool to record physiological workload parameters. Descriptive statistical methods were used to analyze the obtained data. The results show differences between the duration and frequency of working operations. Also the results of all other measures (psychophysiological and psychodiagnostical) as well as the research project´s strengths and weaknesses are described. Outcomes for improvements of the educational process of students/operators are discussed.

Keywords

Biofeedback, electromyography, forest harvesting training, harvester simulator

Introduction

While performing work activities such as operating a forest harvester, a man is exposed to various types of loads, depending on the machine and also the work conditions of his actual workplace. The monitoring and analyses of work conditions as well as workload help to reduce possible risks, injuries and long-term illnesses caused by occupational stress. According to Eagan and Garvey (2015: 924) “the consensus in the literature suggests that stress cannot be considered as a uni-dimensional construct. Instead, stress is multifaceted, and different types of stress relate to performance in different ways”. Usually the term “workload” corresponds to mental as well as a physical type of load. On the physiological level, both physical and mental workloads evoke responses in the organism, which result in an increase in blood pressure, heart rate, cardiac output and skeletal muscle blood flow in addition to a decrease in renal and visceral blood flow (Wasmund et al, 2002; Zużewicz et al, 2013).

In the past, the primary goal of biofeedback training is the enhancement of bodily relaxation, but it is also frequently used for measurement and acquisition of data about psychophysiological indicators during different types of work and working environments (Peper et al., 2003).

Surface EMG biofeedback provides instant feedback of the myoelectric signals and is

often used as a cognitive/educational method to learn how to control musculoskeletal responses (Ehrenborg, 2010). This fact is important particularly from the viewpoint of health and prevention of diseases associated with one-sided loading of certain muscular groups. In the course of learning to control the harvester on a simulator it might be inspiring for the students to get a physiological feedback. The method may provide the students with an opportunity to exercise conscious coordination of muscular groups and to influence the way they work on the machine and the level of physical loading in the course of the work. Per-Erik (2009) concludes than an employee – the harvester operator – shall be, jointly with the employer, responsible for his working environment. The author says: (Per-Erik, 2009: 2:1) "It is important for you to maintain good health and avoid any work site accidents. Your health is also important to the enterprise since it is clearly important that you are present on the work site and can work. To be able to work you have to be in good health and have no injuries."

The aim of this paper is to assess the methodology and whole research design by presenting the results of a single-case study of workload during the work on timber harvester simulator. Working on harvester simulator is a part of professional education of timber harvesting students in most colleges in the Czech Republic. The idea of using biofeedback in the education and professional training of college students is not common, we found only references to reducing stress in students via biofeedback sessions (Ratanasiripong et al, 2015). In the chapter Materials and Methods we present a research design of this study, we describe characteristics of the participant and we present also all the methods of data acquisition and processing. The section Results provides an overview of our findings, including their descriptions. The focal point of the study is its Discussion section in which we have tried to reflect on our results, confront them with views of other authors and to present different viewpoints of the concerned topic. A brief summary of the most important findings is provided in the Conclusion section and the study is also provided with a list of references.

Materials and Methods

Two groups of methods were used in this study. First we used a set of psychodiagnostical tools to provide a detailed psychological description of the subject (to avoid some characteristics that can influence working behavior or physiological measurements, e.g. long reaction time, extremely low vigilance characteristics). After this part, the work on timber harvester simulator and physiological measurements followed. Physiological measurement provides information about muscle tension during the work and this information is crucial for preventing overload of muscles and appropriate professional training at the position of timber harvester operator. The subject of this single case study is of a young man (18 years old), a college student of forestry in Svoboda nad Úpou. All procedures were applied directly in a classroom in his high-school, to lower the level of stress due to an unknown environment. All subjects in our study are asked to refrain from consuming alcoholic and caffeinated beverages for 12 hours before the measurements. Subjects participate voluntarily and are not paid.

The objective of this single case study was to implement experimental measurements and to analyze the selected relations between independent variables (individual working operations) and dependent variables (the duration of the working operation, changes of the heart rate, body temperature and surface muscle tension). The diagnostic multimedia system Biofeedback 2000 X-pert was used for measuring and recording the changes in dependent variables. Applied biofeedback typically refers to electronic modalities, such

as electromyography (EMG), electroencephalography (EEG) and the measurement of thermal activity, electrodermal (ED) activity, heart rate, and blood pressure (BP) (Schwartz and Andrasik, 2003). In our study, temperature, heart rate and electromyography were recorded during the work on the harvester simulator. For the left and right side muscles at *m. trapezius*, the EMG signal amplitude was determined.

Before working on a harvester simulator the participants in the study take a battery of psycho-diagnostic tests to verify their long-term alertness, vigilance and some personal characteristics. The battery of tests consists of two sets of tests for long-term alertness and vigilance using the methods of CompACT-SR and CompACT-VI in the environment HTS and NEO Five-Factor Inventory, in the Czech version according to Hřebíčková and Urbánek (2001).

The measurement of physiological parameters was performed under optimal conditions of the environment: the air temperature in the room was 22 ºC and the relative humidity was 60%. The length of the time interval of work on the multi-operation machine was 45 minutes. In the end, one measurement was performed at rest, in the so-called "resting phase". It was during a 10-minute working break and the measurement was conducted after the end of the operator´s working activity. All of the activities of the operator as well as the attending personnel were digitally recorded and the resulting videos have been saved, including the installation of the sensors and modules.

Results

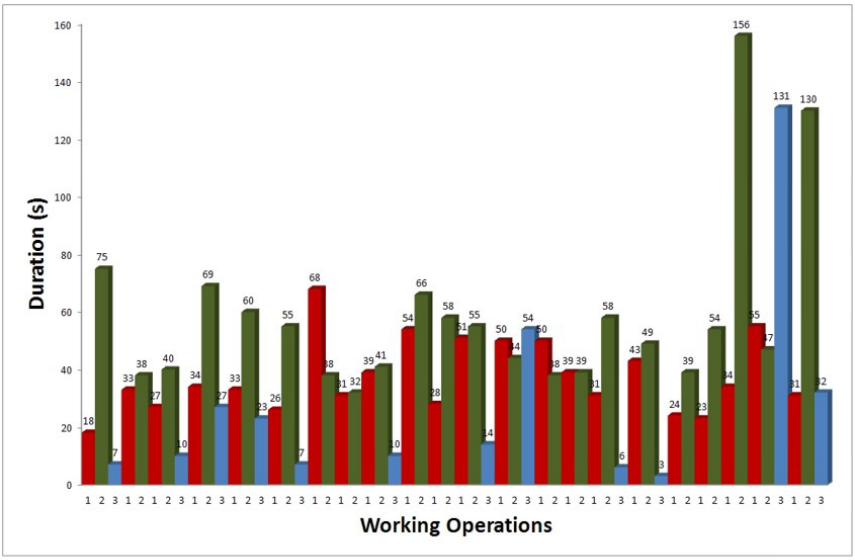
In the first part of this subchapter we will briefly present results of psycho-diagnostic methods described above. In all the sub-tests measuring both vigilance and long-term alertness the subject of the study demonstrated highly above-average results – he responded quickly, promptly and correctly. He made no mistakes or nearly no mistakes (in terms of incorrect response). In the sub-testes of response time his results were excellent – his score was around the 80th percentile. The stability of his reactions in time ranged around the population average (the 50th percentile). Based on the NEO personality inventory we can conclude that the subject makes a rather relaxed impression, he is composed even in stressful situations (the neurotic score corresponds to the 12th percentile of the population). He is sociable, dynamic and energetic (his extroversion score corresponds to the 73rd percentile of the population), practically oriented (the score of openness to new experience is in the range of the population average). He has a better than average score in agreeableness (73rd percentile) which indicates friendly and good relations with other people. The highest score (the 96th percentile) was achieved for conscientiousness – the respondent is probably dutiful, high-performing, ambitious and hard-working, with strong will (Hřebíčková and Urbánek, 2001: 46).

The working process, during which the physiological indicators associated with the stress were measured, consisted of three work operations: Felling, Sorting and Driving. Table 1 shows the number of the individual operations and their duration in the course of his work on the harvester simulator.

	Felling	Sorting	Driving
Number of the performed operations	22	22	12
Duration (s)	822	1281	281

Table 1: Overview of work operations, their numbers and duration.

For more detailed information about the individual work operations, their duration and sequence in the course of the work – see Figure 1.



*1 =Felling, 2 = Sorting, 3 = Driving

Figure 1: Sequence of the individual work operations with regard to their duration.

The Table 1 and the Figure 1 indicate that the least frequent is the work operation No. 3 – Driving. The Table 1 and the Figure 1 also demonstrate that the operation 2 - Sorting - is the longest. In this respect we need to observe that the respondent behaved correctly – from the economic point of view (the highest performance at the lowest operating costs) and also from the environmental viewpoint it is efficient to reduce the driving interval and to get as much as possible from the place where it is operating.

The first necessary step in the analysis of data was to smooth the data obtained from Biofeedback 2000-xpert. The original set of data contained 65 501 measurements which were reduced by averaging of data from the individual channels with regard to individual time operations using the start-stop system.

We will now present physiological parameters measured in the course of the work operations. Their descriptive characteristics are provided in Table 2.

Descriptive Statistics								
	N	Mean	Std. Deviation	Minimum	Maximum	Percentiles		
						25th	50th (Median)	75th
emg1	56	18,2086	4,58255	9,46	29,40	14,6722	18,6669	21,4250
emg2	56	11,2880	4,31315	5,99	25,53	7,7012	10,5876	14,8805
temp	56	35,4435	,34008	33,80	35,64	35,4520	35,5909	35,6095
heart_rate	56	46,4715	6,51323	37,05	65,92	41,4256	45,1274	49,6016
duration	56	43,3393	28,68593	3,00	156,00	27,2500	39,0000	54,0000

Table 2: Descriptive characteristics of the set of dependent variables

The descriptive characteristics provide a certain summary overview of the monitored characteristics. It is obvious that there are differences in average values and other descriptive characteristics (minimum, maximum etc.) between the two measuring channels for electromyography. On the contrary, for the temperature variable the differences in the values are only marginal (this is obvious when we look at values of the lower and upper quartile). However, those characteristics are affected by a significant reduction because the development of the concerned variables in time is disappearing. More detailed information is provided in Figure 2 which shows values of physiological indicators in a time sequence, as they were evaluated in relation to individual work operations.

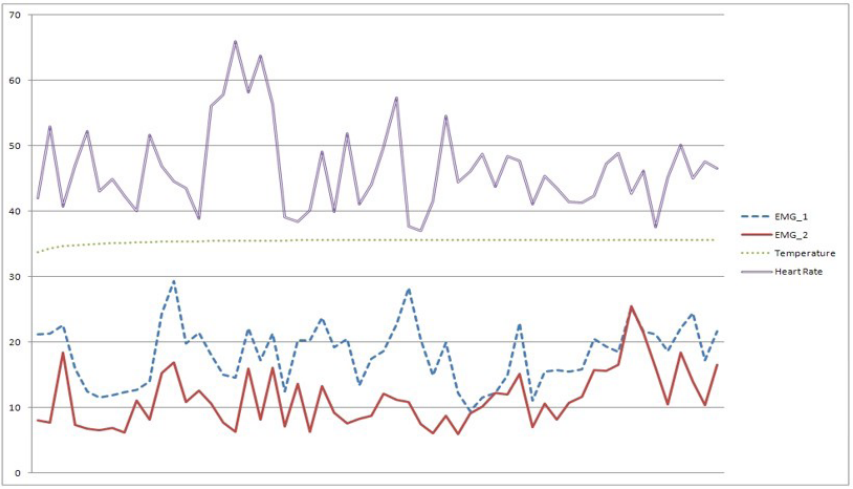


Figure 2: Changes of physiological parameters measured in the course of the work activity

The Figure 2 indicates several findings. As already suggested by the descriptive characteristics indicated in Table 2, the temperature variable practically does not seem to change at the first sight. Taking a closer look at Figure 2, the development of changes in muscular tone is very similar for both the measured channels (emg1 and emg2). In case of the heart rate variable we can observe a high level of variation – it is probable that this indicator is very sensitive, as confirmed by Taelman et al. (2011: 1497): "meaning that HRV is sensitive to any change in mental or physical state".

Discussion

The topic of this paper is not very frequently studied in our conditions. Using biofeedback in professional training of timber harvesting at various educational levels (college, university etc.) is not very common, although we can find references to biofeedback training in large scale of disorders and diagnoses (e.g. chronic pain, headaches, hypertension, ADD and ADHD, anxiety etc.). Furthermore, a combination of psychological assessment tools and physiological status monitoring devices is noteworthy. Psychological methods give us an overview of main characteristics essential for the work position of a harvester operator and are a logical "first step" in our study of workload in timber harvesting.

The research design of this project is currently "only" a case study which may be a source of various hypotheses to be later verified on a bigger group of respondents. In that case, using a time-frequency analysis would be appropriate (Taelman et al., 2011). The

biofeedback may be used to monitor the initial training of the respondents. However, to monitor development of the investigated parameters in the course of the initial training it would be appropriate to select a finer scale – it is necessary to expose a group of respondents to a standard experimental situation repeatedly, not only once as in the above-described case study. When using a bigger group of respondents it will be possible to differentiate between effects of the initial training from a mere reduction of situation anxiety as a result of being familiar with the experimental situation. This will require a control group of individuals who will not undergo the systematic training to control the harvester but they will be exposed to it in some way. The differentiation of effects of the initial training and its efficiency may be then directly reflected in the pedagogical work with students or individuals interested in the initial training on the harvester. An analysis of data obtained from a big group of respondents would probably offer answers to more research questions, e.g.: Which type of work benefits most from the training? In other words, what is the most important factor that generally improves operator's performance at the end of the training and which factor provides the highest potential leverage - what should be the main focus of the training?

Apart from pedagogical impacts, the investigation of psycho-physiological indicators is also important for occupational hygiene and prevention of diseases associated with certain professions. In other words, many work-related problems could be prevented with proper ergonomic techniques. Peper et al. (2003: 179) in a study investigating the potential of psychophysiological feedback in treatment of repetitive strain injury argue, that "with the information of their physiological response patterns, participants appear to better understand the repetitive strain injury processes, become motivated to work on changes, and have a shift in their belief structure about their ability to change and control their mind-body responses."

It should be also noted here that investigation of physiological response to mental and physical stress is, to a certain extent, a controversial topic. As observed by Wasmund et al. (2002: 1828) "some previous studies have suggested, that physical and mental stressors elicit similar responses, whereas others have found them to be quite different depending on where the responses were measured and what physical and mental stresses were used".

Conclusion

Initial training for the work on a harvester and also prevention of occupational disease and protection of the operator´s health have provided both research and practical results. As observed by Per-Erik (2009: 4:1): "A harvesting team annually handles material with huge economic value. Therefore, doing the work well is extremely important and highly appreciated. Some teams harvest nearly 100,000 m^3 solid wood under bark, worth around 60 dollars per m^3 at roadside, and thus about 6 million dollars per year." In the conditions of the Czech Republic the situation is slightly different but even here significant amounts of money are at play (especially for the machinery owners). Therefore it is in the interest of the operator, of the company for which he works and also of the applied research in this field to identify and to describe psychophysiological responses to the given work and the working environment. This may lead to adoption of preventive measures during the work and also to adequate training of future operators at school.

Acknowledgements

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FOREIGN STUDENTS IN CZECH LANGUAGE STUDY PROGRAMMES

[1]✉Lea Nedomova, [2]Jana Hanclova

[1]Department of Systems Analysis, Faculty of Informatics and Statistics, University of Economics, Prague, W. Churchill Sq. 1938/4, Prague 3, 130 67, Czech Republic, +420 224 095 475, nedomova@vse.cz

[2]Department of Systems Engineering, Faculty of Economics, VŠB - Technical University of Ostrava, Czech Republic

Abstract

Our article analyzes entrance exam results for foreign students at the University of Economics, Prague (the UEP). The contribution presents a partial output of the analysis of study prerequisites for economic studies. Using anonymous data obtained from documents submitted for the admission procedure and entrance exam results, we present data queue for number of applications for study and acceptance rate of study and results of entrance exams with accent on foreign students applied at the UEP in period 2010 – 2015. This article offers answers on five presented research questions. The answer to the last one is presented using panel regression test.

Keywords

Entrance exams, graduate study, rate of acceptance, undergraduate study

Introduction

Globalization is a process, which has affected many areas of human life, one of those being education. In the last century, many developing countries have experienced growth in the educational facilities available to them due to the entry of institutions from the West. Some believe that this process is an invaluable opportunity for the people of the developing countries to raise their skills and standards of education. (Chinnammai, 2005; Doucek, Maryska, Nedomova and Novotny, 2011) Others fear that it is merely a modern version of cultural imperialism that will lead to the creation of a universal, ultimately Western society. One aspect of the globalization of education has been the creation of 'twinning projects' between one Western and one non-Western university. Through Globalization of education, which is being knowledge transfer from the Western countries into developing countries, is intended to improve the skills and capabilities of the people receiving it.

The effects of globalization on education bring rapid developments in technology and communications are foreseeing changes within learning systems across the world as ideas, values and knowledge, changing the roles of students and teachers, and producing a shift in society from industrialization towards an information-based society. It reflects the effect on culture and brings about a new form of cultural imperialism. (Doucek, 2004; Maryska, Doucek, 2011)

Globalization and technological advancements are delivering and increasing access to the world and subsequently subjects should reflect this global outlook. The internationalization of higher education can be linked to various internal and external changes in the international system. Externally, there have been changes in the labor market, which

have resulted in calls for more knowledge and skilled workers, and workers with deeper understandings of languages, cultures and business methods all over the world (Maryska, Doucek and Novotny, 2012).
The University of Economics, Prague (UEP) is the biggest economics university in the Czech Republic that is closely related to business (Doucek, Maryska and Novotny, 2013; Maryska, Doucek and Kunstova, 2012). Currently more than 17.000 students is studying at the UEP and every year is applying for entrance exams approximately 16.000 students. The mission of the UEP is providing Czech and foreign students high quality university education not only in micro and macro-economic subjects but also in statistics, informatics, accounting, management, international relations, law, finance etc. in bachelor, master and doctor study programs. The aim of education is to educate high quality professionals that will find occupation not only on Czech labor market, but also abroad. Czech and foreign students can apply for studies in 30 bachelor subjects of study, 39 master subjects of study and 29 doctoral subjects of study (UEP, 2015). The other side of the UEP specialization's is openness to all students from foreign countries and openness in sending students abroad for one or more semesters in Erasmus Plus and another exchange programs.
The problems of education, acceptation rates and knowledge tested during entrance exams are solved in plenty of papers (Vltavska, Fischer, 2015).

Problem Formulation

As part of the surveys annually 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 **foreign students** of the University of Economics, Prague during **their studies in Czech language study programme**s. 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 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, we focus on a changes in number of foreign students applying for studies at UEP, their success rate and changes in knowledge expressed as an average score in English and Mathematics.
For the purposes of our survey, we formulated the following research questions:

- RQ 1: Share of foreign students applying for studies is increasing.
- RQ 2: Share of foreign students accepted for studies is increasing.
- RQ 3: Average score from English is increasing on undergraduate level.
- RQ 4: Average score from Mathematics is increasing on undergraduate level.
- RQ 5: Foreign students with higher score from English entrance exam have higher score from Mathematics as well.

Material and Methods (Data Collection)

The central data systems of the UEP are our basic source of data. These systems contain data about all applicants as well as about the study results of all accepted students.
In this article, we analyze in detail only a data group showing foreign students applying for studies at the UEP. **In our case for this article the foreign students are all applied or accepted students that mark as a citizenship different than Czech Republic**.
In context of mentioned study programmes and subject of studies, the UEP consist of six faculties:

- FFA – Faculty of Finance and Accounting,
- FIR – Faculty of International Relations,
- FBA – Faculty of Business Administration,
- FIS – Faculty of Informatics and Statistics,
- FEC – Faculty of Economics,
- FMA – Faculty of Management.

Each faculty of the UEP has its own entrance procedure and it can choose how it will be carried out or it may even be removed. The following three basic approaches are used at the UEP – students are accepted based on:

- specific results of high school grades;
- the entrance exam;
- the SCIO test results.

Two faculties of the University of Economics, Prague are not included in here presented analysis due to different working out of entrance procedure. The entrance procedure on Faculty of Economics is fully based on SCIO test results and the Faculty of Management does not provide entrance exam in Mathematics and English in the same structure. Mathematics is substituted by the "General managerial skills" exam. That is the reason why these two faculties are not included in the research question analysis.

The Czech Republic passed Act No. 101/2000, on the protection of personal data. Therefore, we made all processed data anonymous at multiple levels. We made all information anonymous 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 a concrete applicant or student.

General Data Characteristics

The data file with entrance exams currently includes 120.795 records that we have been collecting since the year 2010. Each record provides information about the admission procedure result of one student. If an applicant took the entrance exam in several years or full filed several applications for the UEP study, she/he is then included in the data files several times. The most key attributes in the data file include gender, field of study, faculty, and type of study, entrance exam result and information about whether or not a student passed the entrance procedure and if she/he was accepted.

Data analysis has been performed in MS Excel tools and the analysis for RQ 5 was realized in SPSS software.

Results and Discussion

General Overview

The UEP received 120.795 application forms since year 2010. 84.141 applicants were for undergraduate study, 36.651 were for graduate study and 1.490 for doctoral studies. Doctoral studies are specific and cannot be compared with other levels of studies. From this reason we are not analysing these type of study in this paper.

Applications are distributed among faculties in percentage that are displayed in Table 1 and Table 2.

Year/Faculty	FFA	FIR	FBA	FIS	FEC	FMA	Total	SOT[1]
2010	16.27%	17.29%	25.15%	14.11%	20.10%	7.07%	100.00%	**73.53%**
2011	16.82%	18.44%	26.10%	15.31%	16.52%	6.80%	100.00%	**71.32%**
2012	17.53%	18.73%	26.56%	16.21%	14.71%	6.26%	100.00%	**70.97%**
2013	18.13%	19.90%	24.80%	17.59%	13.31%	6.26%	100.00%	**66.60%**
2014	18.12%	21.70%	23.05%	16.95%	13.50%	6.67%	100.00%	**64.42%**
2015	16.57%	20.25%	25.37%	16.89%	14.91%	6.02%	100.00%	**64.57%**

[1]SOT – the column identifies the share on total number of all foreign student's applications at UEP in appropriate year. The rest of missing per cents are applications for doctoral level of study.

Table 1: Distribution of Applications among Faculties – Undergraduate Studies (source: own calculation)

Year/Faculty	FFA	FIR	FBA	FIS	FEC	FMA	Total	SOT
2010	15.85%	22.38%	31.14%	11.51%	8.55%	10.57%	100.00%	**25.08%**
2011	16.27%	17.81%	30.53%	14.29%	8.94%	12.16%	100.00%	**27.42%**
2012	15.55%	19.07%	26.39%	13.93%	9.39%	15.67%	100.00%	**27.91%**
2013	17.07%	15.48%	28.37%	16.67%	8.41%	14.00%	100.00%	**32.23%**
2014	17.80%	14.69%	29.71%	14.99%	7.94%	14.87%	100.00%	34.44%
2015	16.64%	19.55%	25.65%	17.10%	5.81%	15.24%	100.00%	**34.20%**

Table 2: Distribution of Applications among Faculties – Graduate Studies (source: own calculation)

The distribution of applications among faculties is almost stable in investigated period. Exception are visible for FIR and FIS increasing trend and decreasing trend for FEC in undergraduate study. In graduate study, we identified decreasing trend for FIR, FBA and FEC, increasing trend for FIS and FMA.

Foreign Students in Entrance Exams

The UEP received 24.771 applications from foreign students since year 2010. 18.270 applications were for undergraduate studies, 6.237 were for graduate studies and 264 for doctoral studies. For the purpose of this paper we don't care about doctoral studies. The overview for undergraduate applicants is in Table 3.

Year/Faculty	FFA	FIR	FBA	FIS	FEC	FMA	Total	SOT
2010	21.32%	17.59%	31.69%	16.86%	7.52%	5.02%	**100.00%**	**76.89%**
2011	21.64%	18.12%	31.47%	15.96%	6.80%	6.00%	**100.00%**	**75.16%**
2012	22.99%	18.08%	32.28%	16.88%	5.66%	4.11%	**100.00%**	**75.41%**
2013	23.31%	19.98%	29.85%	17.66%	5.28%	3.93%	**100.00%**	**72.77%**
2014	23.86%	20.15%	28.31%	17.45%	5.68%	4.55%	**100.00%**	**73.97%**
2015	22.58%	17.84%	30.87%	18.95%	5.74%	4.02%	**100.00%**	**70.44%**

Table 3: Distribution of Foreign Applications among Faculties Undergraduate Studies (source: own calculation)

Almost for three faculties is visible decreasing trend in number of foreign students applications, except FFA, FIR and FIS, but the increase is not significant for any faculty (no more than 2.50 percent points).

Year - N	FFA	FIR	FBA	FIS	FEC	FMA	Total	SOT
2010	18.20%	25.89%	34.40%	13.00%	4.14%	4.37%	**100.00%**	**18.20%**
2011	20.69%	22.32%	37.82%	10.81%	3.77%	4.59%	**100.00%**	**20.69%**
2012	18.72%	23.77%	36.11%	11.63%	4.12%	5.66%	**100.00%**	**18.72%**
2013	20.33%	17.53%	36.55%	14.72%	4.65%	6.22%	**100.00%**	**20.33%**
2014	22.62%	17.06%	36.85%	13.20%	4.43%	5.84%	**100.00%**	**22.62%**
2015	19.68%	22.53%	30.10%	17.90%	3.83%	5.97%	**100.00%**	**19.68%**

Table 4: Distribution of Foreign Applications among Faculties Graduate Studies (source: own calculation)

In graduate studies is visible increasing trend in applications of foreign students for FFA, FIS and FMA. The highest increase was identified for FIS (approximately 4.90 percent points). The decreasing trend was identified by FIR, FBA and FEC. The highest decrease is by FBA (4.30 percent points).

The second important indicator for each university is rate of acceptance. Following tables show acceptance rate for undergraduate foreign students (Table 5) and for foreign graduate students (Table 6).

Year /Faculty	FFA	FIR	FBA	FIS	FEC	FMA
2010	43.37%	43.29%	23.82%	44.38%	14.60%	43.71%
2011	27.27%	41.10%	26.54%	44.24%	15.64%	46.24%
2012	42.33%	37.57%	28.06%	41.95%	21.71%	61.42%
2013	28.17%	43.08%	16.74%	38.97%	26.19%	52.80%
2014	29.59%	40.32%	23.80%	28.84%	30.11%	53.90%
2015	26.71%	45.27%	30.12%	45.08%	33.75%	47.32%

Table 5: Acceptance Rate for Foreign Students – Undergraduate Studies (source: own calculation)

Trends in acceptance rate for foreign students in undergraduate studies on faculties are different and changing in time. FFA presents strongly decreasing trend (in six years 16.66 percent points), other faculties tend in increasing acceptance rate with peak on FEC (19.15 percent points), followed by FBA (6.30 percent points).

Year/Faculty	FFA	FIR	FBA	FIS	FEC	FMA
2010	51.95%	74.43%	43.99%	78.18%	48.57%	18.92%
2011	40.39%	66.21%	25.88%	33.02%	43.24%	35.56%
2012	28.02%	57.58%	30.77%	26.55%	25.00%	38.18%
2013	38.36%	56.50%	23.74%	28.57%	24.53%	28.17%
2014	40.00%	54.14%	30.43%	34.29%	27.66%	29.03%
2015	49.32%	45.06%	36.69%	42.79%	23.26%	41.79%

Table 6: Acceptance Rate for Foreign Students – Graduate Studies (source: own calculation)

For graduate study was identified decreasing trend in acceptance of foreign students at FFA, FIR and FEC. FBA and FIS presents decreasing trend but this one was broken at the last year and possible it shows change for future years. Data of the FMA indicate permanent increasing number of accepted foreign students – in observed period 22.87 percent points. It can signalize that this faculty has been discovered by international students especially in 2015 and that it became attractive for them.

Answers on Research Questions

RQ1, RQ2: Share of Applicants and Accepted Students

Appl/Accept	Undergraduate		Graduate	
Year	Czech	Foreign	Czech	Foreign
2010	81.81/82.44	18.19/17.56	85.00/85.42	15.00/14.58
2011	81.13/81.76	18.87/18.24	84.47/85.55	15.53/14.45
2012	79.71/79.16	20.29/20.84	83.78/85.43	16.22/14.57
2013	76.71/79.02	23.29/20.98	82.75/85.30	17.25/14.70
2014	73.30/76.64	26.70/23.36	82.91/84.54	17.09/15.46
2015	73.85/74.57	26.15/25.43	80.10/82.04	19.90/17.96

Table 7: Application/Acceptance Rate of Foreign Students in Per cents (source: own calculation)

Table 7 presents two trends that are answers to research questions one and two. Answers for research question 1 and two are visible on Table 7. For answer on **RQ 1** is visible that the **share of application forms from foreign students is permanently increasing for undergraduate study** (for 8.04 per cent points) **as well as for graduate study** (for 4.90 per cent points) **since 2010.** The data for RQ2 - accepted students - are rather similar. At undergraduate level is the increase of acceptance rate 7.87 per cent points and at graduate level is the increase 3.38 per cent points. Both research questions are confirmed.

RQ3, RQ4: Results of Entrance Exams – Undergraduate Study Programmes

E/M	FFA		FIR		FBA		FIS	
Year	Czech	Foreign	Czech	Foreign	Czech	Foreign	Czech	Foreign
2010	64.38/ 66.53	74.87/ 77.68	73.43/ 68.04	78.12/ 75.28	67.55/ 65.57	73.21/ 73.30	57.63/ 55.45	66.50/ 71.22
2011	63.59/ 61.66	71.79/ 71.19	72.26/ 61.30	76.55/ 70.21	64.77/ 58.32	71.19/ 66.16	58.52/ 53.11	67.06/ 70.05
2012	64.97/ 60.69	74.08/ 72.61	71.55/ 58.19	74.63/ 66.78	65.59/ 62.34	71.85/ 73.39	60.71/ 54.39	65.52/ 66.88
2013	64.18/ 56.42	72.58/ 67.76	71.54/ 54.29	75.94/ 65.76	67.11/ 57.10	71.62/ 61.84	64.19/ 50.16	69.95/ 61.05
2014	63.75/ 55.70	72.44/ 68.04	70.06/ 52.22	71.84/ 60.25	68.62/ 56.00	71.83/ 62.09	66.53/ 53.00	70.72/ 64.12
2015	68.09/ 54.10	75.14/ 70.16	70.26/ 51.69	73.31/ 62.13	70.21/ 52.11	73.06/ 67.38	69.40/ 53.46	70.23/ 67.36

Table 8: Results of Entrance Exams in English and Mathematics (source: own calculation)

Trends for research questions three and four are visible on the Table 8. Answer on RQ 3 can be interpreted that for FFA is identified small increase but only in the last year (for 2.70 per cent point but in comparison to the year 2010 is the increase only for 0.27 per cent point), for FIS is also identified increase for 3.73 per cent points. On the other hand the decrease was identified for FIR (3.17 per cent points) and for FBA (0.15 per cent points). The increase of points obtained in English entrance exams at all faculties did not succeed to prove.

The situation with point in entrance exam in Mathematics is simpler. Trends on all faculties show decreasing trend in obtained points, difference is only in difference in observed period. The answer on RQ 4 is negative too.

RQ5

The sample of the data sets contains 24.771 records and we applied the SPSS software for analyzing this set. To explain the dependencies of the monitored variables we formulated the following model:

$$X_{MA} = \alpha + \beta X_{EN} + \varepsilon$$

Year	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
2010	1	0.494	0.244	0.243	18.302	1.934
2011	1	0.435	0.189	0.189	19.257	1.868
2012	1	0.438	0.192	0.191	19.939	1.837
2013	1	0.437	0.191	0.191	20.220	1.945
2014	1	0.415	0.172	0.171	20.807	1.882
2015	1	0.405	0.164	0.163	21.479	1.840
All years	1	0.436	0.190	0.190	20.288	1.833

Table 9: Results of Entrance Exams in English and Mathematics (source: own calculation)

We proved that linear dependency of the results of the math entrance examination on English is given by the 'Adjusted R' determination coefficient ranging from 0.163 to 0.243 in 2010 through 2015 and has largely a downward trend, which means the degree of explanation of the math results with a linear relation in respect of English is on a lower level averaging 19%. The downward trend bears witness to the increasing variability of the deviations from the straight regression line. The reason of this higher variability is the decreasing number of points scored in the entrance examinations for both subjects.

Correlation indexes R range from 0.494 in 2010 to 0.405 in 2015 – for the entire period they decrease and are significant. The 'R square' column indicates the proportion of the number of the math points can be explained using the variable X_{EN}. Here too we see a decreasing degree of explanation from 24.3% in 2010 to 16.3% in 2015. Durbin-Watson coefficient, which ranges around 2, documents that the residual component does not show auto-correlation of the first order.

A regression model was also estimated for the entire period under review 2010 - 2015 by means of combined regression and the results are shown in the last line of the table. The estimated constant coefficient was $\hat{\alpha}$ =25.902 slope. The estimated slope coefficient $\hat{\beta}$ =0.660 shows that an improvement of the English entrance examination by 1 point of average the math examination will improve by 0.66 points. This confirms Hypothesis RQ5.

Conclusion

In conclusion we observe that we succeeded in conforming research questions RQ 1 and RQ 2, on the contrary we did not succeed in proving the dependencies postulated in RQ 3 and RQ 4. RQ 5 represents the evolution in the number of points where we established a correlation of medium significance between the number of points scored in both entrance examinations.

These paper is a result of a long term project realised at the University of Economics, Prague that help UEP answer questions like:

- Does exists relations between results from entrance exams and results from exams in a standard study?
- Does exists relations between results from entrance exams and results from exams in a standard study based on the nationality, type of high school etc.?

- What is passableness in the study?

Thanks to this research and this paper we find out plenty of new knowledge abou structure of applicants for study, their knowledge and differences based on the nationality, type of high school etc. Very important information is success rate based on the study subjects, years of study etc.

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EVALUATION OF COMPREHENSIBILITY OF TEACHING AND LEARNING TO LEARN COMPETENCE

[1]Karel Nemejc, [2]✉Lucie Smekalova

[1]Department of Pedagogy, Institute of Education and Communication, Czech University of Life Sciences Prague, Czech Republic

[2]Department of Lifelong Learning and Study Support, Institute of Education and Communication, Czech University of Life Sciences Prague, V Lázních 3, Praha 5, 159 00, Czech Republic, +420 224 386 022, smekaloval@ivp.czu.cz

Abstract

The paper presents the significance of the evaluation process of a particular university with focus on the aspect of comprehensibility of teaching. It provides empirical data of the evaluation of this aspect retrospectively for the last few academic years. Furthermore, it extends these data for a new evaluation survey associated exclusively with learning to learn competence. The aim of the paper is to describe and quantify the aspect of comprehensibility of teaching for individual academic years, further to present the latest research survey which object was both the learning to learn competence and secondly barriers of the comprehensibility of teaching. A potential link between the learning to learn competence and comprehensibility of teaching can be derived from the results. The survey was conducted at the Czech University of Life Sciences Prague and the number of respondents amounted 368 students. Using the Chi-Square statistical method it was concluded that: (1) there are significant differences among the selected barriers of the comprehensibility of teaching, (2) there are significant differences among the evaluation of responses involving the quality of the learning to learn competence.

Keywords

Comprehensibility of teaching, evaluation, learning to learn competence, university students

Introduction

Evaluation of education is a highly desirable topic in the scientific discourse because it is related to the quality of education. Searching for and finding tools to guarantee and measure the quality of education are one of the many tasks of educational evaluation. The evaluation approaches are diverse and each of the educational institutions has its own ways to reflect and evaluate the educational process.

Educational institutions make an idea about their accountability on the basis of evaluation. Such accountability expresses the responsibility of the institution for the quality of educational services, i.e. for the realization of teaching and learning and for learning outcomes (Starý, 2009: 572). The quality of the educational process is closely linked with its efficiency, in this case with so-called *procedural efficiency* which emphasizes the process as opposed to the resultative efficiency which emphasizes the learning outcomes (Kulič, 1980). Campbell, Kyriakides, Muijs and Robinson (2004) point out that it is just the lack of attention to the procedural efficiency which causes criticism of research focused on the effectiveness of teaching and efficiency of the work of teachers.

The abovementioned motivated us to carry out an empirical survey aimed at the evaluation of the educational process, not the learning outcomes. The educational process is

represented by subjective evaluation of students' learning (the area of the learning to learn competence) and teaching of teachers (the area of comprehensibility of teaching). Both areas include the didactic aspect of teaching and learning, i.e. the didactic competence of teachers and the self-education competence of students.

The paper presents empirical data that result from the subjective perspective of students on their own learning and on teaching of their teachers. The quality of students' learning is represented by the evaluation of learning to learn competence in students. The quality of teaching is reduced to the didactic aspect of comprehensibility of teaching where we are looking for causes or more precisely for barriers of the comprehensibility of teaching. Barriers of comprehensibility of teaching refer either to the cause on the part of teachers or on the part of students. From the abovementioned, combination of relations suggesting possible links between comprehensibility of teaching and the learning to learn competence can be concluded.

Our empirical research does not refer to a comparison with similar research because it has its own specific methodology that is subject to its own know-how guaranteed by the Institute of Education and Communication of the Czech University of Life Sciences Prague (furthermore CULS). So far only one survey dealing with the subjective evaluation of teachers' reflection involving their professional competence was published in the academic year 2012-2013 (Tomšíková, Smékalová and Slavík, 2014).

The aim of the paper is to describe and quantify the aspect of comprehensibility of teaching for individual academic years and furthermore to present the latest research survey which object was both the learning to learn competence on one hand and secondly comprehensibility, or barriers of the comprehensibility of teaching. A potential link between the learning to learn competence and comprehensibility of teaching can be derived from the results. The aim of the research survey then reflects two research questions: (1) *Are there any significant differences among the selected barriers of the comprehensibility of teaching?* (2) *Are there any significant differences among the evaluation of responses involving the quality of the learning to learn competence?*

If the results prove the statistical significance it can be concluded that the difference among the obtained responses cannot be attributed to the influence of chance and then it will be possible to carry out further research surveys. These issues are related to the target group of students with different specializations of bachelor and master study programmes across the CULS Prague.

In particular, we observed the learning to learn competence which has been described through its features and offered the choice within closed-ended questions. Additionally, we observed the comprehensibility of teaching through a scale of closed-ended questions, too. In both cases respondents recorded their responses on a four-level Likert item scale as a categorical statement. The research survey took the form of a short questionnaire consisting of two questions. The questionnaire was distributed and processed in November 2015 of the winter term of the academic year 2015-2016. Because of the personal contact of the researchers with the target groups the response rate of the questionnaires was 100%. After sorting the data 368 questionnaires remained valid, thus the total number of respondents counted 368 students.

The data processing was carried out so that the responses for each item expressed absolute and relative frequencies regardless of the faculty, specialization or year of study. The summarization of the empirical data allowed having a look at observed issues followed by carrying out a statistical survey using the Chi-Square Test of Goodness of Fit.

Materials and Methods

The research sample was obtained by deliberate selection which copied the method of selection of the rules for the evaluation survey of the university. The research sample is represented by 368 students of the CULS Prague in bachelor and master full-time study programmes from different faculties, specializations and years of study.

The section of the original evaluation questionnaire dealing with the students' opinion of the quality of teacher's work consists of 7 items. The questionnaire has two variants for the same items: (1) the evaluation is carried out by students, (2) the evaluation or the self-evaluation is carried by the teacher. Most of the items of students and the teacher are then mutually compared and the degree of the difference between the view of the teacher and view of students is determined. In our empirical research we used the option where *students evaluated the educational activities of the teacher*. From the original questionnaire, we were only interested in the item dealing with *the comprehensibility of teaching*. The item "comprehensibility of teaching" along with the items "motivation of students" and "the choice of appropriate teaching methods" belong to a group of items that reflect *the didactic competence of teachers*.

Of the total amount of the questionnaire items for the past 6 years the item finding the comprehensibility of teaching reached the 5th place in the ranking of all 7 items. That is why we decided to carry out the empirical research to find out the causes or the barriers of the comprehensibility of teaching and the subjective view of students on the learning to learn competence.

The characteristics of the learning to learn competence is based on *The European Framework for Key Competences for Lifelong Learning* (2006), where it is described as follows: I am able to organise my own learning, including through effective management of time and information, both individually and in groups. I am aware of my learning process and needs; I am able to identify available opportunities and to overcome obstacles in order to learn successfully. I am able to gain, process and assimilate new knowledge and skills as well as seeking and making use of guidance.

Answers to the characteristics of the competence represented a range with a choice of a categorical statement on the degree of agreement with the learning to learn competence as follows: (1) strongly agree, (2) somewhat agree, (3) somewhat disagree, (4) strongly disagree.

The comprehensibility of teaching refers to the didactic competence of teachers and the self-education competence of students. The didactic competence can be described as: the amount of didactic abilities, skills, knowledge and experience that are necessary for adequate didactic analysis, transformation, transfer and internalization of the curriculum to students (Smékalová, 2007: 26). In our empirical survey, however, we were looking for the most common barriers of comprehensibility of teaching. Therefore the questionnaire provided responses on the categorical scale as follows: (1) the lack of knowledge from previous studies, (2) high demands for understanding the course content, (3) insufficient or inappropriate way of explanation of the teacher, (4) fast pace of the teacher.

The data processing was carried out so that to express absolute and relative frequencies of the responses. The statistical processing was done using *the Chi-Square Test of Goodness of Fit* that verified whether the frequencies obtained by measuring differed from the theoretical frequencies that matched the null hypothesis (Chráska, 2007: 71). The Chi-Square Test of Goodness of Fit was used in both cases (see survey questions no. 1 and 2) for the significance level of 0.01 and three degrees of freedom. The interpretation of the test of significance was based on the following rule (Chráska, 2007: 73): *if the calculated*

value of the test criterion is greater than the critical value, we reject the null hypothesis on the selected significance level and accept the alternative one.

Results and Discussion

The description and quantification of the aspect of the comprehensibility of teaching from the perspective of students for academic years 2009-2010 to 2014-2015 is as follows (Slavík, Miller and Dvořáková, 2010; Slavík, Miller and Němejc, 2011; Miller and Němejc, 2012; Miller and Němejc, 2013; Němejc and Miller, 2014; Němejc and Miller, 2015):

- 2009-2010: the comprehensibility of teaching was evaluated by 1 721 students of whom only 33% rated it to be *absolutely comprehensible* and without any barriers of the comprehensibility of teaching;
- 2010-2011: the comprehensibility of teaching was evaluated by 1 874 students, 46.5% of them rated it to be *absolutely comprehensible*;
- 2011-2012: the comprehensibility of teaching was evaluated by 1 887 students, 42.1% of them rated it to be *absolutely comprehensible*;
- 2012-2013: the comprehensibility of teaching was evaluated by 2 464 students, 41.7% of them rated it to be *absolutely comprehensible*;
- 2013-2014: the comprehensibility of teaching was evaluated by 2 266 students, 44.6% of them rated it to be *absolutely comprehensible*;
- 2014-2015: the comprehensibility of teaching was evaluated by 1 634 students and 41.3% of them rated it to be *absolutely comprehensible*;
- 2015-2016: the collection of evaluation data of CULS Prague is not completed for this academic year, the data from the distributed questionnaires dealing with the learning to learn competence and the comprehensibility of teaching in students were processed.

We found out that the aspect of comprehensibility of teaching does not have an adequate position in students' evaluation. Subsequently it was found out that the item finding the comprehensibility of teaching reached the 5th position in the ranking of all 7 items. Thus we were interested in the view of barriers of the comprehensibility of teaching and evaluation of the learning to learn competence.

First, the following research question was examined: (1) *Are there any significant differences among the selected barriers of the comprehensibility of teaching?* The verification was performed on the basis of testing of the hypotheses: (a) *Null hypothesis:* The differences among the barriers of comprehensibility of teaching are not statistically significant, (b) *Alternative hypothesis:* The differences among the barriers of comprehensibility of teaching are statistically significant.

Summarization of the data is presented in the table (see Tab. 1) showing the dominant barrier, i.e. *the insufficient or inappropriate way of explanation of the teacher* (reaching 42% of the responses of students). The items such as the lack of knowledge from previous studies and high demands for understanding the course content took more than one fifth of the responses (24%). Responses referring to the barrier of the fast pace of the teacher were on the last position (10% of responses).

Scale: Barriers of the comprehensibility of teaching	Frequency	
	Absolute	Relative
1_The lack of knowledge from previous studies	87	24%
2_High demands for understanding the course content	89	24%
3_Insufficient or inappropriate way of explanation of the teacher	155	42%
4_Fast pace of the teacher	37	10%
Total	368	100%

Tab. 1: Absolute and relative frequency of responses on the scale: barriers of the comprehensibility of teaching

It can be concluded from the distribution of the frequencies that most students attributed the barrier of comprehensibility of teaching to insufficient or inappropriate way of explanation of the teacher, i.e. on the part of teachers. The cause of bad comprehensibility on the part of students was stated only by 24% of them. The question is whether these data are so remarkable that they are statistically significant.

Through *the Chi-Square Test of Goodness of Fit* the test criterion (i.e. 76.37) for the significance level of 0.01 and 3 degrees of freedom which is a value greater than the critical value (i.e. 11.34) was calculated. Then, the interpretation of the test of significance reflects *the adoption of the alternative hypothesis* that there are statistically significant differences among the studied barriers and there is not the influence of chance. We can legitimately claim that the barrier of insufficient or inappropriate way of explanation on the part of teachers is the dominant cause for the comprehensibility of teaching for the students.

Although the causes appeared also on the part of students (see barriers of no. 1 and 2) the greatest frequency was caused on the part of teachers (see barrier no. 3). Of course, the subjectivity of evaluation by students may also play a role, however this barrier obtained a large percentage representation which was confirmed by statistical testing. The research comes out to the disadvantage of the didactic competence of university teachers.

The same students were asked the question regarding their learning to learn competence so that the research was not unilaterally focused. Based on the acquired empirical data, we can conclude back both on the truthfulness of students' responses and also on other potential (hidden) connection.

The research question no. 2 was examined: (2) *Are there any significant differences among the evaluation of responses involving the quality of the learning to learn competence?* The verification was performed on the basis of testing of the hypotheses: (a) *Null hypothesis:* The differences among the evaluation of responses involving the quality of the learning to learn competence are not statistically significant; (b) *Alternative hypothesis:* The differences among the evaluation of responses involving the quality of the learning to learn competence are statistically significant.

The summarization of the data is demonstrated in the table (see Tab. 2) showing that students were likely to be able to learn (up 68.5%) as they chose the response "somewhat agree". Less than a fifth of students believed with certainty that they were able to learn. Only 13% of students thought that their learning to learn competence was not sufficient ("somewhat disagree"). Only one student assessed the competence to be absolutely inadequate ("strongly disagree").

Scale: Quality of the learning to learn competence	Frequency	
	Absolute	Relative
1_Strongly agree	67	18.20
2_Somewhat agree	252	68.50
3_Somewhat disagree	48	13.00
4_Strongly disagree	1	0.30
Total	368	100%

Tab. 2: Absolute and relative frequency of responses on the scale: quality of the learning to learn competence

Frequency of the quality of the learning to learn competence in the category of „somewhat agree" responses occupies a dominant position and we can conclude its significance. Nevertheless we use the statistical testing.

Using *the Chi-Square Test of Goodness of Fit* the test criterion (i.e. 396.10) for the significance level of 0.01 and 3 degrees of freedom which is a value greater than the critical value (i.e. 11.34) was calculated. Then, the interpretation of the test of significance reflects *the adoption of the alternative hypothesis* that there are statistically significant differences among the evaluation of responses involving the quality of the learning to learn competence and there is not the influence of chance. We can legitimately claim that the category of „somewhat agree" responses highlights the dominant quality of students in the area of the learning to learn competence.

Because of the distribution of frequencies it can be concluded that the greatest number of responses was approaching the medium option of responses (i.e. somewhat agree) since the „strongly disagree" option only amounted one response. Again we must consider some misrepresentation caused by subjective responses of students.

If we compare the results across the barriers of the comprehensibility of teaching with the quality of the learning to learn competence in students it was possible to observe that: (a) students who stated a sufficient level of the learning to learn competence (see strongly agree responses) might not be significantly affected by barriers of the comprehensibility of teaching; (b) students who believed that they were likely to be able to learn (see somewhat agree responses) might be affected by barriers such as the lack of knowledge from previous studies and high demands for understanding the course content; (c) 13% of students who evaluated their learning to learn competence to be rather unsatisfactory (see somewhat disagree responses) might feel more significant barrier pointing to insufficient or inappropriate way of explanation of the teacher.

The given context is only potential and the combinations can be diverse. Even those students who were able to learn effectively can evaluate the comprehensibility of teaching as insufficient. Likewise, it is possible to ask why a higher percentage of students (over 13%) who were not much able to learn did not appear when the barrier of insufficient or inappropriate way of explanation of the teacher reached up to 42% and it should have a significant impact on the understanding (i.e. comprehensibility) of teaching content.

In order to evaluate the context objectively it would be necessary to summarize the data in a contingency table and search for links between the comprehensibility of teaching and the learning to learn competence in students. Our results and conclusions indicate a further research plan. Our aim was to have a look at students' evaluation of education in terms of the comprehensibility of teaching on the one hand and from the perspective of the learning to learn competence to determine the significance of these aspects and also to get a basic idea of the procedural efficiency of evaluation.

Conclusion

On the analyzed sample, the empirical research proved that: (1) there are statistically significant differences among the examined barriers and we can legitimately claim that the barrier of insufficient or inappropriate way of explanation by the teacher is the dominant cause for the students' comprehensibility of teaching; (2) the differences between the assessment of responses involving the quality of learning to learn competence are statistically significant and it can be legitimately claimed that the category of "somewhat agree" responses refers to the dominant level of quality of students in the learning to learn competence. The paper revealed answers dealing with the procedural efficiency of evaluation of the CULS and indicated a further exploratory intention in the form of exploration of the barriers of the comprehensibility of teaching in relation to the quality of the learning to learn competence.

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HEURISTIC STRATEGIES IN SOLVING OF MATHEMATICAL PROBLEMS AT SCHOOL

Jarmila Novotna

Department of Mathematics and Mathematical Education, Faculty of Education, Charles University in Prague, Magdalény Rettigové 4, 116 39, Praha 1, Czech Republic, jarmila.novotna@pedf.cuni.cz

Abstract

The paper focuses on mathematics problem solving based on the use of heuristic strategies. Special attention is paid to organization of suitable didactical situations. Three theories are used to explain the effects of the use of multiple solution tasks and pupils' investigative way of solving these problems: Theory of didactical situations in mathematics, theory of heuristic strategies and theory of multi-solution tasks. The main goal of the paper is to present an environment suitable for development of pupils' understanding of mathematics and their problem solving ability including taking into account both the advantages but also the related risks. The results presented in the paper have significant consequences for pre- and in-service teacher education.

Keywords

Problem solving, heuristic solving strategies, Theory of didactical situations, multi-solution tasks

Introduction

> "Offering pupils suitable environments for working in a more creative way when solving problems helps them in situations when they do not find a solving algorithm in their repertoire of knowledge and have to look for suitable heuristic strategies for the solution." (Novotná, Eisenmann and Přibyl, 2015b: 441)

One important goal of school mathematics is to teach a pupil or a student to solve mathematical problems independently, see e.g. (National Council of Teachers of Mathematics [NCTM], 2000). However, this does not seem to be the common practice where problems are often used as instruments for checking if and what pupils have learned, not as an opportunity to learn mathematics. Consequently, pupils understand problems as a tool used for grading, not as a tool that could help them to learn something applicable in different contexts (Brousseau and Novotná, 2008). However, curricular documents demand that pupils be engaged in their own investigations. The use of investigative approaches in education is recommended as a good practice. The Framework Education Programme for Basic Education lists the following requirements:

> "Owing to its activity-driven, practical nature, using appropriate methods, education motivates pupils to continue learning, leads them to a learning activity and to finding that it is possible to seek, discover, create and find suitable ways of solving problems. "(Ministry of Education, Youth and Sports, 2007: 9)

Teachers often face the requirement of planning a teaching unit supporting investigative and creative pupils' approaches to problem solving and giving the pupils the chance to experience the pleasure of discovery but also the chance to learn, to acquire new knowledge or skills they would be able to apply in other situations, to generalize etc.
In this paper we focus on three areas that provide space for this type of pupils' efficient work: use of heuristic solving strategies (see e.g. Eisenmann et al, 2015; Břehovský et al, 2013), multiple solution tasks (Leikin, 2009) and Theory of didactical situations (Brousseau, 1997).
There are a number of researches that focus on whether it is sufficient for successful mastery of school mathematics to master prescribed algorithms or whether school mathematics should also develop their independence and creativity in problem solving. Results of these researches that explore the issue in various perspectives agree that it is essential to create conditions for pupils' creative approaches to problem solving. Otherwise pupils lack motivation to look for a solution in situations when their current repertoire of mathematical knowledge does not feature an algorithm leading to its solution or to consider whether there is only one or more solving procedures available.
In 2012–2014 a longitudinal experiment was conducted within the frame of GA ČR project *Developing culture of solving mathematical problems in school practice.* The goal of the experiment was to teach 12-18-year-old pupils to use heuristic strategies in problem solving. The experiment was conducted in four classes of Czech schools with 70 12-18-year-old pupils. The pupils were gradually introduced to heuristic strategies in problem solving for the period of 18 months. The pupils' progress in success rate in problem solving and changes in selected internal factors affecting pupils' success in problem solving (reading comprehension, creativity, ability to apply existing knowledge) were studied in the experiment. Apart from that changes in pupils' attitudes to problem solving and changes in teachers' styles brought about by the teaching experiment were assessed. An important finding of the experiment was determination of those solving strategies that can be taught to pupils within the limited period of time and of those that are hard or impossible to teach in the limited time.
Results of this research were published in several research papers on conferences and in scientific journals. This paper focuses on issues related to organisation of teaching units that can be used for development of pupils' ability to use heuristic strategies in problem solving. Also the drawbacks and risks of implementing these teaching units that must be avoided are discussed. Such situations enable the important shift from the question: "*What have pupils in their heads?*" To the question "*In which milieu are pupils' heads*?"

Theoretical background

Theory of didactical situations in mathematics

One of the theories that has impacted mathematics education over the past decades is the Theory of didactical situations in mathematics – TDSM (Brousseau, 1997, 2012). Brousseau perceives teaching mathematics as a sequence of didactical situations that a teacher plans of their pupils and in which pupils step by step discover mathematics and its principles. Pupils' activity and discovery is of utmost importance. The teacher plays the role of a guide on pupils' way to knowledge.
The basic concepts of TDSM that will be used here are *savoir*/*connaissance*, *didactical situation* and its types and components, *didactical contract* and the related paradoxes, especially *metadidactical shift.* (Brouseau, 1997, 2012), (Brousseau and Sarrazy, 2002)

Savoirs and connaisances

The Theory of didactical situation distinguishes between two types of knowledge pupils are trying to discover, *connaissances* et *savoirs. Connaissance* represents partial solving strategy, a tool for making conjectures and for making decisions about selection of following activity. Pupils do not necessarily have to be able to formulate *connaissances* and still may be using them on intuitive level. *Connaissance* develops spontaneously in interaction with a situation, it allows pupils to understand a situation and is always immediately connected to this situation. Within the process of *institutionalization* the teacher defines links between a pupil's *connaissances* and previous knowledge and helps their pupils formulate more general *savoir*. Institutionalization is thus in fact a process in which *connaissances* are recognized, checked, sometimes named and stored for future application and reference. If *savoir* is meaningfully integrated and firmly anchored in a pupil's cognitive structure, it is ready for future use as the starting strategy when solving other problems. (Brouseau, 1997, 2012)

Didactical situation

Brousseau distinguishes two types of situations: *non-didactical* (the evolution of the actor is not submitted to any didactical intervention whatever) and *didactical* (an actor, for instance a teacher, organizes a plan of action which makes clear his/her intention of modifying or causing the creation of some knowledge in another actor, a pupil) (Brousseau and Sarrazy, 2002).

Didactical situation consists of three main phases: devolution, a-didactical situation and institutionalisation (Brousseau, 1995; Nováková, 2013; Novotná, Eisenmann and Přibyl, 2015a). An *a-didactical situation* is a situation liberated from teacher's direct interventions; it enables pupils to gain new knowledge individually. In an a-didactical situation pupils construct pieces of knowledge and include them into their cognitive networks. An a-didactical situation consists of three types of situations: *situation of action* (its result is an expected (implicit) model, strategy, initial strategy), *situation of formulation* (formulation of conditions for successful functioning of the initial strategy), and *situation of validation* (verification of the validity of the strategy, whether it functions or does not).

Devolution is the process by which the teacher manages in a didactical situation to put the pupil in the position of being a simple actor in an a-didactical situation. In doing so, he/she tries to set things up so that the actions of the pupil are produced and justified entirely by the necessities of the milieu and by his/her knowledge, and not by the interpretation of the didactical procedures of the teacher. It is the condition for opening an a-didactical situation. *Institutionalization* follows an *a*-didactical situation. It is the process in which the teacher collects what students discovered in the situation of action, formulation and/or validation and transfers it into knowledge. "Thus it affirms: 1) that the student's proposition is valid and recognized as such outside of the particular context of the present situation, 2) that it will be useful on other occasions, not yet known, 3) that it will then be more advantageous to recognize and use it in its reduced form than to re-establish it, 4) that it will be accepted directly by all, or at least by the initiated." (Brousseau and Sarrazy, 2002)

Didactical repertoire

TDSM distinguishes two types of didactical repertoire: *Didactical repertoire of the*

class is a set of instruments that the teacher thinks he/she can expect by his/her pupils. It consists of *savoirs, connaisances* and tools allowing the pupil to generate new knowledge. The other type is *a pupil´s effective didactical repertoire* which an individual pupil has at his/her disposal when confronted with a situation; it may be different from the didactical repertoire of the class. The pupil acts according to his/her effective didactical repertoire.

Didactical contract

The culture of relationships within a group of pupils and their teacher is reflected upon in Brousseau's concept of *didactical contract.* It corresponds with the set of the teacher's behaviours (specific for the taught knowledge) expected by the pupil and the set of the pupil's behaviour expected by the teacher. This contract is not a real contract; it is contracted neither explicitly nor implicitly between the contractors. Its regulations and its criteria of satisfaction can never be really specified by either of the parties. It becomes obvious only when the contract is breached.

Metadidactical shift

When a teaching activity has failed, the teacher can feel compelled to justify herself and, in order to continue her activity, take her own formulations and heuristic means as objects of study in place of genuine mathematical knowledge. This effect is called *metadidactical shift.* What happens is that *connaissance* is substituted by another model, its description in metalanguage. It can be iterated several times; it can concern a whole community and constitute a veritable process escaping from the control of its actors. (Brousseau, 1997) Metadidactical shift can have different forms, e.g. mnemotechnic instruments, use of metaphors, teaching the algorithms instead of applying properties (Sarrazy, 1997).

Heuristic strategies in problem solving

We understand problem solving as a cognitive process that can be conducted in one of the three ways shown in Fig. 1 (Eisenmann et al, 2015: 538).

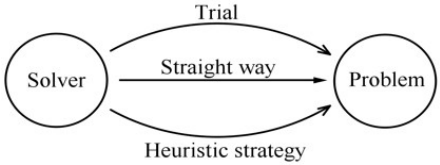

Figure 1: The process of solving a problem

Trial is the crudest way of dealing with a problem. The solver does not question whether they are solving the problem correctly, they only want to "have it solved", usually only once, without and internal feedback on the correctness of the solution. Straight way is based on application a learned piece of knowledge. The solver knows the required solving procedure and is able to see that they are expected to use it and apply it. Heuristic strategy is used when the solver does not have the required knowledge needed for straight way of solution or cannot use the knowledge; use of a heuristic strategy allows them to solve the problem despite these problems.

Let us consider a situation in which a solver is trying to solve a problem but there are (objective or subjective) obstacles that keep them from achieving the goal. At this point the solver will use heuristic strategies. The strategies we refer to as heuristics, in

accordance with Polya (2004) and Schoenfeld (1985), are those solving strategies that pupils use to solve problems in another way than using school algorithms. Heuristic strategies are informal, intuitive, concise. The advantage of heuristic strategies is that they can be applied in any situation regardless of how difficult or confusing they may be. (Novotná, Eisenmann and Přibyl, 2016)

Vohradský et al (2009) point out that heuristic strategies motivate pupils and help them grasp the content and master new knowledge but can never entirely replace other methods. For a successful use of heuristic strategies, it is "essential that pupils have mastered prerequisite knowledge and skills and that the goal they want to achieve be clear to them and adequate to their abilities. The main goal of heuristic strategies is development of independent, creative thinking in pupils." (Vohradský et al, 2009: 15).

Novotná et al (2014) introduce heuristic strategies used within the research conducted with the project GAČR P407/12/1939 *Development of culture of problem solving in mathematics in Czech schools*. The basic characteristics of these strategies are discussed in detail in (Přibyl and Eisenmann, 2014) where the authors show how these properties can affect pupils' ability to master these strategies.

***Strategy of analogy*:** Analogy is a type of similitude. If we are to solve a particular problem we find an analogical problem, i.e. a problem that will deal with a similar problem in a similar way. If we manage to solve this similar problem, we can then apply the method of its solution or its result in the solution to the original problem.

***Guess – check – revise*:** This is a strategy in which we first, drawing from our experience, make a guess about the solution to the given problem. Then we check whether the solution meets the conditions of the assignment. The next guess is made with respect to the previous result. We carry on in this way until we find a solution.

***Systematic experimentation*:** Systematic experimentation is a strategy in which we try to find the solution to a problem using several experiments. First we apply some algorithm that we hope will help us solve the problem. Then we proceed in a systematic way and change the input values of the algorithm until we find the correct solution.

***Problem reformulation*:** When using this strategy we reformulate the given problem and make another one which may either be brand new, is easier for us to solve and whose solution is either directly the solution to the original problem or facilitates its solution. A specific and very important example of this strategy is translation of a word problem from one language of mathematics to another. Classical geometrical problems such as trisection of an angle were easy to solve when translated to the language of algebra.

***Solution drawing*:** When using graphical representation we usually visualize the problem by making a drawing. We write down what is given and often also what we want to get. The drawing we get in this way is called an illustrative drawing as it illustrates the solved problem. Sometimes we can see the solution of the problem immediately in this drawing. However, in most cases we must manipulate with the drawing (e.g. we add suitable auxiliary elements) and we solve the problem with the help of this modified drawing. We call this drawing the solution drawing.

***Working backwards*:** This is a very common strategy in mathematics. We assume that what we have to find/prove/construct holds/exists. Then we try to deduce from this assumption something we already know or something that is easy to prove/calculate/construct. Thus we in fact try to get from the end to the starting situation as close as possible. The procedure is reverted in the final calculation/proof/construction.

***Use of graphs of functions*:** When there are functions in the problem assignment or

when it turns out within the solving process that it is desirable to introduce functions then it is usually good to draw graphs of these functions. These graphs often considerably contribute to finding the solution to the given problem.
Generalization and specification: We choose a more general problem that we are able to solve. Then using the specification we transfer the answer to the original problem.

Multiple solution tasks

"*A multiple solution task (MST)* is an assignment in which a pupil is explicitly required to solve a mathematical problem in different ways. Solutions to the same problem are considered to be different if they are based on: (a) different representations of some mathematical concepts involved in the task, (b) different properties (definitions or theorems) of mathematical objects within a particular field, or (c) different properties of a mathematical object in different fields." (Leikin, 2009: 133).
Leikin (2007) introduces the concept *solution space* that allows us to study different aspects of solving procedure in MST. She distinguishes between various types of solution spaces: An *Expert solution space* is the most complete set of solutions to a problem known at a particular time. In school mathematics, the following types of solution spaces are distinguished: *Conventional solution spaces* consist of solutions that are generally recommended by the curriculum, displayed in textbooks, and usually taught by the teachers; *unconventional solution spaces* include solutions based on strategies usually not prescribed by the school curriculum. *Individual solution spaces* are sets of solutions produced by an individual to a particular problem. *Available individual solution spaces* include solutions that individuals can use on the spot or with some effort without help from others; *potential solution spaces* include solutions that solvers produce with help from others. *Collective solution space* is combination of the solutions produced by a group of individuals.

Materials and Methods

Main teaching experiment

The experiment is described in detail in (Eisenmann et al, 2015). It was conducted from September 2012 to February 2014 in four classes in four schools with the total of 70 pupils aged 12–18. The teachers of these classes can be described as engaged teachers interested in their work and following new trends in mathematics education.
Pupils were gradually introduced to heuristic strategies for the period of 18 months. This was done in the form of solving problems. 120 problems illustrating the use of individual strategies were made available to the teachers who used them in their lessons during the 18 months of the experiment.
The problems came from different areas of mathematics and the teachers were selecting them with respect to the mathematical topic they were dealing with in their lessons and with respect to mathematical skills of their pupils. Each problem was supplemented by solutions using straight way, using the strategy most efficient for their solution and by at least one alternative solution using a different heuristic strategy.
The structure of the teaching units was identical: The teachers gave the task to their pupils (usually in a written form, on a worksheet). They let them work and after some time (when at least one half of the class had completed the task) a pupil was asked to show their solution to the rest of the class. The teachers then checked other pupils had understood the presented solution. They also asked for alternative solutions and if some pupils had

used them, they were asked to demonstrate it to the class. If none of the solutions used the strategy that was intended, solution using this strategy was shown by the teacher. The pupils were always encouraged to solve the problem using more ways and to record their solving procedures. In the following discussions the pupils were encouraged to defend their solving procedures. Sometimes problems were set for homework. The form of checking this homework was identical to work with problems in regular lessons.

Results and Discussion

Let us now look at the presented organization from the point of view of the three theories introduced in Theoretical background.

Heuristic strategies and multiple solution problems

All the selected problems could be solved using one or more heuristic strategies. All of them belonged to multiple solution task category. Solution space of the problems can be illustrated by the following example.

Decide which fraction is greater: $\frac{125}{126}$, or $\frac{124}{125}$. [Result: $\frac{125}{126} > \frac{124}{125}$.]

a) Arithmetical way – calculation e.g. using a calculator: $\frac{125}{126} \doteq 0.99206$; $\frac{124}{125} = 0.992$.

b) Arithmetical way – using common denominator: $\frac{125}{126} = \frac{15625}{15750}$; $\frac{124}{125} = \frac{15624}{15750}$.

c) Generalization and specification: For every natural n it holds that:

$$0 < 1$$
$$n^2 + 2n + 0 < n^2 + 2n + 1$$
$$n(n+2) < (n+1)^2$$
$$\frac{n}{n+1} < \frac{n+1}{n+2}$$

If we substitute $n = 124$, we get a solution to our problem.

d) Strategy of analogy: The situation between the numbers $\frac{124}{125}$ and $\frac{125}{126}$ is analogical to the situation between $\frac{2}{3}$ and $\frac{3}{4}$, where the result is obvious.

e) Reformulation: Let us reformulate the assignment. Let us have two identical pizzas (congruent circles). Let us divide the first one into 125 identical pieces and the other into

126 identical pieces. As we are dividing the same object, the pieces in the other pizza are smaller (we divide the same area into a higher number of identical parts). If we take away one piece of each of the pizzas, 124 pieces are left in the first pizza and 125 pieces are left in the second pizza. As a smaller piece was taken ways from the second pizza, there must be more left.

The teacher must always think about what unsuitable strategies might be used by their pupils. This also belongs to didactical repertoire of the class. However, in MST theory these strategies are not pre-analysed with respect to solution spaces. Obviously a teacher may not anticipate all possible mistakes their pupils might make. However, based on their experience they can predict the most likely mistakes to occur. In the above presented problem e.g.:

f) Wrong idea, correct result: Pupils compare the fraction by saying: 125 is greater than 124, let us ignore the denominator and just compare the numerator, i.e. $\frac{125}{126} > \frac{124}{125}$.

g) Wrong reduction, correct result: $\frac{124}{125} = \frac{\cancel{12}4}{\cancel{12}5} = \frac{4}{5}$; $\frac{125}{126} = \frac{\cancel{12}5}{\cancel{12}6} = \frac{5}{6}$; $\frac{5}{6} > \frac{4}{5}$, thus $\frac{125}{126} > \frac{124}{125}$.

Theory of didactical situations in mathematics

The implemented teaching units complied with the requirements on organization of didactical situation according to TDSM.

Devolution was taking place on two levels. At the beginning of the experiment the pupils had to be introduced to what was expected of them: They have to solve the problem on their own (individually or in groups); each problem can always be solved using several procedures and each pupil is free to select any procedure they find suitable; the solving procedure will be presented to the whole class and correctness of these procedures will be justified; written record of their solving procedure will be given to the teacher at the end of the activity; having solved the problem using one strategy the pupils will try to find other solving strategies for the same problem. On the second level each implemented teaching unit asked for appropriate introduction to the pupils in such a way that the teacher would give no hints on how the pupils should proceed.

A-didactical situation involved all stages of TDSM: In *situation of action* pupils were solving the problem on their own using one or several solving strategies. When presenting the used strategies to the class, *situation of formulation* and *situation of validation* were conducted. During the discussion of the solutions to the problems, partial *institutionalization* took place; its other part was brought about naturally as the created didactical situation was repeated regularly (with different problems).

When conducting a didactical situation it is essential to avoid the so called *metadidactical shift*. In case of the here presented experiment it could have the form that the teacher, trying to help their pupils, will teach what a heuristic strategy is or what kinds of heuristic strategies exist instead of providing an environment in which these strategies will be

used spontaneously. The structure of the individual teaching units in the here discussed experiment was such to maximally reduce this danger.

A priori analysis of a problem (Brousseau, 1997; Nováková, 2013; Nováková and Novotná, 2014) that a teacher carries out before implementing a didactical situation gives them the answer what knowledge is prerequisite for the given solving strategy if it is to be used successfully; see also (Moraová and Novotná, 2014). For example for strategy a) in the problem of fractions presented above it is enough to know what a fraction is and to be able to find the value of both fractions on a calculator, while for strategy b) pupils must know the least common multiple, conversion of fractions to the same denominator and comparison of fractions with the same denominator. This means that the teacher is defining the expected *didactical repertoire of the class* with respect to the group of pupils they are assigning the problem to. A class is formed by individuals each of whom has their own *effective didactical repertoire*. Thus it may happen that some solving strategy a teacher expects to be approachable to their pupils might be out of reach for some of them.

In case of the analysed problem *solution spaces* differ from *repertoire.* While both types of *repertoires* include not only the strategy itself but also both *connaissances* and *savoirs* needed for the use of this particular strategy, *solution spaces* only work with solution strategies. *Expert solution space* includes all the solving strategies a) to e). *Conventional solution space* depends not only on the problem as such but also on the class that is solving the problem. It will be different for 6th graders and for upper secondary school students – for the latter it should correspond to expert solution space. *Individual solution spaces* are different for each individual pupil (similarly as in the case of *repertoires*) and they do not have to be the same as *conventional solution space*.

If a didactical situation is well planned and structured, we can expect that after its completion *didactical repertoire of the class* and *effective didactical repertoires*, as well as *potential* and *collective solution spaces* should broaden. If the teacher wrongly estimates *didactical repertoires* and *solution spaces* of the given class, it can happen that the teaching unit will be conducted in an environment that reduces the pupils' natural will to handle an assigned problem.

Conclusion

Longitudinal observation of the pupils during the whole experiment and structured interviews with pupils and teachers show that the involved pupils became more willing to experiment, their ability to communicate, to defend and explain their solving procedure, to react to opponent's remarks improved. They also got better at recording their solving procedures and became more sensitive to the need of feedback (they checked correctness of their result).

The most important outcome of the experiment is the change in pupils' overall attitude to problem solving. The participating pupils stopped fearing problem solving, they did not put it off if they could not see a suitable solving procedure immediately. They learned to look for solutions and not give up. This change could be observed in about one half of pupils involved in the experiment.

The overall design of didactical situations in which multiple solution tasks and heuristic strategies are used is demanding for the teacher: explaining the task, choice and preparation of the problems, evaluation ... It is necessary to be aware of the risk of metadidactical shift and, more generally, of other effects related to the paradoxes of didactical contract. We would like to stress the importance of institutionalization of the discoveries for pupils and transformation of the newly discovered *connaissances* to *savoirs*. It is also crucially

important that a teacher be able to prevent a situation in which pupils appropriate some heuristic strategy (usually the strategy that they used successfully in problem solving) as an algorithm and stop thinking about its suitability for the particular situation.
Even though this project is aimed at improving the pupils' culture of problem solving, we are convinced that the activities we have presented can be useful for designing new didactical situations (namely, a-didactical) also in other areas of school mathematics, and their diffusion among more teachers.

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HOW DO WE UNDERSTAND EACH OTHER WHEN WE DESCRIBE CLASSROOM ACTIVITIES – LEXICON

[1]✉Jarmila Novotna, [2]Hana Moraova, [3]Alena Hospesova, [4]Iva Zlabkova, [5]Jiri Bures

[1]Department of Mathematics and Mathematical Education, Faculty of Education, Charles University in Prague, Magdalény Rettigové 4, 116 39, Praha 1, Czech Republic, jarmila.novotna@pedf.cuni.cz

[2]Department of Mathematics and Mathematical Education, Faculty of Education, Charles University in Prague, Czech Republic

[3]Department of Pedagogy and Psychology, Faculty of Education, University of South Bohemia in České Budějovice, Czech Republic

[4]Department of Pedagogy and Psychology, Faculty of Education, University of South Bohemia in České Budějovice, Czech Republic

[5]Department of Mathematics and Mathematical Education, Faculty of Education, Charles University in Prague, Czech Republic

Abstract

The paper focuses on the issue of how the terminology which a person is able to use actively influences her perception of pedagogical reality. The research is conducted within the frame of the international *Lexicon Project.* In the paper, the process of evolution of Czech lexicon of didactical terms for description of facts from educational reality is described. The methodology and materials used for creation of the lexicon are presented. The main methodological approach used is open and axial coding of episodes from classroom video recordings. The paper answers the following research question: What is the structure of terms suitable for description of a lesson of mathematics?

Keywords

Pedagogical reality, terminology in mathematics education, educational research, comparative international research, Lexicon

Introduction

Both in theory and practice we often need to reflect pedagogical reality. Teachers, principals, inspectors, researchers and pupils often try to describe "what is really going on in a classroom", i.e. what was observed as really going on at a given time and place. Janík and Slavík (2007: 267) emphasise that to grasp and describe meaningfully "what is actually happening" (i.e. didactical facts) in a lesson is the outcome of intellectual work based on observer's/actor's prior experience. Using terms from pedagogy allows us to interpret the facts in a meaningful way and also to communicate them. It can be said that the used terminology forms a common interpretative context. This implies we should ask to what extent the terminology a person is able to use actively affects their perception of pedagogical reality. The search for an answer to this question was at the birth of the international project Lexicon (Clarke, 2009). More information about the pilot study of the project can be found in (Clarke and Mesiti, 2010). This study reports on its first stage that has already been concluded.

In the year 2014, D. Clarke created and international community from nine countries

(Australia, Chile, China, Czech Republic, Finland, France, Germany, Japan, USA) to solve the project named *The Lexicon Project: Analysing pedagogical naming systems from different cultures to reconceptualise classroom practice and advance educational theory* (Clarke, 2015). The main goal of the project is to create a database of terms for classroom research on international level. Cultural specificity of classrooms poses challenges for international comparative research. Educational theories, research and descriptions of practice are contemporary framed in English, which names some aspects of the classroom, but ignores key aspects named in other languages. This limits the capacity to access, connect and adapt the wisdom of other cultures (Clarke et al, 2008). The Lexicon Project initiates cross-cultural dialogue to identify pedagogical terms from selected Asian and European educational communities and use these as analytical tools to categorise, interrogate and enrich our classroom practice, classroom research, and educational theorising.

The impact of culture on classroom reality and how it is perceived attracted a lot of attention in the field of mathematics education in the 1980s' (see e.g. Bruner, 1996). Rezat and Sträßer (2012) relate different perception to different actors in education visualized in the form of didactical tetrahedron (Rezat and Straesser, 2012: 648) and discuss conventions about what it means to be doing mathematics, to be a mathematics teacher or a pupil studying mathematics, about school as an institution, about textbooks and their structure and form, public image of mathematics in a society etc. All these have impact not only on mathematics lessons but also on discourse about these lessons. This may result in a situation when researchers and teachers from different countries may fail to understand each other since the terminology they use refers to very different situations.

All the above mentioned reasons were at the birth of the idea of developing a book of reference, a lexicon that would provide the needed terminology as well as examples of what is meant by different terms used for description of classroom practices. A book that would facilitate communication across cultures and borders but also across the world of researchers and theory and practicing teachers. The here presented study summarizes the results of the first stage of the solution of the project – creating the Czech version of the lexicon. We describe how lexicon was constructed and try to answer the question: What is the structure of terms suitable for the description of a mathematics lesson?

Materials and Methodology

Realization of the project Lexicon has just finished its first phase: creation of national lexicons. Supported by the classroom videos national groups identified such activities that their local education community would consider significant enough to be named and create national lexicons. The list of terms is compared with national research publications dealing with classroom research. In the case of the Czech lexicon, we worked with the Czech dictionaries (for example Průcha, Walterová and Mareš, 2013).

The first step when we enter the project was to make decision about who should be in the project team to hit the balance between everyday school practice and the world of research. The lexicon must be built on solid terminology used in mathematics education but must at the same time be comprehensible to practicing teachers. This lead to the decision of building a team made from researcher and teachers (mathematics educators from University of South Bohemia and Charles University in Prague, researcher in pedagogy from University of South Bohemia, mathematics teacher-researcher and language teacher). The presence of the language teacher was decided upon for two reasons: focus on types of discourse and communication in mathematics lessons from linguistic point of

view and also the necessity to translate Czech lexicon into English for international use. Mathematics teacher is a part of the team because of his contact with everyday school reality and researcher in pedagogy because of their knowledge of terminology used in pedagogy in general.

As no similar study could be found, the team decided to use qualitative design. The team worked with video recordings of one Czech mathematics lesson and eight video recordings of other project teams. Foreign video recordings had English subtitles and all the lessons used were transcribed into English.

In the first stage, open coding was used (Strauss and Corbin, 1999). The team members gave terms to events they could discern. This means they divided the lesson into shorter episodes that they found distinct. They defined the beginning and the end of the particular episode. These episodes were described by a code the team members found apposite. As was expected, there were huge differences in approaches to description of various phenomena.

Having finished individual work on this stage, all the team members were presented with coding of other team members. The team met and the different codes were grouped into larger codes using axial coding. The result of this process was a list of codes – the first draft of Czech lexicon. After this the Czech lexicon was verified. This was done by coding foreign lessons – two members of the team were always coding two lessons. The results of their coding were compared and the list of codes extended and restructured.

Results

Stage of open and axial coding

The whole work started by analysis of a "national" lesson. At the beginning the team members coded the lesson using open coding: they divided lesson into segments that were meaningful to then and were looking for suitable terms for these segments. Five descriptions of the same lesson were the outcome of this stage of open coding. These descriptions were of two different natures:

1. detailed and very lesson specific terms (example of terms used for the description of a classroom dialogue in Table 1);
2. generalized and grouped into structures to be more universally usable terms (example of the same segment in Table 2).

In general, it can be said that detailed terms (Table 1) were more likely to be used by teachers, who were observing the lessons very closely. More general terms were used by researchers, especially the researcher in the field of pedagogy.

	Transcript of the lesson	Lexicon terms
T	Well, OK now, as some of you have mastered it already and some of you are already working on your homework to have nothing to do at home, I like that, obviously we‘re getting better again, so we now have it checked. Now I believe all of you are confident you have the calculations right. OK.	teacher addresses the whole class, a positive evaluation comment that many students are immediately working on the task
T	Let‘s now stop the discussion, let‘s listen to each other and show the right solution on the whiteboard. If you‘re sure you understand, you can continue solving the assigned problems. Who needs some explanations watches the whiteboard, OK? It‘s up to you. But, listen to each other.	attracting attention and a new instruction on how to proceed in other activities (once again the opportunity to work independently on assignments and exercises in addition)
T	So, problem a), 78, 2a. Who will show us? Klárka? Klárka, please, come here	an instruction for the concrete student to write a solution of the task on the blackboard
S	Because the minus two upsilon reverses.	the student writes the solution on the blackboard and comments
T	Now, it does not reverse, you move it and use the inverse sign. Excellent!	positive assessment

Table 1: Step by step description of the lesson

	Transcript of the lesson	Lexicon term
T	Well, OK now, as some of you have mastered it already and some of you are already working on your homework to have nothing to do at home, I like that, obviously we‘re getting better again, so we now have it checked. Now I believe all of you are confident you have the calculations right. OK.	The teacher assesses the work of students
T	Let‘s now stop the discussion, let‘s listen to each other and show the right solution on the whiteboard. If you‘re sure you understand, you can continue solving the assigned problems. Who needs some explanations watches the whiteboard, OK? It‘s up to you. But, listen to each other.	Teacher assigns a new task
T	So, problem a), 78, 2a. Who will show us? Klárka? Klárka, please, come here	
S	Because the minus two upsilon reverses.	The student solves the task and writes on the blackboard
T	Now, it does not reverse, you move it and use the inverse sign. Excellent!	The teacher clarifies the pupil´s explanation and assesses the work of the pupil

Table 2: Larger segments of a lesson, generally described

After this stage we proceeded to axial coding. The team faced the task of having to create such codes related to segments that would be at the same time fitting but also more universally usable and not tied to the one particular analysed teaching episode. The team members tried to group their terms into larger and more universal categories. During this activity as well as while comparing the created descriptions with video recordings of other lessons, more items had to be added to the list.

While working on the lexicon, the team members were facing many difficulties that had to be solved. One of the problems encountered was the non-existence of appropriate and fitting terms, both in the area of didactics of mathematics and pedagogy. A solution

that proved to be effective was to omit the term itself in an item and to use only its description. It also proved to be very difficult to label an activity universally but at the same time depicting all that was happening at that moment in the classroom, especially in case that different actors were carrying out different activities (teacher, pupils). In some cases, the existing universal terms were not subtle and precise enough to allow us to distinguish between various episodes from the analysed lesson. The result of overcoming this obstacle was inclusion of items that were not necessarily disjunctive, might overlap to a lesser or greater degree. Moreover, two-level descriptions are used. This allows us to describe the differences and similarities in the lesson more finely. A compromise had to be made between the effort to make the descriptions universal enough to allow their use for different parts of a lesson and between the need to depict the character of different parts of the lessons as accurately as possible; an example is distinguishing between different type of questions asked by the teacher and the goals the teacher wants to achieve by asking them.

The whole team discussion of descriptions resulted in creating a structure that can be used as an umbrella for the lexicon. The following categories for the lexicon were agreed on: Classroom management, Introductory communication, Explanation of new topic, Revision of a previously taught topic, Solving of a problem, Checking individual work, Institutionalization, Summary, Non-mathematical social interaction, Assessment, Concluding the lesson, Individual consultation with a pupil.

After that each member of the team observed eight lessons and tried to use the created lexicon for their analysis. If it were needed, the team members were expected and allowed to create their own terminology for description of what was going on in each of the lessons. All the lessons had subtitles in English and transcripts of the lessons were also available.

Having created the above mentioned structure, it became obvious that a more refined classification of the different categories would be needed to allow a finer, more accurate description of classroom interaction. The stage of elaboration of individual categories followed. An example is given in Table 3.

The same was done with all categories and a lexicon of about 100 items was thus developed. Each item used in the lexicon is illustrated by at least one example from a lesson and a short video illustrating what is meant by the particular item. Sometimes non-examples are also presented to show what is NOT meant by the particular term. Also in many cases there are a number of different activities illustrating the same item.

Sample of Czech lexicon

Lexicon has the form of a table with 8 columns. The content of these columns is illustrated in Table 3, which is a part of Czech lexicon – section Explanation of a new topic. The term is structured as follows:

Explanation of new topic

- in the form of a monologue
  - transmission
- explanation with questions
  - with one pupil
  - with a group
  - with the whole class
  - pupils reply collectively, thus they show they are following teacher's explanation or are providing additional information
- heuristically

- linking
- using aids
  - using a drawing
  - using a projector, a smart board

In Local Language (where applicable)		In English		User	Video Examples		
Pedagogical Term	Description	Pedagogical Term	Description		Lesson	Time Stamp IN	Time Stamp OUT
Výklad nového učiva	U vykládá nové učivo	Explanation of new topic	T explains a new topic				
linking	U upozorňuje na souvislosti s dříve naučeným	linking	T draws attention to links with previously acquired knowledge	R	Australia	00:27:25	00:27:32
za použití pomůcek		using aids					
s oporou o kreslený obrázek	U vykládá a současně kreslí na tabuli	using a drawing	U explains and at the same time makes illustrative drawing on the board	T, R	China Finland	00:23:56 00:11:12	00:36:18 00:14:30
s použitím projektoru, interaktivní tabule	U vykládá a prezentuje na interaktivní tabuli, resp. na projektoru	using a projector, a smart board	T explains and presents on a smart board or a projector	T, R	China	00:03:55	00:05:00

Table 3: Sample of Czech lexicon

The first two columns make the lexicon comprehensible to Czech users whose knowledge of terminology, especially of terminology of pedagogy, is not sufficient, the third and the fourth column allow the lexicon to be used on international level.

Discussion

Our work on the Czech version of lexicon highlighted some of the difficulties of research and practical work in the area of mathematics education. The structure of entries in Czech lexicon is significantly affected by the fact that terms describing the course of mathematics lessons were used as the basis. Thus the structure of entries follows the structure of a mathematics lesson and is based on terminology from the field of pedagogy. This approach differs from approaches of other national teams that base the structure of their lexicon in the culture of education and discourse typical for their country. For example, the first version of American lexicon presents: Organizational structure, Discourse, Pedagogical strategies and thus emphasises a teacher's structured view

of the lesson. Japanese lexicon is based on traditional (and practiced) lesson planning and defines the categories: Structured Problem Solving Phase, Organization of lesson, General teaching strategy, Explicit reference to the Values related to Mathematics, Others. Finnish colleagues come out of terminology used in education and define the following categories: Administrative, Upbringing, Working Climate, Organising the Lesson, Tools and Materials, Homework, Evaluation, Work Modes, Teaching Methods, Guidance, Mathematical Content. In our opinion these are not activity based but their Finnish authors claim they summarize a Finnish teacher's thinking about a lesson.

Use of lessons from nine different countries showed how difficult it is to describe practices not typical for the Czech mathematics lessons in Czech. In many cases the research team was able to use a term in English but were not able to find a convenient Czech word with identical meaning. Thus at this stage, there are many items that are generally described and illustrated by a video sample but not labelled by a specific Czech term. Czech terminology in the area seems to be unsettled. The need to cultivate subject didactic discourse is seen as one of the prerequisites to emancipation of subject didactics (Stuchlíková and Janík, 2015: 449).

The ongoing process of validation of Czech lexicon also showed how difficult it is for Czech teachers to speak of lessons in general terms. In the workshop on the national conference, the teachers tended to pass many evaluating judgements and discuss the conception of the lesson and assess its quality rather than describe the classroom interactions in general terms. They also tended to use everyday language rather than terminology from pedagogy. This only shows that existence of lexicon is needed. It allows sharing knowledge in the school environment as "… a process whose core is a given problem on the solution of which participate several different subjects" with a different level of previous knowledge and experience (Švec, 2009: 26). Cooperation in the team clearly showed that work on the project Lexicon made it essential to deepen our understanding of the processes in a mathematics classroom.

Conclusions

Let us conclude by saying that organization of teaching units in the sense used in the lexicon has not been yet presented on ERIE conferences. However, organization of teaching units in a different perspective, focusing on the quality of teaching strategies was presented by (Gavora, 2015).

The Lexicon project continues with new activities. National groups validate national lexicons within the national professional community. All teams under the leadership of the Australian team compare national lexicons. An international lexicon of terms for the activities of the mathematics classroom, together with an illustrative library of video material is created.

The Lexicon project offers insight into how a lexicon can be created if it is to describe the classroom reality and practices rather than a list of terms detached from everyday life. The authors of this paper discuss the individual stages of work on the lexicon and comment on the obstacles that had to be overcome to ensure a lexicon that will enable communication between researchers, educators and teachers is created. The goal of the paper is at the same time to trigger discussion in pedagogical community on Czech terminology used in didactics of mathematics.

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FactOrEasy© GAME

[1]✉Josef Pavlicek, [2]Vaclav Svec, [3]Petra Pavlickova, [4]Jana Kreckova

[1]Department of Information Engineering, Faculty of Economics and Management, Czech University of Life Sciences Prague, Kamycka 959, Prague, 165 00, Czech Republic, pavlicek@pef.czu.cz

[2]Department of Management, Faculty of Economics and Management, Czech University of Life Sciences Prague, Czech Republic

[3]Department of Systems Engineering, Faculty of Economics and Management, Czech University of Life Sciences Prague, Czech Republic

[4]Department of Systems Engineering, Faculty of Economics and Management, Czech University of Life Sciences Prague, Czech Republic

Abstract

This article describes the "FactOrEasy" management game, which was developed as a tool to help provide practical experience for students following the Strategic Management module at the Czech University of Life Sciences, Prague. The game was developed at the Czech University of Life Sciences as a collaboration between the Department of Information Engineering, and the Department of Management. The tool follows the established decision making steps, tries to support them and helps the player to gain valid and specific experience. This experience is taken as a transformation of theoretical knowledge into practical behaviour. This behaviour is partially intuitive and partially gained from their studies. Intuitive behaviour can be understand as tacit knowledge, and this tool helps highlight tacit knowledge and combine it with practical experiences. This process of transformation of knowledge (from theoretical to practical) is crucial to the educational process. This process is provided by FactOrEasy.

Keywords

Artificial intelligence, Business game, game strategy, FactOrEasy game, tacit knowledge

Introduction

This article describes the design of the "FactOrEasy" managerial game, developed for classes of Strategic Management students. We describe the students' behaviour whilst playing the game, and we show how students can be influenced by computer interaction. The results presented below are gained from our primary research, and have not been presented before.

Last year, a team of authors (Pavlicek, Svec and Ticha, 2015) presented at the ERIE conference, a paper discussing the possibilities of using managerial games for teaching strategic management. We discussed about students' ability to solve business tasks, make suitable decisions, and to be able to make strategic decisions. We said that the students' behaviour is primarily based on their tacit knowledge. This knowledge can be obtained during the course of Strategic management (Svec, Pavlicek, and Ticha, 2015). According to the Polanyi (1959), who divided knowledge into two categories: explicit knowledge (written and formalised), and tacit knowledge (the action related and unformulated), we can understand the educational process provided by managerial games as some transformation of explicit student knowledge into real (tacit) knowledge.

In comparison with Polanyi (1959), Jarosova (2005) defines two main approaches that she calls experiential and academic (based on the theoretical knowledge). Finally we can understand both these approaches as a process of transformation from "soft skills" (not practically verified, called academic by Jarosova) into practical verified "hard skills" (tacit or experimental by Jarosova).

This fact is significantly verified during the study of students play. A student who (in this work we will call him/her the "player") plays the game, has to make some strategic decisions. These decisions depend on the student's gained knowledge (gained during study at the university) and practical experiences (Pavlicek et al., 2015). This practical verified knowledge we can understand as an experience. This process was described by Kolb (1984:41) as a learning definition "the process whereby knowledge is created through the transformation of experience". To provide support to "gain" the best experiences is the goal of our team. As a direct result of the 2015 game results (Pavlicek et al. 2015, Svec, et al., 2015), we significantly improved the designed electronic managerial game powered by artificial intelligence (AI). The solved questions that were presented at the ERIE conference were: (Pavlicek et al., 2015):

1. How does a (human) player react when a relatively simple market context is presented for decision-making?
2. What does the player's approach look like, during the game strategy settings?
3. How many rounds does a player need to optimise his/her strategy?
4. In which round does the player begin to win safely over all the artificial intelligence players?

The answers to these brought significant new data, which we have used to improve the most recent version of our game. The results from our research are presented below.

The aim of this paper is to describe the changes to the FactOrEasy managerial game, based on the results of 312 students' tests, according to the 4 research questions (above) presented at the previous ERIE conference.

Materials and Methods

The managerial game has to support suitable player's operations. Because the computer powered managerial game is de facto an electronic information system, and each electronic information system needs to bring together Humans, for working procedures; Data, as a communication bridge; and Software and Hardware. Our team had to make a decision, how the system should be built. According to our research presented in the previous ERIE conference (Pavlicek et al., 2015) we designed the game as:

1. Humans: They are the de facto game players; they are students of the strategic management module, plus a few volunteers from students and researchers.
2. Working procedures: These are supported by using an internet browser (each User Interface (UI) element is used as common known element). Although the game was originally based on UI designed at the Java EE, we finally decided to move it into a pure Web based form (based on the Vaadin technology). The user no longer has to work with commands such as "java –jar FactoriesClient.jar" etc. and everything is now running from the Factoreasy.cz domain. It is now easier for the users.
3. Data: are used for communication between the user and the game (and partially between the other players who are simulated as Artificial intelligence robots). Thanks to visualized data (as the charts at the statistic section, or at the competitors' window) the player can make strategic decisions. The player can follow the strategy

of other players, primarily at the game statistic dashboard. This has been developed to graphically visualize the game situation and historical trends.

4. Software: This has mainly been developed at the University, in the Department of Information Engineering and Department of Management. The GlassFish 4.0 application server and Vaadin 7.5 framework were mainly used for GUI (Graphical User Interface) rendering.
5. Hardware: This is located on the university servers in a dedicated server space.

All components of the game (as an information system described above) are fully covered. We will now describe, how the questions above were addressed. Please note, the results from the research are already described in the paper: "ARTIFICAL INTELLIGENCE IN EDUCATION: CAN THE AI TEACH THEM?" (Pavlicek et al.). In this presentation, we will focus only on the new results (we will not recapitulate the known facts).

Solution to issue 1:

As is known, most of the players play defensively at the start. Pavlicek et al (2015) found this continued until about the 5th round. We decided to make the game more difficult. If the market is relatively stable, the player can start to play defensively and wait for the decisions of the others. Theoretically, this improves the play strategy, however in practice this is not realistic. In the real world, the market is dynamically changing. Because of this, the players in the real market try to be dominant. This domination can be achieved via a big money buffer or via mechanism, which helps to earn the money at the end of round. We decided to cover the first need via the possibility of obtaining a loan (and thus make a big money buffer, to be able to buy all the necessary material or sell goods under the price). The second solution is the possibility of buying another factory. If the player has more factories, he/she is able to produce more goods. If, in the market, there is a bigger demand for the product offered, this player has a business advantage. The ability to fix the game strategy is harder now. Players were bankrupted 2-3 times before they fixed the strategy (Table 1).

Solution to issue 2:

If the market is stable (it is not possible to take a loan and buy more factories) the players optimize the strategy at 4-5 round (Pavlicek et al., 2015). Thus, the situation in the market became more dynamic (Table 1). Primarily, it is not easy to bankrupt the opponent player. The player can save his/her round by taking out a loan. Taking a loan helps to make the strategy more aggressive for the other players. This strategy needs money, but thanks to the loan, there is enough money in the game. An aggressive player must be careful, however; the loan interest rate is 15% and unpaid interest decreases profit. This needs to be taken into account.

Solution to issue 3:

During the first version of the game the players were able to fix their strategy between the 3rd and 4th rounds. Now it is not possible. The market is still changing. Now "the accident" plays a more significant role. If some player is bankrupted, the situation on the market changes significantly. There is still a similar demand for goods (at the interval 4-9) (Pavlicek et al., 2015), but thanks to gaining more factories, the players can cover the demanded amount (Table 1). The demanded amount is done stochastically, so here is the opportunity to improve the game to make it more realistic. It can be controlled according to the final market situation. If quantity of material demanded is decreasing (thanks to the bankruptcy of one or more players), the quantity of goods demanded can also be partially decreasing. De facto, in the market is less money amount and this situation can model economic stagnation (crisis).

Solution to issue 4:
We decided to support this issue via a statistical dashboard and the competitor's window. At the time of writing (May 2016) it is not possible to directly answer the question 4, because we would like to study the player's behaviour more deeply (using more data, which we don't currently have). The data presented in Table 1 is, say, at the 6th round. However, finding an accurate answer to this question is not the goal of this paper. What we want to do is to discover how best we can support the user so that he makes a better decision. To fix the strategy depends on the amount of qualitative "information" available to the player. To assist with this we have given to the player two panels to give him/her what probably the player needs.

Results and Discussion

The results presented in this section are based on data from two study subjects at Faculty of Economic and Management (FEM) Czech University of Life Sciences (CULS) Prague and random volunteers (Table 1).

Number of players	Subject (anonymized)	Avg. count of games to fix the business results	Avg. count of bankrupt at the game to fix the business results	Avg. count of game laps to significantly gain market superiority	Total loans count for all players / Avg. on player	Avg. number of requested factories
52	Volunteers	6	2	6	33/64%	0.5
63	Subject 1	12	3	7	42/67%	1.3
231	Subject 2	9	3	6	170/74%	0.9

Table 1: Game results for the task: "Win till 12 game lap".

Note: These results contain the human decision making only. No account has been taken of the robots' game strategies.

The results from our research can be identified as follows:

1. It is necessary to add new functionalities into the game (as a result of solving the 1st, 2nd, and part of the 3rd questions). We decided to implement this decision in view of the test results presented at the previous ERIE (Pavlicek et al., 2015):
   - Fist solution is to allow loan request (more than 60% of players used loans).
   - Second solution is to permit the purchase of more factories (more than 50% of players from volunteers set, and more than 90 % of subject students chose to do this).
2. To provide support to the decision making (cover all functions), is necessary to improve the game design by providing:
   - List of materials available.
   - List of products available.
   - Competitors window.
   - Add a statistical dashboard into the game.

This decision was implemented according to the qualitative research, done with 15 participants from the volunteers set.

1. To follow the main game better, improvements have been made to the Decision making panel.

The point number 1 is covered now by two buttons placed in the Decision making panel.

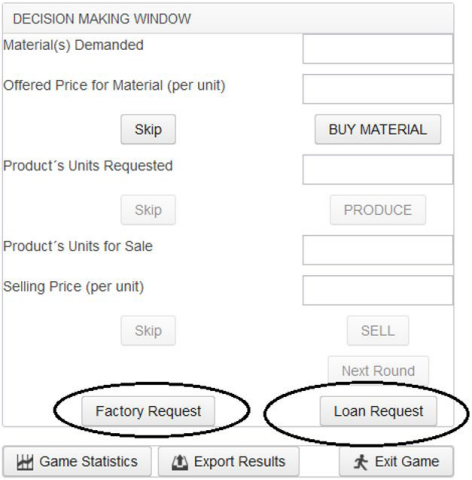

Figure 1: Factory and Loan request. Image was recorded at Factoreasy.cz (Pavlicek et al. 2016)

This functionality is placed into the bottom of the Decision making window for two important reasons:

1. These functionalities are important for the game strategy
2. These functionalities are important during the game round, if the player knows final cash in the account (he/she can save or increase the business via a Loan or buying a new factory)

If we follow the game step flow, we can construct the "Decision making" panel in a logical sequence (Figure 1). The steps follow:

1. Buy material (if you need it) or skip this phase
2. Produce product (if you decide to) or skip this phase
3. Sell product or skip this phase
4. Play next round

Alternative flow (Figure 1):

1. Make Loan or Factory request
2. Visit game statistic (player account trend etc.)

To support the Decision making we decided to design a "Competitors window".

In Figure 2 it can be seen that, the main information about the players is presented. Please note, this is not realistic. In the market we do not usually know the costs in the account of our opponent. Material or product in stock is hidden. We can predict it statistically or by artificial intelligence – this technology is implement in this game for robots according to the players' decision making. The same applies to Loan amount. What is known is the number of factories, i.e.: production capacity during game round. This window was provided, however, to help the students make better decisions – to help them to gain tacit knowledge.

COMPETITORS WINDOW

	Human	Robot 1	Robot 2	Robot 3
Cash	5800	5800	5800	5800
Material(s) in Stock	4	4	4	4
Product(s) in Stock	2	2	2	2
Material(s) Demanded	0	0	0	0
Offered Price for Material (per unit)	0	0	0	0
Purchased Material(s) (units)	0	0	0	0
Product(s) Offered (units)	0	0	0	0
Sold Product(s) (units)	0	0	0	0
Price per one Product	0	0	0	0
Sales	0	0	0	0
Loan	0	0	0	0
Number of Factories	2	2	2	2

Figure 2: Competitors window. Image was recorded at Factoreasy.cz (Pavlicek et al. 2016)

Discussion

According to Becker (2011), who describes the impact of business games as a tool of experiential learning, we can follow his conclusion and use the tool for experimental learning. If we need, we can dynamically update the teaching tool. Thanks to the game architecture (Pavlicek et al. 2015, Svec, et al., 2015, Pavlicek et al., 2014) which is based on artificial intelligence, we can update the opposite player behaviour (Robots 1-3) in Figure 2, very quickly. As we suggested in the publication (Svec et al., 2015): "By adapting the methods of artificial intelligence, the solution can evolve together with the players and thus better support their professional development". A similar conclusion can be seen in Wawer et al (2010), and Wolfe (2000). The dynamic character of Factoreasy game, makes it difficult to predict on the one hand, but the decision making is as easy as is possible (for example Figure 2). On the other hand it helps the students to gain the experiential (or practical) knowledge as was suggested for example at Jarosova (2005).

Conclusions

Our team has tried to describe, how we can improve the mechanisms of gaining experiential knowledge by the students. The study presented above, describes the software Factoreasy etc. and is based on 3 years of research work. The theoretic base is gained primarily from sources such as Jarosova (2005), Kolb (1984), Wawer et al (2010), Wolfe (2000) and our results (Pavlicek et al. 2015, Svec, et al., 2015, Pavlicek et al., 2014). This business game is based on artificial intelligence and has proved to be very useful for the education of students of the strategic management courses. But not only for them. Thanks to the support of the study of the subject "Human computer interaction" lead by Pavlicek at the Czech University of Life Sciences, department of Software Engineering, we can practically test this game from the point of view of the usability. How usability does influences the managerial skills, you may be asked? Because the following game steps, which simulate activities in a real business (material buy decision, produce good, sell good, build factory, take loan, study game result of opponents etc.) deeply influence the players' decision (Pavlicek et al. 2015, Svec, et al., 2015). As discussed above, the game design can help (or hide) the mandatory information needs for making the decision. Our software tries to follow common steps and tries to be as helpful as possible for the

students. But we can change it. We can develop new decision making issues as Wolfe (2000). These decisions can be (as educational plugin – "add-on" plugged into the game) offered as a played service. For example the game statistic is now for free, but in real business you have to pay for that etc. the game will be improved and the results will be presented.

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EFFICIENCY OF SOCIAL MEDIA COMMUNICATION OF CZECH UNIVERSITIES AND FACULTIES

[1]✉Marie Pechrova, [2]Vaclav Lohr

[1]Institute of Agricultural Economics and Information, Mánesova 1453/75, Prague, 120 00, Czech Republic, Pechrova.Marie@uzei.cz

[2]Department of Information Technologies, Faculty of Economics and Management, Czech University of Life Sciences Prague, Czech Republic

Abstract

Universities and faculties increasingly use social media in their communication with current or prospective students, employees, community etc. Therefore, the aim of the paper is to assess the efficiency of this communication. Data from Facebook (FB) pages in the Czech Republic for 2015 were used. We included the number of fans and number of posts as inputs and posts' likes, shares, and comments as outputs in Data envelopment analysis. BCC model was calculated to assess the pure and scale efficiency of the universities and faculties in communication on FB pages. The results show that there were only 5 universities and 12 faculties 100% efficient while others have unused potential for higher outputs as they achieve increasing returns to scale. Average efficiency was lower for universities (48.59%) than for faculties (51.16%). Nevertheless, all should focus on higher users' engagement by the interactions with the audience and creating the relevant content.

Keywords

Efficiency, data envelopment analysis, social media, communication

Introduction

University students can be described as digital natives, because they were born in the digital age and have been interacting with digital technology from an early age. They are used to communicate via social media in almost all life situations including learning process. "Social media technology has become an essential part of personal life as users generate content, share photos, choose to ''like'', or interact in a game." (Tess, 2013: A60) Indeed, the communication is not only of the nature of written messages, but the content can take various forms. For example a "like" button serves as a form of virtual endorsement to publicly support another user or an organization (Lee, Hansen and Lee, 2016). Comments and private messages enable deeper interaction and help to spread the content.

Particularly, Facebook was chosen in this study as it is the most popular social networks among university students as the majority of Facebook users in the Czech Republic (31 %) is in age of 25 – 34 followed by category from 18 to 24 years (Dočekal, 2015). As Cheung, Chiu and Lee (2011: 1341) found out, "social presence is the most important factor that determines students' usage of Facebook. The features of social presence indeed can also encourage students to collaborate and work together." The communication process does not occur exclusively among students. A study of Hartman, Moskal and Dziuban (2005) suggest that excellent teachers should communicate ideas and information effectively. Besides, "If we, as professors, want to make strong connections with our students and engage them with the materials we want them to learn, we need to adapt our teaching

strategies to their lifestyles." (Sánchez, Cortijo and Javed, 2014: 138) This can be done using social media also for the connection between teachers and students.
Besides, Facebook has the potential to serve mediate communication between faculty or university and its stakeholders (e.g. for announcement, informing, training, and congratulation purposes – see study of Elitaş (2015). It can also be an efficient tool to attract prospective students and help them to select a study programme because the other students' or alumni recommendations written on faculty's FB application contain important information which prospect students need to know (Pechrová, Lohr and Michal 2015).
Universities and faculties are increasing utilizing social media in their communication. However, the research among them is in the Czech Republic to our best knowledge still mild. Therefore, the aim of the paper is to assess how efficient is the communication of the Czech universities and faculties. The paper is structured as follows. Firstly, used data are described together with the methods how they are processed. Then the results are presented and discussed in the context of other surveys' results. Last section concludes.

Materials and Methods

The main aim of the paper is to assess how efficient are the Czech universities and faculties in communication with the stakeholders. Efficiency is understood similarly as it was defined by Pitt and Lee (1981) as the ability to produce the maximum quantity of output attainable from given inputs. This represents the output oriented approach applied in the paper. Non-parametric approach to efficiency analysis, Data envelopment analysis (DEA), was chosen to calculate the efficiency score of the particular university of faculty. DEA measures relative efficiency of a set of alternatives (decision making units - DMUs) that consume multiple inputs and produce multiple outputs (Jablonský, 2011).
Two types of models are distinguished based on the assumption about returns to scale (RTS). CCR model by Charnes, Cooper and Rhodes (1978) assume constant RTS and is used to calculate overall efficiency (TE). BCC model (Banker et al., 1978) gives efficiency score under variable RTS and pure technical efficiency (PTE). Scale efficiency (SE) is calculated as division of TE and PTE. The technology is unknown in our case, but it might be assumed that variable returns to scale are more appropriate, i.e. that one unit of input generates more than one unit of output. The models are constructed separately for universities and faculties in order to create as homogenous groups of DMUs as possible. Efficiency score is a relative measure of the performance of one DMU in relation to others. It is calculated for each DMU separately and ranges from 0 to 1, where 1 represents 100% efficient DMU.
Two inputs (n = 2) and three outputs (m = 3) are included to DEA analysis. First input is the number of fans (i.e. how many people "like" the FB page) on 31st December 2015 (x_1) and second the number of posts published during year 2015 (x_2). Having this certain number of fans and posts, it is assessed how attractiveness is the communication of the FB page, in other words, how the content is relevant and interesting for the fans. Fans can express their interest by liking, commenting or sharing the posts. Therefore, it was assumed that the output of successful operation of the administrators of the FB pages can be measured by the number of likes (y_1), comments (y_2) and shares (y_3) of the posts.
We used publically available data from FB pages of the Czech universities and faculties. A special software tool was created in order to obtain the information automatically. The data were downloaded for 20 Czech universities ($q_1 = 20$) and 43 faculties ($q_2 = 43$), which are active on FB, i.e. for those where no zero values occurred for the number of

fans and posts. An average FB page of the university had 6164 fans and published 192 posts in year 2015.
On average a post achieved 4 266 likes, 464 comments and 165 shares. Average number of fans of faculties is more than two times lower (2 605), but the number of posts higher (207). A post received 1 900 likes, 74 comments and 188 shares on average. Statistical description of the data is presented in Table 1.

FB page	Variable	Mean	Std. dev.	Min.	Max.
University (20 DMUs)	x_1 – No. of fans	6 164	7 247	26	34 286
	x_2 – No. of posts	192	143	4	524
	y_1 – No. of posts' likes	4 266	7 148	1	31 947
	y_2 – No. of posts' comments	165	289	0	1 237
	y_3 – No. of posts' shares	464	958	0	4 439
Faculty (43 DMUs)	x_1 – No. of fans	2 605	2 810	128	15 382
	x_2 – No. of posts	207	190	4	840
	y_1 – No. of posts' likes	1 900	2 488	1	12 703
	y_2 – No. of posts' comments	74	104	0	422
	y_3 – No. of posts' shares	188	322	0	1 470

Table 1: Statistical description of the data from FB pages (source: own calculation)

BCC model unlike CCR model, it includes variable v taking arbitrary value, which ensures the convexity. DEA output oriented model is formulated as (1) (e.g. Jablonský, 2014):

$$\begin{aligned} &\text{max} && g = \sum_i^m v_j x_{jq} + \upsilon, \\ &\text{s.t.} && \sum_i^m u_i y_{ik} \le \sum_j^n v_j x_{jk} + \upsilon, \quad k = 1, 2, ..., q, \\ & && \sum_i^m u_i y_{iq} = 1 \\ & && u_i \ge \varepsilon, \quad i = 1, 2, ..., m, \\ & && v_j \ge \varepsilon, \quad j = 1, 2, ..., n, \\ & && \upsilon \text{ - arbitrary,} \end{aligned} \tag{1}$$

where each input x is weighted by $v_j, j = 1,...n$ and virtual input is gained and each output y is weighted by $u_i, i = 1,...m$ and virtual output is get for each DMU_q ($q_1 = 1,...20$ or $1,...43$). Constrains limit the efficiency of other DMUs to be ≤ 1. Besides the position of each university or faculty, it was also examined, how the universities and faculties can improve their performance. The calculations were done in econometric software Stata 11.2.

Results and Discussion

Because the underlying technology of transformation inputs to outputs (i.e. FB algorithm) is unknown, but more likely to pronounce variable RTS, BCC model was calculated. While CCR model consider that the increasing the inputs by one unit will bring increase in output in the same proportion, in BCC model the output can change by more or less than one unit. Average efficiency was quite low in both cases of universities and faculties (see results presented in Table 2).

Efficiency	FB Page	Mean	Median	Std. dev.	Min.
PTE	University	0.4859	0.4306	0.3122	0.0161
	Faculty	0.5116	0.4863	0.3039	0.0042
SE	University	0.9853	0.9938	0.0216	0.9229
	Faculty	0.9586	0.9813	0.0555	0.7114

Table 2: Pure technical efficiency (PTE) and scale efficiency (SE) of universities and faculties on FB pages (source: own calculations)

Pure technical efficiency reached 48.59% for universities and 51.16% of faculties. Half of universities were efficient from less than 43.06%. Half of faculties were able to transform the inputs to outputs only with 48.63% efficiency. The distribution of pure technical efficiency among universities and faculties is displayed at Figure 1.

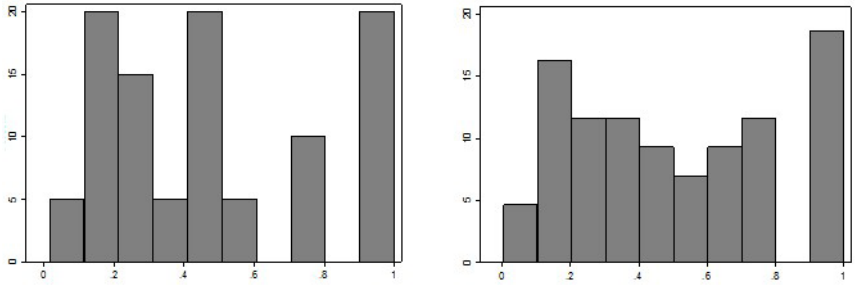

Figure 1: Distribution of pure technical efficiency of universities (left) and faculties (right) on FB pages (source: own elaboration)

There is high potential for improvement as only 4 universities (Karlova univerzita UJOP Liberec, Vysoká škola báňská - Technická univerzita Ostrava, Univerzita Karlova v Praze, and VŠCHT Praha[1]) and 6 faculties were 100% efficient (Fakulta agrobiologie, potravinových a přírodních zdrojů ČZU v Praze, Ústav techniky prostředí, Fakulta strojní ČVUT v Praze, Přírodovědecká fakulta Univerzity Karlovy v Praze, Fakulta dopravní ČVUT v Praze, Filozofická fakulta Univerzity Karlovy, and Matfyz /Matematicko-fyzikální fakulta UK/).

It is hard to find common pattern which could serve as an example of good practice to others. For example Univerzita Karlova v Praze has the highest number of fans of all and it is able to stay efficient as it generates sufficiently high outputs (in terms of numbers of likes, comments and shares). On the other hand, Karlova univerzita UJOP Liberec has only 166 fans and 80 posts per year, but is able to stay efficient as it generates high number of likes for their posts. We can also compare two universities with almost similar

1 The names are not official, but reflect the designation of the FB page.

inputs. Vysoká škola ekonomická v Praze /VŠE/ and VŠUP - Vysoká|škola|umělecko-průmyslová|v|Praze have almost similar number of fans, only the first mentioned published 62 posts more. The outputs differ significantly (the number of likes and comments is much higher at FB page of Vysoká škola ekonomická v Praze /VŠE/). Only the number of shares is higher in case of VŠUP - Vysoká|škola|umělecko-průmyslová|v|Praze. This implies that the first mentioned university is more efficient (from 52.00%) than the latter one (from 45.37%).

Regarding the faculties, Fakulta humanitních studií UK Praha despite having the most fans (over 11 thousands), is efficient only from 38.98%. It implies that the fans are not much active and they lower the efficiency. This case is a confirmation of the fact that the strategy used by some webpages when the fans are "bought" is not worth it. Filozofická fakulta Univerzity Karlovy has slightly over 8 thousand fans, but its posts were liked 1.5 times more (12.7 thousand likes). It is 100% efficient similarly to Ústav techniky prostředí, Fakulta strojní ČVUT v Praze with less than 2 hundred fans and almost 3 hundred likes. Despite of difficulties to find common efficiency pattern, it is possible to observe that faculties with low number of fans and posts published per year (such as Fakulta technologie ochrany prostředí VŠCHT Praha or ČVUT Fakulta Strojní - Biomedicínské a rehabilitační inženýrství) are less active or inactive and so are their fans who do not like, comment or share their posts.

Scale efficiency was higher for universities which were efficient on average from 98.53%. Faculties were exploiting on average economy of scale from 95.86%. Half of universities was scale efficient from more than 99.53% and half of faculties from more than 98.13%. The distribution of scale efficiency among universities and faculties is displayed at Figure 2.

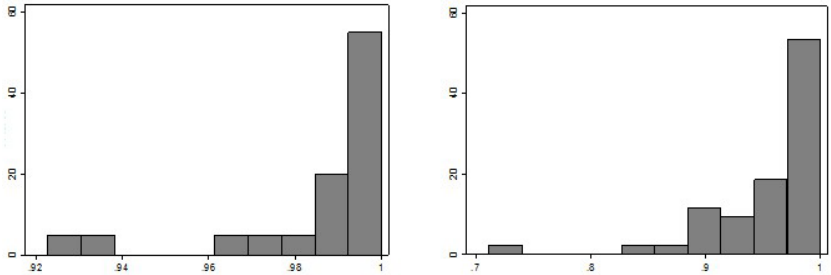

Figure 2: Distribution of scale efficiency of universities (left) and faculties (right) on FB pages (source: own elaboration)

If we have a closer look on the nature of the returns to scale, we can conclude that only five universities, but twelve faculties operated at optimal range. Mostly universities and faculties are achieving IRS. Only one university and two faculties show decreasing returns to scale.

How the universities and faculties which are not 100% efficient can improve their performance was assessed by Pearson correlation coefficient between the development of number of fans and the number of posts, and the number of likes, shares and comments for both groups separately (see Table 3). The correlation coefficients shows that the higher is the number of fans, the higher is the number of likes, comments and shares of the posts. The correlation is strongly positive and statistically significant. In case of universities the relation was stronger than in case of faculties. The more fans the FB page has, the more

likes, shares and comments to their posts it receive and vice versa. It is expected relation. The more likes, share and comments are given to their posts by current fans, the friends of its fans may see the posts too and also like the FB page. However, the correlation between number of posts and number of their likes, comments and shares is not that strong as in case of the number of fans at FB pages of universities. Nevertheless, it is still statistically significant at 10% level. FB pages of faculties have only weak correlation between number of fans and number of shares (even though it is statistically significant). There is rather strong correlation between number of posts and the number of their likes, comments and shares. Therefore, universities and faculties should not focus only to publish high number posts, but also try to involve fans, i.e. to react on the comments of their fans under the posts and interact with them and support sharing and marking with likes of the posts.

Oeldorf-Hirsch and Sundar (2015) came to similar conclusions that users involvement in the posts of the FB page depends on whether the FB administrator allow customization and provide feedback. "Asking the network's opinions and targeting specific friends led to greater involvement in the news content. Discussion through comments led to a greater sense of influence and greater involvement for those sharing the news story." (Oeldorf-Hirsch and Sundar, 2015). Also the importance of encouraging users to also act as sources of information in their networks to drive engagement can be highlighted. From psychological point of view, clicking on "like" may express also the personality of the user as the findings of Lee, Hansen and Lee (2016) showed relationship between psychological characteristics (self-esteem, diligence and emotional stability) and the reason of clicking on Like. While the user higher self-esteem, more diligence, more emotional stability, and less subjective norm clicked "like" to express enjoyment, motivation of the group with opposite characteristics clicked "like" was to please others. Besides trying to improve the effectiveness of a post, there might be two other strategies how to increase the reach of the posts. Ballings, van den Poel and Bogaert (2016) name also the strategy of increasing the network size or buying more reach.

FB Page	University		Faculty	
Variable	No. of fans	No. of posts	No. of fans	No. of posts
No. of posts' likes	0.9241 (0.0000)	0.5572 (0.0107)	0.5441 (0.0002)	0.8218 (0.0000)
No. of posts' comments	0.8773 (0.0000)	0.5353 (0.0150)	0.6044 (0.0000)	0.8254 (0.0000)
No. of posts' shares	0.9392 (0.0000)	0.4342 (0.0558)	0.3903 (0.0097)	0.6198 (0.0000)

Table 3: Pearson correlation coefficients with significance levels in parentheses (source: own calculations)

Our results can be compared with the performance of the universities and faculties on their web pages. There is "Webometrics Ranking of World Universities" – an initiative of the Cybermetrics Lab, a research group in Spain, which rank the web sites according to various criteria. Detailed methodology can be found on their web pages. Current edition of Webometrics from January 2016 (Cybermetrics Lab, 2016) rank highly web pages of Charles University in Prague. They are the first in the Czech Republic and 113 in the world ranking. In our calculations it has also high rank as it is 100% pure technically efficient. On the other hand, its faculties or parts (with exception of Přírodovědecká fakulta Univerzity Karlovy v Praze and Matfyz /Matematicko-fyzikální fakulta UK/) do not belong to 100% efficient (Pedagogická fakulta UK is efficient from 58.86%, 2. lékařská fakulta UK from 53.88%, Fakulta humanitních studií UK Praha from 43.49%, and Fakulta sociálních věd UK Praha only from 36.87%). Second in Webometrics ranking is Masaryk University in Brno which was not included in our research due to the lack of data.

Conclusion

The aim of the paper was to assess the efficiency of Czech universities and faculties in communication with the stakeholders. Data envelopment analysis was used and BCC model was calculated. The inputs were the number of fans and posts, and the outputs their likes, shares and comments. Data were collected from 20 FB pages of Czech universities and 43 faculties for year 2015 by a special user-programmed software tool. The average pure technical efficiency accounted to 48.59% for universities and 51.16% for faculties, which implies that there is still a space for improvement (there were indeed only four 100% efficient universities and five faculties that formed the efficiency frontier). Majority of universities and faculties was working with increasing returns to scale. Only 12 faculties and 5 universities were working in optimal scope. Universities and faculties which are not working efficiently should concentrate on the interaction with the fans (mainly students) on their FB pages. They should engage more the FB users in commenting, sharing and clicking "like" by the interactions with the audience and creating the relevant content. Consequent research shall perform content analysis of the posts and try to identify the determinants of the successful message which brings higher engagement of the users and fans.

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GAMIFICATION IN EDUCATION: CURRENT STATE

[1]✉Ladislav Pilar, [2]Stanislav Rojik, [3]Tereza Balcarova, [4]Jana Polakova

[1]Department of Management, Faculty of Economics and Management Prague, Czech University of Life Sciences Prague, Kamýcká 129, Prague, 165 21, Czech Republic, pilarl@pef.czu.cz

[2]Department of Management, Faculty of Economics and Management Prague, Czech University of Life Sciences Prague, Czech Republic

[3]Department of Management, Faculty of Economics and Management Prague, Czech University of Life Sciences Prague, Czech Republic

[4]Department of Management, Faculty of Economics and Management Prague, Czech University of Life Sciences Prague, Czech Republic

Abstract

Recently, gamification has been perceived as an emerging field of interest among scholars because of its broad application spectrum. This study is aimed at the identification of community-based scholars, on the most frequent collaborative topics, leading to the research of gamification in education. The first part of the study identifies the development of a network of keywords, from the years 2012 - 2015, based on the following indicators: Average Degree, Graph Density, Modularity, Number of Components and Number of Nodes and Edges. The study evaluates the results of the network analysis conducted within 2012 and 2015. The results of the survey identified 6 main communities publishing in the field of gamification: (1) Gamification in general, (2) Motivation & student´s engagement, (3) Virtual world & augmented reality, (4) Serious games, (5) Students engagement & virtual worlds and (6) Active learning. Uncovering the research topics of academic communities in scientific collaboration, networking can improve the quality of applications, such as, recommendations or retrieval in a knowledge-based service system.

Key words

Community, education, game-based learning, Gamification, network analysis

Introduction

Using games for learning has been discussed since 1938, when Huizinga defined the typology of games (Huizinga, 2000). Gamification, as a new trend in the use of game mechanisms, increases the motivation and commitment of the users, as well as in many non-gaming situations, such as, marketing, business and education (Kuo and Chuang, 2016; Kosmadoudi et al, 2013; Simões, Díaz and Fernández, 2012). As it has been stated in previous studies, the purpose of gamification is to break down tasks into various sub-tasks and goals. Users can solve these subtasks by trial and error, and repeat until the problem is resolved and a certain skill level is reached (Harman, Koohang and Paliszkiewicz, 2014; Simões, Díaz and Fernández, 2012).

The usage of gamification in education is developing the acceleration of the experience curve of learning, systems and analytical thinking and is perceived as a serious educational approach (Harman, Koohang and Paliszkiewicz, 2014). The basis is that the learning process is perceived by students as a game and that thought is amusing. Gamification is extracting such game elements that create fun, and adapts them to the

teaching processes (Simões, Díaz and Fernández, 2012). Many authors are focused on the definition of gamification and on the usage of this term. Huotari and Hamari (2012:17) define gamification as 'a process of enhancing and servicing, with affordances for gameful experience, in order to support the user's overall value creation'. Scholars argued that the actuality of a game depends on the perception of the player. Increasingly, the development and design of game programs, with application to education, leads to the development of scientific research activity (Holmes and Gee, 2016) for example they can be for example used in the education of students of management course (Pavlicek et al, 2015). The first article dedicated to the term gamification has been indexed in Scopus in 2011 (Deterding et al, 2011).

Harman, Koohang and Paliszkiewicz, (2014) reported that the issue of gamification was increasingly popular. Therefore, in this study, we agree with the thesis of the need to create an overview of the level of interest and range of conducted studies on the topic of gamification, to provide data on previous studies, structure, and cohesion of keywords that are associated with gamification. However, gamification is still considered as a new and rapidly developing area of research, especially the use of gamification in Education (Dicheva et al, 2015; Deterding et al, 2011). Brughmans (2013) stated that the creation of such a citation analysis quantifies the successful results of a literature review of already published studies. Gamification is actually a very diverse area, which interests the scientific environment in the area of communication, and it is a very fruitful area for understanding the theoretical link between gamification and identifying patterns of scholarly communication, in general (Harman, Koohang and Paliszkiewicz, 2014). Regarding the analysis performed in this study, it is based on the already conducted research aimed at the evaluation of co-authorship networks (Corley, Boardman and Bozeman, 2006; Kretschmer, Hoffmann and Kretschmer, 2006), or the monitoring of publications of individual authors (Moody, 2004) and published topics. The purpose of this study is to make an analysis of the citation network and community focus on the term gamification for the past 5 years, by linking keywords and authors.

Materials and methods

To obtain data for analysis, SCOPUS database was used with the search of keywords "Gamificiation" and "Education". Data was exported to a CSV format and processed in the program Gephi 0.9.1. To build a network or a type of network: Authors and Authors´ Keywords co-appearing in the same paper have been chosen. For a network analysis the Average Degree (Carrington, Scott and Wasserman, 2005), Density Graph (Scott, 2000), Modularity (Knoke and Yang, 2008) and the Analysis Component (Blondel et al, 2008) method was used. Nodes - Authors and Authors´ Keywords, Edges - connections between Authors and Authors´ Keywords. Degree: The degree of a node in a network is the number of connections (edges) with other nodes. Average degree: The average degree of a graph is another measure of how many edges are in set compared to number of vertices in set. Density Graph: Graph Density was defined as the number of edges divided by the number of possible edges. Modularity: It was designed to measure the strength of division of a network within modules (also called groups, clusters or communities). Networks with high modularity have dense connections between the nodes within modules but sparse connections between nodes in different modules. Modularity is often used in optimization methods for detecting community structure in networks. Analysis Component: number of components that are created on the basis of selected modularity detection algorithm. A graphical representation method was used ForceAtlas 2 (Jacomy et al, 2014).

Results

Research results identified a shift in the structure of citations and links to individual communities of authors. Interconnection of the topic, 'Gamification', and other keywords associated with this term, as well as the range of authors' communities, has been observed during the years 2011 - 2015.

In 2012, in the top 10 nodes with the largest degree, there was only one keyword - 'Gamification' and 9 authors. Among the most important authors during this year were Huotari, K. and Hamari, J. with their work: Defining Gamification - A Service Marketing Perspective (Huotari and Hamari, 2012), which was cited 62 times in 2015. In 2012 only nine articles on Gamification, in which 17 authors participated, without co-authorship, were published. In terms of Country/Territory the most articles were published in the United States (3) and Australia (2). Among the most important authors during this year were, Barata G. and S. Gama, who, as a team of authors with other co-authors, published in 2013, four articles about gamification (Barata et al, 2013a, 2013b, 2013c, 2013d) can be mentioned. In terms of Country/Territory, the most articles were published in Australia (13) and United States (12). In Europe, most articles (5) were issued in Germany. From the perspective of the document type, the distribution was as follows: Conference Paper (44), article (7).

By the end of 2014, in the field of gamification in education, 125 articles (68 in 2014) from 348 authors were published. Most significant work in terms of citation this year was: A Systematic Mapping on Gamification Applied to Education (De Sousa Borges et al, 2014), at the end of 2015 was cited 7 times. Most publications published in this year had, as a main author and co-author, Meloni, A (Melonio, 2014; Dodero et al, 2014; Fatto et al, 2014). In terms of Country/Territory, many articles were published in the United States (10), followed by Brazil (6). Among European countries, Germany is in first place (6). From the perspective of the publication type distribution was as follows: Conference Paper (53), Articles (15).

By the end of 2015, in the field of gamification of education articles, 230 (102 in 2015) from 602 authors, were published. Most publications during this year were published by Isotan, S., but only as co-author with others (Challco et al, 2015; Pedro et al, 2015; Araújo, Bittencourt and Pedro, 2015). The most cited publication was Gamification in Education: A systematic mapping study (Dicheva et al, 2015). From the perspective of publication type, the distribution was as follows: Conference Paper (70), Articles (19). In terms of Country/Territory many articles were published in the United States (23), followed by Germany (11). The Table 1 shows top 15 keywords in each year.

Another important part of the study is the analysis of communities by keywords and authors. When analyzing communities based on publication activities, the research defined 39 communities. In determining the 5% threshold for clarity communities was the possible exploration of six major communities.

The Table 2 shows the characteristics of the network in each year.

Average degree since 2012 (3.407) rose to 5.816 in 2015, which means an increase by 71%. This suggests that the continuation of the same keywords, which are used in articles and can thus, form a community. Together with decreasing Graph Density, it can be said that there is an emergence of new separate communities where there are points which are not connected to all other points. In other words, in 2012, the linkage between keywords was higher than in 2015. The value of modularity is approximately at the same level from.649 to.692, suggesting that the nodes in individual communities are connected thicker than

knots, between different communities. The exploration of 6 main communities can be seen in the Table 3 below.

Year	Top 15 keywords
2012	Gamification (17) Blended learning (3), Certification (3) Disruption (3), Higher education (3) Innovation (3) Institution (3) Learning markets (3) MOOCs (3) Motivation (3) Personal Information management (3) Self-awareness (3) Sense-making (3) e-learning (3) Emotional Engagement (3)
2013	Gamification (177) Augment reality (62) Simulation (56) Virtual worlds (56), 3D multi-user virtual environments (52) natural interfaces (52) e-learning (37) education (33), engagement (24), motivation (22) learning (17) Serious games (12) technology-enhanced learning (12) technology-enhanced learning (12) Ar book (10)
2014	Gamification (330) Augment reality (62) Simulation (56) Virtual worlds (56), 3D multi-user virtual environments (52) Natural interfaces (52), Education (51), Motivation (45) E-learning (38) Management (38) Learning (25) Serious games (21), Higher education (19) Badges (15) Mobile learning (14)
2015	Gamification (573) Education (91) E-learning (80) Simulation (67) Motivation (66) Augument properties (62) Virtual words (56) 3D multi-user virtual environments (52) Natural interfaces (52) Engagement (50) Serious games (45) Learning (33) Game elements (28), Game-based learning (27), Higher education (23)

Table 1: Top 15 keywords 2012 – 2015

Year	Average Degree	Graph Density	Modularity	Number of Components	Nodes	Edges
2012	3.407	0.032	0.678	9	54	92
2013	5.989	0.008	0.649	27	369	1105
2014	5.683	0.004	0.692	30	688	1955
2015	5.816	0.003	0.682	39	1152	3350

Table 2: Network analysis in the period of 2012 – 2015, 2016

No. Community	Nodes
1	Gamification, Game-based learning
2	E-learning, education, motivation, student engagement
3	Virtual worlds, augument reality, 3D multi-user virtual enviroments, simulation
4	Serious games, higher education, enterpreneurship education
5	Student engagement
6	Active-learning

Table 3: The exploration of 6 main communities, 2016

Firstly, the strongest community (14.53% of Nods) is an undefined community of authors dealing with gamification, in general. These authors are also linked to other communities, but the topic is not consistent and therefore, has the strongest links only to gamification than to the other group. The second largest community (10.76% of Nods) is focused on the linking of e-learning, education, motivation and student engagement. The most outstanding authors in this community are the team of authors Barata G., Gama S., Gonzales and Isotan S. always as co-author. This community is focused on the motivation and engagement of students learning through gamification (Barata et al, 2013a; Barata et al, 2014; Pedro et al, 2015). This community is closely bound to the third-largest community, which contains 9.01% nodes community focused on gamification, virtual worlds, and augmented reality. This community is connected to gamification by the author Wang X., the co-author in the collective article, Virtual worlds in Australian and New Zealand Higher Education: Remembering the Past, Understanding the Present and Imagining the Future (Gregory et al, 2013). The fourth important community is the community (28.8%) focusing on

gamification, serious games, higher education and entrepreneurship education, where the most cited publications are: Serious Games Integration in Companies: A Research and Application Framework (Azadegan and Riedel, 2012) and Serious Games as a Means for Scientific Knowledge Transfer - A Case from Engineering Management Education (Mettler and Pinto, 2015). Fifth community (6.69% of Nods) is a community that links the second and third community with each other. This community is most focused on student´s engagement through keywords, education, and motivation in the second community, and virtual worlds'community in the third. The significant publication is Gamifying Learning Experiences: Practical Implications and Outcomes (Domínguez, 2013). The last community (5.81% of Nods) is the sixth community that is focused on active learning and its links with gamification. With an important publication, Designing MOOCs for the Support of Multiple Learning Styles (Grünewald et al, 2013).

Discussion

This study identified six strong communities, the first community of authors is bound to the main keyword 'gamification'. It is particularly due to fragmented focus on more keywords where the only link is made by gamification. Recently there has been a rapid growth in the use of gamification in various areas of business through corporate management, education to health and ecology (Dicheva et al, 2015), therefore, the range of possible research areas that may be inconsistent, grows. This community is also the widest.

Representatives of the second community, which is focused on students engagement and motivation of engagers, is the team of authors Barata et al (2013a), whose research deals with the development of students and their competence and autonomy and creativity through virtual environment.

The third community is significant and it is mainly a group of authors dedicated to the virtual environment, the virtual world and augmented reality used for educational purposes. The broad study of the current state of virtual worlds in the teaching and learning arena revealed main obstacles that influence the level of virtual worlds´usage within higher education, such as, the lack of familiarity of academics with VWs technology, lack of awareness of its affordances, general IT literacy of academics and students, institutional infrastructure blockages, etc. (Gregory et al, 2013).

The fourth community that is bound by the serious games keywords is led by Mettler and Pinto (2015), who first presented serious games as an alternative method that may accelerate learning, increase motivation, and support the development of higher order cognitive thinking skills.

Virtual worlds and its influence on the student's engagement, a main topic of the fifth community, was recently verified by the research of Domínguez et al (2013). They argued the previous theories stated e.g. by Simões, Díaz and Fernández (2012) and Deterding et al (2011). The findings of Domínguez et al (2013) suggests that some common beliefs about the benefits of game based learning can be challenged. Although students can perform better within practical assignments and their overall score is high, they performed poorly on written assignments and participated less in class activities, even though their initial motivation was higher (Domínguez et al, 2013).

The last community of authors mostly targeted gamification as a part of active learning, Grünnewald et al (2013) aimed their study at Massive Open Online Courses that brings together thousands of learners into a common event and gamification features that increase learning motivation and creates responsibility and engagement.

The research results showed that using the word gamification is increasing in relation

to education process in time, this point to the fact that the topic is actual and has a good potential for further research.
Based on the results of communities´evaluation we can say that there are six strong communities, which are relatively much isolated. If we want them to be more interconnected and synergistic effect can be though applied, based on the results of previous research (Drlík and Beránek, 2015) certain community events must be created (conferences, workshop etc.) This research serves as a basis for subsequent targeting of conferences topics aimed at 6 identified connected communities.
This research also shows that over the years there is a greater focus on e-learning, augument reality and virtual worlds. This area, however, is still mostly focused on the field of education - higher education like (Pavlíček et al, 2014), but education in business (corporation) is still at the weak level. Both of these can be used in finding opportunities for further specialization of gamification and the creation of specialized conferences.

Conclusion

In this paper we have identified the network of authorship of the research community aimed at Gamification in education. We have used the Gephi 0.9.1. programming as an essential tool to analyze the data. Our network of authors and keywords shows the rising number of new individual communities, where the nodes are not linked with the others. 55.08% of the keywords and authors are part of 6 large communities in which everyone is connected through other authors (connex graph). The other 44.92% is made up of small independent communities and the remaining 12% are authors who publish individually. The information obtained from the communities and their research topics, in a knowledge based system, will help users find interesting topics and papers. This information will also help researchers in the area of improving the application effect in the academic recommendation system. We can say that the connectivity between communities was high (in comparison with connectivity between independently communities) during the reference period and there is a rising degree, which indicates the continuity of keywords and the possibility of making new communities, even though there are still many authors who only work in their small communities or individually, according to common keywords. There are some challenging problems for future studies. The results of this research is also the basis for the study of interdependence and cooperation between authors who are engaged in the field of Gamification.

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THE EDUCATION NEEDS OF MICRO ENTERPRISES IN ON-LINE MARKETING

[1]Jitka Pokorna, [2]✉Ladislav Pilar

[1]Department of Management, Faculty of Economics and Management Prague, Czech University of Life Sciences Prague, Czech Republic

[2]Department of Management, Faculty of Economics and Management Prague, Czech University of Life Sciences Prague, Kamýcká 129, Prague, 165 21, Czech Republic, pilarl@pef.czu.cz

Abstract

The aim of this paper is to identify the educational needs of micro enterprises in online marketing. Primary data was gathered using an electronic questionnaire (n = 176). It was designed for micro enterprises and semi-structured interviews with experts in online marketing. It was found that micro enterprises primarily care about activity on social networks, and do not deal with or outsource website management, PPC advertising, e-mail marketing and analytics. Those made responsible for online marketing assess their knowledge of online marketing as low, which is reflected in the limited ability to evaluate the results of external entities. Due to the increasing complexity of online marketing, the inability to formulate the basic issues of contracts and related unrealistic demands, it is recommended to focus training on the management and control of outsourced activities. Especially, in the areas of options, prices, and desired outcomes, thus increasing the bargaining position in negotiations with external partners.

Keywords

Education, micro entreprises, online marketing, outsourcing

Introduction

Online marketing takes place in the specific environment of the Internet and uses the services there for the implementation and support of marketing activities. In the changing marketing environment, the role of the Internet, and the role of social media in particular, becomes crucial. For marketing strategists, the message is simple: cope with the increasing demands of customers, do not rely on traditional marketing tactics and segment the customer base, understand the importance of technologies used for marketing purposes and, in particular, engage social media as part of marketing campaigns (Constantinides, 2014). According to Gostian (2015), it can be observed that at present, many marketing companies or marketing specialists have skills primarily in activities such as market research, advertising, and sales support. Often companies do not have sufficient knowledge reflecting the modern technological environment. This knowledge is necessary in order to take advantage and so function successfully in the market. The Internet cannot be ignored and must be used in the search for new channels to reach customers, especially those who prefer the electronic environment and are multimedia-oriented. Customers are given the opportunity to be active in communicating, more engaged, creative and expressive. Applying online marketing enables the creation and maintaining of long-term relationships with clients through the management of online activities, allowing the exchange of observations, and evaluation of products and services (Orzan and Orzan, 2007).

The most widely used forms of online marketing realization, targeted at user information searches on the Internet are PPC (pay-per-click) or PPA (pay-per-action), space advertising, records to catalogues, priority listings, search engine optimization, viral marketing, advergaming and the use of various social networks (Madleňák and Švadlenka, 2009). One of the most feasible ways to improve the performance of search advertising, is to achieve a sufficient knowledge of the issue of keywords, and its impact on achieving the desired ad position through various PPC strategies (Ayanso and Karimi, 2015). Social media serves to spread the message through social interaction. It uses techniques to easily publish and distribute content. Social media supports the human need for social interaction, using the Internet and web-based technologies, such as broadcast, in the form of one-to-many. Social media also supports peer-to-peer communication and social networking. Dialogue and social networking promote knowledge and information sharing, shaping individuals from content consumers to content producers (Constantinides, 2014). E-mailing represents the Internet equivalent of direct mail, and includes sending commercial e-mails to Internet users.

Outsourcing can be considered as a tool by which companies seek and entrust external suppliers with the performance of a set of activities that promote their business. Outsourcing, can cover a wide spectrum of activities, including organizational core business activities, such as new product development and/or supporting activities, as well as key organizational activities like IT infrastructure development, maintenance and support or fringe activities such as training, accounting, payroll, data entry etc. Researchers have investigated the importance of outsourcing to businesses over the long term (Ahearne and Kothandaraman, 2007). Carson (2007) points out that outsourcing in the academic field is studied mainly in the area of management, using a range of management theories, or marketing focusing on specific activities like new product development. McGovern and Quelch (2005) also add sales or marketing as such to commonly outsourced marketing activities. Liang et al. (2016) examined the results of previous studies focusing on the factors determining the success of outsourcing in information technology. The outcome was that in the initial phase of IT outsourcing, the companies focused mainly on economic and technological benefits arising from outsourcing, after which success is measured by the expected cost savings. Often, the expected cost savings are negatively affected by hidden transaction costs and other factors, (based on customer needs can also be operating), which will enable evaluation of the appropriateness of outsourcing activities (Rottman and Lacity, 2006). As part of the success of IT outsourcing, four dimensions are monitored: economic, technological, strategic and quality of services (Liang et al., 2016).

The segment of small and medium-sized enterprises in the Czech economy is dominated by micro enterprises employing a maximum of nine people, which represents, in the long term, one fifth of all jobs (Czech Statistical Office, 2013). The results of the survey focused on training efficiency in small and medium-sized enterprises in the Czech Republic, (Fejfarová and Fejfar, 2015), showed that medium-sized enterprises invest more effort in employee training and the evaluation of its efficiency than small enterprises. Nkonoki (2010) identified inadequate education and training as one of the internal factors limiting small firm growth.

The goal of the research is to identify the education needs of micro enterprises in the area of online marketing. The needs are based on determining what types of activities micro enterprises are covering in this field, how the person responsible for online marketing/marketing assesses their knowledge, how they develop their knowledge and what barriers in education they face. Based on the comparison of specialists‘ opinions,

in online marketing and the respondents responsible for its management at the specific micro enterprise, the extent to which the specialists education in online marketing is appropriate is assessed. The primary data was gathered using questionnaires and individual interviews. This research determines what activities in the area of online marketing at micro enterprises are managed internally and what areas are outsourced. In the second part there are defined methods of education and the barriers in managing online marketing at micro enterpises. This study will be followed by further research in the field of medium and large companies. The goal of the research is to define particular areas of online marketing in relation to internal or external solutions. The research will be used to answer the research questions: What areas of online marketing is possible to effectively managed internal and what areas of online marketing is effective to outsource in relationship to the company size?

Materials and methods

The primary data was gathered using questionnaires and individual interviews. The questionnaire is distributed electronically. The company selection is based on the following criterias: (1) micro enterprises, (2) have own websites, (3) public e-mail address, (4) area of the Services and Trades section, with the exception of Computer and Internet services. This segment of micro enterprises was excluded from the investigation, because of its kinship with the subject of the investigation - a level of knowledge and education in the field of online marketing. These criteria can be verified on the basis of the company's profile on the server firmy.cz where companies are selected and contacted. The focus on micro enterprises is based on general assumptions about the lower use of specialists whilst simultaneously, the higher level of complexity in the nature of work in these types of enterprises. The questionnaire was intended for the individuals responsible for the management of marketing/online marketing at the company. Two initial filter questions were used and concerned the number of employees and the importance of marketing for the company. The survey included only micro enterprises with less than 10 employees (annual turnover criterion was not applied). The importance of marketing was evaluated on a scale of 1 to 10 by the entrusted person. The survey included respondents who rated the importance of marketing on a level of 3 and higher. The questionnaire was divided into three parts: (1) knowledge level of online marketing, (2) methods of education in online marketing (3) barriers in education of online marketing. The questionnaire contained 2 filter and 7 core questions. Core questions used multiple choice or scale (1-10; 1 represents minimum, 10 maximum). The questionnaire was completed by a total of 176 respondents (n = 176). Primary data was collected over a period of two months, from January to February 2016. Individual, semi-structured interviews were aimed at specialists in online marketing, who have been operating professionally in the field for at least 5 years. The interviews determined the nature of co-operation with micro enterprises in outsourcing online marketing. This primarily relates to the barriers in the course of co-operation in form of open question. The interviews were conducted with 12 experts. The core question is following: Which problems have you noticed during co-operation with micro enterprises? Results are based on a data analysis expressed in relative frequency and indicators of mean and standard deviation.

Results

Based on the questionnaire survey, it is possible to measure online marketing activities which micro enterprises do internally, do not deal with externally or outsource.

Tools	Internally	Outsourcing	Not being used
Websites	10.2	89.8	0.0
Search Engine Optimization	3.4	46.0	50.6
PPC advertising	4.5	50.0	45.5
Social networks	30.1	2.9	67.0
E-mail marketing	13.1	21.6	65.3
Analytics	5.7	35.8	58.5

Table 1: Usage of On-line Marketing Tools in %, 2016 (source: own survey)

A condition for inclusion in the research was the use of websites in a company presentation. In this area only 10.2% (18 respondents) manage the website internally and 89.8% (154 respondents) of micro enterprises outsource these websites. Conversely, most micro enterprises, (in terms of relative frequencies), managed social networks internally 30.1% (52 respondents). At the same time it is an area that is managed by outsourcing, but lowest usage showed - 2.9% (5 respondents) or was generally not managed - 65.3% (115 respondents). The area that was managed internally, but the most rarely, was Search Engine optimization - 3.4% (6 respondents). This topic was not taken into account by over 50% (87 respondents). In other words, area that is managed internally and the most frequently, is Social networks and the least, Search Engine optimization. Outsourcing is most commonly used for websites and yet rarely for Social networking. In terms of not being used the most neglected are Social networks and at least PPC advertising - see Table 1. Based on the questionnaire survey, it is possible to self-evaluate the subsequent knowledge level of people in online marketing, those who are responsible for online marketing in micro enterprises - see Table 2.

Questions	Mean*	Standard Deviation
How would you evaluate your online marketing knowledge?	3.2	1.36
Can you keep up with the latest trends in online marketing?	2.3	1.42
How well you can assess external subjects' contributions of online marketing activities?	4.2	2.36
How well you can assess costs of external subjects in online marketing?	3.4	3.42

*Note: *scale 1 - 10; 1 represents minimum, 10 maximum*

Table 2: Online Marketing Knowledge, 2016 (source: own survey)

The highest value is found for the ability to assess the results of external entities in terms of contributions to the company (4.2). This reflects the fact that the company can, to some degree, evaluate the increase/decrease in sales as a result of online marketing activites. Despite the highest value in this area of questions, the value is in the bottom half of the rating scale. Standard deviations, taking into consideration the evaluation scale of 1 to 10, are at a relatively low level. The highest value (3.42) has the ability to assess the incurred costs of external entities providing online marketing for the company, so the ability differs in certain companies. On the other hand, the most united are respondents with low levels of online marketing knowledge.

Consequently, it is possible from a questionnaire survey to identify methods of educating people who are responsible for online marketing in micro enterprises. The most widely used method of education in online marketing was through self-study via the Internet (articles, videos and discussions). This option was used in 70.4% (124 respondents). Another method of education is specialized courses, which were used at least once in

35.2% (62 respondents). If the respondent was on a specialized course in the field of online marketing, 77.4% (48 respondents) of these attended only one course. The barriers to education in online marketing at micro enterprises were also identified. Respondents could mark more barriers from the list or fill in their own statement. In the first place, limited funds for training employees in online marketing is mentioned in 97.7% (172 respondents), followed by the lack of free time for education 93.8% (165 respondents) and a high demand for IT abilities in 82.1% (141 respondents). In the "other" category, the most frequently mentioned barriers were inadequate language abilities, 33.0% (58 respondents) or the feeling that online marketing is not perceived as important for the company 15.9% (28 respondents).

Based on the interviews with the experts in online marketing, the following barriers in co-operation were identified:

- **High cost pressures caused by ignorance of the issue** - in connection with the increasing complexity of individual online marketing tools, it is necessary to create specialists for specific areas and it is no longer possible to cover the whole issue on the basis of consulting with one person at a competitive level, which results in greater cost. Experts often face the problem that business owners in order to save money, delegate online marketing to one person who can not handle this job.
- **Unrealistic demands arising from ignorance of the issue** - many companies realize that when searching for companies on the Internet, customers are lazy and most often open the links on the first page of results. Most small companies demand to be on the first page of search results for all highly competitive keywords, which is unrealistic and often go with an unreliable company that promises them this. Ignorance of this problem often causes the loss of the client who goes to another company that offers unrealistic but nice results.
- **Lack of ability to articulate fundamental business issues** - another problem of micro enterprises is the fact that many companies do not set their mission and segments. We then spend much time (which represents costs for the company), by formulating the mission and strategy of the company and defining their customer segments. As a conseqence of a lack of knowledge clients often use services that make any profit. For example, they use Facebook just because it is popular, but do not detect whether their target group goes there.
- Discussion

The results of the online marketing tools usage showed that they are not commonly used in the micro enterprise segment, with the exception of social networks. If a company does online marketing activities, they are mostly outsourced - especially websites, Search Engine optimization or PPC advertising. For example, web or overall online marketing analytics are not used at all by 60 % of the segment. To the opposite, Vaňa and Černá (2012) stated, that the growing complexity of the current market environment, needs a more systematic evaluation process of the organizational marketing performance to deal with the dynamic market. Those made responsible for online marketing, self-evaluated their knowledge as low. They are not able to assess whether external parties do their job well. Similar facts are described by Solčanský, Sychrová and Milichovský (2011), that marketing metrics must follow some principles, so that they can be used in the measurement process: we cannot measure something if we do not understand it; we cannot understand something if we do not control it and we cannot control something if we cannot improve it (Solčanský, Sychrová and Milichovský, 2011). The most common way that those responsible educated themselves in online marketing, is through self-study

on the Internet. It is in accordance with the results of Urbancová (2014), that the use of video-conferences, internet and e-learning has been increasing in recent years.
The research results identified a fundamental discrepancy on the side of costs and staffing at micro enterprises and the increasing complexity of all marketing communication tools. The results of interviews with the online marketing experts complement the results of the share of outsourced communication tools on the web. It can also be concluded that in the years to come, it will not be possible for a single person to effectively handle all online marketing tools. The need to care about marketing, or online marketing activities even in the segment of micro enterprises, is supported by the Bressler (2012) who stated that micro enterprises have to face increasing competition and it is necessary for them to improve themselves in the fields of management, marketing and technological up gradiation.

Conclusion

Even despite the fact that educational companies offer a large number of specialized courses ranging from e-mail marketing, to social network administration and PPC campaign management, these courses cannot be applied in the field of micro enterprise, due to the increasing complexity of online marketing, which cannot be effectively covered by a single employee. This then, is the greatest limitation and restriction to employees gaining knowledge. Micro enterprises already partially recognize this fact, and if they want to actively make use of online marketing, then they outsource it. Still, a high degree of ignorance of the issues and great uncertainty regarding the assessment of reasonable price and quality, is prevalent.
These facts indicate we can expect the extension of specific training courses and programmes for micro enterprises in online marketing in the future. These will focus on management and the control of outsourcing activities in the field of marketing. Rather than create specialists for individual areas of online marketing, it is better for micro enterprises, (within the context of their staffing and financial limitations), to focus on training in key areas of knowledge. These include pricing, options and desired outcomes that will increase their bargaining position when negotiating with outsourcing partners.

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STUDENTS' AUTONOMY AT HEIS IN UKRAINE: CASE OF SUMY NATIONAL AGRARIAN UNIVERSITY

[1]✉Hynek Roubik, [2]Jana Mazancova, [3]Jan Beseda, [4]Oksana Zamora

[1]Department of Sustainable Technologies, Faculty of Tropical AgriSciences, Czech University of Life Sciences Prague, Czech Republic, Kamýcká 961/129, Prague, 165 21, Czech Republic, +420 224 382 508, roubik@ftz.czu.cz

[2]Department of Sustainable Technologies, Faculty of Tropical AgriSciences, Czech University of Life Sciences Prague, Czech Republic

[3]Centre for Higher Education Studies, Czech Republic

[4]Sumy National Agrarian University, Ukraine

Abstract

The students´ self-governments are important in terms of alerting priority issues, such as quality improvement, educational processes and adequate study environment. These days students´ self-governments have already become a common part of higher education institutions in Ukraine. Despite the short history in Ukraine, the students´ self-governments have already been formed in all Ukrainian higher education institutions. This study aimed at identifying university student´s autonomy and its function in the academic sphere at the Sumy National Agrarian University. The study is based on combination of secondary sources study and primary data collection in forms of semi-structured personal interview with the students' rector, discussions with academic staff and university top management including rector and vice-rectors conducted in December 2015. Our case study showed presence of students´ self-governments; however, it also revealed struggle with lack of academic issues while focusing more on social student activities.

Keywords

Academic senate, Higher Education Institutions, students' autonomy, Ukraine

Introduction

The higher education system in Ukraine has been lately reformed. The reforms touched also students´ self-governments as the essential parts of higher education institutions. In terms of democratization of education and its principles, decentralization of higher education institutions and the synergy of all key actors dealing with everyday issues as well as with the strategic decision is fundamental. The synergy and the balance must be found if successful transformation should happen (Ryan and Stiller, 1991; Betoret and Artiga, 2011). The students´ self-governments are important in terms of alerting to the priority issues, such as quality improvement, educational processes, adequate study environment and preventing corruption in the ranks of educational institutions (Aymoldanovna et al., 2015). Students' self-governments are an active form of organization of life of students and provide an opportunity to develop leadership skills, as well as the factor of personal and professional formation of future specialists (Parafiyanovich, 2010).

These days, students´ self-governments have already become a common part of higher education institutions in Ukraine. Students´ self-governments in Ukraine have got rather a short history (in Sumy National Agrarian University (SNAU) since 2009) but they

have already been formed in all Ukrainian higher education institutions (however, their function and performance is various). According to the new Law of Higher Education Act from July 2014 the rectors are elected by all employees and students. The weight of students‘ voice is 15%. Strategic directions of higher education are determined by the Constitution of Ukraine, Education Law, Law of Higher Education Act, Higher Education National Doctrine, decrees of the President of Ukraine and the Cabinet of Ministers of Ukraine. An important task of this process is also to increase the role of students´ self-governments to attract more students into the educational establishment.

The students´ self-governments activity is currently guided by the laws and decisions of the specially authorized central executive authority in the field of education at the ministry level and the relevant central authority which the higher education subordinated by the statute of the university.

The objective of this study is to initially reveal and describe university student´s autonomy and its function in the academic sphere in Ukraine, specifically in the case of Sumy National Agrarian University.

Materials and Methods

The study includes the research based on combination of secondary sources study and primary data collection. Data collection was conducted through one-hour semi-structured personal interview with students' representative – the students' rector who was used as a key informant during December 2015. Main categories of the personal interview were i) current state of art within the students self-government ii) activities of the students self-government iii) plans of students self-government for future iv) pros and cons of the current state of art in the students self-government. Then focus group discussions were conducted with academic staff in the higher management structure (N=10) with a direct influence on the university governance. Major topics in the focus group discussion were as follows: i) students autonomy ii) students – academic staff relations from the students' activity perspective iii) working of self-government. Focus group discussion showed an insight into how a group thinks and the range of their opinions and ideas, as well as the inconsistencies and existing variations in terms of beliefs, experiences and practices. Furthermore, discussion with university top management (N=3) including a rector and vice-rectors was held for further insight into the students autonomy at SNAU. Results were analysed in opinion based methods. Information were collected into a manageable form and constructed into a narrative outcome.

Results and Discussion

The Sumy National Agrarian University (SNAU) was opened in April 1977 (receiving university status in 1997 and receiving national status in 2001) as a branch of Kharkov Agricultural Institute. SNAU established students' government in 2009 called "*Studentske samoradovanie- Студентськесаморадованіе".* The students' self-government follows the university management structure. The current students' self-government has 20 members. The head of the self-government is a student rector followed by student deans from each faculty. All deans have vice-deans and heads for different topics (such as: sports, social activities, quality of education and others). SNAU students' self-government is also a member of the UASS - Ukrainian Association of Student Self-government (UASS, 2016). This is a Ukrainian (independent and democratic) national student union, established in 1999 and is a heritor of the Ukrainian Association for the Development of Students' Self-government. The UASS voluntarily brings together students unions,

community organizations, student clubs and scientific societies that operate in higher educational institutions in Ukraine, as well as some active students to protect the rights and representation interests of the Ukrainian student community at the national and international levels. On the voluntary basis the UASS unites 178 local students' unions that work in higher educational institutions, and other active students. Overall, the UASS represents around 1.6 million of students of Ukraine (in comparison with the Czech Republic where the Student Chamber of the Council of Higher Education Institutions represents around 320 thousands of students). According to the Law of Higher Education Act the UASS elects two members of National Quality Assurance Agency for Higher Education. This agency has got 25 members.

The students' self-government representatives in SNAU (students' rector and student deans) meet every week with the rector of the university to discuss their requests and worries. In 2015 the students' self-government of SNAU dealt mainly with activities such as: volunteering, activities with children (St. Nicolaus day), organizing discussion circles (scientific) and meeting with management and orphanage visits. However, students' self-government is struggling with lack of academic issues and preferably is aimed to the social student activities. If compared to some exposed cases of surrounding universities; two cases should be mentioned: (i) when students of Sumy State Pedagogical University demanded resignation of the rector of their university in 2005 and their requirements were as follows: "*cancelling the resolution of the Minister of education and science of Ukraine –Mr. Stanislav Nikolayenko- about appointing Mr. Pidberezsky as the rector of the Sumy State Pedagogical University; and resignation of the university's administration which promoted conducting the unfair rector election (UHHRO, 2016)*." The second case (ii) from the Sumy State University is about proclamation of the Students' Rector (Head of Student Self-government) and the Head of Student Trade Union of their concerns about the present situation in Ukraine (2015):"*We are against cleavage of Ukraine in any region and we demand from the Russian Federation not to use their military forces in the present situation* (SSU, 2016)". The case (i) refers to the expression of the voice of discontent, the case (ii) to the terms to the situation with social overlap.

According to the students' rector plans of the students' self-government of SNAU for year 2016 are mainly the following: to wider the structure of the students' self-government (such as empowerment of human resources through increase of number of heads of sectors by two people), to set-up new connections with relevant partners, and to look for new funds. The Students' self-government also cooperates with the Municipal Centre for Leisure Activities Sumy. According to Deci and Ryan (1985) autonomy occurs when people feel they are the cause of their behaviour. Autonomy is not independence or total freedom, but rather an internal acceptance of, and engagement with one´s motivated behaviour (Betoret and Artiga, 2011). Supporting autonomy means taking the students perspective, providing choice and providing a meaningful rationale when choice is not possible (Filak and Sheldon, 2003). However, autonomy might turn to be a vague area. According to Timpau (2015) it can sometimes lead to the two extreme opinions; to the institution training robot to only "perform" but not develop them, or as the second extreme provides students too much of the autonomy leading lack of recognition of authorities.

The students' self-government is represented not only at the higher education level, but also at the state level. This is an essential part of every democratization process. In June 2005, the conference of Ukrainian Student Council in Kyiv hosted under the Ministry of Education and Science of Ukraine was held. Students from the self-government from all state regions of Ukraine (from more than 150 universities) approved the National Student

Council in this conference and elected first members of its board. The formation of the Ukrainian Student Council has become possible due to many factors, especially, the implementation of the principles of the Bologna process (which considers a student as a partner in education process). There was a need for coordinating body among the students' self-governments and student parliaments and councils that have been created in various universities and institutes throughout the Ukraine.

It should be stated that the dominant role of students' self-governments in the preparation of the action leaders can creatively and proactively responds not only to the changing demands of society, but also to the global trends of the human development (Vintin, 2006; Procházka et al., 2011; Aymoldanovna et al., 2015). Therefore, it is essential to have students self-determining system guarantees such as students' self-governments and any other legal and organizational principles of its establishment and functioning is stated in the law There is urgency for problem resolution of the insufficient development in educational theory and practice of innovative approaches to the organization and development of the student government as a social phenomenon (allowing the development of leadership skills of university students) as mentioned in the study by Aymoldanovna et al. (2015). There is still lack of preparation of competitive specialists speaking about development of leadership qualities. In recent studies there can be found a significant number of interpretations of the concept of "students' self-government" (Aymoldovna et al., 2015). For example, by the definition of Rozhkov (1987), the student self-government is *"…a way of life of the collective organization, which involves active participation of students in decision making and implementation in order to achieve the objectives of public interest on the basis of interaction with the teachers*". According to Aymoldovna et al. (2015) the students' self-government should consist of activities ensuring development of students´ autonomy decision making and consequent implementation. Further, it should also involve responsibility for the results; as an active form of organization of life of the students and promoting the development of their autonomy. But according to Parafiyanovich (2010) it is defined as a pedagogical category, which deals with justifying the organization activities ensuring the development of students' autonomy in decision making and implementation as well as responsibility for their results. This goes hand in hand with promoting the development of their autonomy in decision making and responsibility for the results obtained to achieve socially and personally meaningful goals.

The students' self-government involves active participation of students in the preparation, adoption and implementation of top university management decisions concerning livelihoods of higher education institution of individual students or groups of students. The students' self-government should be an active form of organization of life of students and can be seen as well as an opportunity to acquire further soft skills essential for leadership (managerial, leadership skills, innovative thinking, problem solving, independence, responsibility, mobility, competitiveness, representation and defend of the interests of young people as well as the development of the factors of personal and professional formation of the future specialists and experts). However, this should be also accompanied by the valuation of such extracurricular activities as involvement in self-government (Procházka et al., 2011). Another form of the students' self-government in Ukraine is the Students` Trade Union (existing at SNAU) which is a public student organization of the university. It serves for representation, implementation and protection of educational, social and economic rights and interests of its members.

An autonomous student is a student who is not afraid to express her/his point of view,

who argues logically and consistently, engages with passion in new situations arising, have initiative, have confidence in her/his own abilities and takes responsibility for her/his actions (Timpau, 2015). There is a lack of research done on university students and their attitude to the student´s self-governments; however, there are existing studies about their attitude towards polity, such as the one by Hooghe (2004) who explains that youth are not involved because they do not perceive that they have a stake in politics. There are some such as the study by Putnam (2000) claiming that social capital declines among youth and therefore leads to the decline of participation. It is essential to realize, that university students and youth in general can be viewed as a preview of the future. As Gauthier (2003) sees the orientation of youth as a litmus test of how democracy will look like in the future. Therefore youth activism is very important. As with an apathetic and uninterested youth the democracy is more prone to suffer from problems of legitimacy and lack of people´s involvement in the essential decision making in the future (Burean and Badescu, 2014).

Trends, challenges and recommendations

As is the education system in Ukraine undergoing major reform and in July 2014 the new Higher Education Act become law, significant reforms were introduced. With the new law, institutional autonomy and self-government was provided. However, there are significant challenges here, especially accompanying responsibilities and accountabilities and the scale of the democratic structures. All of them need to be adequately implemented in the HEIs. Democratization of institutional management and governance envisages devolved and distributed leadership where rectors, staff as well as students have defined their roles and responsibilities. This is however remaining a challenge for fulfilling.

Under the law, student self-government is an intrinsic part of the democratic management process. Students participate in the rector election, they are members of academic councils, as well as working and advisory bodies. However, they still have little understanding of what it means to be part of an autonomous academic community.

Therefore, students' capacity needs to be supported in the terms of students' participation and understanding of the university governance, as well as further collaboration with other students and other students' self-governments in Ukraine. Furthermore, foreign experiences from students' self-government may serve as an adequate accelerator of proper students' involvement.

Conclusion

These days' students´ self-governments have already become a common part of higher education institutions in Ukraine. It is essential to realize that the students´ self-governments are important in terms of alerting to the priority issues (such as quality improvement, educational processes, adequate study environment and preventing corruption in the ranks of educational institutions). Involvement of students in the students´ self-governments brings also development of student´s personality and forming their leadership skills. Student´s self-governments should improve also educational process and its quality through education satisfaction surveys. The case of SNAU showed presence of students´ self-governments; however, it also revealed their struggle with lack of academic issues while focusing more on social student activities. Research done on university students and their attitude to the student´s self-governments is still missing in Ukraine and other post-soviet states and should be more explored. Authors expect to continue with the research in following years.

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ROLE OF EXTERNAL LECTURES AND EXCURSIONS IN UNIVERSITY COURSES

[1]✉Daniela Salkova, [2]Martina Jarkovska

[1]Department of Trade and Accounting, Faculty of Economics and Management, Czech University of Life Sciences Prague, Kamýcká 129, Prague 6, 165 21, Czech Republic, +420 224 382 365, salkova@pef.czu.cz

[2]Department of Languages, Faculty of Economics and Management, Czech University of Life Sciences Prague, Prague, Czech Republic

Abstract

The paper analyses the role of excursions and lectures given by external specialists in the educational process at the university. The article is based on long-term experience with the implementation of visits by students in selected companies during both the bachelor and the master's degree studies at the university and at the same time presents partial results of a survey conducted among full-time students of bachelor's degree program. As a very suitable and effective element completing students' theoretical education proves to be their visits to selected companies operating in the Czech market and the opportunity to meet with experts with practical experience of the functioning of the market. The aim of this paper is to evaluate the role of field trips and lectures by external experts in a learning process and show the importance of gaining practical training and experience over theoretical information while studying at university.

Keywords

Bachelor studies, educational process, excursion, firm, training

Introduction

Despite achieving a higher level of education, young people face a number of problems when entering the labour market. Despite efforts to interconnect the labour market and the specific requirements of the education system, there is still a big difference between labour market demand and supply of knowledge and skills of graduates from different fields of study. This difference is more pronounced in the case of bachelor degree in comparison with master degree studies (Maryška and Doucek 2012). Gaining practical experience and professional skills during the theoretical training while studying at college proves to be a key prerequisite for success in the future career of graduates from bachelor and master degree programmes. Work experience during their studies can improve the so-called "soft skills" of the students and help create contacts within professional networks (Scott-Clayton, 2012).

Regarding college graduates in the labour market, their readiness for practice is often assessed. On the part of graduates, it is their language skills and theoretical amount of information, including work with computer technology that is stated as an asset. On the other hand, graduates are not sufficiently equipped for practice. It is logical, because in the learning process at a number of universities students' supervised fieldtrips are sidelined or limited to their cooperation with practice only marginally. The inclusion of excursions into teaching can, as stated by Baker and Hacisalihoglu (2014), represent an innovative approach to encouraging students' interest in the studied topics. Various studies describing the effect of students' "fieldwork" at different educational levels indicate that

if students have the opportunity to observe / participate in any process in the real world, to see something with their "own eyes", their involvement in the ''Experiential learning pedagogies" is being adopted across undergraduate education and touted as an effective strategy for enhancing student learning. Teaching and understanding of theoretical foundations is much larger (Max, 2009). In other words, integrating activities related to real environment encourages students' critical thinking and learning (Elwood, 2004).
Most students are aware of the importance of gaining practical job opportunities already during their studies and try to focus on the industry they want to work in after graduation, already during their theoretical training in higher education (Šálková and Navrátilová, 2015). This is fully in line with the findings of the Reflex 2010 survey, stating that 66% of Bachelor's degree graduates in economics and related fields hold leading positions within 5 years after graduating, whereas in general it is 37% of all graduates only (Ryška and Zelenka, 2011).
While preparing students, excursions can fulfil several functions in the educational process at university:

- educational (development)
- cognitive
- informational
- marketing

Educational function

In The Academic Dictionary of Foreign Words from 1997 an excursion is explained as an outing, visit, tour for study purposes with a guided tour of a particular place, or enterprise, and so on. In The Dictionary of Foreign Words from 1956 it is defined as a public outing, usually educational, instructive study; breaking into a foreign field. It is possible to say that study knowledge is linked to meeting specific needs of the everyday life of a particular individual. However, and excursion can play such a role only if well prepared. When arranging excursions, it is necessary to respect the continuity between the content of excursion and the subjects taught at the department (Department of Trade and Finance)and stem from the field of study (Business Administration). This requires a sophisticated and targeted selection of companies and organisations operating in a given area of the market.

Cognitive function

This function is based on the fact that achieving the set goals of the excursion as part of education, foresees a thorough preparation so that the excursion has brought a number of findings for both sides. I.e. particularly the enrichment of knowledge about the current state of the visited companies and trading companies operating in all subsystems of internal trade (retail, wholesale, hospitality and tourism). A guide during the excursion is usually a representative of the company management, which provides students with an interesting opportunity to be in contact with experienced professionals.

Informational function

Activities of companies that allow students to visit them by means of an excursion, are directly or indirectly focused on customers, guests, clients, consumers. This requires the source of information, which presupposes a sophisticated marketing information system using integrated marketing communications. Mutual cooperation between universities and business communities can become one of the sources of information. Moreover, students

on an excursion acquire new interesting information from the field. The informational function of an excursion is interconnected with and developed by a following - marketing function.

Marketing function

A marketing approach of a company can significantly affect customer behaviour, especially in a purchase decision-making process through various parts of the marketing mix or interact with the customer and thus affect his or her decision. The marketing mix and marketing communication tools are concepts whose content has a variable trend with regard to developments, new discoveries, opportunities and social phenomena, and thus brings new perspectives and approaches to customers and their needs. The development and current level of marketing, marketing communication tools and integrated marketing communication enable an impact on the customer and vice versa. The integrated marketing communication means merging (joining) the individual instruments; the customer thus obtains a single integrated view of the enterprise. Generally speaking, it is mutual informing consumers and businesses (students and companies). In the course of an excursion, students are acquainted with the products /services offered by a company. Their evaluation involves the company's publicity on several levels-faculty, friends, family, place of residence, as well as giving preference to products of the company when buying the products as consumers, guests in operating units of internal trade and potential partners in trade relations and more. The marketing function of the excursion is thus clear- it develops and enriches marketing communications and provides assets for both parties.
Based on the above, it can be stated that the issue of linking theoretical explanation with a fieldtrip to the real environment and the opportunity to observe the application of theoretical methods in practice plays an important role in greater involvement in the education of students of bachelor's and master's degree. At the same time, it increases their future readiness to meet labour market requirements.
This paper aims to show the importance of excursions of undergraduate programme students in the learning process in terms of selected features that excursion fulfils in the educational process and in terms of the perception of persons for whom these fieldtrips to enterprises and specialized external lectures are intended. The aim of this paper is to point out the importance of gaining work experience and professional skills during the theoretical training while studying at university. In Introduction the theoretical background of the issue is explained. The section Materials and Methods contains characteristics of a pilot project, including field trips and external lectures in teaching the selected subject, together with findings from primary research conducted among the students.

Materials and Methods

Theoretical bases of the article were processed using an analysis of secondary sources, which were drawn from scientific articles, literature and official web portals. Primary data were obtained through own investigation.
The survey was implemented electronically during the month of December 2015 among students of the 3rd year of full-time study in Business Administration (BA) at the Faculty of Economics and Management, Czech University of Life Sciences Prague. The students enrolled in the course were asked to complete a questionnaire. Of the total 304 active 3rd year full-time BA students, n = 112 respondents participated in the survey. The questionnaire focused on the evaluation of the course Fundamentals of Commercial Sciences (lectures and seminars). A part of the questionnaire included an evaluation of

excursions and lectures given by external experts. The questionnaire was composed of 41 questions. Most of the questions were closed questions (the respondent selected one of the offered answers or, rated the observed feature on a scale from ''definitely yes'', ''rather yes'', ''I do not know'', ''rather no'' and ''definitely no'', or on a scale from 1 to 5 with 1 being the best and 5 the worst), 8 questions were open questions.

Basic identification signs of the monitored group of the surveyed students can be defined as follows: based on gender, 64% (85) women and 24% (27) men participated in the questionnaire survey. This corresponds to the overall structure of FEM students with mostly female students prevailing. Other demographic characteristics (structure of students in terms of educational attainment, the size of city of residence, the economic situation, etc.) of the respondents were not observed in this case.

The data were processed and subsequently evaluated by Microsoft Excel spreadsheets.

Results and Discussion

In recent history of the Faculty of Economics and Management, for a number of years' individual departments organized students' excursions as multi-day trips combined with a visit to agricultural, commercial, manufacturing and other businesses along the selected route, combined with accommodation. For full-time students their attendance was compulsory. Shortly after 2000, these mass excursions were cancelled mainly due to economic demands(the bulk of funds for transportation and students' accommodation was paid by the faculty, students participated by smaller portions only). Currently at FEM CULS nothing similar is being realized at such a scale.

Given that the excursion along with lectures of external specialists (both Czech and foreign) present a valuable source of information for students, in the academic year 2015/2016 a pilot project applying these two tools into classes was implemented in the course Fundamentals of Commercial Sciences (FCS) in the third year of a bachelor's degree full-time study programme Business Administration. The content of the course FCS focuses on the theoretical characteristics of a variety of topics from the field of business-retail, wholesale, hospitality and tourism (enterprises, business operations, merchandise and assortment, infrastructure, trade, price and price formation, logistics, consumer protection, etc.). The purpose of excursions, if properly prepared and focused, is to connect the theoretical knowledge gained during lectures and seminars with practical solutions for specific business situations in particular enterprises. Thanks to the excursions, in a number of cases students had a unique opportunity to visit several different places, otherwise inaccessible to the public-distribution centre, business centre facilities, retail warehouse space for on-line order dispatch and more. Thanks to the lectures given by experienced practitioners whose aim was to complement lectured theory with examples of specific solutions and practices of companies operating in trade, the students had an extra opportunity to learn interesting facts about the functioning of trade in practice.

A significant contribution of excursions and lectures for students is also an opportunity to establish contacts important for their future professional career. Many representatives of the companies that participated in this pilot project, offered the students an interesting internship and part-time trainings, or other forms of mutual cooperation. As already mentioned in Introduction, practice during their studies at university is for future graduates a key success factor in the current labour market. As stated by Beer et al. (2012), one of the roles of excursions may be providing different educational environment for personal and professional development. Therefore, the maximization of linking university studies in both bachelor's and master's degree studies with a practical environment is important.

To obtain information on how the inclusion of excursions and lectures by external experts in courses is perceived by the students and how these tools are useful and beneficial for them, a questionnaire survey was used. The course Fundamentals of Commercial Sciences has always endeavoured to connect theoretical knowledge with information from the real business environment. As shown in Table1, in most cases the students are aware of these connections and evaluate the content of the course FCS for the study field BA as useful and interconnected with practice.

Gender	Rather yes	Definitely yes	I don't know	Rather no	Definitely no	Total
Male	12	10	3	2	0	27
Female	33	30	13	8	1	85
Total	45	40	16	10	1	112

Tab. 1: Evaluation of the course content in terms of convenience and connection with practice

In this context, most students appreciate the good preparedness and method of theoretical interpretation, which is connected with practical demonstrations and specific examples. Understanding the issues is thus easier and more memorable for them.

The inclusion of lectures given by experts from practice in the courses was perceived by the students as positive. There were altogether three lectures given during the semester. At first the lecturer from the faculty explained the theoretical framework of the issue and basic theoretical definition and context, which was followed by the lecture of an invited expert practitioner. The practical experience of the external speaker thus aptly complemented the presented theory. Thanks to the theoretical preparation the students could orientate themselves in the issue and have a greater benefit from the external lecture.

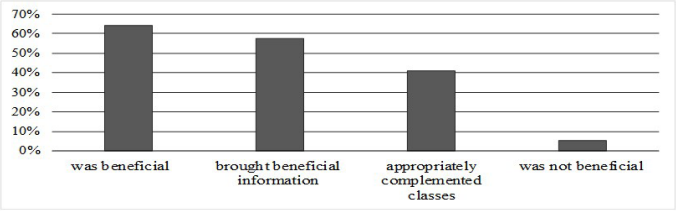

Fig. 1: Evaluation of including lectures given by guest speakers in courses

For69% respondents a lecture given by a guest speaker was a reason for attending the lecture(41% rather yes, definitely yes28%).Several students evaluated the inclusion of lectures by experts from practice negatively because of the need for a greater degree of self-study of areas that were not affected by the lecture and are part of the course content. However, these students were but very few. Most students assessed the lectures as interesting and beneficial. For better utilization of space in the auditorium, promotion could be used to a greater extent next semester -to inform about the visit of a representative of the company so that students of other fields at the faculty can attend if interested.

A large part of the respondents from the addressed group of students in neither case participated in the excursion. The reasons are summarized inTable2. The students who had the opportunity to visit at least one enterprise, evaluated this tool in the context of the course FCS as interesting, beneficial and useful to supplement the theoretical framework of education(Figure2). The students positively evaluated the presentation of trade mechanisms and systems as they could see them directly in practice. An excursion- a visit to a selected company- may therefore be a suitable tool for the application of theoretical methods to a practical environment, as confirmed by Wissmann (2013). As reported by

the students who attended the excursions, some of the visits in particular enterprises even helped them in planning their future careers.

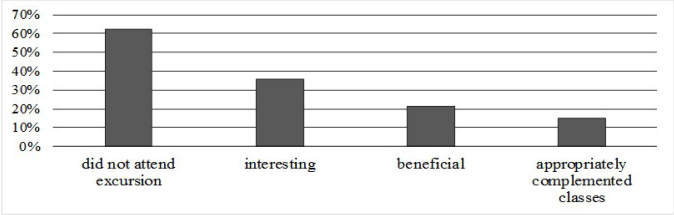

Fig. 2: Evaluation of excursion inclusion into a course

It was further investigated whether there is a link between not participating in field trips and several selected respondents' answers was investigated in the carried out survey. In case of evaluating whether the subject fulfilled the expectations of a student and his or her absence on a field trip, no correlation between a negative answer to meet expectations with respect to the subject matter and the absence at the tour was demonstrated. In the event that a student negatively assessed the connectedness of the course to practice, his or her higher probability of being absent at the excursion was found. A moderately strong dependence between not attending the lectures and not attending the excursion was also confirmed. A link between not participating at the excursion and the student's employment was confirmed as well. If students are employed while studying full-time, their opportunities to participate in an excursion are time-wise restricted.

Reasons for students' not attending the prepared field trips were different. Overall, it can be said that the main reason why some students did not seize this opportunity, even though it was otherwise evaluated as interesting and useful, is a large percentage of students who work during their studies, and related limited amount of their time. Given that gaining work experience in the field and achieving economic independence are two key aspects for future college graduates, this reason is understandable even with full-time students. According to the findings of Fischer and Liptovská (2014), there is a direct correlation between the level of wages and employment of students during their studies, if jobs related to their field of study are concerned. In case of some students, a limiting factor for their participation in the excursion was a need to provide their own transport with respect to the excursion venue outside Prague, or other lessons during the excursion.

Gender	Other lessons	Employment	Limited amount of time	No interest in excursion	Total
Male	6	18	11	5	40
Female	30	40	51	4	125
Total	36	58	62	9	165

Tab. 2: Reasons for non-participation in excursions

For the next excursion organisation in the next semester, inclusion of the visits to businesses rather at the beginning and middle of the semester can be recommended. For many student's excursions included at the end of the semester usually collided with a number of ongoing assessments and final exams.

Conclusion

The results of the pilot project - including excursions and external lectures as part of the course Fundamentals of Commercial Sciences taught in full-time studies bachelor study

programme Business Administration at FEMCULS - showed that these two instruments may, given an appropriate focus and quality organisation, appropriately supplement the theoretical part of the course with interesting and useful examples of solutions to business situations from a practical environment. Providing contact with experts in the field with long-term and valuable experience is highly beneficial for students. Practice in various forms, obtained in the course of study at university, is a key success factor for future graduates in today's job market. Therefore, the maximization of linking university studies in both bachelor's and master's degree studies with a practical environment is important. A limiting factor of the article can be considered the fact that the research was carried out among students of one economic field only. It is desirable to implement it also in other branches of bachelor's study at FEMCULS. The repetition of the survey is expected in the future years so as to allow for comparison of the results obtained in the course of time.

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DEVELOPING OPEN APPROACH TO MATHEMATICS IN FUTURE PRIMARY SCHOOL TEACHERS

[1]✉Libuse Samkova, [2]Marie Ticha

[1]Department of Mathematics, Faculty of Education, University of South Bohemia, Jeronýmova 10, České Budějovice, 371 15, Czech Republic, +420 387 773 091, lsamkova@pf.jcu.cz

[2]Department of Didactics of Mathematics, Institute of Mathematics of the Czech Academy of Sciences, Czech Republic

Abstract

In our contribution we focus on the possibility to develop open approach to mathematics in future primary school teachers during a university course on mathematics conducted in inquiry-based manner. We analyse data obtained in the beginning and in the end of the course with respect to two main aspects related to open approach to mathematics: searching for all solutions of a task, and acceptance of different forms of notation of a given solution. Data analysis revealed in the participants three different shifts towards open approach to mathematics, and showed that after the active participation in the course each of the participants improved at least in one of the monitored aspects, and that none of the participants got worse in any of the aspects.

Keywords

Argumentation, Concept Cartoons, future primary school teachers, inquiry-based mathematics education, open approach, problem solving

Introduction

The study reported here is a part of a three-year qualitative educational research conducted under Czech Science Foundation project. The goal of the project is to implement inquiry-based education into university courses on mathematics and didactics of mathematics for future primary school teachers, and observe how active participation in these courses can influence professional competences of project participants, i.e. their knowledge, beliefs, and practice. As interim results we already detected changes in participants' approach to argumentation (a shift towards more efficient use of counter-examples, and a shift from using empirical arguments to attempts of using deductive arguments; see Samková and Tichá, 2016a), and also changes in participants' beliefs about mathematics (e.g. the newly emerged belief that discovering a thing by oneself helps remembering the thing; see Samková and Tichá, 2016b).

In this particular study we focus on developing project participants' open approach to mathematics. Our research question is "What shifts towards open approach to mathematics can be observed in future primary school teachers after their active participation in an inquiry-based university mathematics course?"

From the perspective of ERIE conferences and ERIES journal, the topic of our contribution is a broad-based one. Since it deals with developing problem-solving skills, it is in relation not only to educational issues such as students' ability to solve mathematical problems (Novotná et al, 2014; Novotná, Eisenmann and Přibyl, 2015) or future engineers' creativity (Zhou, 2012), but also to managerial issues such as decision making or managerial competencies (Hricová, 2015).

Inquiry based education

Inquiry as a pedagogical concept can be traced long way back to the work of Dewey (1938) who introduced it as interplay of the known and the unknown in situations when an individual or a group of individuals face some challenge. On the other hand, nowadays inquiry-based pedagogy is used to be defined as a way of teaching in which students are invited to work in ways similar to how scientists work (Artigue and Blomhøj, 2013), i.e., to observe, pose questions, reason, think, search for relevant information, collaborate, collect data and interpret them, to solve and discuss problems that come out from real life or can be applied in everyday life contexts (Dorier and Maaß, 2014).

Although the term *inquiry* is more common in the field of science education, and its appearance in the field of mathematics education is rather a matter of recent, the idea of *inquiry* is in accordance with educational frameworks that appeared in mathematics long before the term: problem solving, theory of didactical situations, realistic mathematics education, mathematical modelling, anthropological theory of didactics, dialogical and critical approaches (for details on these frameworks and their coherence with inquiry see Artigue and Blomhøj, 2013), problem posing (Tichá, 2009; Singer, Ellerton and Cai, 2015), substantial learning environments (Wittmann, 2001), and many others. Also by looking into the Czech past we can find research content close to the concept of inquiry: the concept of guided rediscovery (Vyšín, 1976), built on characteristics of genetic style of teaching of Brunner (1966), Wittmann (1974) and Freudenthal (1973), the concept of strengthening contact of mathematics education with everyday reality and with other school subjects (Koman and Tichá, 1988), or grasping of situations (Koman and Tichá, 1998). For more details on inquiry based mathematics education see also a survey study by Samková et al (2015).

Open approach to mathematics

Open approach to mathematics is a method that is in accordance with the above mentioned educational frameworks. Within this approach the teachers assign the students problems that are called *open* – problems whose starting or goal situation is not exactly given. Open problems have multiple levels of grasping (i.e. the starting situation is open), multiple correct ways of solving (i.e. the process is open), multiple correct answers (i.e. end products are open) or multiple ways to transform the problem into a new one (i.e. ways to develop are open). Generally, solving an open problem may consist of various ways of formulating the problem mathematically, of investigating various approaches to the formulated problem, and of posing various advanced problems (Nohda, 1995, 2000; Pehkonen 1995).

We consider open approach to mathematics as an important component of future teachers' education. It helps develop pedagogical content knowledge of future teachers, e.g. by making them ready to accept different ways of solving and different solutions proposed by pupils in the classroom.

Materials and Methods

Participants

Participants of the referred study were 29 future primary school teachers, completely all students of the second year of five-year master degree program at the Faculty of Education. They are not math specialists; after graduation they are expected to teach all

primary school subjects (languages, mathematics, science, arts, physical education, etc.). These students actively participated in one-year course on mathematics held in inquiry-based manner. The course focused on introduction to logic, set theory, and number systems; it had a range of three hours per week.

Diagnostic instrument

As a diagnostic instrument in our study we innovatively use a primary-school educational tool called *Concept Cartoons* (Keogh and Naylor, 1999). Each Concept Cartoon is a picture showing a situation well known to pupils from school or from everyday reality, and a group of children in a bubble-dialogue. The texts in the bubbles present alternative viewpoints on the situation or alternative solutions of a problem arising from the situation. See Fig. 1.

Concept Cartoons were developed more than 20 years ago. Its original goal was to support teaching and learning in science classroom at primary school level by generating discussion, stimulating investigation, and promoting learners' involvement and motivation. In later years the tool also expanded to other school subject, including mathematics. When working with Concept Cartoons, pupils have to choose all children that are right, and justify their choice.

Figure 1: Concept Cartoon from the first stage of data collection; template of children with empty bubbles and an empty book taken from (Dabell, Keogh and Naylor, 2008).

Authors of Concept Cartoons performed several researches on the use of Concept Cartoons in primary school science classroom, one of them (Naylor, Keogh and Downing, 2007) showed that the lack of agreement amongst the pictured children encourages pupils to join the discourse with their own opinions, and that such discourse can take a form of sustainable and purposeful argumentation.

In our project we take advantage of this supportive argumentation feature, and innovatively use Concept Cartoons for diagnosing various types of future primary school teachers' mathematics knowledge. We work on establishing a typology of Concept Cartoons that are applicable as a diagnostic tool, and on creating our own database of Concept Cartoons suitable for this purposes (Samková and Naylor, 2015; Samková, Tichá and Hošpesová,

2015). Our recent research on this issue shows that Concept Cartoons can be helpful in identifying various aspects of the process of grasping of a situation (Samková and Tichá, 2015), and that suitably chosen Concept Cartoons allow us to distinguish between subject matter knowledge and pedagogical content knowledge (Samková and Hošpesová, 2015).

Data collection

Data collection took place in two stages, in the beginning and in the end of the school year. In both cases we assigned the participants a worksheet with a Concept Cartoon, and asked them to choose in the picture all the children that are right, and to justify their choice. For the purpose of data collection the participants worked on the worksheets individually.
In the beginning of the school year we assigned the students the Concept Cartoon shown in Fig. 1. The task discussed in the picture has two solutions: the first one is directly described in a bubble B (here the missing digits are ordered like the child reads them from a sheet with a completed task) and also in a bubble A (here the missing digits are ordered from the smallest), the second one is not described in any bubble, its possible existence is just indirectly mentioned in a bubble E.
In the end of the school year we assigned the students the Concept Cartoon shown in Fig. 2. The task discussed in this picture has three solutions. Similarly as in the initial worksheet, the first solution is directly described in bubbles B and A, and the possibility of existence of another solution is just indirectly mentioned in a bubble E.

Figure 2: Concept Cartoon from the second stage of data collection; template of children with empty bubbles and an empty book taken from (Dabell, Keogh and Naylor, 2008).

Both worksheets were treated by 25 students (4 students absented at lessons where data were collected). One of the students made such mistakes in calculations that the data are not applicable for our purpose. Thus, 24 students remained relevant for the study.

Data analysis

During data analysis we registered combinations of bubbles that were chosen by individual students as right. We accepted only responses supported by appropriate justification.
We focused on two main aspects related to open approach to mathematics: searching for

other (all) solutions – the case of choosing a bubble E, and acceptance of different forms of notation of a given solution – the case of choosing *both* bubbles A and B.

Results and Discussion

Searching for other (all) solutions

While observing responses related to this aspect, we realized that the most frequent strategy in the first worksheet consisted in checking the alternatives with given digits (i.e. alternatives in bubbles A to D), and by paying no attention to the possibility mentioned in a bubble E. Students who used this strategy found just one solution of the task, and did not search for any other. In the second worksheet, some of these students used again the same strategy, some of them responded to the bubble E and searched for one other solution, and some of them worked systematically and found all three solutions. For proportional details see Fig. 3.

The less frequent strategy in the first worksheet consisted in paying attention to the bubble E, and thus in searching for a solution not listed in bubbles. But only one of the students worked systematically and verified that there are no other solutions. In the second worksheet, some of these students again paid attention to the bubble E and searched for *one* solution not listed in

bubbles. But they did not find out that there are *two* such solutions. The rest of the students this time worked systematically and found all three solutions. For proportional details see Fig. 3.

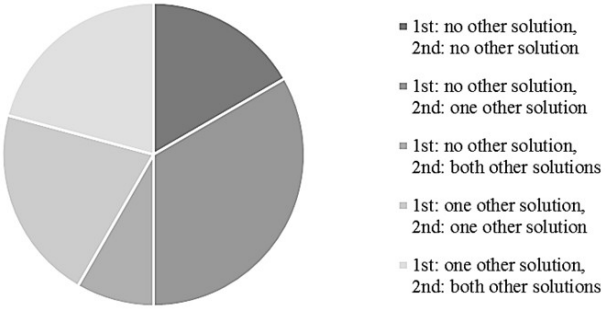

Figure 3: Searching for other solutions presented in 1st and 2nd worksheets, N=24.

Summarized: after the active participation in the course, none of the respondents got worse in the monitored aspect, and majority of the respondents improved in the monitored aspect.

Acceptance of different forms of notation of a given solution

While observing responses related to this aspect, we realized that in the first worksheet majority of the students accepted the bubble B and did not accept the bubble A. In the second worksheet, some of these students used again the same strategy, some of them accepted both the bubbles B and A. For proportional details see Fig. 4.

All the students who accepted both B and A bubbles in the first worksheet, used the same strategy in the second worksheet. For proportional details see Fig. 4.

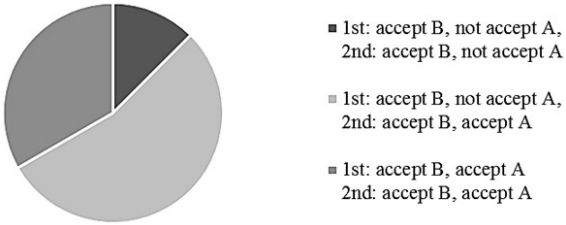

Figure 4: Acceptance of different forms of notation presented in 1st and 2nd worksheets, N=24.

Summarized: after the participation in the course, none of the respondents got worse in the monitored aspect, and majority of the respondents improved in the monitored aspect.

Conclusion

During our study we implemented inquiry-based education into a university course on mathematics for future primary school teachers, and monitored in participants of the course two aspect related to open approach to mathematics: we investigated whether they would search for all solutions of a multiple-solution task, and whether they were able to accept different forms of notation of a given solution.

Collected data showed that in the beginning of the course majority of the participants searched only for one solution of a task, and that majority of the participants accepted only one form of notation of a given solution. By comparing data collected in the beginning of the course with data from the end of the course, we detected in the participants shifts from searching for just one solution to searching for more solutions, shifts from unsystematic search for some solutions to systematic search for all solutions, and also shifts towards accepting various forms of notations of a given solution.

From the perspective of individual participants, data analysis showed that *each* of the participants improved at least in one of the monitored aspects, and that *none* of the participants got worse in any of the aspects.

Undoubtedly we can say that the active participation in the inquiry-based university mathematics course developed future primary school teachers' open approach to mathematics, and thus strengthened their professional competences.

Acknowledgement

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STUDENTS´ OPINIONS ON COPYRIGHT

Tomas Sigmund

Department of System Analysis, Faculty of informatics and Statistics, University of Economics, Prague, W. Churchill Sq. 1938/4, Prague, 130 67, Czech Republic, +420 224 095 362, sigmund@vse.cz

Abstract

At the University of Economics in Prague we organized a survey on copyright issues inspired by a similar research of the European Commission carried out between the years 2013 and 2014. The survey has relevance for education as in education a lot of multimedia content is used and copyright is an issue which must be considered. Our results show students prefer free availability of digital content which indicates there is a tension between current copyright law and consumers´ opinions on it. Our results are in general in compliance with the results of the European survey. That shows the copyright rules will need a reconstruction to allow the use of multimedia content in education.

Keywords

Information ethics, copyright, digital content, internet services

Introduction

Copyright and its regulation present with the introduction of digital technologies an important issue. The possibilities open by the technical development were not expected in the norms established in the analogue time period. Our research tries to monitor the perception of this tension among bachelor students at the University of Economics in Prague.

Jill McKeough identified in his article (2012) some current challenges for copyright law which prove there is a pressure to change it. In McKeough´s opinion (2012) the copyright law has to be understandable, effectively communicated, must fit with community practice, be capable of change and assist in development of an innovation based economy. It has to be able to respond to changes in technology, consumer demand and markets. Digital technology has brought with its implementation a change in consumer attitudes to copyright. Consumer tend less to recognize copyright as an exclusive property of the creator and infringement is seen as justified. This is also the case of educational institutions where students appreciate using media content which is usually copyrighted.

Novos and Waldman (2013) identified three aspects of the new situation of copyright: technology, law, user preference. The new technology has decreased the costs of copying and made distribution and storage of copies cheap and easy. Law affects the behaviour of man and has to come to terms with the new situation. User preferences change with the introduction of new technologies, but the change is not homogenous, different social groups differ in their relationship to the possibilities offered by the new technologies. The young generation - especially students who have high level of computer literacy - seems to be the most innovative and tends to prefer freely available content.

We may add to the above mentioned three aspects the economic relevance. One opinion (Novos and Waldman, 1984) regarding economic effects of copyright think the sales of copyrighted content would decrease because of the illegal distribution of copyrighted content. However starting with Liebowitz (1985) the effects are not considered so

straightforward. The alternative theory is based on the fact that the prices of copyrighted material should increase if they would incorporate the profits from copying. The problem with this alternative theory however is, that the prices of copies will be close to marginal costs and the prices of original content would stay unaffected and that the imperfect substitutability of original and copied content would result in decrease of profitability of original content. It follows the copies can reduce the revenues from original content, but the extent is not predictable in advance.

As for education copyright definitely represents an issue here as a lot of media content is used in the process of education to make it more demonstrative and efficient. There are books guiding academics in the complexity of copyright (e.g. Ferullo, 2014). Alexandra and Miller (1999) show the importance of copyright in teaching materials, Bathon (2013) criticises the legal limits of using copyrighted content in education for both students and teachers. In the Czech Republic the ethical and legal issues of academic publishing are discussed by Knecht and Dvořák (2013).

Materials and Methods

In our survey regarding information ethics 96 participants took part, 60 men (62.5%) and 36 women (37.5%), aged from 19 to 23 years, in the first (89.6%) or second (11.4%) year of their studies. 18.8% of them don´t work, 33.3% have some temporary jobs, 18.8% have part time jobs less than 20 hours a week, 18.8% spend 20 or more hours a week at work and 10.4% work full time. 37.5% of them prefer good social relations, 62.5% prefer work performance. The data were collected from 29 October 2015 to 31 January 2016 through the online questionnaire. The questions reflect the survey organized by the European Commission (2014). Our intention was to compare the opinions of EU citizens with the opinions of Czech students.

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

Students were quite critical regarding the corruption in the society. 14.7% regard corruption very high, 59.3% high and just 26% think corruption is in our society neither high, nor low. The results are on the 5% significance level independent on gender (p=0.789, χ^2=0.475), independent on amount of hours worked (p=0.123, r_s=0.242), but are slightly dependent on the preference of social relations or work performance – those preferring social relations are more critical towards corruption (p=0.03, χ^2=7.021).

The first question inspired by the European survey asked students about their opinions on territorially limited internet services. If the consumer pays for a service in one country he is not automatically entitled to have access to these services in another country. 54.2% of students strongly disagree with the current situation, 33.3% of them rather disagree, 8.3% rather agree and only 4.2% strongly agree. The results represent no surprise, as the consumers prefer comfort and no limits in their use of internet services. The results are on the 5% significance level independent on gender (p=0.505, χ^2=2.338), dependent on amount of hours worked (p=0.004, r_s=−0.285) – the more students work the less they disagree with the territorially limited services, and are dependent on the preference of social relations or work performance (p=0.061, χ^2=7.385).

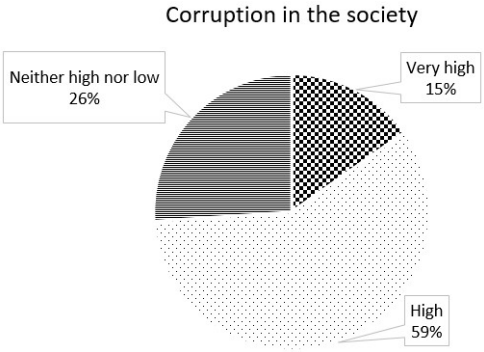

Fig. 1: Corruption in the society (source: author)

The answers on the second question were not as univocal, but in any case we may say more than 60% of students don´t consider a link to a copyrighted content a problem. That is in contrast with the law and the decision of the European Court of Justice in the Svensson case. We asked in the second question about the student´s opinion on the link to a copyrighted content. 10.4% consider it definitely a violation of the copyright, 27.1% consider it a rather a violation, 33.3 don´t consider it rather a violation of the copyright and 29.2% definitely don´t consider it a copyright violation. The results are on the 5% significance level dependent on gender (p=0.013, χ^2=8.626) – men are more tolerant, independent on the amount of hours worked (p=0.07, r_s=−0.185) and are dependent on the preference of social relations or work performance (p=0.03, χ^2=7.01) – those oriented on social relations are more tolerant.

The following question dealt with the length of copyright which is in most European countries 70 years from the author´s death. 33.3% of students consider the length appropriate, 46.7% consider it too long and 20% too short. That is in compliance with the tendency to free access to information. One student added a comment in which he expressed an opinion that the length of the copyright protection should be differentiated according to the character of the copyrighted work. The results are on the 5% significance level independent on gender (p=0.296, χ^2=2.434), slightly negatively dependent on the amount of hours worked (p=0.000, r_s=-0.419) and are independent on the preference of social relations or work performance (p=0.359, χ^2=2.05).

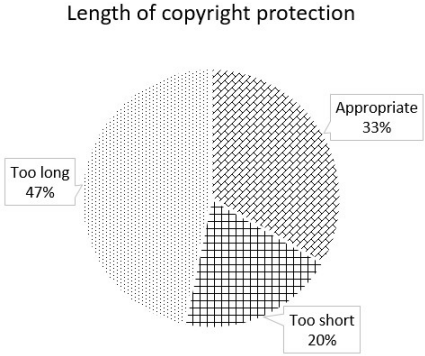

Fig. 2: Length of copyright (source: author)

The trend towards availability of content was confirmed in the question regarding the authority of libraries to lend digital content. 56.3% definitely agree to that, 39.5% agrees, but admits some exceptions and only 4.2% of students disagrees to that right, but admits some exceptions. None of the students was definitely against that right with no exceptions. The results are on the 5% significance level independent on gender (p=0.603, χ^2=1.011), independent on the amount of hours worked (p=0.08, r_s=-0.180) and are slightly dependent on the preference of social relations or work performance (p=0.03, χ^2=7.04) – those preferring social relations rather prefer free availability of digital content in libraries.

Interesting are the results regarding the right of EU member states to have exceptions to the European copyright legislation. 27.1% definitely agrees to that right, 33.3% rather agree, 25% rather disagree, 14.6% definitely disagree. Roughly 60% of students support that right and 40% of students are against it. That is strange as that would make the situation regarding copyright more complicated and the content less available than uniform regulation. The sceptical approach towards the EU may be expressed in the results. The results are on the 5% significance level dependent on gender (p=0.025, χ^2=9.330) – men tend to agree to countries´ exceptions in copyright, independent on the amount of hours worked (p=0.273, r_s=0.113) and are independent on the preference of social relations or work performance (p=0.569, χ^2=2.018).

As for the right to modify the copyrighted content without the author´s consent the students´ opinions tended rather to its support. 31.3% of the support the introduction of that right, 35.4% rather support the right, 18.8% rather don´t support it and 14.6% definitely don´t support it. The results are on the 5% significance level independent on gender (p=0.002, χ^2=14.376) – men tend more to the right to modify the copyrighted content, slightly positively dependent on the amount of hours worked (p=0.02, r_s=0.237) and are independent on the preference of social relations or work performance (p=0.802, χ^2=0.997).

As for the fees for empty media 4.5% definitely support them, 4.5% rather support them, 40.9% are rather against them and 50.1% are definitely against them. That is quite unanimous and expresses the negative approach of students against this rule. Paying for empty media is sometimes interpreted as presupposition that people would copy illegal content on them and that makes people angry. The results are on the 5% significance level dependent on gender (p=0.009, χ^2=6.769) – men are more critical, independent on the amount of hours worked (p=0.214, r_s=-0.134) and are dependent on the preference of social relations or work performance (p=0.008, χ^2=7.071) – those concentrating on work performance are more critical.

In the following question the students evaluated the proportion of the incomes which goes to the author or performer. 54.2% agree to it, 37.5% think the proportion should be higher and 8.3% consider the proportion too high. That expresses their opinion on the importance and remuneration of the publishing companies. The results are on the 5% significance level dependent on gender (p=0.035, χ^2=6.7286) – men would rather remunerate the artists more, independent on the amount of hours worked (p=0.182, r_s=-0.137) and are independent on the preference of social relations or work performance (p=0.069, χ^2=5.342).

In the last question of our survey we asked about the students´ opinion on the relation between copyright and basic human rights. 56.3% of students think the basic human rights are more important than the copyright, 20.8% think there is no conflict and both rights are in compliance, 16.7% of students think that the conflict has no solution and 6.3% would

prefer copyright to basic human rights. That shows students in general prefer human rights to copyright. The results are on the 5% significance level dependent on gender (p=0.007, χ^2=12.144) – men prefer human rights to copyright, almost 40% of women don´t see any conflict between these two rights, independent on the amount of hours worked (p=0.813, χ^2=1.576) and are independent on the preference of social relations or work performance (p=0.06, χ^2=7.4031).

Discussion

The copyright issues have been discussed in scientific literature especially in terms of illegal copying and pirating. The Pew Research Center´s Internet & American Life Project Online carried out a survey of teachers on the impact of digital tools on Students (Purcell, Buchanan, and Friedrich, 2013). Some of the results were that digital technologies allow students to share their work with a wider and more varied audience, encourage student creativity and personal expression. That is in compliance with our findings that students prefer free availability of digital content. However the research (Purcell, Buchanan, and Friedrich, 2013) shows teachers spend a lot of time discussing citation and plagiarism with students. That shows the conflict there is between the availability of content, its positive effects and limits represented by the copyright.

Gunter, Higgins and Gealt (2010) carried out a study with a random sample of 8th and 11th grade students in Delaware to predict involvement in music piracy with demographics (sex, race, and class), educational achievement and aspirations, and self-control. Results indicate each of these factors are related to music piracy in this population. In our survey we came to the conclusion that gender is not important in terms of preference of available digital content.

Interesting is in this regard also the research of American Assembly and Google (Karaganis and Renkema, 2013) which evaluates the effects of streaming and illegal copying on economy. It supports the users´ preference of easy availability of content.

In the context of this paper the public survey on copyright rules organized by the European Commission between 5 December 2013 and 5 March 2014 is important (European Commission, 2014). In the survey information ethics was addressed with the focus on copyright issues. The idea of the survey was to gather information from various stakeholders in order to have some inputs for the EU information and copyright regulation. Almost 10.000 various stakeholders filled in the questionnaire. We have asked our students similar questions. Unfortunately no detailed statistical analysis of the EU research results were published, general outcomes only. We will concentrate on the end users/consumers answers as they are most similar to our students.

The vast majority of end users faced access restrictions regarding territorially valid electronic licenses and didn´t agree to such a practice. The issues concern Youtube content, video on demand services, music services, which have locally dependent restrictions. End users called for common European rules regarding these services.

Regarding linking, the vast majority of end users don´t consider hyperlink to a protected work to be subject to authorization by the holder of the right. Free linking is the essence of the internet for them.

Regarding resale of previously bought digital content many consumers reported they faced difficulties when reselling. They complain about the unequal treatment of physical and digital formats. Most users would like to have the same treatment of physical and digital content.

End users also complained about the length of copyright protection. In their opinion the

length of protection should be shortened because long terms of protection limit innovation potential and increases the price of the content.
In case of exceptions to copyright rules end users consider they create legal uncertainty, but some of them, like exceptions for exceptions for scientific research, education, cultural heritage, disabilities, libraries and archives are necessary. In any case exceptions linked to fundamental rights should be mandatory and harmonized.
Most end users agreed that exceptions and flexibility to copyright is necessary to ensure adjustment to technological changes and future applications. However exceptions specific to EU countries would increase legal uncertainty and many practical problems related to web services, cross-border communication, research, inter-library loans etc. That is why the vast majority of end users don´t agree to territorial exceptions and limitations to copyright.
Significant number of end users highlighted problems related to dissemination on internet of content created on basis of existing works. They reported there is a lack of clarity in the legal framework. The lack of clarity of licences between internet platforms and rightholders was considered a problem for many users. Users often favour legislative exceptions for transformative uses of copyrighted material.
Many respondents disagree with the private copying and reprography schemes including levies for empty media. They are not satisfied with the current opaque levy mechanisms that distort single market. Differentiation between professional and non-professional should be made in order to avoid undue payment.
The vast majority of end users disagree with current schemes of remuneration of authors or performers. They call for a EU action to provide their fair remuneration. They even suggested some rules and guidelines for the fair remuneration for the authors.
Consumers/end users do not generally support stronger enforcement of copyright as they would create further problems related to the difficulties with the implementation. Generally they think other fundamental rights should prevail. They are not in favour of any further inspection, control or involvement of intermediaries in the investigation of copyright cases.
From our findings we may conclude that the students at the University of Economics have similar preferences like the European citizens, with the exception of support of member states exceptions to copyright.
Our research has also relevance for the efficiency and responsibility in education. As learning techniques include more and more multimedia content to make education more interesting, demonstrative and so more efficient (e.g. Cheng, Safont and Basu, 2010), it is good to know students prefer its easy availability. However, current regulation doesn't allow to use the full potential of media content in education. In any case teachers can look for ways how to legally provide students with copyrighted material or how to lobby on students' behalf.
Relevant are in the context of efficiency and responsibility in education questions one, two, three, six and nine from the questions inspired by the European survey. Students travel a lot and there are many online educational tools they use or may use and the territorially limited services may pose obstacles to their online education. Providing links to some content is also quite common and it is difficult for the teacher to know whether the content is copyrighted or not. That is why he should be protected. Copyrighted material represents an important part of education and the length of copyright decides on its availability for both students and teachers. The right to modify copyrighted content for private purposes is relevant especially for practically oriented fields of study. Students could realize their

creative powers and simultaneously learn how to respect the author. The ninth question has a general relevance as it focused on the relationship between copyright and human rights. It shows students' preferences in terms of what they respect and what should also be respected in education.

The other questions show also some relevance for education. Availability of digital content in libraries may increase efficiency of education, EU member states' exceptions in copyright may be relevant for international mobility of students, fees for empty media have predominantly financial impact on students and educational institutions and the proportion of income which goes to the author is practically relevant for those students who would like to become authors of copyrighted material.

Conclusion

We may conclude that the students´ opinions on copyright rules don´t differ very much from the opinions of European citizens. All require easy access to digital content with no barriers, ability to modify it for the personal purposes. Educational institutions should accept this trend and the law should allow it. The end users also complain about the complexity and intricacy of copyright law. The students at the University of Economics support in contrast to European end users more the right to exceptions of EU member states. That shows little identification with European values. The results of our survey are with a few exceptions independent on gender, working hours and preference of social relations or work performance.

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THE EVALUATION OF THE SIGNIFICANCE OF TRANSFERABLE COMPETENCES FOR THE JOB MARKET

[1]✉Lucie Smekalova, [2]Milan Slavik, [3]Katerina Tomsikova

[1]Department of Lifelong Learning and Study Support, Institute of Education and Communication, Czech University of Life Sciences Prague, V Lázních 3, Praha 5 - Malá Chuchle, 159 00, Czech Republic, +420 224 386 022, smekaloval@ivp.czu.cz

[2]Department of Pedagogy, Institute of Education and Communication, Czech University of Life Sciences Prague, Czech Republic

[3]Department of Pedagogy, Institute of Education and Communication, Czech University of Life Sciences Prague, Czech Republic

Abstract

The paper presents the results of a transversal research among the first, second and third study year students of vocational education. The subject of the research is their subjective evaluation of the significance of transferable competences for the job market. The research sample consists of vocational education students specialized in teacher training. A deliberate selection was made at Institute of Education and Communication of the Czech University of Life Sciences Prague. Using statistical methods, it was concluded that there are no significant differences between the first and second, the second and third, the third and first study years in the evaluation of transferable competences expressing the rate of significance for the employability at the job market that students attach to them. On the contrary, the order of the compared competences among the study years is almost identical.

Keywords

Evaluation of significance, job market, transferable competencies, transversal research, vocational education

Introduction

Transferable competences represent an attractive research area, both in academic discourse and in practice. The transformation of work environment (its conditions, requirements, technological advances) as well as the globalization of the job market stimulates the development of transferable competences.

The term ‘competences’ itself is often used in the effort to describe to what extent the individuals have approached the requirements in different fields (Klieme, Maag-Merki and Hartig, 2010: 104). The required quality of activities expressed in competences is related to a professional standard set by the employers’ sphere in order to define a standard qualification and standard performance (Vašutová, 2004: 93). The job market has shown that the term qualification is a static category (where a close relationship to the job performance is missing) and has started to work with competences as a dynamic category which is bound to professional situations (Profesionalizace, 2000: 3).

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).

In the recent years, there have been a number of research surveys in the Czech Republic dealing with transferable competences. For instance, Kozel and Vilamová (2006: 29-31) carried out a survey focused on the preferences of competences from the employers´ point of view. They evaluated the *following competences as the most significant:* active approach of an individual, willingness to broaden one´s knowledge, responsibility, motivation, work with PC, and flexibility. Borůvková, Půlkrábková and Vaníček (2006: 6-10) examine the benefits of bachelor´s studies for the future employment in their research. The following competences are preferred there: communication in mother tongue and foreign language, decision-making and ability to solve problems. An interesting and inspiring survey from the mining industry is presented by Krčmarská, Černý, Vaněk et al. (2014: 7-23) who - on the basis of their research - designated *the significance* of individual competences for the mining industry practice. Other interesting foreign researches in the field of transferable competences are represented by e.g. Frey, Balzer and Ruppert (2014), OECD (2012), Rocha (2014), Yorke (2008).

Moreover, there are research results available that compared the *graduates of vocational education* in the Czech Republic and the Netherlands. The empirical research has proved on the explored sample that: (1) there are significant differences among the respondents of both countries in the individual level of satisfaction with transferable competences; but (2) there are not significant differences among the transferable competences themselves of both countries expressing the level of students´ satisfaction with them (Smékalová, Noom and Slavík, 2015: 524-531). Another research has proved that: (1) there are significant differences among the transferable competences themselves of both countries (CZ and NL) expressing the rate of significance attached to them by the students; (2) in the CZ the following competences are considered absolutely necessary: communication in the mother tongue, work with digital technologies, sense of responsibility; (3) in the NL the competence of communication in the mother tongue is considered absolutely necessary and communication in foreign languages, sense of initiative and entrepreneurship, teamwork are considered important competences (Smékalová, Noom and Slavík, 2016: 109-121).

The aim of this paper is to present the results of transversal research of subjective evaluation of the importance of transferable competences for the job market in students of vocational education.

Materials and Methods

The subject of this research is a subjective *evaluation of the significance of transferable competences of the first, second and third study year students of* vocational education *specialized in teacher training.* The aim of the empirical survey is therefore to *find out the subjective view of the students regarding the significance rate of transferable competences for the employability of individuals at the job market.* The goal of the research then reflects the following research question: *Are there and significant differences between the first and second, the second and third, the third and first study years in the evaluation of transferable competences expressing the rate of significance that students attach to them?* Eight transferable competences were chosen and examined, they were described by means of their characteristics. The respondents wrote down their answers on a 4-degree Likert scale with a categorical expression. The research form was a short questionnaire involving questions about the sex and age of the respondents. The questionnaire was distributed and

processed in the summer semester of academic study year 2014-2015, in February 2015 to be precise. Due to face to face contact of the research team with the target groups, the rate of return was 100 %. After sorting the data, 144 questionnaires remained valid for all three study years.

The data were processed so that each degree of the scale was attached with a point score in a descending order. The summarization of the data represented the average number of points for each transferable competence. Thus, it is possible to compare transferable competences among the three study years. To verify the statistical conclusiveness, the non-parametrical Mann and Whitney U-test was chosen.

The research sample (144 respondents in total) was gained by a deliberate choice of first-study year students (33), second-study year ones (53) and third-study year ones (58) of the study programme. These are students of vocational education specialized in teacher training (i.e. Teaching vocational subjects, Teaching practical training) of the combined study bachelor´s programme at the Institute of Education and Communication of the Czech University of Life Sciences Prague.

There are many listings of transferable competences based on research surveys, for instance Allen (1993), Gibbs et al. (1994) etc. *Defining and Selecting Key Competences* (OECD, 2001) and *The European Framework for Key Competences for Lifelong Learning* (2006) were chosen as key documents. The most frequent competences were chosen for this research. Their characteristics was based on particular sources: items No.1-5 (The European Framework for Key Competences for Lifelong Learning, 2006), item No.6 (Šuleř, 2003: 61-66), items No.7-8 (Mühleisen and Oberhuber, 2008). The following 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 answers to the individual items (competences) represented a scale with the choice of categorical representation within the significance rate of a given competence for the individual´s employability at the job market in the following way: (1) *absolutely necessary*, (2) *very important*, (3) *important*, (4) *less important*. The answers were transferred in the descending order to a point score ranging from 4-1 points for each answer.

The statistical processing was made possible by the Non-parametrical *Mann and Whitney U-test* with a significance level of 0.05 for frequencies $N_1 = 8$ and $N_2 = 8$. The Mann and Whitney U-test which verifies if two samples can come from the same basic set was processed "manually" according to a prescribed methodology for very small sample scopes. The interpretation of the significance test of Mann and Whitney lies in the following rule (Chráska, 2007: 93): *if the calculated U value is smaller or equal to the very critical one, we reject the null hypothesis on the chosen significance level and we accept the alternative hypothesis.*

Results and Discussion

The following research inquiry is explored: *Are there any significant differences between the first and second, the second and third, the third and first study years in the evaluation of transferable competences expressing the rate of significance that students attach to them?* The verification of hypotheses must be divided into three areas, i.e. into partial research inquiries.

Partial research inquiry 1a: *Are there any significant differences between the first and second study year in the evaluation of transferable competences expressing the rate*

of significance that students attach to them? The verification was done on the basis of testing the hypotheses: (a) *Null hypothesis H1a:* There are not statistically significant differences between the results (point score averages) of the researched transferable competences between the first and second study year; (b) *Alternative hypothesis H1a:* There are statistically significant differences between the results (point score averages) of the researched transferable competences between the first and second study year.
Partial research inquiry 1b: *Are there any significant differences between the second and third study year in the evaluation of transferable competences expressing the rate of significance that students attach to them?* The verification was done on the basis of testing the hypotheses: (a) *Null hypothesis H1b:* There are not statistically significant differences between the results (point score averages) of the researched transferable competences between the second and third study year; (b) *Alternative hypothesis H1b:* There are statistically significant differences between the results (point score averages) of the researched transferable competences between the second and third study year.
Partial research inquiry 1c: Are there any significant differences between the third and first study year in the evaluation of transferable competences expressing the rate of significance that students attach to them? The verification was done on the basis of testing the hypotheses: (a) *Null hypothesis H1c:* There are not statistically significant differences between the results (point score averages) of the researched transferable competences between the third and first study year; (b) *Alternative hypothesis H1c:* There are statistically significant differences between the results (point score averages) of the researched transferable competences between the third and first study year.
With regard to the research type, this is a quantitative empirical survey that verifies the null and the alternative hypothesis. In particular, it is a transversal research which explores the evaluation of transferable competences of various respondent groups (in contrast to the longitudinal research which explores the same respondents over the course of time). The transversality of the research relates to the study years, more precisely to how transferable competences are evaluated by students of the first, second and third study year.
The data summarization and results of average point score for all study years are presented in the chart, see Table 1.

Transferable competencies	**Significance**		
	1st study year points_average	**2nd study year points_average**	**3rd study year points_average**
1_Communication in the mother tongue	3.8	3.6	3.6
2_Communication in foreign languages	2.6	2.6	2.9
3_Work with digital technologies	3.1	3.0	3.3
4_Learning to learn	3.0	2.9	2.8
5_Sense of initiative and entrepreneurship	2.8	2.7	2.7
6_Problem solving	3.0	2.9	3.0
7_Teamwork	3.0	2.9	3.0
8_Sense of responsibility	3.5	3.5	3.5

Table 1: The average point score of transferable competences of all study years, 2015

The table shows (see the grey colouring) in which study year a particular competence gained the highest average point score. The significance of transferable competences for the individual´s employability at the job market prevails in the first study year (up to 6

competences), in the third study year 5 competences gain the highest significance with three competences being common to the first study year (problem solving, teamwork, sense of responsibility). The competence „Sense of responsibility" gained the same average point score in all three study years.

It may be assumed that the first and third study year evaluated the transferable competences in a similar way, therefore there are no substantial differences in evaluating the highest rate of significance. It was only the sense of responsibility competence where there was the consensus of the highest rate of significance between the first and second, and the second and third study year. We could therefore expect that there will be some differences among the study years. However, when analyzing the average point score in more detail, all competences are very close (they got a similar point evaluation). The question therefore is if such a small difference will manifest itself in the statistical significance.

By means of a „manual" calculation according to a prescribed methodology (Chráska, 2007: 92) the following test criterion was calculated for the significance level (0.05) and for frequencies (N1 = 8 a N2 = 8) for:

- *partial research inquiry 1a:* the test criterion (which is the smaller one from the two calculated values), that is U = 27; it was compared to the critical value which is U(8,8) = 13 for the given scopes. *We accept the null hypothesis;*
- *partial research inquiry 1b:* the test criterion (which is the smaller one from the two calculated values), that is U = 22; it was compared to the critical value which is U(8,8) = 13 for the given scopes. *We accept the null hypothesis;*
- *partial research inquiry 1c:* the test criterion (which is the smaller one from the two calculated values), that is U = 29; it was compared to the critical value which is U(8,8) = 13 for the given scopes. *We accept the null hypothesis.*

Therefore, we can rightfully claim that *there are not any significant differences in evaluating the transferable competences expressing the rate of significance that students attach to them* between the first and second, the second and third, and the third and first study year.

Due to the fact that the same students were not observed in time (see the longitudinal research), we cannot claim that the evaluation of the transferable competences´significance for the individual´s employability at the job market would stagnate in time (that the same students would have the same opinion of the transferable competences´s significance in the first as well as the second and third study year). In this respect, there is an interesting consensus among the respondents - they all evaluated the significance of transferable competences in a similar way. What does that mean? What factor plays the biggest role in this evaluating?

One of the possible answers is that all the respondents are the students of a combined study programme who have been on the job market, they are employed and that is why the competence rating at the four-grade scale may be similar. As a result, the differences among the competences have not manifested themselves in the given study years. Another possible influence might be the field specialization, that is the employability at the job market distinct by the field. Whereas the number of respondents of the ‚Teaching practical training' field was 109 students, it was only 35 students of ‚Teaching vocational subjects' field in the sample. It is quite possible that the this field´s representation by a third only could have affected the fading away of the differences between the competences significance at the expense of the field representation. In this context, follow-up empirical surveys can be directed in that way.

If the results among the transferable competences evince nearly the same average point score, it will be of interest to focus on their order in each study year, see Table 2.

Transferable competencies	Significance		
	1st study year order	2nd study year order	3rd study year order
1_Communication in the mother tongue	1.	1.	1.
2_Communication in foreign languages	8.	8.	6.
3_Work with digital technologies	3.	3.	3.
4_Learning to learn	4. - 6.	4.-6.	7.
5_Sense of initiative and entrepreneurship	7.	7.	8.
6_Problem solving	4. - 6.	4.-6.	4.-5.
7_Teamwork	4. - 6.	4.-6.	4.-5.
8_Sense of responsibility	2.	2.	2.

Table 2: The order of transferable competences in all study years, 2015

The order of the compared competences is markedly similar among the study years, almost identical except for a noticeable difference between the competences of Communication in foreign languages (6th position) and Sense of initiative and entrepreneurship (8th position) in the third study year. The following competences acquire the same position across the study years: (a) Communication in the mother tongue (1st position), (b) Sense of responsibility (2nd position) a (c) Work with digital technologies (3rd position). The competence of Communication in foreign languages gained the last position in the first and second study year whereas it came sixth in the third year. The remaining competences share the 4th-7th position in the rating.

The results evidence the fact that the respondents attach a considerable significance to Work with digital technologies, but still a limited (even the least) significance to Communication in foreign languages. In this respect, let us remind the results of the research realized by Kalenda and Surý (2013: 10-16) who examined the language competence level of employees in CZ who were applying for job positions in two thousand companies. The results of the sample showed that some job areas and work positions require mastering English as absolutely necessary while the Czech job market on the whole has not yet been substantially internationalized and mastering English is not the key factor of employability.

Despite the fact that the results are almost identical and the dissimilarity among the study years has not proved, the research documents that the respondents evince a high opinion homogeneity regarding the transferable competences´ significance for the job market. In this context, the empirical survey puts forward a reflection not about the consensus among the study years, but about the order of the given competences. Why did some competences get the position they got? What role does a given attitude play? What role does the mentality or culture play? These are also questions for another empirical survey.

Conclusion

The empirical survey has proved at the researched sample that there are no significant differences between the first and second, the second and third, the third and first study years in the evaluation of transferable competences expressing the rate of significance for the individual´s employability at the job market that students attach to them. On the

contrary, the order of compared competences is almost identical among the study years with the exception of the competences (see Communication in foreign languages a Sense of initiative and entrepreneurship) in the third year. In a future empirical survey, it would be suitable to focus the attention on the differences between the study fields. Also, it is convenient to continue in the data collection so that the longitudinal research could be carried out; it explores the opinions of students in the course of time (that is continuously during all the years of study). Finally, it is also good to reflect upon the causes of a given order of the competences.

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THE ORIENTATION ON INNOVATION IS A CHALLENGE FOR ORGANISATIONS OPERATING IN SLOVAKIA

[1]✉Zdenko Stacho, [2]Katarina Stachova

[1]Department of Management, School of Economics and Management in Public Administration in Bratislava, Furdekova 16, 851 04, Bratislava 5, Slovak Republic, +421 907 082 448, zdenko.stacho@vsemvs.sk

[2]Department of Management, School of Economics and Management in Public Administration in Bratislava, Slovak Republic

Abstract

Under current market conditions, companies most frequently focus on customers, innovation, results, quality, team work, market and products. There are other more specific orientations, which are directly focused on a certain industry. Nowadays, the most preferred challenges are shifts from product orientation to market orientation, which is included in orientation to customers and to ensuring adaptability and flexibility, on which orientation on innovation is focused. The orientation on innovation is currently a challenge for organisations operating in Slovakia, which are exposed to progressing globalisation, internationalisation and more and more competitive and turbulent environment.

Keywords

Human resources, innovative organisation, organisational culture, organisations operating in Slovakia

Introduction

Organisational culture is nowadays becoming a preferred subject within various concepts of the growth of effectiveness in the operation of an organisation. Many managers start comprehending it as an important factor of successful operation of an organisation. It is becoming an inseparable part of modern organisational management.

The basis of each organisational culture is adequate labour potential (Stasiak–Betlejewska, Piasecki, 2011; Tidd et al., 2007). We mean both a sufficient amount of employees in a suitable structure and their talent, knowledge and abilities. The quality of employees, its strategically supported approaches, attitudes, activities, way of acting and behaviour are preconditions of creating and developing the strengths of an organisation.

Organisational culture affects all formalised activities (functions) of human resources management. By means of them, it encourages employees to behave desirably and reliably (Majerčáková, 2015; Oblak, Zadnik-Stirn, 2000). Human resources management functions can be applied as a tool of forming and enforcing organisational culture (Franková, 2003; Kampf et al., 2014). The aforementioned suggests that the relationship between organisational culture and human resources management is mutual. It is related to the fact that their primary task is essentially the same: to create conditions for so called positive behaviour of employees in compliance with strategic intentions and goals of an organisation (Remišová, Búciová, 2012; Závadský et al., 2015).

Organisational culture reflects human dispositions in thinking and behaviour, and affects both human consciousness and subconsciousness. It sustains the relationship of a person to work, regulates mutual relationships between employees, and has a significant impact on the activity of employees (Bačík et al., 2014; Papula, Volná, 2012). Generally stated

and declared organisational culture elements include fundamental beliefs, values and norms outwardly demonstrated by symbols and artefacts, created, found or developed by organisations as a result of successful problem solving (Cagáňová et al., 2012; Cannavacciuolo et al., 2015; Dudová, 2014; Gubíniová, Pajtinková-Bartáková, 2014; Šatanová, Potkány, 2004). A group of people bearing organisational culture, in which such a culture is shared, is also a common element (Urbancová, Hudáková, 2015; Hajko et al., 2011).

The objective of development and education of employees interconnected with organisational culture is to positively influence the socialisation of employees as well as to influence and encourage the desired behaviour of employees on the grounds of the awareness of approaches and values of a company and their sharing.

With regard to softness of the issue of organisational culture, the objectives of education related to its improvement, respectively a change of its content are frequently too general (improvement of managerial skills). Therefore, the fulfilment of objectives of education regarding organisational culture also needs to be formulated and subsequently checked.

Not only knowledge, abilities and skills of employees but also their identification with the individual elements of organisational culture need to be considered upon career planning and selection of talents.

The provision of educational possibilities to employees can also be used as a form of motivation and gaining loyal and dedicated employees, as this is how their organisation shows them that they are so valuable for it that it is willing to invest financial resources in them, which subsequently implies that it counts with them in future, whether at their presently held position or a more senior position after completing higher education within their career growth.

Under the present market conditions, the need to implement innovative culture in organisations is increasing, since thinking and will of people, which are directly conditioned not only by their abilities but also the influence of environment, are essential to every innovation. Organisational culture is thus among the key factors affecting the innovative potential of the human resources in organisations.

Innovative organisational culture is an essential precondition of success of the organisations which have chosen the strategy of innovations and want to achieve success on the market by providing better, varied or brand new products and services (Hroník, 2007).

The currently most preferred challenges are transitions from the orientation to products to the orientation to market, which is involved in the orientation to customers and to ensuring adaptability and flexibility, to which the orientation to innovation is focused (Stacho et al., 2015; Pilková et al., 2013). The orientation to innovation is a challenge for the organisations currently operating in Slovakia which are exposed to advancing globalisation, internationalisation and more and more competitive and turbulent environment.

The aforementioned implies a task for company managements to create an environment with room for developing new ideas, i.e. to provide employees with labour inputs (time, material, information, etc.) in order to ensure sufficient room for their innovative behaviour.

The objective of the article is to characterise the level of the focus of organisations operating in Slovakia on innovative organisational culture. This article aims at presenting the results of research conducted each year between 2010 and 2014.

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. The questionnaires were used in a wider research, for example see Stacho and Stachová (2015).

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

Organisational culture is a continual, dynamically developing phenomenon. It neither arises nor disappears in a certain moment, but it acquires the character of a certain process. Like in case of many other long-term phenomena, organisational culture also involves certain regular cyclic movement. It means that each organisational culture goes through the phases of its establishment, functioning, codification, failing, and a possible radical change or recodification.

With regard to the fact that organisational culture analysis should be the first step in examining the present state of culture, our research also focused on finding out whether organisations carry it out. 32 % of organisations responded affirmatively. However, year-to-year comparison shows a negative trend similarly to the case of the focus of organisations on organisational culture change.

Analysing the positive relationship of individual functional spheres of human resources management and organisational culture, organisations carrying out the analysis find the most significant impact in relation to facilitating communication in an organisation as well as upon hiring and evaluating employees (Table 3).

What motivated your organisation to carry out organisational culture analysis?	2010	2011	2012	2013	2014
Decrease in labour productivity	18%	19%	19%	20%	20%
Ineffective usage of working time	15%	14%	16%	18%	18%
Problematic interpersonal relationships at workplace	18%	19%	18%	19%	21%
High employee fluctuation	31%	27%	25%	22%	22%
Unsatisfactory or insufficient communication between individual organisational units	26%	20%	17%	20%	19%
Discrepancy between present organisational culture and strategically necessary organisational culture	12%	13%	11%	14%	15%
Outperforming the character of present organisational culture due to changes in economic, social or technical environment of the organisation	22%	24%	26%	26%	27%
Transition of the organisation from one development stage to another	28%	29%	32%	30%	28%
A significant change of the size of organisation	22%	22%	21%	20%	21%
A significant change in the scope of business	5%	3%	7%	9%	8%
A change in the position of the organisation on the market, takeover or merger of the organisation	17%	15%	14%	15%	17%

Table 3: Motivation to carry out organisational culture analysis

As Slávik (2000: 23) presents in his publication Change Management: ´**O**rganisational culture either significantly helps or obstructs successful change implementation.´ It is therefore necessary that culture supporting innovative behaviour of employees is implemented in innovative organisations. The questionnaire survey showed that up to 81 %, respectively 91 % of the interviewed perceive the importance of focusing on innovations, however only approximately a third of the interviewed organisations stated that they had elaborated an organisational culture strategy, which means not only that they share the values and standards of behaviour but also that they know how they are going to develop them in future. In addition, the fact that the number of organisations with innovation-oriented organisational cultures is even smaller does not sound positive. It means that more than 70 % of organisations have not created suitable conditions in order to support innovative behaviour of their employees (Table 4).

Approach of interviewed organisations to innovative culture	2010	2011	2012	2013	2014
Do you consider dealing with creation and maintaining of innovative culture to be important?	81%	85%	88%	87%	91%
Have you implemented innovative culture in your organisation?	22%	23%	25%	26%	27%

Table 4: Approach of interviewed organisations to innovative culture

In organisations without an implemented organisational culture, we were subsequently finding out the reasons (see Table 5). Most frequently, in 67 % - 71 % of cases, the interviewed stated that they innovate even without an implemented innovation culture, and in 16 % - 18 % of cases, innovative culture is not considered as important. The third option was “the implementation of innovative culture is financially demanding for our organisation”, which was the answer of 11 % - 14 % of organisations. The remaining 1 % - 3 % declared other reasons, most frequently including considerable time required for implementing an innovative culture.

Why do not you carry out organisational culture analysis in your organisation?	2010	2011	2012	2013	2014
we do not consider innovative culture implementation to be important	18%	16%	17%	16%	17%
we innovate even without implemented innovative culture	67%	68%	71%	69%	70%
innovative culture implementation is financially demanding for our organisation	14%	14%%	11%	12%	12%
others	1%	2%	1%	3%	1%

Table 5: The reason for not having implemented innovative culture

Discussion

If managers want to create innovative culture purposefully it is first of all necessary to create pro-creative and pro-innovative atmosphere. It means they should focus on social and psychological atmosphere supporting initiative and safety (Kotter, 2008).

In case company management succeeds in creating such pro-innovative environment, it is able to adopt innovation-related decisions very fast, which is seen as a significant factor in terms of competitiveness in the current turbulent environment.

The given fact is declared by both a number of significant authors dealing with the issue and different research studies. For instance, the consulting firm Booz & Company analysed the financial statements of 243 companies from 17 fields over 30 years, and was searching for the aspects differentiating the organisations with above-average profitability in the long term. One common feature was found – a great ability to adapt to changes, which is conditioned by the existence of an innovative organisational (Molnár, 2016). We can thus state that the ability of an organisation to innovate supports its economic efficiency in the long term.

However, fact that less than 30 % of organisations have an innovation-oriented organisational culture appears unflattering. It implies that more than 70% of companies do not have suitable conditions to support innovative behaviour of employees. Unless this trend changes, it might happen that most organisations operating in Slovakia will be unable to respond to changes in global environment sufficiently fast, which will cause their inability to compete.

Conclusion

Upon implementing innovations, i.e. upon changes, organisations frequently invest considerable financial resources in machines and technology in an effort to valorise their value as much as possible. However, the results are not as good as they assumed. It is therefore crucial to realise that how inputs are valorised in a company mainly depends on how such a change is perceived by people and on their readiness (education, the feeling of safety, understanding, obtained information on the need to carry out a change, etc.) to accept it. For this purpose, it is necessary for company managements to realise the significance of the environment in which innovations are developed and implemented on success or failure in their implementation. This was among the reasons why the paper is focused on using human potential upon the creation, respectively maintaining of so called "innovative organisation", as it is essential upon the creation and success of a change; however it might also be a reason of its failure.

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THE PERSONALITY OF A UNIVERSITY (LANGUAGE) TEACHER: A SURVEY-BASED STUDY

Martin Stefl

Department of Language Studies, Czech Technical University in Prague MIAS, Kolejní 2637/2a, Prague 6, 160 00, martin.stefl@cvut.cz

Abstract

The study represents the outcome of the first phase of an on-going research which was conducted within the Masaryk Institute of Advanced Studies of the Czech Technical University in Prague. The presented pilot study focused on perceived differences between university teachers of the so called "core curriculum subjects" and university language teachers. By examining the differences between these two categories of university teachers, the project focuses on a broadly defined phenomenon of the personality of university teachers, in particular on the extent into which university teachers, understood as unique independent personalities, should influence the content of their educational activities by introducing their own, subjectively selected themes, topics, and/or opinions that are not directly related to the prescribed subject matter into the educative process.

Keywords

University teacher, language teaching at tertiary level, personality, questionnaire survey

Introduction

In recent years, an increasing number of researchers in the field of pedeutology and theory of education have focused their attention on the personality of university teachers. Blašková et al (2014) attempt to examine some of the key personality competences of university teachers by contrasting their expectations with the expectations of university students. In a similar vein, Sirotova and Frydkova (2012) discuss the personality of a university teacher as a factor influencing the attitude of university students toward university education in general. Other authors, such as Arif et al (2012), consider the importance of professional training that precedes the educational practice of university teachers, examining the so-called "Big five personality traits" (conscientiousness, emotional stability, agreeableness, extraversion, and openness to experience) of prospective teachers. Yet other researchers, such as such as Lumpkin (2008) or by Fenstermacher, Osguthorpe and Sanger (2009), prefer to focus on psychological and moral dimensions of the problem, scrutinising the importance of moral behaviour of university teachers.

Despite the range and erudition of the ongoing research, relatively less attention has been paid to systematic investigation of the role of personality of university teachers in respect to different specialisations, namely in respect to the specific role of a university language teacher. In order to address this problem, the presented questionnaire-based study examines and analyses students' expectations about the personality of two stipulated specialisations of university teachers in the context of technical or business/economy related universities. These specialisations are: (a) the "core subject teacher" (hereafter referred to as "CC teacher"), i.e., a teacher responsible for teaching core curriculum subjects that form the main subject portfolio of the university and typically constitute the core of university's research activities, and (b) "language teachers" i.e., teachers responsible for language training, often across various departments or subjects.

In an attempt to contribute to the existing research, the presented survey examines the relationship between different expectations of university students regarding the personality of the above defined teacher categories in relation to the problem of subject matter, class-content, in-class strategies and the use of "authentic" language materials as explored by Heitler (2005) or Al Azri and Al-Rashdi (2014). A careful examination of these questions represents a vital contribution to understanding the balance between teacher's effectiveness and responsibility for the educative process. Given the ever-changing methodological terrain and development in ELT (English Language Teaching), these questions grow on importance with the increasing emphasis which authors such as Richards (2006) or Savignon (2002) implicitly put on the teacher's personality in new dynamic ELT methodologies, such as Communicative Language Teaching. In line with this development, the problems addressed by this research further resonate with other important methodological approaches within the field of ELT, namely Content-based Language Learning analysed by methodologists such as Pessoa et al (2007), or newer trends such as the intercultural dimension of language learning widely discussed by Kramsch (2001) and Byram (2003).

Drawing on these theoretical standpoints, the aim of the presented study is to determine the extent into which university teachers of different specialisations, understood as unique independent personalities, should influence the content of their educational activities by introducing their own subjectively selected themes, topics and/or opinions that are not directly related to the prescribed subject matter. In line with these standpoints, the research attempts to enhance our understanding of the teaching-learning process of ELT, leading to a closer and more efficient cooperation with the so-called "core curriculum subjects", and contributing to the systematic reflection of students' needs in relation to their reflection on teacher's professional practice.

Materials and Methods

The research conducted at the Masaryk Institute of Advanced Studies in January 2016 consists of a questionnaire-based survey among more than two hundred 1st and 2nd year BA students of the study programmes "Management and Economy of an Industrial Enterprise" and "Personnel Management in Industrial Enterprises". The study follows the main declared objectives and stipulated needs of the institution, i.e., to "develop pedagogic and research activities, and expand professional education in the fields of economic and management education, engineering pedagogy and language education" (MUVS 2016). Further, it reflects on the needs of teaching language for specific purposes and aims at students of technical, natural, or business-related study programmes.

In order to obtain feasible results, a questionnaire based survey was designed, utilising a non-standardised questionnaire consisting of eleven statements about the importance of teacher's personality in the educative process. Each statement offered a modified ten-point Likert Scale with the response categories to each of the statements arranged in descending order of weighting from "Strongly Agree" (10 points) to "Strongly Disagree" (1 point). Respondents were asked to express their opinion by indicating the selected level of their agreement with each individual statement of the inventory. The presented statements can be divided into three main categories: paired statements concerning (a) the personality of university teachers in general (statements 1 - 5), corresponding statements concerning (b) the personality of university language teachers (statements 6 – 10), and non-paired statements examining (c) student's attitude towards university language training in general

(statement 11). Beside these statements, each respondent was asked to express their gender, field and year of study. The questionnaire consisted of the following statements:

1. A university core curriculum teacher should be well trained in teaching methodologies.
2. It is important that a university core curriculum subject teacher has a strong personality with his/her own opinions.
3. A university core curriculum teacher should integrate his personality and opinions into his/her classes.
4. During their classes, university core curriculum teachers should address topics that are not directly connected to their subject (social, political or cultural topics, etc.).
5. A university teacher should be active in expressing his subjective opinions on topics (social, political, cultural) that are not connected to his subject.
6. A university language teacher should be well trained in teaching methodologies.
7. It is important that a university language teacher has a strong personality with his/her own opinions.
8. A university language teacher should integrate his personality and opinions into his/her classes.
9. During their classes, university language teachers should also talk about topics that are not directly connected to their subject (social, political or cultural topics, etc.).
10. A university language teacher should be active in expressing his subjective opinions on topics (social, political, cultural) that are not directly connected to his subject.
11. University language teachers have a different position in comparison to university core curriculum teachers.

The total amount of 215 paper questionnaires was distributed among students during different classes in the final week of the winter term 2015/2016. In order to maintain the ethical standards, all questionnaires were anonymous and student participation was strictly on a voluntary basis. High response rate of 98% was secured by personal distribution and collection of the questionnaires. The respondent group consisted of 210 students out of which 43 were males (20.5%) and 167 females (79.5%). 58% of the students were form the 2nd year of the BA study and 42% from the 1st. Collected data were analysed and tested by using mean and student's t-test. Given the above formulated problems, the results of the research are used to test the following hypotheses:

$H_{0:1}$ there is no significant difference between the student's perception of the importance of methodological training between university CC teachers and university language teachers. (Pair statements no. 1 and no. 6)

$H_{0:2}$ there is no significant difference between the student's perception of the importance of strong and opinionated personality between university CC teachers and university language teachers. (Pair statements no. 2 and no. 7)

$H_{0:3}$ there is no significant difference between the student's perception of university CC teachers and university language teachers in terms of integrating their personalities and opinions in their classes. (Pair statements no. 3 and no. 8)

$H_{0:4}$ there is no significant difference between the student's perception of university CC teachers and university language teachers in terms of addressing topics (social, political or cultural topics, etc.) that are not directly connected to their subject. (Pair statements no. 4 and no. 9)

$H_{0:5}$ there is no significant difference between the student's perception of university CC teachers and university language teachers in terms of active expressing of their

subjective opinions on topics (social, political, cultural) that are not connected to their subjects. (Pair statements no. 5 and no. 10)

Results

Results summarised in Table 1 below indicate that the mean score in favour statement no. 1 is greater than the mean score in favour of statement no. 6. However, the table further indicates that t-value 1.56 is not greater than the critical t-value 1.965 at 5% level of significance. Therefore, the two samples should not be seen as significantly different. The null hypothesis $H_{0:1}$ proposing that there is no significant difference between the student's perception of the importance of methodological training between university CC teachers and university language teachers therefore remains valid.

Research Statement	Stat.dev	Mean Score (1-10)	t-value
statement no. 1 (n1 = 210)	1.69	8.17	1.56
statement no. 6 (n2 = 210)	1.86	7.90	

Table 1: Mean scores of the pair statements no. 1 and no. 6.

Results summarised in Table 2 below indicate that the mean score in favour statement no. 2 is greater than the mean score in favour of statement no. 7. The table further indicates that t-value 10.12 is significantly greater than the critical t-value 1.965 at 5% level of significance. Therefore, the two samples are to be seen as significantly different, and the null hypothesis $H_{0:2}$ proposing that there is no significant difference between the student's perceptions of the tested phenomena is rejected. From these results it is possible to infer that there is a significant difference in the student's perception of the importance of strong and opinionated personality between university CC teachers and university language teachers, favouring university CC teachers to language teachers.

Research Statement	Stat.dev	Mean Score (1-10)	t-value
statement no. 2 (n1 = 210)	1.37	8.08	10.12
statement no. 7 (n2 = 210)	2.03	6.37	

Table 2: Mean scores of the pair statements no. 2 and no. 7.

Results summarised in Table 3 below indicate that the mean score in favour statement no. 3 is greater than the mean score in favour of statement no. 8. The table further indicates that t-value 2.01 is not significantly greater than the critical t-value 1.965 at 5% level of significance. Therefore, the two samples are not to be seen as significantly different. Consequently, the null hypothesis $H_{0:3}$ proposing that there is no significant difference between the student's perceptions of the tested phenomena remains valid. From these results it is possible to infer that there is no significant difference in the student's perception of the difference between university CC teachers and university language teachers in terms of integrating their personalities and opinions in their classes.

Research Statement	Stat.dev	Mean Score (1-10)	t-value
statement no. 3 (n1 = 210)	2.08	6.38	2.01
statement no. 8 (n2 = 210)	1.90	5.98	

Table 3: Mean scores of the pair statements no. 3 and no. 8.

Results summarised in Table 4 below indicate that the mean score in favour statement no. 9 is greater than the mean score in favour of statement no. 4. However, the table further indicates that t-value – 0.91 is not greater than the critical t-value 1.965 at 5% level of

significance. Therefore, the two samples should not be seen as significantly different. The null hypothesis $H_{0:4}$ proposing that there is no significant difference between the student's perceptions of university CC teachers and university language teachers in terms of addressing topics (social, political or cultural topics, etc.) that are not directly connected to their subject therefore remains valid.

Research Statement	Stat.dev	Mean Score (1-10)	t-value
statement no. 4 (n1 = 210)	2.35	6.36	- 0.91
statement no. 9 (n2 = 210)	2.36	6.57	

Table 4: Mean scores of the pair statements no. 4 and no. 9.

Results summarised in Table 5 below indicate that the mean score in favour statement no. 5 is greater than the mean score in favour of statement no. 10. The table further indicates that t-value – 3.37 is significantly greater than the critical t-value 1.965 at 5% level of significance. Therefore, the two samples are to be seen as significantly different, and the null hypothesis $H_{0:5}$ proposing that there is no significant difference between the student's perceptions of the tested phenomena is rejected. From these results it is possible to infer that there is a significant difference in the student's perception of university CC teachers and university language teachers in terms of active expressing of their subjective opinions on topics (social, political, cultural) that are not directly connected to their subjects, favouring university language teachers to university CC teachers.

Research Statement	Stat.dev	Mean Score (1-10)	t-value
statement no. 5 (n1 = 210)	2.27	4.42	- 3.37
statement no. 10 (n2 = 210)	2.24	5.25	

Table 5: Mean scores of the pair statements no. 5 and no. 10.

Statement	1.	2.	3.	4.	5.	
Mean (1 - 10)	8.17	8.08	6.38	6.36	4.42	
Statement	6.	7.	8.	9.	10.	11.
Mean (1 - 10)	7.90	6.37	5.98	6.57	5.25	3.13

Table 6: Mean score for statements no. 1 – no. 11.

Discussion

The results of the first tested hypothesis $H_{0:1}$ reveal that there is no significant difference between student's perceptions of the importance of methodological training for both tested teacher groups for statements no. 1 and no. 6. The mean score for both groups (8.17 and 7.90) is comparatively high, especially in comparison to the mean scores for statements no. 4, 5, 9, and 10, testifying to the importance students ascribe to methodological equipment of university teachers in general, irrespective of their specialisation. These results may seem unexpected, in particular given the ever growing number of various didactic approaches and ELT methodologies, and the increasing emphasis put on continual methodological training of language teachers. Despite recent developments described by Hultman, Löfgren, and Schoultz (2012), this emphasis might still be seen as comparatively higher than the emphasis laid on the methodological equipment and continual training in teaching methodologies of CC teachers, in particular in the Czech Republic (Kotásek 2011: 226).

Comparing statements no. 2 and 7, the results of the second hypothesis $H_{0:2}$ reveal the most significant difference between the two compared teacher groups, clearly ascribing more importance to personality with university CC teachers (8.08) to that of language teachers

(6.37). Similar though not as significantly different results can be observed for the third tested hypothesis $H_{0:3}$. The rejection of $H_{0:2}$, which demonstrates the stronger perceived importance of personality in favour of university CC teachers, is in an interesting contrast with a relatively low mean score for statement no. 11 (3.13) where respondents express their "moderate disagreement" with the statement that university language teachers have a different position in comparison to university core curriculum teachers.

The results for hypotheses $H_{0:4}$ and $H_{0:5}$ show significant difference between the perceptions of the two compared teacher groups. The most interesting results can be observed with statements no. 5 and no.10, i.e. with test hypothesis $H_{0:5}$. The mean score for both statements indicates decreasing level of agreement (in case of statement no. 5 even disagreement) of the respondents. At the same time, the result analysis shows significant difference, rejecting hypothesis $H_{0:5}$. The results are, contrary to the trend set by previous tested hypothesis $H_{0:1}$, $H_{0:2}$ and $H_{0:4}$, significantly in favour of the university language teacher. These results can be interpreted in the following way: Firstly, although the mean score for statements no. 1 – 4 and 6 – 9 indicates general agreement with the high importance of personality of both university CC and language teachers, the agreement indicated by the falling mean score indicates that the teacher should not, however, be all too active or pronounced in incorporating their personality, subjective opinions or non-related topics into their class.

This tendency becomes most pronounced in the reluctance to give full consent to the statement that the teacher should in fact be active in expressing his personality, subjective ideas, and/or in introducing subject-unrelated to his class in statements no. 5 and 10. Contrary to the general tendency of higher means scores for CC teachers, the difference of mean score for statements no. 5 and 10. This suggests that according to the respondent's perceptions, it is more acceptable for a language teacher (although the expectations regarding his personality are not as high as discussed above) to *actively* employ his personality, opinions and subjective themes, and more *actively* influence the class content that his CC colleagues. These results should have an important impact on methodological discussions concerning the role of content in language learning and training, in particular in the field of English for special purposes (ESP) understood as a subject taught in technical and business study programmes.

Conclusion

As a part of the larger debate about efficiency and responsibility in education, the results of the student's survey demonstrated statistically differences between the perceptions of the two compared group of teachers, i.e. between university CC teachers and university language teachers in some of the examined categories. Whether merely subjectively perceived or in some respects really existing, the differences between these two teacher groups deserve closer theoretical attention and careful study. Importantly, it seems possible to summarize that both of these teacher groups are subject to high expectations of students in terms of personality and personality-related competences, and are therefore not to be seen as essentially different. Instead of pointing out imaginary hierarchies, the conclusions of this research offer an opportunity to understand subtler mechanisms working on the background of the generic and often homogenised "category" of a university teacher. As such they lead towards a more refined idea of the role of personality, subjective opinions, and standpoints in different fields of study. Further, these results are an important contribution to the on-going discussion within the didactics and methodology of language teaching as such, in particular to the discussions between researchers and practitioners

regarding the role content in language learning not only in general ELT but also, most importantly, in the field of ESP (English for Specific Purposes).

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HRM WITH SPECIAL EMPHASIS ON TRAINING AND EDUCATION IN CASE OF CZECH NGO´S

[1]✉Andrea Stolfova, [2]Pavla Fajfrlikova

[1]Department of Psychology, Faculty of Economics and Management, Czech University of Life Sciences Prague, Kamýcká 129, Prague 6 - Suchdol,165 21, Czech Republic, stolfova@pef.czu.cz

[2]Department of Psychology, Faculty of Economics and Management, Czech University of Life Sciences Prague, Czech Republic

Abstract

The article focuses on the importance of Human Resource Management (HRM) with an emphasis on training employees in the non-profit sector in the Czech Republic. The aim of this paper is to introduce the current state of HRM and training in NGOs in the Czech Republic using a theoretical model Strategic and Human Resources Orientation Dimension and its four architectures (Administrative HRM, Strategic HRM, Motivational HRM and Value-based HRM) according to Ridder, Baluch and Piening (2011). The data for the assessment of the current state of NGOs in the Czech Republic is based on a qualitative and a quantitative research conducted by the authors in 2015 in cooperation with the non-profit organisation SANEK Ponte. The identified architectures of the Czech non-profit sector currently correspond to three architectures, Administrative HRM architecture, Strategic HRM architecture and Motivational HRM architecture (ordered by frequency).

Keywords

Education, HR orientation, HRM, motivation, NGOs, strategic orientation

Introduction

Ridder and McCandless define two HR dimensions in the Human Resource Management (HRM). These two are the so-called Strategic Orientation and HR Orientation (Ridder and McCandless, 2010) which they supplement by findings in the NGO sector.

The mail goal of all organisation is efficiency of human resources (HR), therefore, HR management but also cutting costs are important theme (Vnoučková, 2013: 179). "Strategic Orientation" in the private sector places emphasis on achieving firm's strategic goals and on maximizing shareholder value (Ridder, Baluch and Piening, 2011: 4). The development of HR direction stems from the strategic direction of an organisation (Lepak and Snell, 1999: 35). Strategic orientation functions are different as their strategic direction is dictated by their unique values, mission and social outcomes. HR management (HRM) is managed differently than in the private sector as the mission, goals and expectations of external stakeholders, which may not always be completely identical, are achieved through HRM (Ridder, Piening and Baluch 2011: 613). Ridder and McCandless link the second dimension, HR Orientation, to the theory of Resource-Based View (RBV). In this view, HRM places its emphasis on human resources. This concept stems from the premise that HR development serves as a source of a sustainable competitive advantage on the market (Ridder and McCandless in Wright, McMahan and McWilliams, 1993: 5). Investment into HR in the form of trainings or mentoring programmes helps develop those skills and abilities of employees which are not easily transferrable to other organisations (Lepak and Snell, 1999: 34). Human resources are educated towards value creation of

a firm and towards covering their own individual needs (Wright, Dunford and Snell 2001: 705). The RBV theory is valid in terms of human capital even in the non-profit sector. The distinction stems from different motivations and values of non-profit organisation workers which then shapes a different HR architecture based on the emphasis on individual care of a worker (Schepers et al, 2005: 193).

The two described dimensions make up a concept model of a matrix of 4 architectures – Administrative, Motivational, Strategic and Values-based. Each of these HR architectures impacts the performance of a firm through HRM work. Distinction of work depends on the strength of the emphasis in strategic orientation and HR orientation (Ridder, Baluch and Piening, 2011: 6).

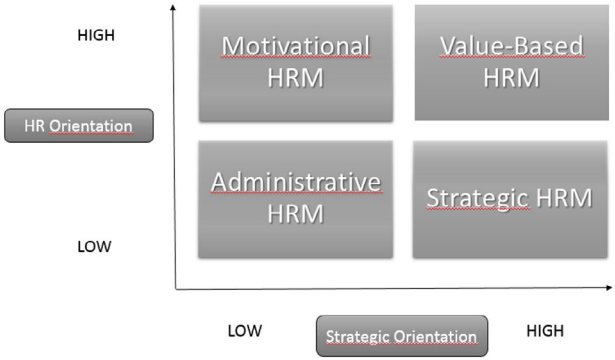

Figure 1: Types of HR architectures in nonprofit organizations. (source: Ridder, Piening and Baluch, 2011: 615)

Administrative HR architecture has minimal input of strategic and HR orientation. This type is characterised by lowering expenses on workers, workers themselves work on short-term contracts and are not perceived as a resource for long-term value creation. Moreover administrative HR architecture has internal documents management processed (organization plan, workloads). Strategic HR architecture is typically highly strategically oriented and not very HR oriented. The aim of this architecture is orientation on the strategic goal of an organisation. Achieving strategic goals is monitored through the use of measurable indicators based on which the workers are remunerated. This architecture proves to be demotivating in the context of NGO workers, as they are only perceived as tools to achieving strategic goals. Their inner motivation is suppressed. Motivational HR architecture is highly oriented on HR and only a little strategy-oriented. This architecture mainly supports strengths and individual needs fulfilling the inner motivation of workers. Value-based HR architecture is strongly aimed at both strategy and HR. Worker development programmes are long-term designed and are linked to the strategic direction of an organisation. These workers, whose inner motivations are met, can also function as further strategic direction of a firm (Ridder, Piening and Baluch, 2011: 614-616).

The aim of this paper is to introduce the current state of HRM and training in NGOs in the Czech Republic using a theoretical model Strategic and HR Orientation Dimension and its four architectures (Administrative HRM, Strategic HRM, Motivational HRM and Value-based HRM) according to Ridder, Baluch and Piening (2011).

Materials and Methods

The paper is based on quantitative and qualitative research aimed at the issue of management

in Czech NGO HRM. The quantitative research was carried out as a questionnaire survey under the support of the SANEK Ponte NGO. The questionnaire was thematically aimed at 4 areas of management – strategy, PR, finance and HR. Almost 2,500 NGOs operating in the Czech Republic were given the on-line questionnaire in 2015, 313 of them actually returned the filled-in questionnaire. 40% of organisations who filled in the questionnaire were focused on social services, 26% work with children and youth, the remaining NGOs were in equal part aimed at culture and arts, environmental protection, community development, research and education, and human rights protection. In the questionnaire, organisations were divided into two groups. Group A consisted of organisations utilising systems of complex management, actively working with PR, fundraising and HR (159 respondents). Group B consisted of organisations which were either small in size (maximum 5 employees) or beginning their operation, or which work on volunteer basis, or which do not utilise management systems in their operation. For the purposes of this paper, we further worked only with organisations from the A group, as they use HRM education. Selected specific questions in the questionnaire for the purposes of this paper were: *"Does your organisation have a strategic organisation plan?, Which sections are represented in the strategic plan?, Do you have an HR plan?, Do you provide further education?, How do you do that?, Which educational methods do you use in employee capacity building?"* Qualitative research was carried out in 2015 in the way of semi-structured interviews with a total of 25 directors of NGOs. As an appropriate sampling method of directors, the snowball method was chosen. Questions from the semi-standardized interviews served to deepen the information acquired in the questionnaire survey. NGOs were thematically focused in relatively the same way as in the case of returned questionnaires. Organisations focused on providing social services were significantly represented (19 respondents), roughly equal was the proportion representation of respondents working in areas of child and youth services and development help and culture. A quarter of the organisations approached filled in the questionnaire and took part in the semi-standardized interview.

Results

In the questionnaires, 70% of the organisations stated to have a strategic organisation plan. In all of the cases they stated their strategic plan to contain vision, mission and values of the organisation. The strategic plan of a quarter of the respondents contains a chapter on HR. Equally, a long-term HR plan as a separate document was indicated by a quarter of the organisations. Results of the survey into worker educational needs indicate that in 88% of the cases the organisations try to find out about the educational needs, most often depending on the current needs of the organisation (34%), then according to the requirements of an employee (27%), by the means of an analysis of educational needs of an employee (19%), by analysing the educational needs of the organisation as a whole (17%) or at random (3%). This signifies that the NGOs consider the current needs of the organisation to be primary and training is not included in their long-term strategy. The semi-structured interviews determined that an educational plan for the workers is put together during an evaluation interview with a worker's superior once a year. A worker meets their superior and together, they evaluate the work activities during the given year based solely on self-assessment of the worker in question and their superior's feedback. The plan is partially determined by legal obligation of organisations operating in social areas, meaning an obligatory amount of time. In the interviews, NGO directors stated that a worker can take part in any educational activities which may not be directly related to the worker's job description even above the legally set minimum. In relation to that the

directors admitted that insufficient emphasis is being placed on strategic direction of an organisation in terms of employee education. Financial resources and the time reserves of the employees are proving to be the limiting factor in the realization of any educational activities. Investments into HR, namely into employee education, is often not a priority for organisations, finances are primarily channelled into services provided for their clients.
The questionnaire survey further proved that the most often occurring methods of employee education are training sessions or workshops, second most often occurring is supervision, third place belongs to self-study and conferences, while the least often used methods are coaching, mentoring, video-training and shadowing (fig. 2).

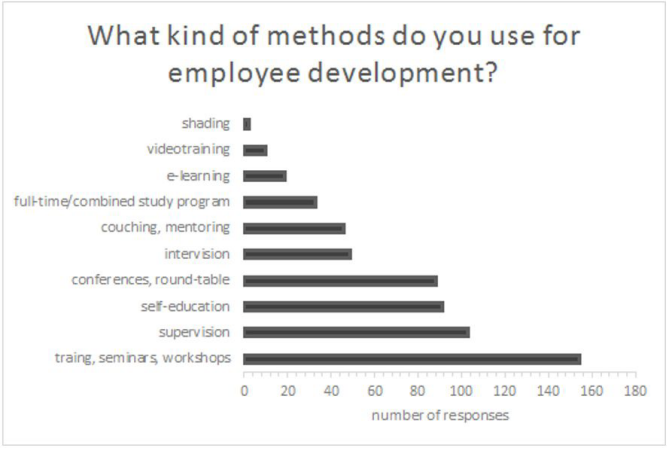

Figure 2: Methods for employee´s development, 2015 (source: based on own research)

The interviews showed that organisations most frequently use open training courses which belong among the most inexpensive varieties of educational methods. However, these courses only serve to provide the employee with basic orientation in the given issue. To cultivate and develop knowledge and skills obtained in this way is practically often not made possible by the organisations. Directors stated that tailor-made courses and subsequent extension courses are outside both their financial possibilities and the time reserves of the employees. Another explanation why open courses are among the most frequently used forms of training might be the small number of employees within the organisation for whom the training topic would be suitable. Another aspect to take into consideration when looking at NGOs in the social welfare sphere is the yearly target of the obligatory number of hours spent on training within a given field. After having completed the training, the organisations also lack systematic evaluation of whether the employees find the training activity beneficial and put it into practice.

Discussion

The chapter Results implies that HRM in NGOs in the Czech Republic is not yet a priority, which is an incorrect approach. However, this is not a strictly Czech trend – according to a Nonprofit HR Solutions survey (2013:19), aimed at American non-profit organisations showed that the lack of further training and professional development possibilities is one of the challenges, which the non-profit organisations have to face. The Czech NGOs reached a professional level in the services provided, the next step is the

topic of the professionalization of the management. NGOs are aware that it is not merely professional service but also the introduction of management to the organisation that lead to organisational sustainability. NGOs also start to realise that human resources training is of a key significance regarding the organisations' competitive advantage. Bahlis and Tourville (2005: 1) are of the same opinion, stating that without due investment into employees training, an organisation cannot reach set targets and missions. The intrinsic motivation of each employee to educate and develop themselves belongs among the factors that strengthen the organisation as a whole. Serra, Serneels and Barr (2011: 2) believe that NGO employees are in large part driven by this intrinsic motivation. Based on the theoretical typology of 4 HR architectures introduced by Ridder, Baluch and Peining (2011: 614-616) and the results of the qualitative and quantitative research of non-profit sector in the Czech Republic, the authors of this work identified three HR architectures (ordered by frequency). Administrative HR architecture refers to the organisations that stated in the questionnaire that they do not have any strategic plan and their planning might or might not include HRM. The interviews implied two characteristic features of the organisations. The first feature is connected with the project orientation of the organisation (a complete dependency on funding and grants and no employees' development). The second feature is the issue of the compiled basic internal documentation for HR management (organisational structure, job content) lacking any development potential. The creation of intern rules that might paradoxically not be functional is a legacy from the era of the Austro-Hungarian Empire and its bureaucratic system. Hofstede defines this approach as a dimension of avoiding uncertainty. This dimension characterises the need for written rules that reduce the tension of the employees against their feeling of being threatened by uncertain or unknown situations. The Czech Republic ranks among the group of German speaking countries (the country with the closest results is Austria) with medium values within the dimension (demanding rules on medium to high level) (Hofstede, 2007: 133). This type of architecture has been assessed as the most frequent one in the Czech NGOs. Organisations work towards the ideal type, Values-Based Architecture (VBA), however, they have not yet managed to fully connect the strategic direction with HRM. The questionnaire research shows 25% of respondents with a strategic plan interconnected with HRM. The interviews with the directors showed that a majority of organisations puts strategic documents into practice incorrectly. The current needs in training are given preference to the needs set in their strategy (see Results; 34% of the cases according to current needs of the organisation, a counterpoint to the analysis of training needs for the whole organisation – 17%). In order to connect strategy with HRM, NGOs in the Czech Republic need to reach Administrative HR architecture through the Strategic HR architecture. Strategic HR architecture is the incoming NGOs architecture in the Czech Republic. The results of the questionnaire research (70% of respondents have a strategic plan) show priority being given to the creation of organisational strategy. The directors themselves have confirmed that they already have a strategy or plan to create it shortly. Organisational strategy helps to define the vision, mission and specific values that result in the employees uniformly identifying themselves with the organisation. Strategic HR architecture leads to "knowledge-sharing" behaviour of and individual which is important for the organization (Minbaeva: 2013, 379). Based on these foundations, the organisation is then able to head towards HRM with functional training (VBA). The Czech NGOs are currently in the phase of learning to apply the strategies in practice. The employees strive to unify themselves with individual organisation values in their everyday work. The greatest obstacle on the journey to VBA is the philosophy of directors who decide

to invest their remaining funds primarily into their clients who they understand to be the organisation's strategic direction. Motivational HR architecture can be supported by the results of the questionnaire research. 25% of respondents has an HRM plan. On the scale of the needs detection, the respondents put training on the second and third place according to the employees' needs. During the interviews, the directors confirmed that they support their employees in education also outside of the organisation direction. This training is carried out in practice only if it is free and the employees have completed their obligatory training (NGOs in the sphere of welfare services). The importance of this architecture is mentioned by Akingbola (2006: 1707 - 1725), who believes the employees with a good quality HRM to be willing to work even in temporarily unsatisfactory conditions and still meet the strategic targets of the organisation. This architecture is not typical for the Czech Republic because the organisations are not used to work with their employees' internal motivation. The motivation of the employees is perceived as a given due to the not-for-profit philosophy. The quantitative research revealed deficiencies in compiling the management documents and a less frequent usage of analyses to determine training needs. The qualitative research highlighted mainly the small priority given to the development of training within HRM in the organisations researched. If an organisation has funds available, it invests them primarily back in the services for the clients. The Czech NGOs lack research investigating the connection between internal motivation and defined values of the organisation with training (which characterises the ideal VBA type). Is VBA type suitable for the Czech NGOs? Will this connection support sustainability of the organisations in the Czech Republic?

Conclusion

Three architectures were identified within the organisations researched: Administrative, Strategic and Motivational HR architecture (ordered by frequency). Value Based Architecture has not yet been achieved in the Czech Republic. The available data shows the HRM in NGOs to be insufficient. In the interviews, the NGO directors stated that an emphasis on quality of HRM is not possible due to insufficient funds that are primarily directed at providing services to clients. Within the Administrative HR architecture, the Czech NGOs put emphasis on the internal rules of the organisation that might not be fully functional. Administrative HR architecture fluently converts into the Strategic HR architecture in connection with the emphasis on the professionalization of the organisational management. NGOs focus on creating strategies including integrated values that they are now learning to put into practice. Strategic planning does not fully take account of HRM yet. The directors are aiming to theoretically apply the Motivation HR architecture, but it is not implemented due to the motivational nature of the NGOs which allows for it not being further developed. It is the least common architecture in the Czech Republic.

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EVALUATION OF MATHEMATICS TEXTBOOKS' POTENTIAL TO DEVELOP KEY COMPETENCES

[1]✉Tereza Suchoparova, [2]Helena Binterova, [3]Martin Gunzel

[1]Department of Mathematics, Faculty of Education, University of South Bohemia, Jeronýmova 10, České Budějovice, 370 15, Czech Republic, suchot00@pf.jcu.cz

[2]Department of Mathematics, Faculty of Education, University of South Bohemia, Czech Republic

[3]Department of Mathematics, Faculty of Education, University of South Bohemia, Czech Republic

Abstract

In the following article the authors introduce a tool designed to evaluate the potential of mathematics textbooks to develop key competences, specifically learning and problem-solving competences. In recent years, key competences have become an important part of many school systems across Europe. Results and first findings from a pilot use of the tool are described in the paper and following steps are suggested. Future specifications and improvement of the tool may allow to evaluate and compare textbooks that are used in lower secondary schools and also identify weak points of individual textbooks.

Keywords

Key competences, learning competences, mathematics, problem-solving competences, textbook.

Introduction

Since 2006 when the European Commission introduced eight key competences for lifelong learning they have become part of every developed European country's educational program. The European commission followed similar tendencies of international organizations, e.g. UNESCO in 1996 or OECD in 2001, to define other goals of education than encyclopaedic knowledge (Säävälä, 2013). European Commission defines the key competences for lifelong learning as 'set of knowledge, skills, and attitudes that will help learners find personal fulfilment and, later in life, find work and take part in society' (EC, 2006). The reason why most experts consider key competences an important part of the school reform is the changing world. A supporting document to the Czech Framework Educational Program (MŠMT, 2007b) comments that today's pupils will face many unexpected situations that we can hardly imagine and work in areas that do not even exist yet. In later life we sometimes also speak of professional competences (compare Procházka, 2014 and Vítečková et al, 2014).

In the Czech Republic there are six key competences defined in the Framework Educational Program (MŠMT, 2007a). For the purposes of our research we will focus only on two of them: learning competences and problem-solving competences. There are many researches focusing on development of these two sets of competences. For example Hašek and Petrášková (2014) consider a relation between a suitable task and problem-solving development. Chvál and Straková (2014) conducted a research on pupil's level of learning competences and compared their results with an original research conducted in Finland.

In this article we will use a term sub-competence to refer to more specific elements of learning and problem-solving competences. They will be defined in the following chapter.

Another concept we would like to specify is our understanding of the term potential. Potential of a task to develop key competences means that the dispositions, nature and content together with processing and solving of the task could develop students' competences.

The aim of our pilot research was to measure the potential of textbooks (tasks) to develop learning and problem-solving competences. According to many researchers (compare Sikorová, 2011 and Oates, 2014) mathematics teachers rely largely on textbooks in their classes. In her own research, Sikorová (2011) compared the use of textbooks in Mathematics, History, Civics and English lessons. One of Sikorová's findings was that mathematics teachers rarely use additional materials compared to teachers of other subjects. Other researches mentioned in the article also proved high dependence of mathematics teachers on textbooks. In addition to that, Oates (2014) sees the reason of England's poor results in mathematics is due to a lack of textbook use in classes, comparing to well performing Singapore or Finland.

Given the obvious importance of textbooks in mathematics education, we are interested on whether tasks in Czech mathematics textbooks have a potential to develop the learning and problem-solving competences through their sub-competences. In the following text we will describe our pilot research, the methods we have used to obtain results and our findings and conclusions.

Materials and Methods

The questionnaire designed for the pilot research was inspired by a similar research on geography textbooks (Lokajíčková, 2010). In this article we present a tool that we are trying to design to evaluate mathematics textbooks from the perspective of key competences development. The pilot researches will help us create a system of categories for textbooks evaluation that would enable us to conduct a valid and reliable research and to compare mathematics textbooks. If such survey proves that some sub-competences do not have their place in the books, it would be a reason for a didactic discourse.

For the pilot research we decided to evaluate one chapter in three textbooks. We chose a topic from 8th grade geometry – Thales' theorem. We consider this topic a very tricky curriculum since there is a high danger of verbalism and formalism. The evaluated textbooks are books that are currently used in Czech schools. Molnár et al (M) – Matematika 8 (2000), Binterová H., Fuchs E. and Tlustý P. (B) – Matematika 8 pro ZŠ a VG Geometrie (2009) and Kadleček J., Odvárko O. (K) – Matematika 3 pro 8. ročník základní školy (2013), where textbook (M) was published before the Framework Educational Program came into effect. Our evaluators were four lower-secondary school teachers of various ages, sexes and lengths of years in practice and from different schools.

The questionnaire designed for the first pilot research should enable us to measure the potential of tasks and, hence, also of textbooks to develop learning and problem-solving competences. We took advantage of the fact that key competences have been partially unpacked in the Framework Educational Program (MŠMT, 2007a). In this document, every competence is divided into smaller and finer sets of skills or 'subcompetences'. We have adjusted this classification to create a list of 13 subcompetences of the learning and problem-solving competences that can occur in mathematics textbooks.

The learning competences (labelled U) are divided into 8 categories:

U1 – Pupil selects and uses suitable methods and strategies for efficient learning,

U2 – Pupil plans and organizes their own learning process,

U3 – Pupil searches for information,

U4 – Pupil classifies information,
U5 – Pupil works with commonly used terms, signs and symbols,
U6 – Pupil interlinks pieces of knowledge, creates a complex view of mathematical, scientific, social and cultural phenomena,
U7 – Pupil makes independent observations and experiments, compares and criticizes the results and draws conclusions for the future,
U8 – Pupil recognizes the meaning and goal of learning, assesses their own progress, critically reviews the results of their learning.
The problem-solving competences (labelled P) are divided into 5 categories:
P1 – Pupil recognizes and understands problems, plans a solution and uses their own reasoning and experience,
P2 – Pupil seeks for information suitable for solving problems, identifies identical, similar and different features, uses knowledge and skills to discover new solutions,
P3 – Pupil addresses problems independently, chooses suitable ways to solve problems, uses logical, mathematical and empirical methods,
P4 – Pupil tests practically their solution and applies proven methods to solve similar or new problem situations,
P5 – Pupil thinks critically, makes prudent decisions and is able to defend them, is aware of the responsibility for their decisions.
In the questionnaire, we asked the evaluators to decide whether or not they see a potential to develop each of these subcompetences in the tasks from textbooks. There were 15, 17 and 24 tasks respectively on Thales' theorem in the textbooks. We obtained a table of answers for each textbook and each evaluator. Table 1 shows how teachers evaluated one particular task (Figure 1) from textbook (K) (Kadleček, 2013: 22).

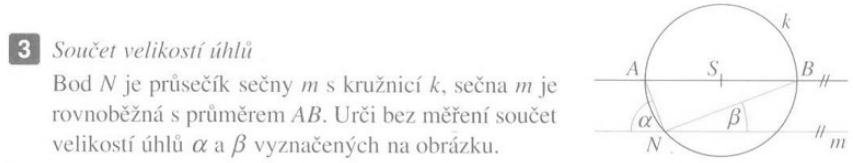

Figure 1: A task from textbook (K)

Evaluator	Textbook - task	U1	U2	U3	U4	U5	U6	U7	U8	P1	P2	P3	P4	P5
H1	K11	0	0	0	1	1	1	0	0	0	0	0	0	0
H2	K11	0	0	0	1	1	0	1	0	1	0	0	1	0
H3	K11	1	1	1	1	1	0	0	0	0	0	1	0	0
H4	K11	1	0	1	1	1	1	1	1	1	0	1	0	0

Table 1: Evaluation of a task

All the answers were summarized into a pivot table and a data analysis was carried out together with an absolute and relative frequency calculation of individual sub-competences. Apart from that, we also decided to calculate Cohen's kappa, which enables us to measure the level of agreement between two evaluators (Chráska, 2008: 172-174) in order to compare answers of the teachers. Usually, the value of this coefficient is required to exceed 0.8 (Chráska, 2008: 174). Because our evaluators could have chosen not one but zero to thirteen options for each of 56 questions, we will consider values over 0.4 as

satisfactory, which is a value also acceptable by some authors (Landis and Koch, 1977 in Günzel et al, 2015).

Results

We have summarized the results of the pilot research according to textbooks, evaluators and individual tasks.

Table 2 shows the teachers' different approaches. While H4 is very optimistic, points of view of H1 and partially H3 are quite strict. An interesting result is that the first two evaluators see slightly more opportunities to develop problem-solving while the other two evaluators see higher potential to develop learning competences. Despite the differences between H1 and H4, they are consistent in the result that textbook (M) has the highest potential to develop problem-solving while the other two teachers evaluated this textbook as the weakest.

	H1			Total	H2			Total
	M	B	K		M	B	K	
Competences	21.8%	19.6%	18.1%	19.5%	33.8%	34.5%	30.3%	32.5%
Learning to Learn	18.3%	24.3%	20.8%	21.2%	41.7%	39.7%	32.3%	37.1%
Problem-solving	36.0%	20.0%	20.8%	24.6%	34.7%	40.0%	39.2%	38.2%

	H3			Total	H4			Total
	M	B	K		M	B	K	
Competences	12.4%	31.8%	32.8%	27.0%	53.8%	61.2%	50.3%	54.5%
Learning to Learn	23.3%	45.6%	50.0%	41.5%	60.0%	77.9%	66.7%	68.3%
Problem-solving	0.0%	22.4%	18.3%	14.6%	65.3%	58.8%	44.2%	54.3%

Table 2: Overall results of each evaluator

Considering all four evaluators, the three textbooks have a very small potential to develop critical thinking – P5. This subcompetence was measured to be the least developed one in almost all textbooks. The only exception is textbook (B), for which two evaluators see a potential to develop critical thinking in 30% of tasks. One of these evaluators also sees such higher potential in textbook (K). Other weak results are for subcompetences U2, U3 and U8 that are below average of all the learning sub-competences. Among problem-solving P2, P4 and of course P5 were also below the average level of P.

From the perspective of individual tasks, there are seven tasks from textbook (B) among ten tasks with the highest potential. The remaining three tasks are from textbook (K). For five of these ten tasks there is also a potential to develop each of the sub-competences 25% or higher, which means that at least one of the four evaluators determined the potential. There are only two more tasks with this quality in all the textbooks. Three of the tasks are from textbook (B), four are from textbook (K). There are also only eight tasks whose overall potential to develop learning and problem-solving competences are higher or equal to 50%. On the contrary, there are only four tasks with potential below 25%. What notably distinguishes the "top" tasks from the rest is higher or at least any potential to develop critical thinking.

To determine the level of consensus among the evaluators we also calculated Cohen's kappa for each pair of evaluators. The results are slightly disconcerting since the teachers answered very differently with only a few exceptions. There is always a high level of agreement for U5 which is also the most frequent subcompetence. There are only a few cases when some of the evaluators did not see a potential to develop U5 in a task. Apart from U5 there is only a limited number of Cohen's kappa above 0.4 in all the textbooks (e.g. Table 3).

Cohen‘s kappa for textbook (B), sub-competence U7, evaluators: H1 vs H3	
Cohen‘s kappa:	0.876
Level of agreement measured via Cohen‘s kappa:	Excellent agreement
Hypothetical probability of chance agreement:	0.526
Relative observed agreement:	0.941

Table 3: Example of Cohen’s kappa results

Table 4 displays the total results of Cohen’s kappa for all pairs of evaluators considering the overall results as well as both competences separately in all three textbooks.

	H1	H2	H3	H4
H1		0.23	0.23	0.19
H2	0.23		0.09	0.14
H3	0.23	0.09		0.19
H4	0.19	0.14	0.19	

Total results

U	H1	H2	H3	H4
H1		0.27	0.36	0.14
H2	0.27		0.17	0.09
H3	0.36	0.17		0.18
H4	0.14	0.09	0.18	

Learning competences

P	H1	H2	H3	H4
H1		0.17	-0.05	0.30
H2	0.17		-0.05	0.22
H3	-0.05	-0.05		0.15
H4	0.30	0.22	0.15	

Problem-solving competences

Table 4: Matrices of Cohen’s kappa

It is obvious that the values of the coefficient are very low for every pair of evaluators. This shows us how important is the role of a teacher because each of them saw a potential to develop key competences in different tasks.

Discussion

There is a question if low potential detected in U3/P2 categories is something to be considered an insufficiency of a textbook. Does searching for information have its role in mathematics? This is one of the questions to be resolved for our second pilot research. Similarly, we could discuss if developing U2 (pupil plans and organizes their own learning) does not depend mainly on a teacher. Low U8 potential may suggest lack of real-life problems in textbooks, which is understandable for such a theoretical topic as that of Thales’ theorem. We will be able to confirm this conclusion after the second pilot research is complete, where we intend to focus on a curriculum that is more linked to real life situations.

Given the different results of our evaluators we will consider making a change in the way of selecting the teachers. A possible improvement for our next pilot research could be a team of experts on key competences who could do a pre-evaluation of a short and various set of tasks. Only those teachers whose level of agreement with this pre-evaluation is over 0.4 would be asked to participate on the next pilot research.

If we compare our results with a study carried out in geography (Lokajíčková, 2010) where they focused only on the learning competences we can say that the results differ a lot. In this research they identified lack of tasks that develop what we labelled U1 and U7 while U3 (together with U4 and U5) were detected in more than 60% of tasks. This could possibly be caused by the different natures of mathematics and geography. In addition to that, we believe that these differing results could be beneficial in case these subjects were complementary from the perspective of key competences.

Conclusion

In our pilot research our aim was to create a tool to measure textbooks’ potential to develop

key competences. For this purpose we conducted a first pilot research where we tested the tool. The main problem detected during this pilot research was a huge disagreement among the teachers who evaluated the textbooks. For the second pilot research we will choose another curriculum for more results. We will also form a group of experts for a pre-evaluation of the books and compare teachers' answers with the expert data.

One of our expectations proved to be correct so in our next pilot research we can omit the U5 sub-competence since it is obvious that when solving a mathematical problem pupil has to work with commonly used terms, signs and symbols. Another sub-competence that could be omitted is either U3 or P2 since they both focus on searching for information. After a discussion with the teachers we should also shorten and simplify the descriptions of some subcompetences.

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CHANGES IN THE MASTER STUDY ADMISSION PROCEDURE AT THE UEP BETWEEN 2010 AND 2014

[1]✉Zdenek Sulc, [2]Zdenek Smutny

[1]Department of Statistics and Probability, Faculty of Informatics and Statistics, University of Economics, Prague, W. Churchill Sq. 4, Prague 3, 130 67, Czech Republic, zdenek.sulc@vse.cz

[2]Department of Systems Analysis, Faculty of Informatics and Statistics, University of Economics, Prague, Czech Republic

Abstract

In the last five years, substantial reduction occurred in the number of people at the university age. The demographic turning point can be found around the year 2012 when students born in the mid 90s, a low birth-rate period, reached the university age. This situation caused decrease in the number of students studying for a bachelor degree at universities. In order to maintain the quality of master degree study, universities began to restrict the number of admitted applicants. This paper examines the changes which occurred in the admission process in the master type of study at the University of Economics, Prague between 2010 and 2014. It builds on findings of the authors' previous research, which examined changes in the bachelor type of study. The main findings of the research are an increasing number of applicants for study, a decreasing number of admitted students, and an increasing internationalization of the university.

Keywords

Admission examination, changes, master study, University of Economics Prague

Introduction

Currently, the Czech tertiary education faces a decreasing number of people at the university-age cohort, which was caused by the weak population years in mid 90s. However, the number of tertiary education institutions remains constant. In our research we study how these changes affected the admission procedure at the University of Economics, Prague (UEP) between the year 2010, before the impact of the low birth-rate period, and the year 2014, when the impact of the low birth-rate period was already eminent. Whereas in our previous article, see (Smutný, Šulc, 2015), we dealt with changes in bachelor type of study at UEP, in this article we present changes which occurred in the master type of study. Particularly, our aim is to analyze the effects of the changes in the admission procedure on the admission process, and how the structure of admitted students changed between the observed years.

Czech universities in the 2000s were initially exposed to an increasing demand for study, but in the last few years, on the contrary, they have been facing continuous reduction in the number of applicants. Whereas in 1989 there were approximately 113,400 enrolled students, in 2010 there were approximately 396,000 students. This is the highest number of all the observed years, see (Kočí, 2014). In the following years this number only declined, and thus, it further caused the increased competitiveness of university environment, see (Fischer, Finardi, 2010). The decreasing number of young people at the university-age cohort who have completed high school declined due to the reduction in the number of births in the 1990s from about 120,000 to 90,000 between 1996 and 2001, see (ČSÚ, 2015). Currently, there exist 26 public, 2 state, and 44 private universities in the Czech Republic.

However, their numbers grew unequally since 1989. Whereas the number of public universities rose from 23 to 26, the number of private universities rose more dramatically (from 8 in 2000 to 44 in 2014). These changes are related to the character of the expansion of tertiary education, which was more intensive in post-socialistic countries and rather continuous in the countries of continental Western Europe, see (Štefánik, 2014). Thinking in this context about the closing some public universities shows the long-term negative economic effects as well as the decreasing competitiveness of the Czech Republic among EU countries in terms of human capital, see (Vltavská, Fischer, 2015; Bernardi, Ballarino, 2014; Maryška, Doucek, 2011). Rather than closing public universities it is necessary to establish rules for continuous improvement the efficiency of tertiary education, and the competitiveness of universities at an international level. The effectiveness of the tertiary education system is a complex socio-economic relationship influenced by qualitative and quantitative factors that have an impact on the whole society, see (Gogu, 2013; Ciumaş, 2013). For this reason, it is necessary to solve this problem systematically. Our research is focused only on one institution of higher education. It presents what changes occurred in the admission procedure in an observed period with respect to an expected decrease of people in university age cohort, and to maintaining the quality of the study. In order to achieve this aim, the paper examines admission procedure in all its parts, and individual characteristics of applicants for the study. Some outputs are confronted with the results from the study focused on the bachelor type of study. The outputs of the research can be used by the UEP management to assess the current status and to establish mechanisms that would ensure necessary arrangements to achieve the required quality of the study.

Materials and Methods

The data used in this contribution were 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 were rendered anonymously.

The data were processed by the IBM SPSS statistical software. Because the complete data were available for the whole population of students, the methods of descriptive statistics were sufficient for the analysis. Therefore, there was no need to verify the results by statistical tests. In order to determine the dependency structure among several categorical characteristics, multiple correspondence analysis (MCA), which shows multidimensional relationships between categories of all variables in a two-dimensional graphical form called the correspondence map, was used.

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 considered period. The last part of the analysis is an application of multiple correspondence analysis, which examines multidimensional relationships between applicants' characteristics; and thus, it provides a comprehensive view on their structure.

Results and Discussion

Between 2010 and 2014, there occurred some substantial changes in the admission procedure. Although the number of registered applicants rose by nearly 30%, the number of admitted students decreased by 10%. Thus, the success rate decreased from 55% in 2010 to 38% in 2014. This contrasts with the bachelor type of study, in which the success rate remained constant at 35%. Probably the most important change in the admission procedure is by the conditions for entering an admission procedure. Whereas in 2010, 74% of students were admitted without an admission procedure, in 2014, their number made up only 36%. This steep decrease was caused by a new rule which enabled students to avoid the admission procedure only if their average grade is lower than two. This rule is a part of broader arrangements with the aim to improve the quality of master study. This is also connected with the new policy of the Ministry of Education, Youth and Sports (MEYS) after 2012, which sets a lower limit for the number of accepted students, see (Fischer, Vltavská, Schatral, 2014). Conversion rates, presented in Tab. 1, display in a simple way how the registered students who undertook the admission procedure went through it in years 2010 and 2014.

	Applied	→	Came to the exam	→	Passed the exam	→	Accepted	→	Commenced study
2010	100%		59%		49%		82%		91%
2014	100%		69%		72%		58%		88%

Tab. 1: Conversion rates for the admission procedure in the years 2010 and 2014. All percentages take the value in a previous column as 100%.

The results show that applicants took the admission procedure more seriously in 2014. They showed up more often for the admission exam (69% in 2014 vs. 59% in 2010), and they were also much more successful in it (72% in 2014 vs. 49% in 2010). In spite of these facts, the ratio of accepted applicants was lower. The ratio of accepted students who commenced the study did not change very much, staying constantly around 90%.

Fig. 1 offers the main reasons for not-acceptance in the admission procedure, which are consistent with those from Table 1. In both years, the main reason for not-acceptance was not attending the admission procedure. In 2014 there was a major increase in the number of students who were not admitted due to the insufficient capacity of the study program. This is exactly the opposite situation to the bachelor type of study, see (Smutný, Šulc, 2015), in which almost all the applicants who passed the exam were admitted.

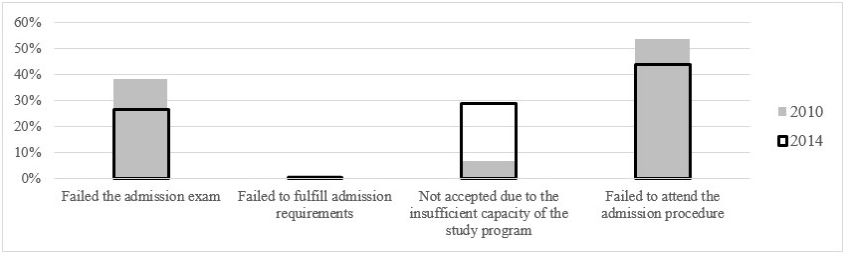

Fig. 1: Reasons for non-acceptance in the admission procedure.

The nationality structure of accepted applicants at UEP, presented in Tab. 2, did not change very much between the examined years. The proportion of students with Slovak citizenship slightly decreased (from 10.3% in 2010 to 8.9% in 2014), whereas it remained almost the

same for Russian citizens. The share of Ukrainian students almost doubled, and the share of Vietnamese students quadrupled. The other category, which predominantly consists of students from former Soviet Union countries, almost doubled as well. Even though these are still small percentages, the trend is obvious. The number of foreign students at UEP rose slightly between the observed years. Thus, UEP has become more international. Still, there is a shortage of students from Western Europe, Northern America, and East Asia.

Nationality	2010	2014
	in %	in %
Czech	85.7	84.5
Slovak	10.3	8.9
Russian	1.8	2.0
Ukrainian	0.7	1.3
Vietnamese	0.2	0.8
Other	1.4	2.5
Total	100.0	100.0

Tab. 2: National composition of accepted applicants.

All faculties at UEP reduced the numbers of accepted applicants. The shares of particular faculties did not change very much, see Tab. 3. Almost half of all students attend the faculties F2 and F3. The largest relative decrease of students occurred at the faculty F5, which now attends only 7.1% students of the whole university.

Faculty	2010	2014
	in %	in %
F1 – Faculty of Finance and Accounting	16.8	18.6
F2 – Faculty of International Relations	27.9	26.0
F3 – Faculty of Business Administration	22.7	21.8
F4 – Faculty of Informatics and Statistics	16.3	15.9
F5 – Faculty of Economics	9.2	7.1
F6 – Faculty of Management	7.1	10.7
Total	100.0	100.0

Tab. 3: Shares of accepted applicants to master study at UEP faculties.

The correspondence maps presented in Fig. 2 display multidimensional relationships among the characteristics of admitted students. The closer two categories are placed in a correspondence map, the more similar (more associated) they are. Although the maps are differently oriented, it is apparent that the association structure did not change very much between the observed years. In both maps, men are more associated to faculty F4, and women to faculty F2. Also, faculty F6 was in both maps the most associated with part-time study, although in 2014 the distance to other categories is not as large as in 2010. There are two reasons for that. First, faculty F6 accepted more students to fulltime study in 2014; second, faculty F4 offered a distance study in 2014. In the nationality structure, there were more substantial changes between the observed years. In 2010, Slovak and Russian students were typical for faculty F2, Ukrainian and other nationalities for faculty F4, and Vietnamese for faculty F2. In 2014, all foreign students were mostly associated with faculty F3. The reason is that the share of foreign students increased the most (by 5.4%) at this faculty. The increasing trend of foreign students is apparent; in 2014, the share of foreign students was over 20% at faculties F1, F2 and F3. A part of the correspondence analysis is an interpretation of the axes of the correspondence maps.

Both horizontal axes separate Czech and foreign students, and thus they can be labelled as *nationality*. Both vertical axes separate men and women, and thus they can be labelled as *gender*.

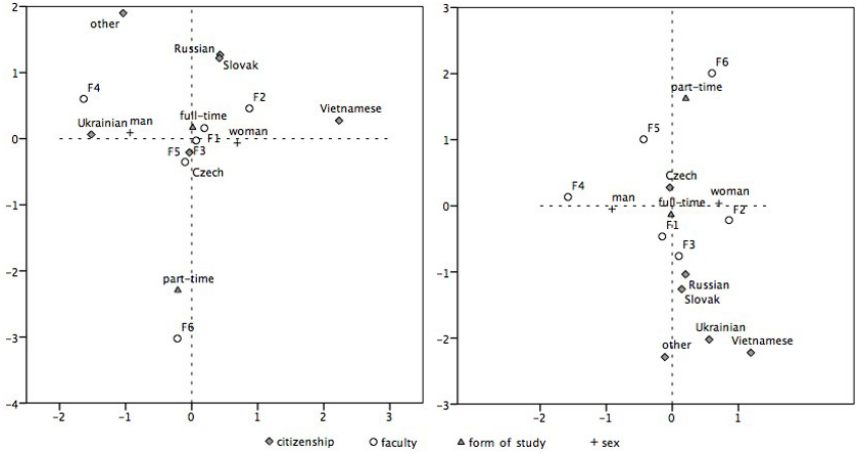

Fig. 2: Multiple correspondence analysis of admitted students in 2010 and 2014.

A comparison of average scores reached by applicants and accepted students in the admission procedure, as it was performed in (Smutný, Šulc, 2015) for the bachelor type of study, does not make any sense for the master type of study. The admission processes differed not only among faculties, but also among particular study courses; thus, there are practically incomparable.

Conclusion

This paper examined the changes in the structure of the admission procedure which occurred between the years 2010 and 2014. The most important changes are related to the arrangements taken by the faculties of the University of Economics, Prague in order to face the decreasing number of people in the university-age cohort, and to maintain the quality of education. Among such changes is an obligatory admission exam for most applicants. The arrangements as a whole caused a decrease in the admission success rate at all the faculties. Another visible trend is an increasing internationalization of the university. At most faculties, the share of foreign students increased substantially, most of all at faculty F3.

The development on UEP reflects the changes made by the Ministry of Education, Youth and Sports in order to reduce the number of students admitted to master studies and to gradually increase the quality of graduate studies. However, these changes are only applied to state and public universities. A systemic problem in this intention lies in the private universities, which do not keep the general limits of admitted students according to accreditation and they admit several times more students, see (ČSÚ, 2015). The Accreditation Commission of the Czech Republic reacts to the problem and penalizes these practices if the quality of study is endangered (e.g. the scandals around Jan Amos Komensky University Prague in 2014). But this approach is unsatisfactory because the commission bases its findings on formal mistakes, which affect only a few subjects.

Therefore, it is necessary to create a systemic solution in next years which would include national, public and private universities.

Acknowledgements

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EXPLORATIONAL APPROACH TO TEACHING AT ELEMENTARY SCHOOLS

[1]Barbora Svatkova, [2]✉Milos Maryska

[1]Sunny Canadian International School, Czech Republic

[2]Department of Information Technologies, Faculty of Informatics and Statistics, University of Economics, Prague, Czech republic Department, W. Churchill sq. 4, Prague, 130 67, Czech Republic, milos.maryska@vse.cz

Abstract

In this article we explore a theme of immediate interest, the application of inquiry-based learning at elementary schools where it is supported by the Czech Ministry of Education. We compared two types of inquiry-based learning with traditional frontal learning at the bilingual Sunny Canadian International School. We compared the interest, clarity and easiness of remembering of each type of learning from the perspective of the students and the teachers using a didactic test. During the survey we obtained 207 responses showing that although the selected inquiry-based learning methods are rated better by the students, they achieved better results through traditional frontal learning.

Keywords

Cooperation, explorational teaching, frontal teaching, microscope, science education, sensors Pasco

Introduction

The current ever-changing economic situation, general standards of education and demographic developments in relation to globalization show a great potential in the form of promising students having almost unlimited capabilities. In this respect we do not focus merely on university students, but also on elementary and secondary school students. For the purposes of this article our sole focus of attention was on elementary and secondary schools.

Globalization affects many aspects of peoples' lives including the important aspect of education. Globalization of elementary and secondary education is linked to many system-wide changes, both internal and external (Maryska and Doucek, 2011; Výzkumný ústav pedagogický, 2010). This trend is most marked in the twentieth century. Many developing countries report increasing numbers of educational facilities, including elementary and secondary schools (Chinnammai, S. 2005; Doucek, Maryska, Nedomova and Novotny, 2011). We see an increase in the private education sector, which is typified by school fees whereas education is a rule free in state schools, and a different approach to learning.

The increasing numbers of educational facilities are mainly due to an increasing number of students and their parents who are interested in quality education, which means nowadays full bilingual teaching from elementary school. To make learning more attractive these schools offer extra courses which the students can attend after school. In selected secondary schools students can graduate according to Czech and English standards. These students graduate twice which facilitates their admission to foreign universities (Doucek, Maryska and Novotny, 2013).

Globalization of education on all levels may bring about diverse external and internal changes within the international system. The demands of the global employment market,

which seeks graduates with requisite linguistic and working skills, have changed (Maryska, Doucek and Novotny, 2012; NVF, 2015; Lizalova and Kuncova, 2011).

One of the problems of modern-day primary and secondary is the students' lack of interest in learning science and technical subjects (Rocard et al., 2015). Popularity of science and technical subjects is currently low (MSMT, 2011). Their low popularity influences decision-making on university studies. Most students prefer subjects which are seen as more lucrative. They are evidently influenced by parents who want to find for their children more lucrative professions, such as law or economics. We can find many studies pinpointing this problem, such as Trends in International Mathematics and Science Study, The Programme for International Student Assessment, Badatele.cz, and Project for improving science subjects to increase motivation for their study (*Česká školní* inspekce*,* 2013; MSMT, 2011).

This article aims to determine how the students at Sunny Canadian International School (SCIS, 2016) rate the use of the teaching methods preferred today (inquiry-based learning) tackling selected problem assignments. The research is based on an assessment of inquiry-based learning methods (Cincera, 2014), specifically working with Pasco (Pasco, 2016) probes and microscopes in science classes with the traditional approach, which is frontal learning.

The survey was conducted at the private Sunny Canadian International School (SCIS), which was established in 2002, when it opened a kindergarten. Then, in 2006, it opened an elementary school and in 2014 a four-year secondary school. At present, more than 500 students study at SCIS (SCIS, 2016). Since its establishment SCIS has upheld the principle of bilingual learning where all the subjects are taught in Czech and in English by native speakers. The vision of SCIS is to inspire each student to become healthy, open-minded and responsible, ethical citizens, who achieve academic and linguistic success while attaining personal fulfillment through engaged and knowledgeable inquiry. One of the ways of achieving this goal is to make the study conform with similar aims defined by the Czech Ministry of Education (see above). SCIS is the first institution in the Czech Republic that integrates in its curriculum preparation of students for the IGCSE examination (International General Certificate of Secondary Education) and its graduation after the second year of secondary school. IGCSE is an academically rigorous, internationally used, and specialized English language curriculum which is offered to students to prepare them for International Baccalaureate (IGCSE, 2016).

During the survey we received 207 responses from 85 students of the second level of SCIS. The second level represents 6-9 classes. Three monitored lessons were given in each class. The first lesson was based on traditional frontal learning, in the next the students worked with a microscope set and in the last with Pasco probes. The last two lessons are a typical example of inquiry-based learning, which is preferred today in teaching of science and technical subjects. After the lessons the students completed an evaluation questionnaire and a control test on a given theme.

This paper is divided into three parts. The first one is devoted to the problem formulation. The second part is mainly about methodology and general data characteristic. The third part is devoted to the results, discussion and conclusions that were identified during our research.

Problem Formulation

During the survey conducted at the Sunny Canadian International School we focused on a relatively specific area – a comparison of knowledge acquired by the students through

two completely different learning methods. Our analysis is to help make to a key decision, whether to change the current learning method at the SCIS, including inquiry-based learning in the learning, or whether to prefer frontal learning.
The broad aim of the research and the results presented here is to map the students' current views of the learning styles, to determine the preferred learning method and the type of learning on the students' knowledge ascertained through the control test.
For the purposes of this article we formulated the following Research Questions:

- RQ1: Are Frontal-based lessons rated worse than inquiry-based lessons?
- RQ2: Do the students enjoy inquiry-based learning with support for work with Pasco probes more than frontal learning classes?
- RQ3: Do the students enjoy inquiry-based learning with support for work with microscopes more than frontal learning classes?
- RQ4: Is it easier to understand and memorize knowledge acquired through working with Pasco probes than that acquired through working with microscopes?
- RQ5: Are students' knowledge assessed through the test better in the case of inquiry-based learning in comparison with the results of frontal learning?

Material and Methods (Data Collection)

The project using inquiry-based learning in lessons at the SCIS elementary school was implemented in the period 1.4.2013 - 31.12.2014 (SCIS, 2016). For the project SCIS bought special study aids that could be used in the incorporation of inquiry-based learning into the SCIS curricula. Specifically, SCIS purchased Pasco probes for measuring various biological processes, such as working with CO_2 and taking blood pressure, and microscopes enabling the students to understand in more depth other natural phenomena. After the completion of the project in the period 01.2015-12.2015 we assessed the success of the implementation of inquiry-based learning in study. The research took the form of a full survey 6-9 SCIS classes.

Methodology

We have defined teaching methodology for sensor Pasco for teachers and for students. Similar methodology was prepared also for work with microscopes. The methodology is described in detail in (Svatkova, 2015).
At the outset each of the groups of respondents was introduced to the survey course and the methods that would be employed during it. The students were acquainted with each learning approach. The survey was divided into frontal learning, inquiry-based learning using microscopes, and finally, inquiry-based learning using Pasco probes.
The learning was assessed in two ways:

- Enjoy, doesn't enjoy, not interested, where the students only mark whether they enjoy the learning regardless of the comprehensibility of the supplied information and its easiness to remember,
- With a mark 1, 2 and 3, where the students assess whether the transmitted knowledge is understandable and easy to remember.

The research was realized among all students of sixth, seventh, eighth and ninth grade at Sunny Canadian International School.
The Czech Republic passed Act No. 101/2000, on the protection of personal data. Therefore, we made all processed data anonymous at multiple levels. We made all information anonymous that could lead to the identification of a specific student.

General Data Characteristics

The data file with research answers currently includes 207 answers from 85 students that we have been collecting in 2015. Each record provides information about how the students evaluate lectures leaded different styles and with different technics (seniors Pasco and microscopes).

The most key attributes in the data file include gender, grade, answers and information about whether or not a student is satisfied with teaching method and comparison with other teaching methods.

Results and Discussion

General overview

In the survey conducted at SCIS we obtained through a full sample survey in 6-9 class a total of 207 responses from 85 students whose numbers are specified in Table 1.

Grade	6A	6B	7A	7B	8A	9A
Boys	7	10	0	7	7	10
Girls	5	5	9	6	10	9
Total Number of Students	12	15	9	13	17	19

Table 1: Number of Students at SCIS (source: authors)

Three surveys were carried out in each class with the exception of 7.A and 7.B, where only two surveys were carried out (frontal learning and learning with support for microscopes). In all, 110 responses were from boys and 99 from girls. Detailed breakdown of the number of responses in individual classes is shown in Table 2. Zero number of responses in 7.A in the case of boys was caused by the fact that it is a girls' class.

Grade	6A	6B	7A	7B	8A	9A
Answers - Boys	21	29	0	13	21	25
Answers - Girls	15	15	14	10	29	15
Total Number of Answers	36	44	14	23	50	40
Rate of return of questionnaires	100%	100%	52%	59%	100%	70%

Table 2: Distribution of Answers of Students at SCIS (source: authors)

Table 2 shows that with the exception of classes 7.A and 7.B the rate of return was very high. Lower number of responses in classes 7.A and 7.B was largely caused by sickness rate which affected significantly the questionnaires' rate of return given the low number of students. Lower rate of return in the ninth class was caused by adolescent behavior of the students who had enrolled at the time of the survey in secondary school and were not much interested in the research. Average rate of return of questionnaires and tests was 80%.

n_m = 110 n_w = 99	BOYS			GIRLS			BOYS + GIRLS		
	Enjoy	Don't enjoy	Not interested	Enjoy	Don't enjoy	Not interested	Enjoy	Don't enjoy	Not interested
FRONT	55.27%	21.05%	23.68%	72.50%	2.50%	25.00%	64.10%	11.54%	24.36%
MICRO	97.06%	2.94%	0.00%	100.00%	0.00%	0.00%	98.51%	1.49%	0.00%
PASCO	88.46%	11.54%	0.00%	65.38%	34.62%	0.00%	76.92%	23.08%	0.00%

Legend: front: frontal education lecture, micro: work with microscopes, Pasco: work with sensors Pasco

Table 3: Percentile expression of enjoyment of methods, broken down by gender (source: authors)

Table 3 shows that enjoyment of inquiry-based Pasco methods and microscopes is substantially higher than traditional frontal learning. It is thought-provoking to compare the responses between boys and girls. Here we see that although the boys clearly prefer inquiry-based learning, the girls prefer frontal learning and inquiry-based learning using microscopes. By contrast, the girls rated very negatively learning with the use of Pasco probes. We believe the reason for this is the fact that the use of the probes is more technological and uninteresting for girls. Based on these findings, we observe that RQ1 and RQ2 is conformed for aggregate numbers of boys and girls. The situation is different in the breakdown to boys and girls where the Hypothesis is only confirmed for boys. The reason may be the fact that inquiry-based learning with support for Pasco probes is too technical, uninteresting and demanding for girls. RQ3 is fully confirmed for both boys and girls because microscopes are not so technologically demanding in comparison with Pasco probes.

n_m = 110 n_W = 99	BOYS			GIRLS			BOYS +GIRLS		
	1	2	3	1	2	3	1	2	3
FRONT	76.19%	23.81%	0.00%	89.66%	10.34%	0.00%	**84.00%**	16.00%	0.00%
MICRO	87.88%	12.12%	0.00%	84.37%	9.38%	6.25%	**86.15%**	**10.77%**	**3.08%**
PASCO	69.57%	30.43%	0.00%	58.83%	35.29%	5.88%	**65.00%**	32.50%	2.50%

Table 4: Percentile expression of enjoyment of methods in terms of intelligibility of learning, broken down by gender (source: authors)

The results presented in Table 4 supplement the students' views of the learning methods shown in Table 3. It is evident from Table 4 that the students consider information that is best understandable, memorable and most interesting through inquiry-based learning with support for microscopes. It is very interesting that traditional frontal learning took second place and the third, with a significantly worse result, by inquiry-based learning with support for Pasco probes. This negative result was largely achieved by girls considering learning with Pasco probes too technical and difficult to understand. This confirmed fully RQ4. It therefore follows that although inquiry-based learning is an interesting trend, it cannot resolve all current learning problems.

n_m = 110 n_W = 99	BOYS			GIRLS			BOYS +GIRLS		
	1	2	3	1	2	3	1	2	3
FRONT	97.22%	2.78%	0.00%	94.59%	2.70%	2.71%	95.89%	2.74%	1.37%
MICRO	69.70%	27.27%	3.03%	77.42%	12.90%	9.68%	73.44%	20.31%	6.25%
PASCO	92.59%	7.41%	0.00%	56.00%	36.00%	8.00%	75.00%	21.15%	3.85%

Table 5: Test results by method (source: authors)

The results presented in Table 5 test students' opinions on comprehensibility and

memorability of knowledge acquired through each method. The teacher prepared a test in which the students answered several questions and were rated with a mark 1-5, the lowest mark being 3. The results presented confirm that the traditional frontal learning method, although it is not rated as enjoyable and memorable, provides the best results of the learning process. A total of 95% students obtained mark 1, in the case of boys it was more than 97% of the students. By contrast, fewest marks 1 were obtained in inquiry-based learning with support for microscopes, which was rated best by the students. In the case of microscopes the greatest number of marks was 3 in comparison with the other methods. Generally speaking, marks 2 and 3 were significantly more frequent in the inquiry-based approaches in comparison with traditional frontal learning. This analysis successfully rejected RQ5.

Conclusion

In conclusion we observe that research questions RQ1 and RQ2 are confirmed for aggregate numbers of boys and girls (see Table 3). The situation is different in the breakdown into boys and girls where the Hypothesis is only confirmed for boys. This may be so because inquiry-based learning with support for Pasco probes is too technical, uninteresting and demanding for girls. RQ3 is fully confirmed for boys and girls as microscopes are not as technologically demanding as Pasco probes.

We also confirmed Q4 in full. The students say that the information which is best understandable, easiest to remember and most interestingly transmitted is that transmitted through inquiry-based learning with support for microscopes. It is very interesting that traditional frontal learning took second place followed, with a significantly worse result, by inquiry-based learning with support for Pasco probes. The explanation is similar to the case of RQ1 and RQ2.

The most interesting result is RQ5, which was fully rejected. The finding is completely out of line with the efforts of the Czech Ministry of Education to support the development of inquiry-based learning at elementary and secondary schools. The results indicate that the students enjoy inquiry-based learning and believe that the knowledge acquired by them is easier to understand and memorize, but the result of the tests were quite opposite. In the relevant literature we often encountered the claim that inquiry-based classes are attended by students who are passive in other classes. Therefore, during the monitored classes we focused on such students and we actually found that most of them tried to get involved in the work and be useful for the other in the group. Naturally, we cannot say this is a common phenomenon. Some students got involved in the work unwillingly, especially ninth-class students who, as we mentioned above, were not generally interested in the work. This is why otherwise passive students were not much interested although these findings may be influenced by the age and the related general unwillingness to make manifest cooperation during school lessons.

In our opinion the particular importance of inquiry-based learning lies in the fact the students learn to be more independent, able to work in a team and last but not least, information need not be imparted to them authoritatively (through frontal learning), and they can obtain it by themselves through their work.

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CASE STUDY FROM ENTREPRENEURIAL WORKSHOP: EVALUATION OF INDIVIDUAL PERFORMANCE IN TEAM

[1]✉Vaclav Svec, [2]Marketa Mala

[1]Department of Management, Faculty of Economics and Management, Czech University of Life Sciences Prague, Kamýcká 129, Prague, 165 21, Czech Republic, +420 224 382 248, svec@pef.czu.cz

[2]Department of Management, Faculty of Economics and Management, University of Life sciences Prague, Czech Republic

Abstract

The aim of this paper is to present technique which allows students in team to self-evaluate themselves, evaluate others, discuss the evaluation, enhance the sense of the responsibility, and to discuss the results this technique used in pilot study. Evaluating the performance of an individual is a very important management tool. However, for a variety of reasons cited in scholarly literature, it is very complicated to measure the performance of individuals within teams. Therefore, we introduce a procedure which utilizes, when applying the coaching approach, multiple conditions of an individual in the Dunning-Kruger effect and can overcome the main obstacle in the evaluation within a team identified by students – a groupthink syndrome. So far, the technique has been piloted in 4 cases in which it brought the intended effects.

Keywords

Dunning-Kruger effect, entrepreneurship, groupthink syndrome, team effectiveness, team evaluation, teamwork

Introduction

Performance evaluation of workers is an important tool for human resource management (Roberts, 2003; Dessler, 2011; Boachie-Mensah and Seidu, 2012). The concept of evaluation can be defined in several respects. Three approaches are mentioned in scholarly literature. The first approach is that evaluation is perceived as a separate process which gives an idea of performances, acts and working skills of individuals (Kociánová, 2010), carried out on a systematic basis over a certain period, in order to provide a comparison between the expected individual (group) performance and the actual performance (Giangreco et al, 2010; Spence and Keeping, 2011). This is a process in which one party passes the information to the other. (Staples and Webster, 2008). The second approach emphasizes the importance of the evaluation as part of the process of human resources performance management whereby, at the beginning of the process of human resources performance management, targets must be set first that are in line with other higher targets and standards, and only then formal evaluation can take place (Snell and Bohlander, 2012). The third approach is a combination of the above two views of evaluation, consisting, namely, in that the evaluation is a process but, at the same time, it forms part of a comprehensive process of human resources performance management or of another process (Dessler, 2011; Lussier and Hendon, 2012).

Due to the fact that more persons participate in the final outcome, the evaluation of the performance of a team is far more complex than the evaluation of individual performance. Teams are often defined as a group of people linked in a common purpose. But team,

according to Belbin (2013), should be understood as a congregation of individuals, each of whom has a role which is understood by other members. O'Leary, Mortensen, and Wooley (2011) see team members as individuals who share "the responsibility and reward (or penalty) for the outcomes of the team's work and recognize each other as members of the team". Unfortunately, not always the definition of the authors O'Leary, Mortensen, and Wooley (2011) is met. Team performance may be negatively affected by some team dysfunctions (Lencioni, 2002) occurring during teamwork. Occurrence of these team dysfunctions among students, their impact on the work and reduced possibility of individual evaluation was confirmed in works by other authors (Michaelsen, Knight and Fink, 2002; Švec, Kadeřábková and Tichá, 2011). Among other issues in the evaluation of individual performance in a group are, according to Prendergast (1999) and Bol (2008) subjectivity which may be due to the impacts of the evaluator's behaviour on the responses of the evaluated persons and vice versa (Liden and Mitchell, 1985), the evaluator's honesty (Bin, 2015) or other influences. The main prerequisite for an objective evaluation of teamwork is thus a team in which the members try together to achieve good results as a group (Michaelsen, Knight and Fink, 2002).

In scholarly literature, there are currently not many studies that would present a procedure how to objectively evaluate the performance of an individual in a team. The exception is a study by Peñarroja et al (2015) which describes a technique of evaluating individual performance in a team while comparing the number of points obtained by an individual and the number of points obtained by the team. The aim of this paper is to present technique which allows students in team to self-evaluate themselves, evaluate others with less subjectivity, discuss the evaluation without the participation of the evaluated person, enhance the sense of the responsibility for self-evaluation and for the evaluation of the others, and to discuss the results this technique in pilot study.

Materials and Methods

The main method used for data collection was hidden observation that took place during the facilitation of the method. What was also used was the analogy and modelling based on which the process and rules for the technology presented were created. To draw general conclusions from the observed results, comparison and categorization methods were used. The presented method of evaluating individual performance when working in a team was used when teaching the Entrepreneurial Skills subject at the Faculty of Economics and Management, Czech University of Life Sciences, Prague, in the winter term of the academic year 2014/2015 in a group of 85 students in 4 different exercises. 2 instructors in the course acted as observers. Time suitable for the technique is approx. 90 minutes.

Context of the Subject

The Entrepreneurial Skills subject enables practical learning of basic entrepreneurial competencies in a form of combination of teaching approaches: learning by doing, experiential learning, case study learning, team learning, coaching, monitoring of the development of the given competencies and the following of the principles of the learning organisation.

The teaching in the course is focused on the identification and development of skills suitable for doing business and part of the term is devoted to doing business via entrepreneurial task. Evaluation of actions and activities that students carried out when fulfilling the entrepreneurial task was partly taken from the evaluation of the student at the exam. For this reason, it was necessary to objectively report and evaluate the activities

carried out by the students. Since it is not possible for the instructor to comprehend and thus objectively evaluate the activities of all the students involved, it was decided that the evaluation would take place based on a coaching approach. Given that the coach (acting officially as an instructor within the taught subject) should not evaluate the students himself, it was necessary, in order to evaluate students' work on the entrepreneurial task, to prepare a technique based on which they would be able to objectively evaluate themselves. The intended technology was thus intended to ensure not only the self-evaluation of students themselves but also the evaluation of each other so that the students were, in self-evaluating themselves and in evaluating others, objective and were able to take full responsibility for their evaluation.

Results

Procedure of the Technique

The overall procedure of the technique consists of 7 points listed below, of which points 1-2 must be carried out prior to the course of the technique itself with students and points 3-7 need to be carried out with students after the procedure is properly explained.

Procedure:

1. Creating a „pool" with points – according to the number of students so that it is not possible to grant full number of points to all students (assuming that some students worked more than others and that students are able not only to identify this but also to admit this in the final evaluation).
2. Determining a point range for 1 person. The maximum number of points that may be awarded to one student is 10 points. The range of the points is as follows: Grade 1 = 9-10 points, 2 = 7-8 points, 3 = 5-6 points, 4 = 0-4 points.
3. A student's self-evaluation – list of activities that the student invented; list of activities for which he was responsible; list of activities in which he participated, what he/she did not fulfil, what competencies he lacked.
4. Group discussions on granting points without the evaluated student being present. (Proposed one's own evaluation of the the evaluated student + reasoning)
5. Vote on awarding points without the evaluated student being present.
6. Announcement of the number of points obtained to the evaluated student. Justification for that decision.
7. Phase 3 continues until all students are evaluated and until points in the pool are all used up.

The instructor, throughout the technique, facilitates discussion, sees to it that the order of the evaluation phases is maintained, records the evaluation of individual students and updates the remaining points (preferably visually – by rewriting the number of points designated for redistribution).

Mode of Operation of the Technique

When the number of students at the exercise is n, it is necessary to create a pool with a total of P points:

$$P = n * ZZ \min \tag{1}$$

where:

P – equals points to be distributed (in the pool),

n – the number of students at the exercise (present),

*ZZ*min – lower limit of the grade obtained. This is a grade that the exercise obtains in aggregate for all its activities. It may be 1, 2, 3 or 4 depending on the evaluation of the instructor who evaluates the exercise as a whole/team (the evaluation refers to the progress and outcome of the entrepreneurial activity carried out by the students of the given exercise).

Technique's Outputs

As the technique is divided to the discrete steps, we provide the results in the form of the phases. **First phase** we named **'**Group acquaintance with the evaluation method rules'. At first students had to absorb the method of evaluation. Some accepted it without questioning, others rejected it and relied on the fact that everything would happen as usual when working in teams. In some students, there was a clear effort to circumvent or break the system, they agreed with each other. Students mostly relied on the groupthink syndrome. In the **second phase** students self-evaluated themselves. Each student made a list of own activities, devised by the student for which he was responsible, in which he participated, what he did not fulfil, what he lacked. Any evaluated student tried to find as many activities as possible for which he could be positively evaluated. Some students added also activities that went wrong. At the end of each evaluation, they always included the number of points they wanted to acquire. During the evaluation, as points in the "pool" were dwindling, it may be observed that students who came next, kept taking their evaluation increasingly more seriously. The **third phase** was a group discussion about awarding points without the evaluated student being present. The remaining students discussed a number of points that the student proposed for himself/herself and whether they may be assigned to the student or not. In the initial cases of evaluation of the others, the students were at a loss. They gave a higher number of points to those who were evaluated the first without any major debate. During the evaluation, a pattern/standard was created against which students that come next were compared and evaluated. The **fourth phase** was voting on awarding points. Students voted, decided by an absolute majority on awarding the points. At the beginning, the students did not realize too much when voting, the seriousness of their actions; the sense of responsibility and prudence grew only when points started to diminish. Announcement of the number of points obtained was the **fifth phase**. Each student, after the debate and voting, always returned to the classroom to identify the number of awarded points according to the record on the blackboard. Students generally accepted the number of points earned well. When evaluating others, they were gradually becoming more active. During the students' evaluation did always appear the awareness of subjectivity of previous evaluations among students. It happened at the moments when it was clear to the group that for the remaining, not evaluated students, no points would remain which they would deserve according to their performance in the course of the term. Therefore a new discussion with the participation of students, proposals of previously evaluated students to reduce their own evaluation score, came to number. Students themselves provoked a new discussion on individual evaluations. It was already an open discussion involving everybody. The evaluated persons remained in the classroom, the arguments for evaluation were discussed in their presence. Previously evaluated students themselves often gave up their evaluation scores because they did not consider them appropriate. The result was a group consensus within the rules of the presented evaluation technique.

Students passed through the technique in the expected order. Initially, the observed students took the evaluation so as not to hurt anyone and were trying to distribute points evenly.

So that no-one was a winner or loser. Given the limited number of points that students had available to evaluate individual student performance in the group, the awareness of the scarcity of points demonstrated in the course of the technique thereby eventually stimulation by conditions manifested itself and thus objective evaluation of individual performance in the group was supported. Students who showed greater activity in the course of the fulfilment of the entrepreneurial task, were justly rewarded by the others.

Discussion

After analyzing the results obtained from the observation, we determined the principles that affected the students in the course of the presented technique. The following principles were identified: stimulation by conditions, conflict situations, scarcity of points, Dunning-Kruger effect and the groupthink syndrome (or rather objectivity).

Stimulation by conditions is a situation when students were informed that the points they would earn from the evaluation by the aforementioned technique would determine their success in an exam (points earned are transferred to the exam). The original purpose of this situation was to alert students not to underestimate the situation. As part of the observation, it was found that this stimulation significantly contributed to the fact that, early in the process of evaluating, students had a serious approach which, however, was in some cases different from the objective of the evaluation technique, i.e. the objective evaluation. Under this situation, students dealt with two basic types of behaviour: 1) have at least a basic number of points (score) which would allow, if possible, to all students to take the exam, 2) objective distribution of points. At the beginning of the evaluation, what occurred the most often, was the 1st strategy that led to the situation when all students earned the points. The objective of the students was to have the exam passed by as many active individuals as possible. In this case, what basically happened was the effect of the so-called groupthink syndrome. This syndrome was first mentioned by Whyte (1952). This is a phenomenon that occurs in a group of people inside which there is a prevalent desire for harmony or conformity, or rather reluctance to provoke a conflict which then lead to irrational or incorrect decisions (Hart and Irving, 1991).

We systematically tried to disturb the groupthink syndrome by the principle of scarcity of points. This principle was taken by analogy from the basic economic theory. Human wishes are unlimited but resources to satisfy them are limited (Samuelson and Nordhaus, 1991). What is scarce is expensive. It is a condition whereby the resources intended for the production of goods are not sufficient to meet all the needs. Scarcity of resources necessitates making choices of the purpose of the use of a precious resource. We used this principle to persuade the students to realize the value of the points granted and thus to take seriously and objectively their self-evaluation and valuation of others.

Another principle which was instrumental in evaluating students was the so-called Dunning-Kruger effect. This effect concerns the anticipation of the level of one's abilities and achievements and says that people generally are not very good at estimating their abilities (Kruger and Dunning, 1999). This Dunning-Kruger effect showed particularly during the early evaluation when students, self-evaluating themselves, demanded higher evaluation than actually appertained to them. Another study (Burson, Larrick and Klayman, 2006) reveals a more detailed look at the Dunning-Kruger effect, or rather at its second phase – the more an individual is capable, the more time and effort they can devote to an activity; the more experience in and information about the activity one has, the better they can compare themselves with others. This situation occurred in all observed cases. At the same time, based on the results of observation, the initial stimulation by

conditions led to decreasing the significance (improvement of the situation for an exam) by a very significant change in how evaluation was perceived. The moment when another phase of the Dunning-Kruger effect took place, or rather after students obtained adequate comparison, we identified a conflict situation. It always originated in the other half of the allotted time. The reason why it originated was the reconsideration of the results which is not expressly prohibited in the presented technique, however, it was allowed only after the students' explicit request. After this situation, during the observed evaluations, what always happened was an adjustment of the evaluation, therefore a situation which is referred to as objectivity.

Conclusion

The purpose of the present article was to present a technique that would ensure evaluation of students and their involvement in the process of evaluating others. The intention was to make students learn how to compare themselves with the others, if possible, in an impersonal way, objectively and to take responsibility for their evaluation. For this purpose, within the technique, the following principles were used: stimulation by conditions, conflict situations, scarcity of points, Dunning-Kruger effect and the groupthink syndrome (or rather objectivity). Through interaction and utilization of various phases of the above principles in the given environment, the intended objective was achieved in all observed cases. After evaluating the technique, the students themselves considered the proposed procedure beneficial, especially the very possibility of self-evaluation of the performance by individual team members. For the instructor, this technique will help reveal the genuine involvement of individuals in the team.

It should be noted that the evaluation of individual performance, although it is a topic that has been studied for many years, has not been sufficiently explored yet. The above technique suggests ways how, under certain conditions, it is possible to evaluate the performance of an individual in a team together with other teaching benefits. A disadvantage of the technique may be seen in its being a novelty and thus in the lack of awareness of all the conditions necessary for its successful use also in other contexts than the educational context. Another disadvantage is a minimum required qualification (coaching approach, teaching experience) for a person who would like to use this technique.

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FactOrEasy©: ART AND CRAFT OF MANAGEMENT?

[1]✉Vaclav Svec, [2]Josef Pavlicek, [3]Ivana Ticha,
[4]Jana Kreckova

[1]Department of Management, Faculty of Economics and Management, Czech University of Life Sciences Prague, Kamýcká 129, Prague, 165 21, Czech Republic, +420 224 382 248, svec@pef.czu.cz

[2]Department of Information Engineering, Faculty of Economics and Management, Czech University of Life Sciences Prague, Czech Republic

[3]Department of Management, Faculty of Economics and Management, Czech University of Life Sciences Prague, Czech Republic

[4]Department of Systems Engineering, Faculty of Economics and Management, Czech University of Life Sciences Prague, Czech Republic

Abstract

The paper introduces newly created specific online business simulation with the artificial intelligence in the role of competitors and reveals some of its possible educational benefits. In the paper we identify the benefits resulting from the use of the unique business simulation FactOrEasy, which uses artificial intelligence to play against human opponent. The pilot study of research was conducted with 44 students. We used the simulation as the repeated experiment with the open and easy instructions for students in which we monitored their behavior due to online saves available in the simulation. To determine what students' feelings and thoughts were we used questionnaires followed up with the personal interviews.

Keywords

Artificial intelligence, business simulation, FactOrEasy, knowledge, management

Introduction

According to Mintzberg (2013) to manage it is necessary to put together art, craft, and science. Science in management lies in techniques and systematic evidence which provide the order through systematic analysis of knowledge. Art produces insights, visions, ideas, integration, and uses the intuition. Craft in management is formed by learning from experience, builds on those tangible experiences, and makes the connections. (Mintzberg, 2013)

Unfortunately, as Mintzberg (2013) also mentions the university professors teaching the management overemphasize the science in the field of management while ignoring its art and craft. There are other authors who also feel the missing parts in the management or business education especially the lack of critical thinking, creativity, innovation, and for too theoretical approach in education (Behrman and Levin, 1984; Hughes, O´Regan and Wornham, 2008) and lack of communication and teamwork (Felder et al., 2000; Alvear et al., 2006). Therefore, the disparity between the requirements of industry and the graduates´ abilities still grows (Dynn et al., 2005; Eskandari et al., 2007).

According to Mintzberg´s management point of view for training managers it is necessary to bring to the management education also art and craft. The key question is: "Where the art and craft of management can be taken from in the form suitable for the classroom?"

There are plenty of teaching methods. Huddleston and Unwin (1997) divide teaching

methods to two categories: 1) teacher-centered methods and 2) learner-centered methods. The teacher-centered methods see teacher as the most active part of teaching on the opposite the learner-centered methods call for students´ activity and experience formation. Therefore, the answer for "How to transfer the art and craft of management to the classroom?" lies in the learner-centered methods. Between learner-centered methods Huddleston and Unwin (1997) rank: practicals, role play, research-based project, group work, self-directed study, trial and error activity.

Such trial and error activity within role play in management teaching might be the games or simulations. This supports Arias-Aranda (2007) by claiming the business simulations´ participants are the only responsible for their decisions, so teachers become observers or game/simulation facilitators. Many authors also agree the simulation is one of the most effective methods in active learning (Cohen and Ledford, 1994; Lainema and Makkonen, 2003).

According to Gogg and Mott (1993) the business simulations are the art and science of creating a representation of a process or system for the purpose of experimentation and evaluation. Hall (2014) adds the business simulation is a learning tool helping players to practice the fundamentals of their future profession using the imitation of human behavior in the occupation, profession, or business in a much abbreviated time with minimal risk.

Salas, Wildman and Piccolo (2009) see game-based training as ideal technique for management education programs in undergraduate and graduate management programs as it gives students practical skills, which they need when entering the business or corporate world. Also Wellington and Faria (1991) found business simulations very effective for enhancing student learning. And according to Mitchel (2004) the use of business simulations in management education can fill the gap between what market requires and what the education brings.

Present article identifies the benefits resulting from the use of the unique business simulation (FactOrEasy) with artificial intelligence in specific context of management education at Faculty of Management and Economics, CULS Prague.

Materials and methods

In the following text we present the usage and benefits of online business simulation called FactOrEasy developed and tested at Faculty of Management and Economics, CULS Prague with the financial aid of Technology Agency of the Czech Republic. In an effort to expand our knowledge we follow the findings from previous research (Švec, Pavlíček and Tichá, 2014a; Švec, Pavlíček and Tichá, 2014b; Pavlíček et al., 2014; Pavlíček, Švec and Tichá, 2015a).

The pilot run of the FactOrEasy simulation has been played in December 2015 and January 2016 with 44 students of management at Faculty of Economics and Management in the Czech University of Life Sciences Prague. Students were in the 1st year of master studies, all of them were studying the course Enterprise Management. There were 13 men and 31 females.

The main methods used in the paper for the identification of simulation´s benefits are experiment, interviews, and analysis. First we asked 44 students to play an online business simulation (FactOrEasy). Students were given following open instructions: 1) to earn as much "cash" as they will be able, 2) to play repeatedly to find the "best" strategy, 3) to provide us with their best simulation results. Students were given limited time period for playing the simulation (6 weeks). And after they had reached the best score, they answered questionnaire which focused on the activities they had performed

in the simulation. The type of questionnaire's administration was paper-and-pencil. After experiment and questionnaire, the face-to-face interviews took place. At the end we had electronically saved results of 44 (repeated) experiments which show us each decision each student made during the simulation, 44 questionnaires about the students' simulation understanding and face-to-face interviewed the same 44 students. The face-to-face interviews were conducted to verify, extend, and understand the students' answers from questionnaires. According to the data we worked with (obtained from recorded results for each game, questionnaires, and interviews) we exclude the random answers and gaming luck (which may occur in simulations) from our reasoning.

Context of the experiment: Description of FactOrEasy simulation

FactOrEasy is the online dynamic deterministic simulation of decision making in operation or strategic management within the factory using artificial intelligence to compete against human player. According Angelidese´s (1999) point of view FactOrEasy can be also classified as the role playing game. The simulation puts players into the role of 1) executive manager, who is responsible for purchasing, manufacturing and sales, or 2) strategic manager responsible for competitive strategy.

The business simulations started after Second World War within the development of analytical and quantitative methods in economy and management. Due to usage of computers the business simulations become easier to be administrated therefore more popular. Simulations had been improved to the present days to use stochastic elements, higher level of complexity, modelling of specific firm´s or industry´s conditions. The usage of artificial intelligence within the business simulation, as in FactOrEasy, is quite unique. The FOE simulation involves the artificial intelligence which is represented by neural network with one hidden layer and had been presented by Pavlíček, Švec and Tichá (2015a). Artificial intelligence in the simulation substitute the human players in the role of competitors.

As there is the artificial intelligence presented in the role of competitors, the simulation is playable just with one human player. The FOE fulfils the conditions set for the successful tacit knowledge training (Švec, Pavlíček and Tichá, 2014): 1) specificity of trained tacit knowledge – as simulation has its own specific didactic goals, which students can achieve by training, 2) repeatability/availability of the situation in which runs – the simulation offers always the same context and is available anytime online, and 3) changeability of the training situation´s conditions – which is provided by the artificial intelligence in the competitors´ role. By adapting the methods of artificial intelligence, the solution can evolve together with the players and thus better support their professional development similar to Wawer et al (2010), or Hawtrey (2007). This way the simulation keeps its dynamic character, which is difficult to predict, and players thus must gradually work on their strategy (Švec et al, 2014b).

Process of the FactOrEasy´s gameplay

The FactOrEasy logic and gameplay had been previously described in detail by Pavlíček, Švec and Tichá (2015a). Therefore, here we describe the logic of the game briefly in summary: FOE´s gameplay is divided to three main phases: a) buying material, b) production, and c) selling the products, as shown in the Figure 1 – FactOrEasy simulation screen – in Decision Making Window. During these phases player makes three basic decisions about buying material, producing, or selling products. Other possible decisions

player can make are to buy another factory (Factory Request) or ask the additional money (Loan Request).
In the FOE simulation, players´ individual decisions are interconnected in the chain of causes and effects, not only within one phase or after ongoing phases, but also in the whole game. Player´s decisions made in the specific moment during the gameplay are affected by decisions made in the past and also determine the player´s future success or failure, in future phases of the game thanks to presence of the artificial intelligence (in the role of competing players). This chain of causes and effects even with just 5 possible decisions to make during the game phase produces fairly complex situation. To ease the situation, the simulation screen uses four windows to serve players the information they might need to make decisions: Game Status window, Material Market window, Competitors window, and Costs window – see Figure 1: FactOrEasy simulation screen.

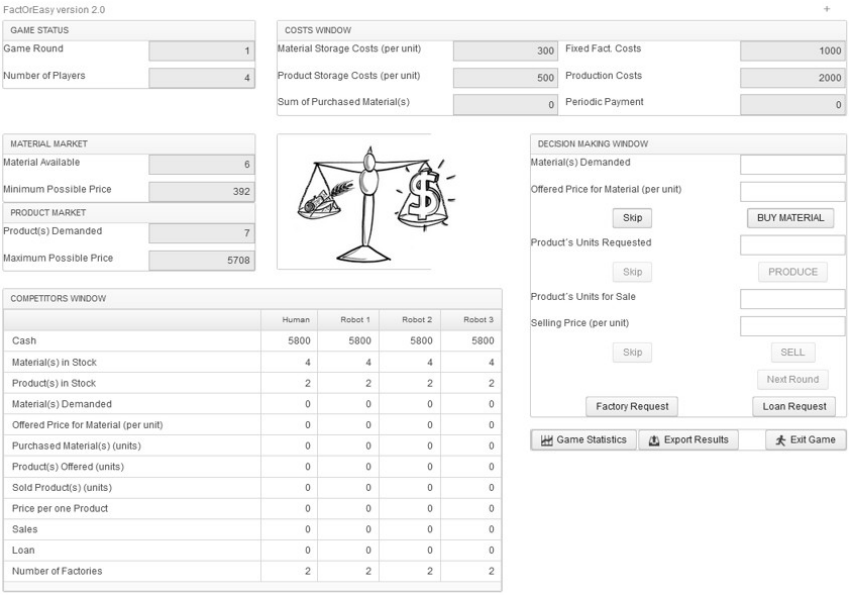

Figure 1: FactOrEasy simulation screen, 2016 (source: Pavlíček, Švec and Tichá, 2015b)

Results

The results achieved from the FOE simulation

For the students the main goal of the simulation was to earn the biggest amount of money. The overview of the students´ simulation results are shown in Figure 2: Simulation results.

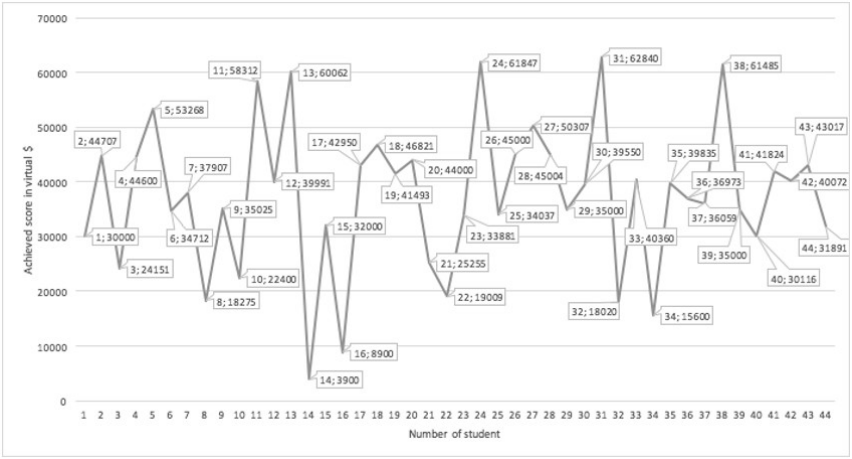

Figure 2: Simulation results, 2015-2016 (source: own calculation)

You can see all the amounts students reached in pilot run in Figure 2. The highest amount was 62840, the lowest 3900, the average 37396.73. Only two players reached the amount lower than 15000, four players did exceed the amount of 60000.

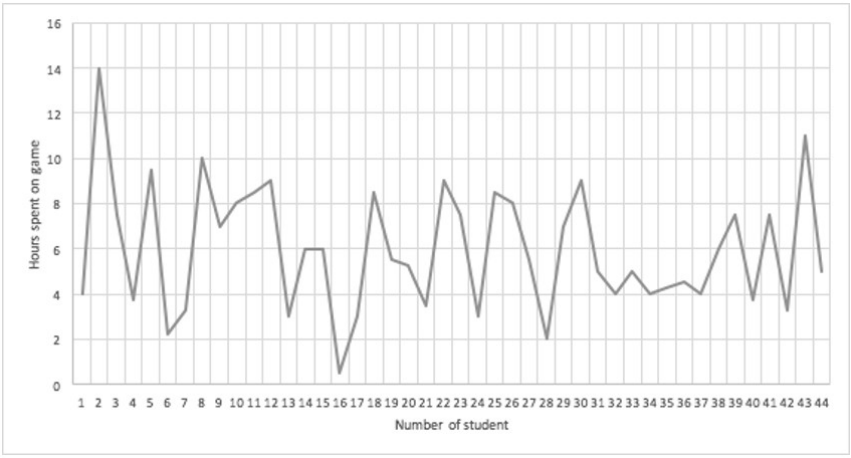

Figure 3: Time spent on simulation, 2015-2016 (source: own calculation)

We wanted students to play repeatedly to find the "best" strategy to achieve highest score. Therefore, students had to play the simulation more than once. As Figure 3 shows, students spent various time playing the simulation. Both figures (Figure 3 and Figure 4) work with the same students' numbers, therefore it is possible to compare achieved best results and time devoted to the simulation. Maximum time spent within the simulation was 14 hours, minimum time was 0.5 hour, an average time was 5.96 hours spent within the simulation.

Results categorization

To categorize the data for the variable 'simulation results' we used categories by the

thousands (of 'cash') and 2 hours' categories for the variable of 'time spent on simulation'. The categories' distribution for both variables are seen in Figure 4: Distribution of simulation results and in Figure 5: Students' distribution of time spent on simulation.

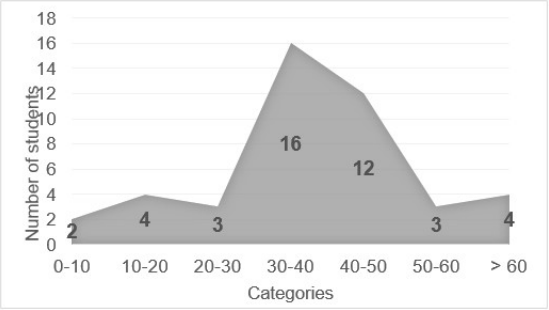

Figure 4: Distribution of simulation results (categories in thousands of virtual "cash" units), 2015-2016 (source: own calculation)

Distribution of time students spent on simulation in 2 hours´ categories is shown in Figure 5: Students' distribution of time spent on simulation.

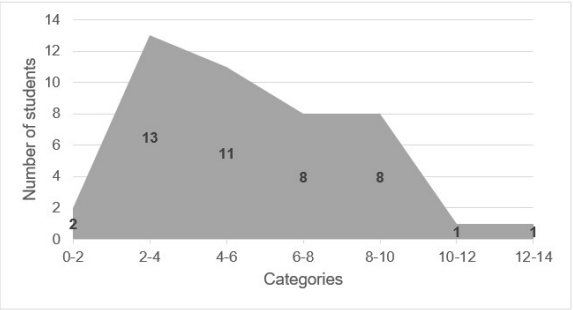

Figure 5: Students' distribution of time spent on simulation, 2015-2016 (source: own calculation)

Although the distribution of simulation results is not perfectly 'normal', it may still be 'normal' enough for use according to skewness (-0.234) and kurtosis (0.026). Also the distribution of time spent on simulation is not perfectly 'normal', but it is still 'normal' enough to be used for the purposes of our pilot study according to skewness (0.511) and kurtosis (0.107).

To find out whether the simulation results and spent time are correlated, whether they change together in a linear fashion, we used Spearman's test of linear correlation. The results are shown in Figure 6: Results of Spearman's test.

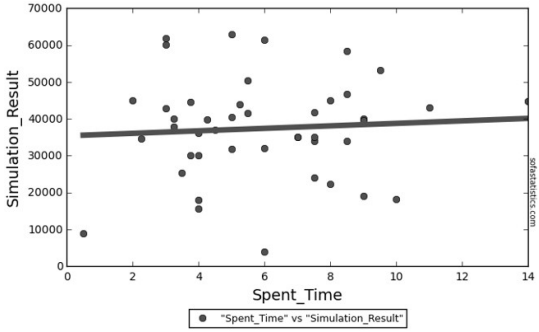

Figure 6: Results of Spearman's test, 2016 (source: own calculation)

The result for p value is 0.8119, Spearman's R statistic is 0.037 (df =42). According to results we can say there is very poor linear dependence between variables in our pilot study.

The results from interviews

We noticed two possible categories of students: 1) students motivated, prepared, willing to speak about their course of actions, and theory they discovered in the FactOrEasy simulation (40 students, 90.9 %), and 2) students less or not motivated, not involved, acting from duty (4 students, 9.1 %).

There was majority of students (90.9 %) who were really motivated by the simulation. Students, who came to interviews pleased, were well practically prepared (they spent a lot of time with the simulation), they were able to talk extensively about strategies they tried, were able to identify the possible best strategy when the conditions changed, and in almost all cases they were also well prepared in theory. The level of preparedness in theory we evaluated according to the number of areas which were students able to knowingly recognize in the simulation, study deeper, and understand the principle.

Members of this category created on their own nonpublic Facebook page to share their results and unwittingly started gamification effect between the students. Reasons why students accept the FactOrEasy simulation so positively were by their words: "the difference from usual teaching methods" or "the option first things to try", also the try "to figure out how it works, how do the AI think", and "I just liked the idea I play the game as a college homework".

Students less or not motivated were rare during the interviews (9.1 %). Without exception they were students who spent the least time on the simulation. According to their statements some of them found the simulation too easy - they reached above average score in the simulation but not the highest. As we found in their questionnaires, these students missed all the theory the FactOrEasy simulation provided. Their answers were significantly reckless, frivolous, with no theory background. On the other end there were also the students who were not able to reach even the average score in the FOE simulation. Therefore, we divided these students to two categories. The students from the first category did achieve really low score during the simulation. During interviews they seemed to be uninterested. According to the interviewees the reason for lack of interest was in the excessive economic focus of the course in which the simulation was used. Less motivated students from the second group did achieve quite high score in the simulation, e.g. compare students number 24 and 28 in Figure 2 and Figure 3. The reason of their

disinterest in more frequent playing the simulation was the fact the students were able to achieve high score with the first attempt, with the first tested strategy in the simulation they chose. Therefore, they were not willing to try another approach to really mine the game's opportunities for their learning. In these cases, we identified too much self-comfort in students' behavior and early feeling of satisfaction, which took them away from further studying the theoretical context of situations in the FactOrEasy simulation.

Discussion

Wilson and Gerber (2008) found out the students - members of Generation Y - have shorter attention spans, desire interaction and stimulation, and they thrive in structured environments. Tanner et al. (2012) add that these students have lived their entire lives with technology allowing the expansion of computer, video, and mobile games, therefore involvement in gaming is not a characteristic of Generation Y, but the expectation of what is required to capture their attention and interest. These conclusions (Wilson and Gerber, 2008, Tanner et al., 2012) fully support our findings with the majority of students (90.1 %) really attracted by the FactOrEasy. Our findings are also consistent with conclusions of Lainema and Lainema (2007) whose research showed students' perception of business games as: engaging, useful, and as effective learning tool.

In our pilot study we obtain contradictory results within time spent on simulation and achieved game results. According to our results from Spearman's test with 44 students in pilot study we cannot say the students who spent the most time playing the simulation did achieve the highest scores. But from the results of interviews we can say the observed variables (time spent on simulation, achieved score) were too general. The specified variables are not able to explain how much each student really improved his or her own knowledge, skills, abilities, or competencies during playing/using the simulation. According to the results of our observations from interviews we can agree with Gosen and Washbush (2004), who say that the majority of studies dealing with the students´ performance in simulations assumed that the students with the best results are also learning the most.

As we found the specified variables too general for evaluating or measuring the change in the students' progress of achieving the knowledge from the FOE simulation, we propose to use the Alic's (1997) categorization of knowledge for next study: declarative knowledge (I can name it) and procedural knowledge (I can use it.). We propose to add also category of no knowledge (I do not know anything about that.)

During interviews with students we recognized significant change in their approach to their own learning. The most of the students expressed the change in an effort to educate themselves as they had the chance to "*touch the "real" situation*" as they often noted, also as "*having good times with the simulation*", or "*to enjoy the competition between comrades*". These findings correspond with the outcomes of Winberg and Hedman (2008) who studied effect of instruction format to the Attitudes of students Toward Learning (ATL) in a computer simulation. They (Winberg and Hedman, 2008) found the dependence between guiding instructions and high conceptual change in levels of "Challenge," "Enjoyment," and "Concentration" but low sense of control during simulation. The students in Winberg and Hedman (2008) experiment with the open instructions and also in our pilot study perceived lower learning score. According to results from our interviews we see this output as a result of an excessive enjoyment and too open instructions with which students were not willing to identify the areas of theory provided by the FactOrEasy simulation.

Another benefit of the FactOrEasy found during the interviews was that students can experience the situations they would fear in the real life. Within the study group the students, for example, did not want to use the external financial sources (loan). During the interviews we found out the cause lies in the student's fear coming out from personal life, where they fear bank loans. Students make no distinction between the behavior in simulation and in real life, they transfer the way how they act from real life to the simulations and vice versa.

Conclusion

As mentioned in the introduction craft in management is formed by learning from experience, builds on those tangible experiences, and makes the connections (Mintzberg, 2013). According to our results of monitored business simulation (FactOrEasy) evokes students experience, make the connections by the acquisition of implicit knowledge, through which students get a competitive advantage in the development of management skills in a different way. Pre-knowledge on declarative level - "I can name it" (Alic, 1997) of theory does not help students in the game. Students have to think first, develop possible hypothesis, find the specific solution of the problem he/she faces, and then look up the theory context to broaden his/her view of the situation. And then comes the understanding of the knowledge on the procedural level - "I can use it" (Alic, 1997). Unfortunately, the identification, support, or quantification of this benefit is possible only after further research.

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COMPUTER ASSISTED MEASURING SYSTEMS IN THE TEACHING OF PHYSICS AND BIOLOGY

[1]✉Libuse Svecova, [2]Jan Martinek

[1]Department of Physics, Faculty of Science, University of Ostrava, 30.dubna 22, Ostrava, 701 03, Czech Republic, +420 553 462 153, libuse.svecova@osu.cz

[2]Department of Physics, Faculty of Science, University of Ostrava, Czech Republic

Abstract

The aim of the article is to present the results of quantitative research carried out amongst 60 physics and biology teachers. The research was carried out at 8 grammar schools, 2 secondary specialist schools and 1 primary school. The research concerned the use of computer assisted measuring devices in the teaching of physics and biology with emphasis on linking findings between physics and biology. The research tool was a criteria questionnaire. This questionnaire consists from 13 items and included information on respondents, frequency of laboratory exercises at schools, measurement systems available for teachers at schools, realisation of interdisciplinary relations between physic and biology in teaching-learning process.

Keywords

Education, information and communication technology, quantitative research, teacher

Introduction

In the Czech Republic there is no systematic, centralised collection of data or research in the area of the use of digital technologies at schools (Ministry of Education, Youth and Sports, 2014: 11). Naturally it is possible to use the general available data from the Czech Statistical Office, Eurostat or the Ministry of Education for an analysis of the current state. Many projects supported by European funds have been created which aim to increase teachers' and pupils' skills in the area of information and communication technology. The latest results of research the *International Computer and Information Literacy Study* (ICILS) 2013 (Fraillon et al, 2015) are very interesting. Pupils' computer literacy was measured in this research and "the pupils of the Czech Republic achieved the best result from all participating countries (Rambousek, Fuglík and Štípek, 2015: 42)." Expert literature contains many articles about the inclusion of ICT in teaching in the Czech Republic, for example Rambousek, Fuglík and Štípek (2015: 35-43); Moraova (2015: 377-384); Švecová et al (2015: 363-386). We know the latest results of research into teachers' skills in the area of ICT around the world.

"The Norwegian International Computer and Information Literacy Study (ICILS) 2013 teacher sample (N = 1072) showed that TEDDICS: (a) comprises three factors which can be identified by exploratory structural equation modeling (ESEM); (b) is positively related to ICT self-efficacy, the frequency of ICT use, and perceived usefulness of ICE; (c) differs across main subjects but not across gender groups. (Siddiq, Scherer and Tondeur, 2016: 1)." Note TEDDICS - teachers' emphasis on developing students' digital information and communication skills.

In Spain Fernández-Cruz and Fernández-Diaz (2016: 97) analysed "the level of ICT skills

of teachers in primary and secondary establishing a competency framework adapted to the Spanish educational environment, using as a basis the standards established by UNESCO in 2008 and reformulated in the year 2011."

The study results (80 schools and 1,433 teachers in the Community of Madrid) „show a significant difference between optimal ICT skills and the low skills that teachers really have to develop learning activities with technological tools for their students (Fernández-Cruz and Fernández-Diaz, 2016: 97)."

The document *Digital Education Strategy to 2020* describes the situation in the Czech Republic. Amongst other things, it contains the following: "In the Czech Republic there is a lack of data and research reflecting the situation inside and outside Czech schools (Ministry of Education, Youth and Sports, 2014: 11)."

We are witnessing many trends including, for example, the introduction and use of mobile digital technologies in teaching. This group includes the global trend for introduction of tablets in teaching Švecová et al (2015: 363-386), also the use of computer assisted measuring systems and mobile measuring systems in teaching, the use of smart phones and different apps in teaching etc.

In current technical fields and biomedicine fields everything is trending towards automation with the use of different intelligent systems. Computer assisted experiments develop habits and skills in pupils which help them during work with various intelligent measuring systems in regular life.

The current trends assume that teachers have sufficient knowledge and skills in the field of information technologies. There is a lack of research mapping out the needs of individual groups of teachers so that they can use ICT effectively in teaching. Individual groups of teachers (note - we mean the division of teachers into fields of the humanities, science, economics etc.) use different ICT tools during teaching. It is appropriate to perform research amongst the individual groups and create suitable distance materials for them. Measuring systems can be used in all science subjects.

The aim of the articles is to present the results of research amongst 60 physics and biology teachers in the Czech Republic (Martinek: 2016). The aims of research were to found out needs of Czech physics or biology teachers in the field of using computer-assisted systems in teaching and learning, e.g. especially types of measuring systems at schools. The research data were applied on development of methodology sheets for teachers and worksheets for pupils. The sheets focused on the human circulatory and respiratory systems, with an emphasis on the linkage of physics and biology findings. The methodology sheets are currently being verified in teaching. We believe, for example, that for the measuring systems from the company Vernier, enough methodology sheets have been processed on the internet for physics and biology teachers, but there are not enough for the measuring equipment EdLaB.

Materials and Methods

The aim of the research was to find out how physics or biology teachers work during teaching with computer assisted measuring systems.

The research was conducted in the Moravia-Silesia Region (hereafter MSR). The Moravia-Silesia Region is the part of the Czech Republic bordering Poland and Slovakia. The region was chosen deliberately because many businesses focussing on engineering and metallurgy have closed down in the region. Many companies have had to undergo restructuring. New firms have been founded which are looking for experts in technical and

biomedical fields. In the technical fields everything is trending towards automation with the use of various intelligent systems, and amongst pupils computer assisted experiments also develop habits and skills which can help them in subsequent education.
A criteria questionnaire for teachers was put together as a research tool. This questionnaire consists from 13 items and included information on respondents, frequency of laboratory exercises at schools, measurement systems available for teachers at schools, realisation of interdisciplinary relations between physic and biology in teaching-learning process. The items of questionnaire were open, multiple-choice, and dichotomy answers.
The criteria questionnaire was voluntary and anonymous. Teachers received the questionnaire printed and in envelopes in order to ensure the complete anonymity of the respondents and to increase the objectivity of the data gained. The research group consisted only of teachers with physics or biology teaching qualifications. Chemistry teachers were not included on the questionnaire because in our opinion the linkage of knowledge of chemistry in the teaching of physics and vice versa is far more common than the linkage of knowledge from physics in the teaching of biology
We give two examples. When electrical current is conducted through liquids (electrolysis), it is assumed that the pupils know how to read the chemical equations of the solutions and the names and abbreviations of the elements. In the physics of the electron shell it is assumed that the pupils have a basic knowledge from chemistry, *that they know how to read the periodic table, they have a basic knowledge of quantum numbers and their consequences* etc.

Results

Sixty teachers from 11 schools in the Moravia-Silesia Region took part in the research. The results of the research were divided into the following parts *General characteristics of research sample, Measuring systems in schools, Laboratory exercises, Interdisciplinary relations between biology and physics.*

General characteristics of research sample

The research was carried out at 8 grammar schools, 2 secondary specialist schools and 1 primary school. Research sample consisted of 60 physics or biology teachers. As concern age and school-practice duration of teachers' physics or biology there's not research in this field in the Czech Republic for recent years. Nevertheless, this information is very important for educational policy in the Moravia-Silesia Region and for universities.
The gender division of the research sample was as follows: 55 % of those involved in the research were women, and 45 % were men. These were teachers who had studied and were teaching physics or biology.
The teachers' age distribution of our research sample is given in Table 1. The boundaries of age intervals were selected with regard to developmental psychology of the personality, which means how the teacher has developed since starting employment.

Boundaries of teachers' age intervals	Relative frequency of teachers' answers in percent
From 25 to 28 years of age	8 %
From 29 to 40 years of age	34 %
From 41 to 50 years of age	35 %
From 51 to 60 years of age	23 %
From 60 to 100 years of age	0 %
Suma	100 %

Table 1: Teachers' age distribution of research sample, 2015

The most important results include the fact that 58 % of the teachers asked were 41 years of age or older, and 42 % of teachers were younger than 41. A total of 8 % of the questioned teachers were from 25 to 28 years of age; 34 % of teachers were from 29 to 40 years of age; 35 % of the questioned teachers were from 41 to 50 years of age; 23 % of the questioned teachers were from 51 to 60 years of age. We consider the age breakdown of the sample to be even, and it corresponds to the state of contemporary schools in the Czech Republic.

Length of teaching experience

The length of teaching experience is another important item showing the characteristic of the sample. A total of 13 % of the teachers asked had 1 to 5 years of teaching experience, 27 % of them had 6 to 15 years of teaching experience, and 60 % of them had 16 to 50 years of teaching experience.

Measuring systems in schools

In the research we discovered whether a school where the research was conducted owned computer assisted measuring systems. We gained the information from an interview with school heads or the teacher responsible for the computer assisted measuring systems. The results can be summarised in several points:

- It was discovered that at all 8 grammar schools teachers had some form of computer assisted measuring system available.
- At 2 of the 11 schools involved in the research the teachers did not have a computer assisted measuring system available. These were a primary school and secondary specialised school.
- At 6 of the 11 schools involved in the research they have a measuring system from the firm Vernier.
- At 3 schools out of 11 schools involved in the research they have measuring equipment EdLaB (Educational Laboratory Board).
- At 2 schools out of 11 schools involved in the research they have measuring equipment e-ProLab.
- At 2 schools out of 11 schools involved in the research they have the measuring system ISES.
- Teachers do not have the measuring system IP Coach available at the schools where the questionnaire survey was conducted.
- At 4 schools out of 11 schools involved in the research the teachers have the measuring system Pasco.
- Most schools had several systems. The results gained afforded us information about the material equipping of schools. The methodology sheets for teachers were developed for those measurement systems that resulted from this research, e.g. on research findings.

Laboratory exercises

It is possible to use computer assisted measuring systems in the teaching of sciences for frontal experiment (note, it can be implemented by a pupil or teacher) or for the performing of laboratory tasks (note, performed by pupil). In the questionnaire there was the item: “How often during teaching do you do laboratory exercises?”

Offered answers	Relative frequency of teachers' answers in percent
Laboratory exercises once a week;	31 %
Laboratory exercises once every two weeks	27 %
Laboratory exercises once a month	17 %
Different frequency	25 %

Table 2: Laboratory exercises, 2015

For other frequency, teachers stated, for example, twice a week during seminars; once a week or twice a week (it depends on the year group). Some teachers stated 4 times a year, and some twice a year. From the results it appears that 58 % of the teachers questioned perform laboratory exercises once a week or once every two weeks. We see it as positive that teachers attempt to incorporate laboratory exercises into teaching. Laboratory exercises are demanding in terms of organisation, both for teachers and school management. Familiarising pupils with educational and virtual laboratories may represent a frequent solution to the problem.

Incorporating measuring systems into teaching

In the questionnaire we were interested in the extent to which teachers use measuring systems. One part of the questionnaire was the item, *State when you most often use systems for computer assisted experiments*.
A total of 40 % of teachers use measuring systems for laboratory exercises, 7 % for frontal experiments, 13 % in physics or biology seminars; 5 % for projects, 3 % as independent pupil work, and a total of 32 % of teachers did not respond.
41 teachers out of 60 respondents responded to the item, these being the ones who have computer assisted measuring equipment available and use it in teaching.

Interdisciplinary relations between physics and biology

Another item was "*When teaching **physics/biology**, do you apply an interdisciplinary approach in the sense of emphasising the connections between certain phenomena to **biology/physics**?* (YES, NO). If yes, state at least one thematic unit where you use this approach..."
The linkage of interdisciplinary relations in teaching is a highly topical subject in Czech education. A total of 83 % of teachers asked stated that they employed an interdisciplinary approach during teaching, 17 % of the teachers asked said that they did not employ an interdisciplinary approach during teaching.
Teachers stated the following thematic units where they apply an interdisciplinary approach *mechanics of muscle contraction, the human body system, the senses, nuclear physics, mechanical wave motion, optics, acoustics, capillarity, thermodynamics, muscle work, the spread of excitation (nervous system), fluid mechanics, plant physiology, animal thermoregulation, mechanical oscillation, conducting of excitation in the heart, biophysics (use of electrical current in medicine, influence of gravitational field on the body), blood pressure, transformation of substances and energies.*
Another item was "*Do you apply an interdisciplinary approach also in the case of computer controlled experiments?* (YES, NO)." A total of 37 % of teachers stated YES and 63 % of teachers said NO.

Discussion

The ICILS 2013 investigated the teachers' opinions on school computer equipment and frequency of using ICT in reference class etc. The Czech ICILS 2013 findings are: 85 % teachers of science applied ICT in teaching/learning process. Interactive electronic learning programme are applied the most frequently by computer science teachers (84 %) (http://www.icils.cz/articles/files/ ICILS_2013_Narodni_zprava_CZE.pdf) and on the second place are science teachers (75 %).

Our research was focused on using the computer aided measurement systems in teaching/learning process in physics and biology, only. That means only one type from many using ICT in teaching/learning process. The referred-to research is part of many partial research that are focussed on mapping conditions of ICT using in teaching/learning process in physics in the Moravia-Silesia Region (Švecová et al, 2015). The instructions for teachers and pupils are developed on the research results to help integration ICT in teaching/learning process physics and the others science subjects. This research was carried out on chosen sample schools and teachers. We are aware that we cannot generalize these results on whole population in this time.

We cannot compare structure of our teachers' research sample as concern age and school-practice duration with all teachers of physics and biology in the Czech Republic because of there's not research in this field in the Czech Republic for recent years. The research was carried out on sample 60 physics or biology teachers with given age structure in the Moravia-Silesia Region. We found out what computer assisted systems for measurement are available at chosen schools. Research findings can serve to modification system of teachers' education at universities and can serve to the Regional Authority and Municipal Authorities for modification of educational policy. The discussions with teachers gave away that numbers of laboratory exercises decline. Laboratory exercises are realized at some schools only 4 times a year, or some twice a year.

The aim of the research was to find out how teachers work during tuition with computer assisted measuring systems. Methodology sheets were drawn up for physics and biology teachers on the basis of the research findings. In the methodology sheets to emphasise an interdisciplinary approach between physics and biology and to use it for implementing computer assisted measuring systems. The methodology sheets are currently undergoing evaluation in schools. We believe, for example, that for the measuring systems from the company Vernier, enough methodology sheets have been processed on the internet for physics and biology teachers, but there are not enough for the measuring equipment EdLaB.

One surprising result was that 83 % of the teachers asked stated that they link findings from physics and biology in their subjects. A total of 8 grammar schools were included in the questionnaire survey. The grammar schools also prepare pupils for the study of medicine. To be accepted for medical school, pupils must take written entrance examinations in biology, physics and chemistry. Sometimes they also have to take examinations in human biology and somatology. It depends on the university, but during the test they are not permitted to use tables, calculators or other aids. Pupils who want to study medicine are expected to have excellent results in physics, chemistry and biology, which places greater demands on the work of teachers. From the results of the research it was found that teachers try to combine physics and biology during teaching.

Conclusion

At the start of the summer of 2015, quantitative research was conducted amongst teachers

of physics and biology focusing on the use of a computer assisted system in teaching. One part of the research focused on the interdisciplinary relations between physics and biology.

A total of 60 % of the teachers asked have 16 and more years of teaching experience, which means that for them the methodology sheets incorporating the ICT resources in teaching should be highly detailed. A total of 58 % of the teachers questioned perform laboratory exercises once a week or once every two weeks. We see it as positive that teachers try to include laboratory tasks in tuition, but in some school there is a restriction of laboratory exercises in teaching. Familiarising pupils with educational and virtual laboratories may represent a frequent solution to the problem.

A total of 40 % of the teachers questioned incorporate measuring systems as part of laboratory tasks. A total of 83 % of teachers questioned stated that they applied an interdisciplinary approach between physics and biology during teaching.

On the basis of the results of the questionnaire survey, 7 methodology sheets were drawn up for teachers of physics and biology with the use of computer assisted measuring systems (Martinek: 2016). Systems were selected on the basis of results from the questionnaire survey.

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CURRENT REAL-LIFE ISSUES ANALYSED IN THE COURSE OF FINACIAL MATHEMATICS

[1]Pavel Tlusty, [2]Tomas Mrkvicka, [3]✉Marek Sulista

[1]Department of Applied Mathematics and Informatics, Faculty of Economics, University of South Bohemia, Czech Republic

[2]Department of Applied Mathematics and Informatics, Faculty of Economics, University of South Bohemia, Czech Republic

[3]Department of Applied Mathematics and Informatics, Faculty of Economics, University of South Bohemia, Studentská 13, 370 05 České Budějovice, Czech Republic, +420 389 032 466, sulista@ef.jcu.cz

Abstract

This paper presents a case study focused on a presentation of a topical issue to students in a course of Financial Mathematics who discovered, by calculating concrete examples, the weaknesses and inconsistencies of the annual percentage rate which may cause disputes between consumers, loan providers and state inspection authorities. The chosen topic and its real-life background made the students think critically about the directives concerning consumer loans derived from Czech legislative and EU regulations. This approach to the teaching of financial mathematics encourages students to be inquiring about the nature of financial products and indicators and enables them to see that with the acquired theoretical background and the skills regarding the use of mathematical software, they are able to make necessary verifications and product analyses. At the same time, the topical issues make the course more interesting for the students and make particular lessons more meaningful.

Keywords

Annual percentage rate, financial mathematics, teaching mathematics

Introduction

Educators are replete with calls to use tasks that are ‘authentic’, ‘relevant’ and related to ‘real-life’ and the ‘real-world’. Such activities are frequently advocated for their potential to motivate and engage students. Links to contexts support the learning of mathematics content, rather than to develop the ability to explore real-world contexts through the use of mathematics (Gainsburg, 2008). At university level, students should gain theoretical knowledge and they should be able to apply it in real-life contexts. The demand for real-life contexts in various courses is essential to help university students to find employment more easily on the labour market. The real-life contexts broadly include situations that refer (directly or indirectly) to everyday activities or concern mathematical applications in different disciplines such as science, business, engineering, and economics (Stylianides and Stylianides, 2008).

For example, Trafton, Reys, and Wasman (2001) noted that well-designed real-life tasks “stimulate student interest and engagement and the development of a healthy, accurate view of mathematics as a useful discipline” (p. 264). Similarly, Schiefele and Csikszentmihalyi (1995) suggested that teachers can place problem solving in real-life contexts as one way to increase their students’ motivation in mathematics. However, some researchers questioned the belief that the real-life aspect of tasks is the primary determinant of how

students engage with them. In particular, Hiebert et al (1996) challenged the view that the source of students' interest and motivation is inherent to the task and advanced the view that the basis for how students engage with a task is students' prior knowledge and the conditions under which the task is completed. When tasks are authentic and situated in real-world contexts, students are more likely to be motivated and motivation is important because it can lead to increased cognitive engagement and thereby enhance learning (Blumenfeld, Kempler, and Krajcik, 2006). Kenk and Kian (2010) claim that authentic stimuli and variables connect mathematical concepts, skills and strategies to purposeful, relevant and meaningful contexts and therefore it promotes a deeper level of understanding in the classroom. On the other hand, some authors (e.g. Verschaffel, L., Greer, B., and De Corte, E. (2000), or Cumming and Maxwell (1999)) point out that some problems solved in mathematics lessons are rather superficial and "pseudo-realistic" and are constructed as a mere veneer of real life. They are made to appear authentic and contextualised and in many educational settings, this method of the authentic assessment can prove impractical.

The course of Financial Mathematics at the Faculty of Economic of the University of South Bohemia offers students both the theoretical background in this field and an intensive focus on practical applications reflecting real-life and often topical issues regarding savings accounts, mortgages, consumer loans, saving for retirement etc. Recently, we could witness some disputes about annual percentage rate (APR) calculation between the Czech Trade Inspection Authority and a non-bank financial institution offering consumer loans using APR calculation methods. This issue was taken as a suitable topic for students attending the course and the aim of this paper is to show how this topic was presented to them and how they discovered the weaknesses and inconsistencies of the APR by calculating concrete examples, as well as how the students perceived their interest and motivation in the lessons based on real-life issues. The main aim of this case study is to see if a real-life context helps to increase the interest of the students in the subject matter and if they are able to use the Internet tools recommended by the Czech Trade Inspection Authority to calculate and verify the APR of consumer loans.

Material and Methods

The APR should enable consumers to better evaluate the favourability of a loan and indicates the percentage of the loan which has to be redeemed within one year, considering instalments, maintenance and other charges that go with the loan. In addition, loan providers are obliged, according to law, to present this rate with their loan offers. APR is one of the topics in the syllabus of the course of Financial Mathematics and the students have to master its calculation to complete the course successfully.

In the European Union, the focus of APR standardization is heavily on transparency and consumer rights: "a comprehensible set of information to be given to consumers in good time before the contract is concluded and also as part of the credit agreement [...] every creditor has to use this form when marketing a consumer credit in any member state". So marketing different figures is not allowed. The EU regulations were reinforced with directives 2008/48/EC and 2011/90/EU which have been fully in force in all member states since 2013.

In the Czech Republic, the APR is, according to Act No. 145/2010 Col., about consumer loans (hereafter the Act), calculated as follows:

$$\sum_{k=1}^{m} C_k (1+X)^{-t_k} = \sum_{l=1}^{m'} D_l (1+X)^{-s_l} \tag{1}$$

where

- X is the APR,
- m is the number of the last draw,
- k is the number of the draw ($1 \leq k \leq m$),
- C_k is the amount of the draw k,
- t_k is an interval expressed in years and fractions of a year between the date of the first draw and the dates of the following draws ($t_1 = 0$),
- m' is the number of the last instalment or charge,
- l is the number of a draw of an instalment,
- D_l is the amount of the instalments or charges,
- s_l is an interval expressed in years and fractions of a year between the date of the first draw and the date of the following instalments or charges.

If the APR should enable us to compare loans with different parameters, it must have the following attributes:

- The APR must exist for every loan.
- The value of the APR must be unequivocally defined; there must be exactly one solution of the APR equation.
- The calculation of the time periods should reflect common conventions.
- The rule for rounding must be defined unequivocally.

It is important to keep in mind that if any of the above mentioned attributes are not met, the APR cannot fulfil to its purpose. It should be mentioned that the calculation of the roots of the given equation is not trivial and it is possible, in most cases, only with the use of a computer. In the course of Financial Mathematics, we use MS Excel and the mathematical software Maple for mathematical modelling and calculations.

Results

In the course of Financial Mathematics, 38 students were presented with 5 different exercises focusing on APR calculation. Some exercises were about a loan for which there is no value or more than one value of the APR calculated in accordance with the Act, or where there is a problem with the APR calculation as there is a third party as an intermediator – see the examples below. Generally speaking, we may say that the given definition (equation) may have up to n different roots (solutions), where n is the number of periods where there is a cash-flow. This is a fact which has not been considered properly and which does not correspond with the nature of the Act. Moreover, some roots may even be negative and the negative APR has no economic interpretation.

Exercise 1: We ask a bank for a loan of 100,000 CZK. First, we have to pay a single approval charge of 14,000 CZK, and after 3 months, we get the loan which is redeemable by the amount of 110,000 CZK 3 years later.

The corresponding APR is calculated as follows:

$$100000(1+X)^{0} = 14000(1+X)^{\frac{3}{12}} + 110000(1+X)^{-\frac{33}{12}}$$

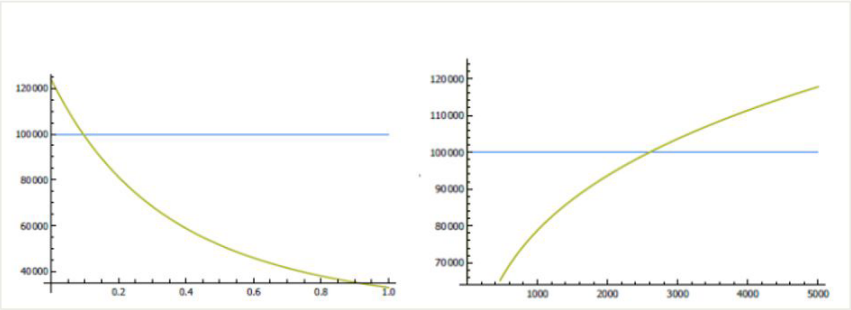

Figure 1: Graphical solution of Example 1(source: own calculation)

As is possible to observe from Fig. 1, there are two solutions X1 = 0.0951 and X2 = 2602, i. e. the corresponding APRs are 9.51% and 260.200 %. There is no doubt that the second value of the ARP is nonsense.

Exercise 2: We ask a bank for a loan of 100,000 CZK. First, we have to pay a single approval charge of 80,000 CZK, and after 3 months, we get the loan which is redeemable by the amount of 60,000 CZK 3 years later.

The corresponding APR is calculated as follows:

$$100000(1+X)^{0} = 80000(1+X)^{\frac{3}{12}} + 60000(1+X)^{-\frac{33}{12}}$$

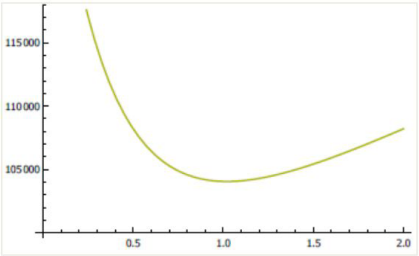

Figure 2: Graphical solution of Example 2 (source: own calculation)

As it is possible to observe from Fig. 2, there is no solution and therefore there is no corresponding APR.

Some financial institutions offer loans to their customers only if they pay a kind of loan insurance on the ability to repay the given loan. This causes another problem, because then the insurance premium is an obligatory charge going with the loan. However, the consumers do not pay back in their instalments only the loan principle, the interest and other charges but they pay for an extra service – the insurance. Should or should not the insurance be included in the APR? Unfortunately, this fact is not treated by the Act.

We can also encounter a case when a non-bank financial company offers a consumer a product and arranges the loan itself with a third party for the consumer. The mediation charge could be seen as a kind of service and again, there is the question of whether the charge should be included in the APR calculation, as the Act considers only two parties. This situation is illustrated by Examples 3 and 4.

Exercise 3: A non-banking financial company offers a product worth 100,000 CZK. The

loan of 100,000 CZK is provided by a bank of the same financial group and there is a mediation charge of 8,000 CZK. The total principal (the loan and the mediation charge) is redeemed with 84 monthly instalments of 2,464 CZK.
The client has to repay the total amount of 108,000 CZK with monthly instalments of 2,464 CZK for 84 months. The appropriate APR is 26.7 %.
Exercise 4: A non-banking financial company offers a product worth 60,000 CZK. The loan of 60,000 CZK is provided by a bank of the same financial group and there is a mediation charge of 48,000 CZK. The total principal (the loan and the mediation charge) is redeemed with 84 monthly instalments of 2,464 CZK.
The client has to repay the total amount of 108,000 CZK with monthly instalments of 2,464 CZK for 84 months. The appropriate APR is 51.3 %.
As we can see, even though the client repays, in both cases, the same instalment for the same time period, the APRs differ. Another problem can be encountered when a bank requires, for example in the case of a mortgage, that the client has to effect mortgage indemnity insurance which is included in monthly instalments. Then, again, it is an extra service and it is disputable whether to include this extra service in the APR calculation or not.
Exercise 5: Determine the APR of a loan of 100,000 CZK redeemable in 84 monthly instalments considering monthly compounded interest of 16.2 % p.a., a single approval charge of 0.5 % of the loan and a monthly maintenance fee of 49 CZK.
The students were asked to calculate the given example using MS Excel. 73 students out of 82 calculated the APR, which is 18.65 % p.a., correctly. The Czech Trade Inspection Authority also devotes information on its websites about consumer loans and APR calculation together with illustrative examples and an APR calculator provided by the European Commission (available on the websites of the Czech Trade Inspection Authority (Česká obchodní inspekce (2014), Consumer Loan Section), which should serve as a helpful tool for consumers to calculate APR and to check if loans offered by financial and non-financial institutions contain true information.
The students were also asked to use a calculator to calculate the APR of Exercise 5. However, none of the students succeeded. Even though a calculator should be simple and easy to use, the complexity of APR makes a calculator very hard to use even for the students who may be considered as experts in the field of financial mathematics.

Discussion

We found out, after short interviews with the students, that all the mentioned facts were perceived by the students as surprising and made them think critically about the given issue. At the same time, the majority of students (86.7%) stated that the nature of the analysed problems made the particular lessons more interesting and motivating as they thought that they were able, with their knowledge and skills acquired in the course, to deal with such real-life problems. This is in accordance with findings of the researchers mentioned in the introduction and also with Harris and Marx (2009) that a key benefit of authentic tasks is that they provide a meaningful and motivating backdrop for learning that affords opportunities to actively think about and apply important ideas, or with research on authentic tasks that had indicated that when these tasks are implemented they are associated with increased achievement and motivation for learning (e.g., Hickey, Moore, and Pelligrino, 2001). Moreover, this approach brought the students (76.3%) a certain responsibility that caused them to think about such issues and verify their essence. As the presented problems had a real background and the students perceived their authenticity

when working with the official websites of the Czech Trade Inspection Authority, there was no problem with a possible impractical impact as mentioned by Verschaffel, Greer, and De Corte (2000), or by Cumming and Maxwell (1999).

Conclusion

The aim of this paper was to outline the presentation of a current issue, which was the problem of APR calculation, in the university course of Financial Mathematics. The students faced the complexity of the APR calculation, discussed its characteristics embedded in the Act and could point out a certain ambiguity which may cause a dispute between consumers, loan providers and state inspection authorities. Considering all the mentioned facts and after discussing the matter, the students could understand that it seems that the APR is not a suitable tool which should be used by financial institutions to help consumers to evaluate the favourability of some types of consumer credit. The evaluation of credit offers should be considered as a problem of great complexity and to compare various credit offers using only one aspect seems to be rather defective.

The chosen topic and its real-life background made the students think critically about the directives concerning consumer loans derived from Czech legislative and EU regulations. This approach to the teaching of financial mathematics helps students to be inquiring about the nature of financial products and financial indicators and enables them to see that with the theoretical background acquired in the course and the skills regarding the use of mathematical software, they are able to make necessary verifications and product analyses. At the same time, the topical issues make the course more interesting for the students and make particular lessons more meaningful.

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TEACHER-STUDENT PERCEPTION DIFFERENCES ON ETHICAL ISSUES IN HIGHER EDUCATION

[1]✉Attila Turi, [2]Marian Mocan, [3]Francisco Xavier Pujol

[1]Management Department, Faculty of Management in Production and Transportation, Politehnica University Timişoara, Piaţa Victoriei Nr. 2, Timişoara, 300006, Romania, +40 721 662 624, attila.turi@upt.ro

[2]Management Department, Faculty of Management in Production and Transportation, Politehnica University Timişoara, Romania

[3]Management Department, Faculty of Management in Production and Transportation, Politehnica University Timişoara, Romania

Abstract

The goal of the paper is to investigate responsibility in education within the teaching-learning process in technical higher education in Romania. The methodology consists in conducting data analysis on the way university teachers and students acknowledge their role and responsibilities within the educational process, through quantitative and qualitative research. Results provide insights on teachers and students views on academic results, as well as some interesting perceptions on how teachers should deal with non-compliance when assessing projects or exams, as well as ethical issues. Results show both teachers and students are aware of the importance and consequences of their responsibilities, but due to certain circumstances they do not always apply commensurate actions.

Keywords

Ethical issues, responsibility, higher education, academic misconduct, students' pass rate

Introduction

Education is a national priority in Romania as it provides the society of tomorrow as a reflection of its quality and efficiency (Klainberg, McCrink, Eckardt, Schecter, Bongiorno and Sedhom, 2014). Besides training students in specific areas and providing the proper tools, one of the most important roles of any type of education is to teach responsibility and proper conduct through ethics (Espinoza and Najera, 2015). By focusing on these two aspects, education in general and higher education in particular need to uphold certain standards in order to inspire students to work hard and fair to achieve their academic results and become successful graduates (Orosz, Toth-Kiraly, Bothe, Kusztor, Kovacs and Janvari, 2015). The respect for the educational process will later prove as a useful asset in their professional and personal careers and help develop an overall better society over time, raising the competitiveness of both the educational system, through its graduates, and of the community which it serves (Blumenfeld, 2015).

Unfortunately due to their increasing lack in fundamental knowledge when entering higher education, a fair amount of students from most faculties are only oriented towards the goal of passing exams, sometimes without even considering the means they use to do so (Brožová and Rydval, 2014; Foltýnek, Kravjar and Glendinning, 2014). Cheating basically implies acting dishonestly or unfairly in order to gain an advantage by using unfair or deceitful methods and is unethical conduct. The most employed means usually are related to the use of cell phones to take pictures of the exam subjects that are later

distributed towards other fellow students (Murphy and Holme, 2015) or using hands-free devices to support and provide unauthorized assistance for a fellow student which is taking the exam (Gallant, Van Den Einde, Ouellette and Lee, 2014). Sometimes cheating is unawarely facilitated by teachers as well, as they sometimes tend to resort to giving the same test throughout consecutive examination sessions (Kun, 2015). This inadequate behavior is subject to sensible and different measures taken by tenured teachers and failing to apply a unitary measure for the same type of misconduct leads to ultimately encouraging students to think that this kind of behavior is acceptable (Chýlová and Natovová, 2013; Švarcová, 2010). A graduate lacking basic specialization knowledge and skills will afterwards discredit himself when applying for a job within his area of studies and also discredit the reputation of the university, putting the collaboration between the private sector and the institution at risk (Dimian, 2011; Cioca and Ivascu, 2013).

The present paper focuses on a case study conducted at the Faculty of Management in Production and Transportation within the Politehnica University of Timisoara and highlights results in three subjects regarding semester activity and exam results. The short presentation of the faculty is followed by an analysis upon semester activity results. The analysis also deals with teachers' and students' views on measures taken against those caught cheating and provides an overview on the exam results and pass rate for each of the three specialization subjects. The final part of the paper underlines the importance of proper ethical conduct within education in general and higher education in particular. The objective of the paper is to assess the perception differences between teacher views upon the subject of proper ethical conduct and associated measures and those of the students.

Materials and Methods

Within the last decade the overall perception is that the quality of the students has constantly been decreasing, as they seem to lack more and more important and essential high school knowledge when entering the higher education system. This is a challenge for both university teachers, who need to train them in more complex matters, as well as for students, who feel overwhelmed by the increased difficulty.

The Faculty of Management in Production and Transportation is among the best faculties of the Politehnica University in terms of collaborations with the private sector and has education programs well-adapted to market requirements, which are taught by competent teaching staff. As a result, the faculty's graduates have a very good reputation within their specialization area and the Board is making efforts to continue to uphold and impose high academic standards for its future graduates as well. One of the pillars of the Politehnica University's prestigious position is its strict policy on breaching ethical conduct such as cheating from students during evaluations (exams or projects). The main problems occur due to a falling interest from some of the students caused by their scarce knowledge background from high school, although overall the faculty is among the highest ranked in terms of attendance and student conduct. Opportunities are constantly developing and the faculty is already well under way to support the public and private sector with graduates in specific areas of specialization whilst other collaboration possibilities emerge. The latest issues associated with universities and their ethics (endorsing books written by politicians and influent people in prison for corruption) as well some proven corruption situations (teachers from universities caught with bribe) have setback the image of higher education, but they need to remain exceptions in order to not further affect the reputation of the other institutions as well.

For this research, we used the case research method to analyze student results in three

different core specialization subjects using quantitative and qualitative data. We compared how ethical issues were handled by the teachers in question and students' representatives' reactions, as well as applying an anonymous questionnaire to the students of the third year at the Faculty of Management in Production and Transportation, using online tools such as Google Form.

The main research questions refer to analyzing why students resort to cheating (hypothesis 1: students cheat because teachers do not strictly uphold regulations), why some teachers indirectly encourage this kind of behavior (hypothesis 2: teachers are more focused on their other activities and are flexible even if they are aware of student misconduct) and why discontent arises when certain measures are applied (hypothesis 3: the lack of unitary application of measures generates frustration and weakens the ethical standard of the university).

The sample used were the students within the third year at the Faculty of Management in Production and Transportation from the specialization Engineering and Management. The selection criteria considered three common core subjects, with an important contribution to the students' competence, which were commonly taught to all four groups (each group having a different specialization area).

The instruments used for the case study were the grade register of the faculty, the exam reports for the three subjects, the Google Form online questionnaire, individual interviews and scheduled meetings with the group and class representatives and the Dean. Data analysis employs tables and figures to help interpret quantitative results, as well as relative change percentage interpretations, which are completed with qualitative results obtained from the online questionnaire and individual conducted interviews.

Results

	Subject 1	Subject 2	Subject 3
Total number of students	109	109	109
Number of students that passed	109	107	79
Number of students caught cheating	5	2	19
Number of students caught and punished	0	0	19
Number of students that did not pass (and did not cheat)	0	2	11
Total number of students that did not pass	0	2	30

Table 1: Overview of semester activity results within the three core subjects, 2016 (source: own processing)

Subject 1 achieves a 100% pass rate, all students have passed the semester activity and seem to have a perfect record. However 5 students have been caught while copying answers from their colleagues during a semester evaluation, but no measures have been taken against them by the teacher. Subject 2 has a 98% pass rate, with only two students not being able to pass the semester activity. The teacher also caught two other students with a copied project, but chose to let them redo their project after the students had admitted their fault and asked for a second chance. Subject 3 has a 72% pass rate only, with 11 students not being able to pass the semester activity and other 19 students being caught having rendered a copied project. In this case, although some students had even scheduled a meeting with their tutoring teacher and Dean, the decision of the teacher in charge of the subject was to uphold the punishment and not give a second chance, the students having therefore to redo the entire semester activity in the following academic year, with extra charge. Teachers from subjects 2 and 3 had also been present while a student used a hands

free device in order to cheat at an exam and was caught by teacher from subject 2, who also got the student expelled from the faculty, after rendering a report to the Dean and the university ethics commission. Within the faculty there are a few known situations within the last decade where students caught cheating had been expelled, therefore all students are aware of this. A summary of the main figures for the semester activity is provided in table 1 and in figure 1.

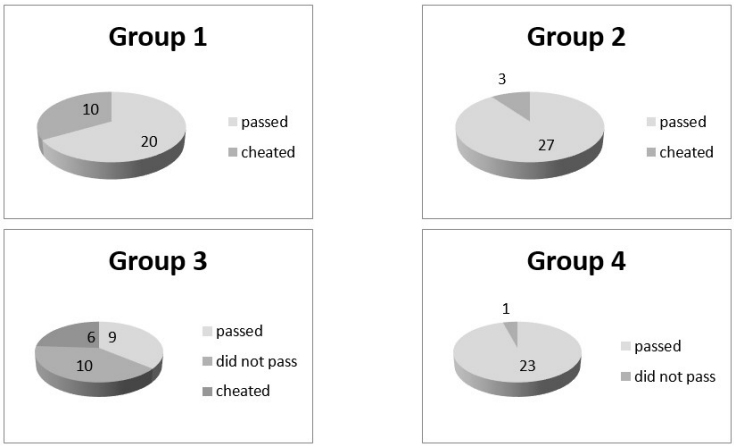

Figure 1: Overview of semester activity results in subject 3 per group, 2016 (source: own processing)

Teachers' views are surprisingly more hesitant than those of the students, as they overall feel that redoing the project is acceptable, whereas cheating during the exam is not. Teachers motivate this lack of coherence mainly due to the funding scheme of the faculty, which establishes the number of students the faculty can receive within their registration in the first academic year. They feel that if they are too strict, students will perceive this as a lack of flexibility and word of mouth will spread towards high school graduates and make them choose other faculties. Other teachers state that they prefer to focus on their other teaching-related assignments and projects or that they do not have the time and energy to deal with such matters. Some teachers simply do not like the idea of failing students, as they prefer to have a quiet teacher-student relationship, without the burden of being perceived as someone who is too upholding of regulations. Another important issue is related to the number of students each teacher supervises for the bachelor thesis, where students usually prefer to be supervised by more convenient teachers rather than someone who will push them to work hard and have a higher level of expectations. Teachers are also more reluctant to take measures against students with good grades as they feel it would affect the faculty's image to have caught good students cheating during evaluations. Similarly if students having a more sensible situation regarding their ECTS credits will be caught, teachers generally become more clement in view of their overall academic situation. Moreover management views a higher than average fail rate as the fault of the teacher and schedules meetings to discuss such poor results. These situations are time-consuming and tend to be avoided by teachers by being more flexible when conducting evaluations, as misconduct needs to be documented by a report, written proof and statements before being handed to the ethics commission. Hypothesis 2 is confirmed. Student representatives have also been asked for their opinion, and their colleagues'

opinion, on the results of subject 3 and more specifically on how they view the measures taken by the teacher in regards to the students copying projects. There is one student representative for each group (there are two groups of 30 students and one group of 25 and one group of 24 students) and one student representative for the entire class. According to the first group's representative (30 students), the students were quite pleased with their grades, except the ones who had been caught cheating on the project. Within this group 10 students had rendered copied projects leading to a pass rate of 66% overall for the group. The second group representative (30 students) stated that her colleagues were very pleased with their results and that only some of them thought they would have deserved a better grade. Within this group 3 students had rendered copied projects, representing only 10% which did not pass the semester activity for ethical issues. Group number three (25 students) is a special case, because after hearing about the copied projects from their colleagues, when the deadline was due to render their projects, not a single student had shown up to do so. After rendering them a few days late, 6 students had still been caught with a copied project, whilst another 10 students did not manage to pass the semester activity due to bad grades and a high lack of interest. Although 24% had been caught cheating and 40% had not passed the seminar, according to the group's representative there had been few complaints from her colleagues regarding these results, which means a pass rate of only 36% overall for the group. The last group (24 students) was the only group where not a single copied project was rendered and only one student did not pass the semester activity, meaning a 95% pass rate, the highest of the entire class. The group representative stated that everyone was content with the evaluation and their only complaints were due to the fact that they were not used to working so hard on a project as they did for this subject. Hypothesis 1 is confirmed.

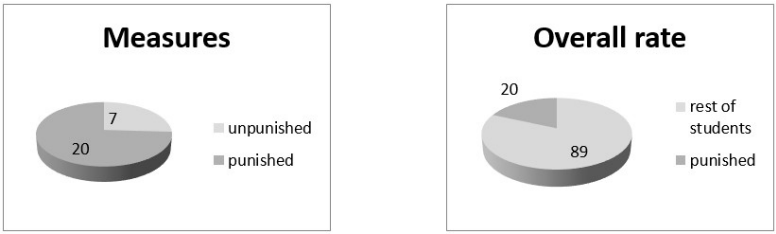

Figure 2: Proportion of students caught cheating and punished, 2016 (source: own processing)

Overall there were 27 students caught cheating, 19 students rendered a copied project for subject 3, whilst two other students did the same within subject 2, a further 5 copied down answers from colleagues during an evaluation in subject 1 and one student was caught cheating during an exam. The students having rendered copied projects in subject 3 and the student caught cheating at the exam were punished (74%), whilst the rest were given another chance by the other teachers. Thus 18% of the class students were caught cheating and punished, 6% were caught and were only given a warning, whilst the rest (75%) have not been exposed to misconduct issues and measures during the first semester within the three analyzed subjects. Figure 2 presents a summary of these results.

When asked upon the fairness of the measure taken by the teacher from subject 3 upon the copied projects the group representatives stated that "the opinions are divided, but that the majority of the colleagues consider the decision as being fair" (group 1), "in a way it is the right thing to do, because I think it is not fair for someone who copied a project to

get the same grade as me or even a better one" (group 2), "I think the decision is ok, but some of my colleagues do not think in the long-term and therefore see things differently" (group 3), "me and my colleagues, we see this as normal, because we all worked hard for our projects and I don't think it is fair for someone who just copied the project in a couple of hours to pass or maybe even get a better grade than us" (group 4). The class representative stated that "I think it is fair, because the teacher warned us from the beginning of the semester of the consequences if someone would get caught cheating and also several times during the semester". Regarding the names of their colleagues caught, there were some surprises as well, although student representatives we not unaware of the inappropriate conduct of some of their fellow students: "lots of them cheat, there are actually few within our group who really do work for their grades" (group 1), "I was not expecting to see some of my colleagues get caught, I thought they did not do things like this, but they will later realize that this attitude is only in their disadvantage" (group 2), "I am actually glad you caught these students and I am not at all surprised, because I know them and they cheat a lot" (group 3), "I was surprised to see the name of some students with very good grades also being caught, I do not want to believe that it is by using these means that they also obtained those good grades, the shorter and easier path is not always the best way to go" (group 4). The class representative stated "I am not really surprised, with a few exceptions, who I thought were good and hardworking students, but everyone has to assume the consequences, because the teacher told us time and time again not to copy or try to cheat". Hypothesis 3 is confirmed.

	Subject 1	Subject 2	Subject 3	Group overall average
Group 1 average grade	8.96	8.33	7.85	**8.38**
Group 2 average grade	8.23	8.16	8.40	**8.26**
Group 3 average grade	6.96	6.60	5.77	**6.44**
Group 4 average grade	7.44	7.08	7.31	**7.27**
Overall class average	**8.03**	**7.75**	**7.55**	**7.77**

Table 2: Average grades per group for the semester activity in all three subjects, 2016 (source: own processing)

The grades considered in table 2 are averaged only for those students who have passed the subject in discussion, while the ones failing to do so are not taken into account. In order to pass a subject, a student must obtain at least the grade 5 for both the exam and the semester activity in order to be able to receive a final grade for that subject. Should students fail to pass the semester activity or/and the exam, they will not receive the associated credits for the subject and will need to retake the semester activity or/and the exam within the following academic year.

Results show that three of the four groups manage to obtain the best results in subject 1, where all students have managed to pass, with an interesting fact: group 2 manages to obtain the highest average in subject 3, where 27% did not manage to pass the subject. Groups 1 and 3 score their lowest average in subject 3, while groups 2 and 4 have their lowest results in subject 2. The smallest difference between grades is for group 2, where there are only 0.24 points separating the highest and lowest average grade, followed by group 4 with 0.46. Group 1 has a wider discrepancy, which ranges beyond one entire point (1.11), whilst group 3 has the biggest range with a difference of 1.19 points. Interestingly each subject scores within the top three averages, with group 1 having the highest average in subject 1 (8.96), group 2 has the second highest average overall individually, but the best average in subject 3, whilst group 1 again has the best average (and the third overall

individually) in subject 2 (8.33). The lowest average grades are all obtained by group 3 (under grade 7 for each of the three subjects), with subject 3 having an overall individual average under grade 6, which is a very low grade for higher education standards (5.77).

	Subject 1		Subject 2		Subject 3	
Exam results	after 1st	after 2nd	after 1st	after 2nd	after 1st	after 2nd
Group 1	15	26	18	24	14	20
Group 2	14	25	18	20	8	12
Group 3	7	21	5	15	6	7
Group 4	6	14	8	11	8	9
Class overall results	**42**	**86**	**49**	**70**	**36**	**48**

Table 3: Overview of exam results within the three subjects, 2016 (source: own processing)

Subject 1 has the highest pass rate after the first 2 exam presentations, with 86 students managing to successfully complete the course, representing 78% of all students. Roughly half of the students that already obtained the credits for this subject managed to pass after the first presentation while the other half did so within the second presentation. Only about 20% of the students did not pass the exam yet and will have to retake the exam another time. Subject 2 has the second best pass rate of the three subjects with 70 students having already obtained the associated credits for the subject, just short of two thirds of the entire class (64%). Interestingly, the tenured teacher of subject 2 had the highest pass rate (44%) after the first presentation, although she is considered the most severe tenured teacher within the faculty. More than two thirds of the students that managed to pass the exam did so within the first presentation, while 39 students have not yet passed the exam (35%). Subject 3 has the lowest pass rate after both presentations, only a third managing to pass after the first presentation (36 students) and only 12 other students doing so within the second presentation (44%). More than 25 students handed in an empty paper within the exam, whilst the tenured teacher of the subject commented that within his teaching career he has never had so many failed students at his exam. More than half of the students (55%) have yet to pass the exam and will have to retake it a third time during the second semester, as the number of students that failed to pass the exam in subject 3 is roughly equal to that of the students that failed to pass subjects 1 and 2 combined. An overview of these results is provided in table 3 and figure 3.

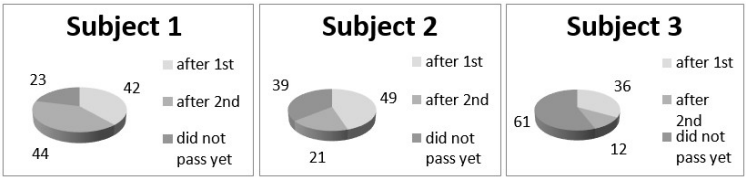

Figure 3: Proportion of passed students at the exam within the three subjects, 2016 (source: own processing)

Discussion

Results are interesting as the majority of opinions within the questioned students lean towards encouraging and praising a strict upholding of ethical issues within all activities associated with university evaluation. It is also to be noted that the vast majority of students are not used to working hard and over an entire semester on projects as the third year marks the beginning of such intense academic activities, as they were only used to

passing the semester activity and exams without too much effort within other subjects. There are also opinions which state that being too strict is not the proper way to go, as more flexibility should be employed in order to find solutions for occurring issues, which is due to the fact that students have come to bond as colleagues and feel sorry for one or another when some of them are caught. These views on flexibility are also common upon the teaching staff of the faculty. Other authors have similar views on these matters and highlight further interesting aspects. Students generally prefer to take the path of minimum effort, because they are less interested in their grades or overall results and are more focused on adjusting their effort solely for passing the subject (Brožová and Rydval, 2014). This is also emphasized by their lack of basic knowledge when entering higher education, which generates stress and has a negative impact on their motivation and personal growth perspectives. When having to cope with projects, they have trouble planning ahead and usually run out of time (64%). This leads to questionable actions, as are copying from the internet (67%), which is convenient and has a high degree of easiness and is endorsed by their conviction that they will not get caught (62%) and aligns with their attitude of not wanting to learn anything, just to pass the assignment (52%) (Foltýnek, Kravjar and Glendinning, 2014).

This is indeed a delicate issue that arises sensible questions and opinions on the matter. Of course it is always best to prevent such conduct, but in case students fail to comply, this requires that the student bears the consequences in accordance with the internal regulations of the university, as the most common penalty in such situations is awarding the minimum grade, which automatically implies repeating or failing the subject. Promoting proper conduct can only be achieved by prevention, making students aware of the importance of high ethical standards and having a zero tolerance policy against those who fail to comply (Chýlová and Natovová, 2013).

The competitiveness of higher education and its graduates mainly depends on the quality of their studies, training and skills they manage to acquire, as well as their ethical and moral values (Švarcová, 2010). Universities face the challenges of freshmen who lack basic knowledge or have a scarce basis for higher education, which generates difficulties for both teachers and students. Sometimes temptation arises and students try the easier way around exams and sometimes they get away with it and think it is an appropriate solution. If universities do not uphold a high reputation and relieve the importance of education then the society of tomorrow with questionable or even without morality has a poor future. Nowadays companies are not only looking for knowledge and/or skills but it is also equally important to have aptitudes to apply them effectively (Dimian, 2011). Good training is essential, but so is proper conduct, because only by jointly applying these skills can a company's objectives be achieved within an overall strategy of competitive advantage and sustainable development (Cioca and Ivascu, 2013).

Conclusion

Results show that students are aware of their duties and responsibilities and they acknowledge the fact that cheating and misconduct during exams, projects or other forms of evaluation are wrong, but they have colleagues who resort to these means. There is a feeling of frustration from students sometimes, because not all teachers apply the same measures and students can become confused when there are differences in how sanctions are enforced as the lack of commensurate and unitary measures can lead to students trying to cheat as well as a lack of reaction from the other students, as they are not sure whether the tenured teacher will or not apply the same measures.

Besides being oriented towards the development of appropriate skills and competencies within their specialization area, education should also focus on teaching them the importance of ethics within the teaching-learning process (Blumenfeld, 2015). Although there is only a small part of students that are caught cheating, all teachers should enforce the strict upholding of ethical principles and have a common policy to apply equal sanctions upon those students who fail to comply with university regulations, in order to eliminate uneven solutions to misconduct issues.

It is important to highlight the fact that students are the central product of higher education and they will have a leading role and contribution to the country's economic development (Draghici, Baban, Ivascu and Sarca, 2015) and will be a central pillar of the society of tomorrow, thus laying a solid and correct foundation for them to build their future both as professionals and human personalities is essential.

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ORGANIZATION OF A SELECTED LIFELONG COMBINED UNIVERSITY PROGRAM

[1]✉Hana Urbancova, [2]Lenka Kucirkova

[1]Department of Management, Faculty of Economics and Management, Czech University of Life Sciences Prague, Kamycka 129, Prague, 169 00, Czech Republic, +420 224 382 026, urbancova@pef.czu.cz

[2]Department of Languages, Faculty of Economics and Management, Czech University of Life Sciences Prague, Czech Republic

Abstract

The organization of teaching is a currently discussed issue. Due to the pressure to increase the quality of teaching in all educational institutions, the feedback from students regarding the organization of teaching and the use of educational methods and techniques in teaching is increasingly important. When deficiencies are found, it is necessary to propose the optimization of individual processes. Owing to the fact that within a combined form of study, e-learning is used to a greater extent, this article focuses on the evaluation of the use of the e-learning applications of moodle.czu.cz, in a selected lifelong learning course. Data were obtained by the questionnaire survey among a selected group of students (n = 362). The results show that 93.4% of the surveyed students consider the possibility of studying within a lifelong education program at the FEM to be beneficial, 65.5% of the respondents prefer using a combination of e-learning applications and lectures, a total of 53.0% of the respondents use moodle.czu.cz actively. The results show that the students prefer a greater connection of the subject with the practice, e.g. the use of case studies or simulations.

Keywords

Evaluation, field of study, methods, students, survey, university

Introduction

The development of new techniques and new technologies as well as the ever increasing willingness of people to invest in their own education, due to the competitive environment in the global labor market, has resulted in the possibility of studying in a distance or combined form of study programs and courses at colleges and universities in the Czech Republic. Nowadays, universities and colleges are competing to obtain students for studies and sometimes also less lucrative fields of studies and try to attract them to quality education, organized through seminars and lectures in various forms of studies. The organization of teaching must be based not only on the requirements of individual students and their demands to adapt themselves, but it must also reflect trends in foreign universities in order to remain competitive in the field of global higher education. (Shahjahan and Morgan, 2016). Joksimović et al. (2015) and Beldarrain (2007) almost unequivocally argue for the importance of interactions in online learning settings. Nevertheless, the relationship between different types of interactions and learning outcomes is rather complex. The results might imply the need for the development of institutional and program-level strategies for learning and teaching that would promote effective pedagogical approaches to designing and guiding interactions in online and distance learning settings. Due to the fact that distance and combined forms of study are demanding as far as leisure time is

concerned and do not have so much personal interaction time allotment with teachers, it is primarily necessary in these forms to have a properly set e-learning program. Faculties at the CULS in Prague have been using the university system moodle.czu.cz. for a long time. Moodle is a software package for creating educational systems and electronic courses on the Internet.

In individual subjects, students can use learning materials in the form of HTML pages, downloadable files, flash animations, structured lectures, discussion forums with subscription on e-mail, tasks for the participants, automatically evaluated tests consisting of different types of test tasks, dictionaries and databases, course participants, polls or educational content according to specification SCORM or IMS content Package may be involved in the fullfilment (Romero, Ventura and García, 2008). The academics at the FEM work with these tools when organizing the combined forms of studies. These e-learning applications can facilitate the home preparation of students. Linna, Keto and Makinen (2015) state that university education is in the middle of a technological and pedagogical revolution. IT education has been radically challenged by new possibilities. The key challenge is to enable an efficient balance between work and studies, especially by supporting distance learning. Koole, McQuilkin and Ally (2010) in their survey in Canada, state that further focus research is necessary on usability, education and the social interaction present in a mobile approach to online study materials. Additionally, the level of flexibility of a mobile technology and the related quality of interaction for distance students, must be dealt with.

The aim of the paper is to evaluate the use of the e-learning moodle.czu.cz application in selected lifelong learning courses in a combined form of study. The partial goal is based on the student´s opinions to discuss pros and cons of the e-learning application in selected courses.

Distance studies consist of two interconnected areas; the first area is focused on self-study and the other one is mostly based on the electronic communication with academics. Therefore, studies are mainly based on the principle of e-learning, i.e. the study carried out through computers and the Internet (e-learning systems) using interactive teaching aids. Combined studies, i.e. the combination of distance and full-time studies, are also based on a similar principle. Teaching of this type of study is carried out in blocks, typically once a fortnight throughout the day. The structure of subjects in some fields of studies is different from that in full-time studies. While some courses in a full-time form are divided into two semesters, in the combined form they are condensed into one semester. Nevertheless, they end with exactly the same examination. This obviously implies higher demands of combined studies on homework. It requires a significant portion of the student's self-study, thus it becomes necessary for universities and colleges to have an appropriate e-learning tool that makes students' learning easier and at the same time increases the quality of education at a given university.

The fact that a properly configured e-learning system helps increase the quality of the educational process is supported by the research of Thatcher et al. (2016). They state that the analysis reveals the evidence of multiple value added factors; it was found that the existence of knowledge, either present or generated through blended learning techniques, was a key value added element. Their results show that the organization of learning and training processes and the use of particular methods at universities are very important for the assessment of quality of education and Königová and Fejfar (2011) add that proper learning/training methods lead to the development of future managers competencies. The Faculty of Economics and Management (FEM) of the Czech University of Life Sciences

(CULS) in Prague organizes the teaching of selected fields of studies in the form of lifelong education in the combined form of study in the consultation centers of FEM in Hradec Králové, Cheb, Klatovy, Jičín, Litoměřice, Sezimovo Ústí - Tábor, Most and Šumperk. However, in the context of primary research, only the data obtained from the field of Public administration and regional development were processed. The participants of the research were the students in the second and third years of study because they will be the future graduates who will make the decision during the summer term 2016 as to whether they will pursue master studies. The way of organizing teaching and the quality of e-learning applications can be a decisive criterion for some students, which is why the article deals with this issue.

Materials and Methods

The theoretical background for this study was collected from analyzing secondary sources, synthesis, induction and deduction. The primary data came from quantitative research. The questionnaire was sent out electronically during the winter semester of 2015/2016 and targeted to students enrolled in the distance bachelor program in the lifelong education program of the Faculty of Economics and Management of the CULS in Prague. The students in the 2nd and 3rd year of the Public administration and regional development field of study within subjects of the Management of administrative and administration processes and Accounting of non-profit organizations were selected. The questionnaire survey was voluntary, all students who attended the lectures in consultation centers could take part in it.

Respondents (n=362) were selected on a non-random basis. Their basic characteristics are as follows:

- By age: 18 to 25 years 19.1%, 26 to 32 years 27.1%, 33 to 40 years 21.0%, 41 to 51 years 29.0%, 51 years or more 3.9%.
- According to the working position in their current job: managerial positions 21.8%, administrative positions 44.8%, technical positions, 9.4%, specialists 24.0%.
- Depending on the size of the organization where they work: small up to 50 employees - a total of 33.4%, medium (51 to 249 employees) 28.5% and large (over 250 employees) 38.1%.

Closed or semi-open questions, which were compiled on the basis of the study of literature, documents and other related research, were used to obtain answers. The structure of the questionnaire was the following: 9 research questions and 10 identification questions. In order to evaluate the results, descriptive statistics tools such as absolute and relative frequencies, dependence tests ($\chi 2$ test) and tests of strength dependence (Cramer's V) were used. If the p-value was lower than $\alpha = 0.05$, the null hypothesis was rejected. For the processing of the results, correlation and association tables were also used. Further analyses were based on the method of multidimensional statistics – the factor analysis (Varimax rotation (Anderson, 2009); 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 of over 0.3 were selected as significant for factor development; positive and negative dependency was further analyzed in relation to its final benefits). To evaluate the data, the SPSS 22 statistical software and MS Excel 2007 were used.

Results

The results of the conducted survey show that of the addressed students,77.6% began to

study at the FEM CULS Prague because of a personal need to be educated, only 9.7% of respondents reported that they had to start studying because the employer demanded it. Other respondents stated a list of personal reasons for studying while working (e.g. a better position on the labor market, getting a job on the labor market after maternity leave, etc.).

The results of the survey

As far as the teaching of selected subjects at the FEM is concerned, the respondents indicated that they preferred a combination of a contact and contactless form of teaching (65.5%), only 27.3% said they preferred lectures and exercises with the teacher and 7.2% preferred e-learning applications. In the case of distance learning, there must be more time devoted to self-studies and work on moodle.czu.cz. Therefore, it is necessary for the applications in moodle.czu.cz to be user-friendly. Table 1 presents the preference of the method of teaching based on the age category of respondents in absolute frequencies.

Way of teaching	Age category				
	18 - 25	26 - 32	33 - 40	41 - 50	51 and more
E-learning	13	9	3	1	0
Combination of a contact and contactless form of teaching	39	64	51	73	10
Exercises and lectures with a pedagogue	17	25	22	31	4

Tab. 1: Statements of respondents related to subject organizing

It can be summarized that the combination of contact and contactless teaching is preferred (43.0%) by people in administrative positions in large organizations, which relates to the content of their work. They are supposed to have a mastery of computer work, which is a prerequisite for the use of e-learning applications, and at the same time they also emphasize the explanation of the substance correlation of teaching topics within exercises. The use of interactive learning means, including moodle.czu.cz, is most positively evaluated by respondents who work in technical positions. The relationship between the given position in the organization and the method of teaching that students prefer was determined. P-value is 0.324, which is higher than $\alpha = 0.05$, therefore, the null hypothesis cannot be rejected (**there is no correlation between preferences for the teaching method by the respondents and their position in the organization**).

With regard to continuous innovation of the courses in moodle.czu.cz within the FEM, it was investigated whether the students addressed actively use materials on moodle.czu.cz and other options (discussion forums, news, etc.). Most of them (53.0%) stated that they utilized moodle.czu.cz actively and that they tried to exploit the full potential of what moodle.czu.cz offered, including associated applications. On the contrary, 46.7% of respondents said that they used moodle.czu.cz only passively when they needed to download necessary materials for learning. Table 2 shows the structure of responses by age category of respondents (in absolute frequencies).

Using moodle.czu.cz	Age category				
	18 - 25	26 - 32	33 - 40	41 - 50	51 and more
Not used	1	0	0	0	0
Used actively	29	48	47	61	7
Used passively	39	50	29	44	7
Total	69	98	76	105	14

Tab. 2: Statements of respondents related to using moodle.czu.cz

Only one respondent said that Moodle was not used by him/her. However, owing to the fact that it was a student in the 2nd year, it is supposed that in the first year of study he/she used the application moodle.czu.cz at least once, but the content may not have corresponded with his/her requirements, therefore, he/she chose the response „not used". Therefore, it was further investigated how the moodle.czu.cz application was considered by respondents to be adequate for the needs of the study. Most of the respondents (87.0%) stated that the moodle.czu.cz application was sufficient for the needs of students, 11.3% of respondents said they considered it inadequate – they are the respondents who reported in the previous question that moodle.czu.cz was used only passively to download important materials (e.g. text of lectures). A total of 1.7% said that they could not consider this issue as they personally did not use it and had moodle.czu.cz materials sent by their classmates to them. It should be noted that they are predominantly (66.7%) students older than 41 years, who prefer personally meeting with teachers to e-learning. Based on the results, it can be stated that 93.4% of the surveyed students consider the possibility of studying within lifelong education at the FEM beneficial, 5.8% reported that they could not in the second year consider it relevantly, only 0.8% of respondents (simultaneously ending a bachelor degree of study) reported that the study was of no contribution. Taken into consideration that that the quality of teaching is influenced by many factors, but primarily by the correct choice of educational methods in the classroom, the factor analysis was used for further testing. The aim of the factor analysis was to reduce the number of variables (to reduce the dimension of data) and to determine relationships between variables (i.e. used educational methods in the classroom, see Tab. 3).

Component	Total	% of Variance	Cumulative %
1	1.486	18.576	18.576
2	1.279	15.983	34.559
3	1.203	15.040	49.598

Tab. 3: Total Variance Explained

Although according to Hebák et al. (2007), it is appropriate to interpret results which explain at least 50% and more of the behavior of the sample, owing to the fact that this is the field of education and use of educational methods in the classroom, but because the value approaches 50%, the following results according to Anderson (2009) can be used to comment on the results. The results of the factor analysis should be treated as supplementary within the conducted survey. The results of factor analysis which identified three factors are given in Table 4.

Component	1	2	3
E-learning	-0.166	0.215	**0.713**
Videoconference	0.004	-0.183	**0.721**
Blended-learning*	0.052	**-0.681**	-0.157
Workshops	**0.617**	0.018	-0.178
Case study	**0.684**	-0.153	0.329
Lecture	-0.067	-0.178	-0.185
Seminar	**0.448**	0.329	0.018
Role playing	**0.543**	-0.185	-0.153
% of Variance	18.576	15.983	15.040
Factor	Active participation on education	Combination	Pasive participation on education

Tab. 4: Rotated Component Matrix * Combination of e-learning and lectures

Based on the results, we can say that the first factor consists of educational methods that are based on the interaction of students and their active participation. On the other hand, it is associated with a plurality of knowledge transfer and experience between teachers and students, as well as the understanding of the topic based on practical examples. The factor explains that 18.576% of the target behavior is formed by the methods of education - workshops, case studies, seminars and role plays. Values range from 0.448 to 0.684. The second factor can be called the blend, since there are supported lectures and e-learning due to the blended learning. The third factor is composed of the e-learning and video conferencing, which supports the passive participation of students in the classroom. On the other hand, the advantage is that students can study even if work obligations do not enable them to take part in the lessons personally. The results of the factor analysis are complementary, based on the obtained data. They present a possible distribution of educational methods and how they can be combined with one another with regard to students´ preferences. With the third factor, which includes the e-learning and videoconferencing, the coefficients are very strong (over 0.7) and that is why it is necessary to mention the disadvantages of e-learning applications too. The students of blended learning disciplines are in fact often deprived of daily contact with their classmates. Therefore, it can be expected that they do not create strong relationships, they do not have sufficient information as far as events at the faculty are concerned, they have fewer chances to react flexibly to interesting offers, and share important information. They do not know the academics very well, so they can have more problems with choosing a diploma or bachelor thesis supervisor.

Discussion

Obtaining feedback from students and the optimization of an educational process is an important element in the system of management of educational process quality at all universities in the Czech Republic. In the context of increasing competition among Czech colleges and universities, it is necessary to pay attention to improving the educational process, to the organization of teaching and the use of appropriate teaching means. According to the results of Sarabdeen (2013) and Cheng (2003), it can be said that the quality of teaching is affected by the proper selection of educational techniques and technologies used in the lessons (lectures and seminars) and according to Borges and Stiubiener (2015), also by correct settings of e-learning applications within the lessons. Based on the above mentioned, it can be stated that the system moodle.czu.cz should not

be only a repository of materials for the students, but it should also be based on interaction. There should be an option to work on case studies, get feedback and communicate with teachers and other students. These options are provided by moodle.czu.cz, unfortunately, it is not effectively used by both students and teachers.

Conclusion

The results showed that the majority of surveyed students (77.6%) at the FEM began to study due to their personal need to be developed. Overall, 65.5% of the respondents said that they were satisfied with the current methods of teaching (the combination of moodle.czu.cz and lectures within the consultation centers), unfortunately, 46.7% of the respondents use moodle.czu.cz only passively. Therefore, it is appropriate for teachers to focus on the ways of modifying currently used educational methods and techniques and to use the possibilities of moodle.czu.cz more efficiently. The researches of Linna, Keto and Makinen (2015), Borger and Stiubiener (2015) confirm that using modern learning/ training methods and ICT (such as e-learning) is important nowadays.

The practical contribution of the paper is in presenting the results of a current survey focused on the organization of the selected lifelong combined university program. The organization of teaching, particularly at this time of an ever increasingly competitive fight for students among universities, must be constantly modified according to the requirements of students. Taking into account the potential of this topic for further research, it would be useful to extend the survey to other fields of studies at the FEM, with an emphasis on the determination of the organization of teaching quality in individual subjects.

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THE NEED FOR LIFELONG LEARNING IN THE NON-STATE NON-PROFIT SECTOR

[1]✉Pavla Varvazovska, [2]Martina Jarkovska

[1]Department of Humanities, Faculty of Economics and Management, Czech University of Life Sciences Prague, Kamýcká 129, Prague 6, 165 21, Czech Republic, +420 224 382 312, varvazovska@pef.czu.cz

[2]Department of Languages, Faculty of Economics and Management, Czech University of Life Sciences Prague, Czech Republic

Abstract

The aim of the paper is to determine whether lifelong learning in the non-state non-profit sector is a necessity for the successful functioning of non-state non-profit organizations. Partial aim is to analyse the system of lifelong learning in selected non-profit organizations in a given region. The theoretical part is based on the study of documents, the practical part is based on quantitative and qualitative approach to sociological research. For this purpose, questionnaires were used among employees of non-profit sector and semi standardized interviews with those involved in influencing the operation of non-profit organizations. For the analysis a simple statistical evaluation and comparison method were used. Relations between variables were constructed into the association and contingency tables, which were the basis for further statistical evaluation. A positive finding was that rather than the possibility of obtaining higher wages, respondents identified knowledge, work success and moral achievement awards as their main motivation for training. The results were evaluated and final recommendations were given.

Keywords

Field investigations, lifelong learning, motivation, non-state non-profit organization, selected region

Introduction

Lifelong education as such leads to the development of individual social, cultural and economic capital. The diffusion of knowledge and work on one's own development strengthens symbolic capital and power of the individual (his or her competitiveness). It is this effort to increase one's wealth in the form of individual capital that could be seen as one of the primary factors motivating individuals to further education and increasing their employability on the job market - the personal development certainly has a positive impact on personal lives.

The fact that an individual's personality and his or her "equipment" are crucial for access to work and learning, is also discussed by Billett (2010) who comments on the theory of Giddens (2009), that in modern society the primary task of our personality is to protect his or her own stability relative of the period of turbulence.

Further education includes education of citizens, interest and other professional education, which is subsequently engaged in qualification, retraining and normative education (Tureckiová, 2010: 14). Hanemann (2015) supports the idea of lifelong learning, and points out the necessity of education of each individual. He sees the learning especially important for those who have been excluded from formal education or, for whatever reason, have not acquired basic competencies. Without opportunities for lifelong learning,

additional acquisition of literacy, without the knowledge of the basic initial skills that form the core of basic education, such individuals cannot participate fully in society.

Among their own individual and situational factors, social practices and cultural conditions, lifelong learning can be seen as an inevitable and permanent process of personality development that occurs through the involvement of the individual in the conscious and unconscious processes of thought and action throughout life (Billett, 2010: 5).

To create a future among countries is one of the main means of lifelong learning. Lifelong learning should be accessible to all. Everyone is inherently able to study and learn, but also a substantial motivation is important (Lifelong learning for all; 1997: 33). Bengtsson (2013) notes that of the one hand, the development of the lifelong learning concept is accepted in principle by all OECD countries and many others, but on the other hand, there is an uneven and slow pace of implementation of lifelong learning. Bengtsson (2013) lists three main reasons hindering lifelong learning, namely the lack of feasible implementation strategies, inadequate funding system and resistance to change of everyone involved. He does not deny that each country is different and must develop its own strategy. Bengtsson (2013) further identifies a number of strategies and research issues common to all the countries that are relevant to the acceleration leading to the implementation of lifelong learning strategies and programmes.

Motivation for further education must be strong enough to overcome the individual feeling that at the moment one has a steady job, there is no need for further work on oneself. Nowadays, it is obvious that formal education that helps one to get to perform a specific job, and assigned tasks, and meet certain standards of the profession, is no longer enough (Skok, 2013).

For the staff of non-profit organizations, a crucial ability is to persuade, communicate properly, promote the interests of the organization (lobbying in the positive sense), and get on their side fans and supporters of non-profit organizations.

Specialist education in the field of action of non-profit organizations is necessary for their continued existence. For example, non-profit organizations working in the social services are even obliged to educate in order to obtain the appropriate accreditation for their operations. Educational projects in non-profit organizations in the field of ecology are often targeted at practical environmental education and analysis of the motivations and experience of volunteers (Haigh, 2006). The further education areas are interesting for non-profit organization workers as they expand their social capital and are necessary for their continued functioning. It is mainly about education in the so-called soft skills, i.e. communication, presentation, public relations, marketing communication, basics of effective lobbying and more. In recent years, the most growing interest of non-profit organizations has been in the field of management education and in obtaining financial and non-financial resources (O'Neill, 2007).

Lifelong learning is definitely significant for the non-profit sector, where workers and possibly even volunteers working in non-profit organizations attend educational events twice or more times a year (Varvažovská and Jarkovská, 2012).

Keller, Hruška and Tvrdý (2008) also point out that education in the country leads to a greater economic flexibility and the development of business activities, which is crucial for the country's competitiveness.

Based on the analysis of selected non-profit organizations of the selected region (Vysočina region), the aim of this paper is to identify the need for lifelong learning for the successful functioning of non-profit organizations. A partial objective is to determine among the

respondents of the selected non-profit organizations their interest in and motivation for lifelong learning in different areas.

Materials and Methods

Based on the theoretical foundations, field research was prepared using quantitative and qualitative approach to sociological research. On the one hand, non-profit organizations were selected by the key links to activities in the Vysočina region, consequently the criterion of interest and orientation of the non-profit organization was taken into account. The aim was to obtain the sample of such organizations which differ in the subject of interest so that the sample is not inclined to homogeneity. To ensure this effort the catalogue of non-profit organizations in the Vysočina region was used (NIDM, 2009). The quantitative survey was conducted on the sample of non-profit organization representatives in November 2015. 250 questionnaires were handed out and the final number of returned questionnaires was 216, i.e. the 86% return. 77 women and 139 men responded. Based on these results, however, we cannot say that in the non-profit sector in the Vysočina region more men are employed; it rather shows the willingness of male respondents to fill in the questionnaire. The lowest number of respondents in the non-profit sector were in the age interval 51-60 years, with the number of 16 persons. On the contrary, most of the respondents were between 31-40 years of age. In the examined sample the largest group consists of men with school-leaving examination aged 31-40. The highest educational attainment is clearly "secondary school with school-leaving examination". As for university education, a total of 40 university graduates worked in the non-profit sector. Seven persons received apprentice training and nine respondents obtained higher professional education.

Research questions can be summarized into the following considerations. The work position to which the individual has been promoted or, on the contrary, the position he or she would like to be promoted to, in most cases is not the ultimate goal in his or her career. Such a position can often be described as unstable and demanding requirements that the individual is forced to defend. It can be expected that if the individual voluntarily educates him or herself, it is more likely that his or her workplace will be left to him or her. It can be assumed that the non-profit sector workers will learn more and will search for courses, seminars, lectures to attend. The more he or she wants to keep his or her job, the more the nature of his or her training will become a long-term issue, and the more he or she will learn on their own initiative, the more time he or she will sacrifice as opposed to a situation in which an employer will force him or her and he or she will devote to education only the time absolutely necessary. The paper analyses the results of the survey and the analysis of the qualitative phenomena (attributes) relationships (1).

Such questions can be answered using testing procedures where statistical significance of the relationship between two qualitative attributes under study is verified. In the present solution $\chi 2$ test has been used. The test is based on null hypothesis assuming independence of the two attributes. The test criterion is defined in general by:

$$\chi^2 = \sum_{i=1}^{k} \sum_{j=1}^{m} \frac{(n_{ij} - o_{ij})^2}{o_{ij}}, \qquad (1)$$

where, n……size of the sample,

n_{ij} ……observed frequency,

o_{ij} ……expected (theoretical) frequency,
i = 1, 2,…, k, where k is the number of varieties of one attribute,
j = 1, 2,…, m, where m is the number of varieties of the other attribute,
ij = frequency combination.

Qualitative approach to sociological research was used in the form of semi-standardized interviews with representatives of the non-profit organizations in three areas (sports, health and social sector, education sector). Three interviews were provided by chief executives and a director, and three interviews by staff. Five question areas were prepared. For executives: 1. How often do you educate yourself per year / attend courses per year? 2. Do you offer or recommend employees courses / seminars? 3. Do you have to meet some educational points / quota? 4. Do you allow employees to participate in seminars - yes / no and under what conditions? 5. How do you reward employees for participation in seminars? For employees: 1. How often do you educate yourself per year / attend courses per year? 2. Do you have requests for training activities or do your supervisors offer you courses? 3. What area are courses in? 4. Does your employer allow you to participate in training or do you have to attend the course in your spare time? 5. Does your employer appreciate your participation in seminars?

Due to a limited length of the paper, the results of the qualitative research are presented in a verbal commentary only.

Results and Discussion

The questions were targeted at finding effort for training on one's own initiative in order to maintain a job and use the acquired practice. The more the individual will educate, the more likely he or she will retain his or her current post. 171 people (i.e. 79% of all respondents in the non-profit sector) wanted to learn voluntarily. All respondents also indicated that their education would withhold their existing jobs and some would get another job or employment. Many of them would receive a certificate after their training. The most visited is a language course with 117 respondents (Figure 1). 30 people only, i.e. 87% of respondents do not attend any course, i.e. 87% respondents attend a course. It can be deduced that those who want to educate themselves often seek offers for courses, workshops and other educational activities.

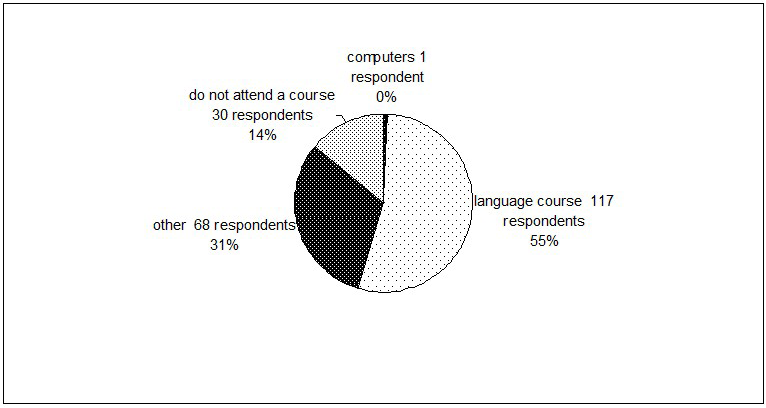

Figure 1: Participation in training: Currently I attend a course or private lessons

Given the characteristics of the examined sample of respondents, the null hypothesis is at hand: There is no significant relationship between older workers of non-profit sector and their participation in education (Tab.1).

2015	till 30 year of age	31 - 40 years of age	41 - 50 years of age	51 - 60 years	61 +	Total
Course attendance in non-profit sector	43	73	55	7	8	186

Table 1: Course attendance with regard to the age of the respondents

With $\chi^2 = 52.76$ and $\chi^2 0.05 = 9.488$, the null hypothesis of independence can be rejected; age is related to participation in educational activities. With Pearson coefficient = 0.37, maximum value Cmaxfor $n = 2$ and normalized coefficient $Cn = 0.2$, the described dependence can be assessed as moderate.

Most course participants are eager to satisfy their need immediately. It can be assumed that the more they participate in training courses, the more they apply acquired knowledge, skills or information in their jobs. The 167 survey respondents said that they definitely or rather used their knowledge in employment.

Human capital is an essential element of a well-functioning organization or business. It is indispensable. It can be assumed that the more the individual will educate the greater human capital he or she will bring to an organization and the support of the organization will be of a rising character. The employer has several options how to promote the education of his or her employees. The questionnaire survey distinguishes between financial and other possibilities. 17 respondents were supported financially while 108 respondents mentioned non-financial support. Uniqueness and originality of each individual brings individual traits that must be respected. Inside stimulus affect behaviour and attitudes to meet the needs. The motivation of adults to lifelong learning is an important factor in education. The process of learning motivation is influenced by age, sex, current education level, employment, life situations and current needs.

Qualitative research aimed to determine deeper attitudes of the individual randomly selected representatives of the non-profit sector regarding their current education. The results of the quantitative survey showed, from the authors' point of view, interesting information on participation in seminars, courses and other educational activities. Non-profit sector employees were addressed from the area of sports, social and health education and the training centre. Neither of them agreed to the interview being recorded.

Based on the interviews it can be stated that employers and employees participate in training courses. Participation is of a regular as well as irregular character. Neither short- or long-term time horizon is preferred over another. What is a decisive factor is the theme and fast benefits. Respondents are interested in increasing their knowledge, skills, competencies and qualifications. However, there are various practical reasons for not participating in seminars. Nearly all respondents are, on their own initiative, trying to find a course that would be beneficial and that is important for them. They do not take advantage of time and financial resources of the organization. Once respondents support their application for participation in an educational event on reasonable grounds, in most cases they have support from the employer. If a course is not directly related to their job descriptions, they attend the course in their spare time or they voluntarily sacrifice holidays. They are almost regularly interested in a range of offered courses. They are given offers on the basis of previous involvement or previous interest in the seminar. Other offers are available on the website or are recommended by colleagues and employers. Most of the employers share

a consistent view of the valuation of employee participation in educational events, except for social and health sectors. According to all stakeholders, the purpose of the educational process is the development of personal advancement.

Conclusion

Nearly thirty percent of respondents from the non-profit sector have no support from the employer. Yet they are motivated to study and educate themselves. Besides wages and liabilities, which are key factors of material motivation, the respondents enjoy the pleasure of working success and praise. Most respondents look optimistically at education and devote to learning even a few hours a day. It is not only knowledge and skills that are enough to maintain a job, but also obtaining a valuable document, as is seen from the survey results. In the non-profit sector, the main interest in lifelong learning comes from the individuals themselves.

A positive finding also was that neither group identified the possibility of obtaining higher wages as their main motivation for training. Equally positive was a result related to finances, i.e. that representatives of public administration did not point out financial problems connected to the implementation of courses. This "neglecting a financial point of view" and focusing on "deeper meaning" of the training was common to both groups, which can clearly be considered a positive result.

Despite all systematic differences and learning objectives, the research shows that the respondents represent people, employees who wish to further develop themselves and keep their jobs and support the organizations in their development. Moreover, in terms of the practical application of the findings made in the context of this study, a significance of further education for the economic performance of each country cannot be forgotten. A clear emphasis on the upgrading of qualifications of professional staff must be the priority of every employer. Current times can be regarded as rather turbulent. It is necessary to face huge demands in order to deal with changes in technology and progress in all areas of human activity. Under such conditions, unskilled workers, who are reluctant to further educate themselves, cannot succeed.

Several studies (e.g. Kinnair et al, 2014) introduce a view that in the slowly fading economic crisis organizations will renew and increase their budget for educational activities. It is evident that the prospects are rather optimistic and executives of private companies report on the intention to pursue this issue in an effective employee training. This opinion is also shared by the representatives of non-profit organizations.

There is also a change in an approach to how lacking knowledge or skills can be complemented. And this is precisely why it is not possible to claim that the topic of lifelong learning is already fully explored and theoretically researched. As was previously stated, lifelong learning is an enduring process, and it is to be hoped that each member of our society will have an insatiable need for further learning even after completing his or her formal education. These are the demands that are currently placed on individuals. The demands are not new; they have dramatically altered their appearance in the course of history or ever had to arise due to the transformation of society. The theme of lifelong learning is still current and dynamically evolving. Thus the Czech Republic's economic performance will be successful in international comparison and the competitiveness of the country will grow.

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MORAL FOUNDATIONS AND CARING CAPACITY IN BUSINESS EDUCATION

Marek Vich

Department of Managerial Psychology and Sociology, Faculty of Business Administration, University of Economics, Prague, Czech Republic, W. Churchill Sq. 4, Prague 3, 130 67, Czech Republic, marek.vich@malp.cz

Abstract

Escalating number of business scandals in the first decade of 21st century have called for more responsibility in business education and evidence shows business universities to have the significant role in shaping the moral attitudes and values of the students. This paper examines the relationship between moral foundations and caring capacity in order to provide more an exploration into moral equipment of business students in Czech Republic. Results (N = 66) showed significant positive effect of moral foundations (liberal and conservative) on active-empathic listening and partially significant positive effect on isolation and self-judgment. This study suggests that moral foundations to support caring focused on others, but also to have negative impact on self-focused caring. Therefore, it might be beneficial for local business education programs to include the development of self-focused caring methods (like self-compassion) into their curriculum in order to help their students to become more ethical and caring leaders.

Keywords

Business ethics, moral development, Moral Foundations Theory (MFT), self-compassion, responsible education

Introduction

Interest in moral aspects of business education has significantly increased after the revelation of the frauds and corruption of some American corporations like Enron or World Com, and even more intensified after the debacle of financial sector in 2008 (Treviño & Nelson, 2011). Recession in 2008 also inspired some authors to question not only the leadership of certain businesses, but also a way, how are the "future leaders" educated and shaped by contemporary business universities (Salaman, 2011). Some authors even claimed business education to be one of the main contributors to moral decay in business (Alimo-Metcalfe, 2013). Based on such criticism some business universities already implemented adopted various business ethics programs into their standard curriculum (Treviño & Nelson, 2011). Despite apparent progress in teaching of ethics is still not clear, whether growing application of traditional moral development methods (like moral discrimination) is a sufficient step towards higher responsibility in business education. Strong evidence shows that moral discrimination is in practice actually weakened and preceded by fast heuristic-type intuitions, which may trigger (despite one's good intentions) immoral actions (Haidt 2001; Gibbs, 2014). Therefore, every individual comes into moral development programs already pre-equipped with some culturally shaped setting of moral intuitions. Graham et al. (2011: 368) suggest moral intuitions to be closely related to moral foundations, defined as the "*five top candidates for being the psychological "foundations" upon which cultures construct their moralities."* Moral foundations are culturally obtained moral intuitions and values, which may trigger one's

actions without his/her conscious awareness. Another area related to moral intuitions is the capacity to give and receive care (caring capacity) (Gilbert & Choden, 2014) and its development is strongly influenced by one's early development (Bowlby, 1969).
This paper focuses on the examination of the relationship between moral foundations and caring capacity, more specifically between conservative moral foundations (CMF) and liberal moral foundations (LMF), and caring capacity focused both on others (others-focused caring) and self (self-focused caring). This study is perhaps the first to examine the moral foundations in our academic environment. Study on the sample of 66 business students was conducted to test the different effects of CMF and LMF on active-empathic listening (component of others-focused caring), isolation and self-judgment (components of self-focused caring). In material and methods, this paper presents theory background, related hypotheses, sample and employed measures. Paper then focuses on the presentation of the results followed by discussion.

Material and Methods

Moral foundations are formed by five groups: Harm/Care maps one's concern about non-harming others and his/her caring attitude towards others, Fairness/Reciprocity maps one's concern about fairness and justice in his/her environment, In-group/Loyalty maps one's loyalty for his/her community, Authority/Respect maps one's obedience to authorities and hierarchical order, and finally Purity/Sanctity maps one's allegiance to religious rules and supreme moral power, like God (Graham et al., 2011). Graham, Haidt & Nosek (2009) also suggest In-group/Loyalty, Authority/Respect and Purity/Sanctity to form the group of conservative moral foundations (CMF), and Harm/Care and Fairness/Reciprocity to form group of liberal moral foundations (LMF).
While moral foundations represent cultural representations of one's moral patterns, caring capacity (ability to give and receive care) represents one's openness, connection and ability to receive and give nourishment to both others and himself/herself (Gilbert & Choden, 2014). Gilbert & Choden (2014) further suggest every person to have the potential for caring capacity, although the fulfillment of this potential is highly dependent on one's early development (which is influenced also by one's culture) (Bowlby, 1969). Caring capacity plays role of intuitive factor in one's moral decision-making, meaning that caring individuals may recognize needs of others and are able to quite naturally act according to such recognition in almost every situation (Neff, 2011; Gilbert & Choden, 2014). This paper focuses on examination of active-empathic listening, defined *"as the active and emotional involvement of a listener during a given interaction — an involvement that is conscious on the part of the listener but is also perceived by the speaker (Bodie, 2011: 278)"* in order to access the element of external level of caring. Active-empathic listening focuses on one's ability to verbally and nonverbally relate to others in other to strengthen mutual relationship (Drollinger, Comer & Warrington, 2006). Distinct effects of both conservative and liberal moral foundations on active-empathic listening are examined with suggestion that both groups of moral foundations might predict higher caring towards others.
Hypothesis 1. Conservative moral foundations are positively related to active-empathic listening.
Hypothesis 2. Liberal moral foundations are positively related to active-empathic listening.
Ability to give and receive care can be also directed towards oneself. Self-focused caring is related to one's attitude towards his/her self, especially in difficult moments (Neff, 2011).

According to Neff (2003) does self-directed caring attitude stem from self-compassion, which entails *"being kind and understanding toward oneself in instances of pain or failure rather than being harshly self-critical; perceiving one's experiences as part of the larger human experience rather than seeing them as isolating; and holding painful thoughts and feelings in mindful awareness rather than over-identifying with them (Neff, 2003: 223)."* Graham et al. (2011) show that conservative moral foundations have mostly grouping tendencies, meaning that they guide individuals to put family, community and social (and sometimes also religious) rules on the first place (before the self). Despite the fact that moral systems seem to promote caring tendencies toward others, their effect on self-directed caring might be just the opposite. Individuals with high conservative morality might be highly critical towards themselves and feel isolated from others, as they obey the rules, which force them to suppress the individuality.

Hypothesis 3. Conservative moral foundations are positively related to isolation.

Hypothesis 4. Conservative moral foundations are positively related to self-judgment.

Liberal moral foundations, on the other hand, inspire individuals to express their individuality in moral decision-making (Graham et al., 2011). Such individuals might feel as their personal responsibility to non-harm the others and to treat them in caring and just way. Such approach might, therefore, help to weaken self-directed criticism and feelings of isolation, as such attitude seems to be less obligational, more opened and voluntary.

Hypothesis 4. Liberal moral foundations are negatively related to self-judgment.

Hypothesis 6. Liberal moral foundations are negatively related to isolation.

Sample

Sixty-six students of business administration and economics faculty of the University of Economics in Prague (Czech republic) were recruited as participants in the study. Forty-nine participants were recruited through local career advisory center and seventeen participants were recruited through the career development course. Participants (M age = 23.32, SD = 3.04) were 62.1 % female and 92.4 % Caucasian and 34.8 % reported previous managerial or entrepreneurship experience.

Measures

All questionnaires were translated from original English version to Czech language and translated back to English by an independent translator in order to access high quality of translation. Final versions of questionnaires were then created in accordance with one independent researcher and one translator.

Liberal and Conservative Moral Foundations. Moral Foundations Questionnaire (MFQ) is a 30-items scale, divided into 5 subscales of Harm/Care, Fairness/Reciprocity, In-group/Loyalty, Authority/Respect and Purity/Sanctity (Graham et al., 2011). Liberal moral foundations were accessed through subscales of Harm/Care and Fairness/Reciprocity, while conservative foundations were accessed through subscales of In-group/Loyalty, Authority/Respect and Purity/Sanctity. Participants responded by using 1 – 6 Likert scale (from 1-not at all relevant to 6-extremely relevant in first part of test and from 1-stronly disagree to 6-strongly agree in the second part of test). Level of Liberal and Conservative moral foundations was measured as a mean value from all answers.

Active-Empathic Listening. Level of active empathic listening was measured through Active-Empathic Listening Scale (AELS), the 11-item self-report scale, designed to measure the quality of empathic based listening in business settings (Bodie, 2011).

Participants responded by using 1 – 7 Likert scale (form 1-never or almost never true to 7-always or almost always true). Level of active-empathic listening was measured as a mean value from all answers.

Self-Compassion Subscales. Isolation (4 items) and Self-judgment (5 items) were accessed as the subscales of 26-item Self-Compassion Scale (Neff, 2003). Positive counterparts of Common Humanity and Self-Kindness were not included in the study as previous analysis did not proved any positive effect of both conservative and liberal moral foundations on any of those variables. Other subscales of Mindfulness and Over-Identification were not included in the study, as those focus more on one's mindfulness over his/her emotions and not his/her caring qualities. Participants responded by using 1 – 5 Likert scale (from 1-almost never to 5-almost always).

Reliability test showed Cronbach alpha.79 for CMF,.62 for LMF,.81 for active-empathic listening,.62 for isolation and.73 for self-judgment. Apart from hypothesized relationships the correlation analysis showed also highly significant relationship between isolation and self-judgment and significant relationship between CMF and LMF. However, those relations were not selected for further examination as they did not directly related to any of hypotheses. For more detailed data see Table 1.

Variables	M	SD	1	2	3	4	5
Moral Foundations							
1. CMF	2.76	.58	(.79)				
2. LMF	3.46	.49	.27*	(.62)			
Other-Focused Caring							
3. AEL	5.11	.72	.29*	.36**	(.81)		
Self-Focused Caring							
4. Isolation	3.10	.90	.22†	.23†	.20†	(.62)	
5. Self-Judgment	3.06	.81	.17	.22†	.12	.47**	(.73)

*Note. M = mean; SD = standard deviation; CMF = Conservative Moral Foundations; LMF = Liberal Moral Foundations; AEL = Active-empathic listening *p<.05, **p<.01, †p< 0.1*

Table 1: Means, Standard Deviation, Bivariate Correlations and Scale Reliabilities (N = 66)

Results

Series of linear regressions were used to examine the effect of CMF and LMF on active-empathic listening, isolation and self-judgment. Results showed highly significant relationship between LMF and active-empathic listening (β =.53, p <.01) and significant relationship between CMF and active-empathic listening (β =.37, p <.05). LMF was further partially significantly positively related to both isolation (β =.42, p < 0.1) and self-judgment (β =.36, p < 0.1), while CMF showed partially significant relationship with isolation (β =.34, p < 0.1) but not with self-judgment (β =.24, p =.18). For more detailed data see Table 2.

	CMF		LMF	
	β	*R2*	β	*R2*
AES	.37*	.09*	.53**	.13**
Isolation	.34†	.22†	.42†	.05†
Self-judgment	.24	.03	.36†	.05†

*Note. CMF = Conservative Moral Foundations; LMF = Liberal Moral Foundations; AES = Active-Empathic Listening; *p<.05, **p<.01, †p< 0.1*

Table 2: Standardized Regression Coefficients per relationship between Conservative & Liberal moral foundations and active-empathic listening, isolation and self-judgment

Discussion

A study on the sample of 66 Czech business university students was conducted to examine the positive effects of CMF and LMF on active-empathic listening (others-focused caring), isolation and self-judgment (both self-focused caring). Similarly to Graham et al. (2011), the results first of all showed that participants scored higher on LMF (M = 3.46) than on CMF (M = 2.76), which confirmed suggested tendency of western population to score higher on LMF. Results support both hypotheses H1 and H2, suggesting that both groups of moral foundations support the development of caring capacity focused on others. Highly significant positive effect between LMF and active-empathic listening also shows that more liberal and individualistic moralities seem to be even more significant factor in promotion others-focused caring. This paper also examined the effects of moral foundations on self-focused caring. In accordance with hypothesis H3, the CMF showed partially significant positive effect on isolation. This result suggests conservative moralities to be a contributing factor to one's feelings of isolation in society. Results showed positive but not significant tendency of CMF on self-judgment (thus H4 was not confirmed). Results from the effects of LMF are more surprising, as they did not confirmed the suggestion of negative effect of on isolation (H4) and self-judgment (H6). Similarly to CMF, the effects of LMF on both isolation and self-judgment are positive, suggesting that liberal morality even stronger effect on feelings of isolation in community than CMF. Partially significant positive effect on self-judgment also suggests, that liberal morality might contribute to inner self-criticism. Therefore, both hypotheses were not confirmed.

Results show that CMF and LMF promote caring attitude towards others, but also that both groups of moral foundations do more likely the opposite in the case of self-focused caring. These findings support assumption of Moral Foundations Theory (MOT) (Graham et al., 2011; Graham et al., 2013) about positive impact of moral foundations on cooperation among individuals. However, findings also suggest that moral foundations are not only sufficient for development of caring towards oneself, but that they might be the triggers of the feelings separations of society and harsh self-criticism. Responsible business educational programs might, therefore, consider support the development of self-focused caring capacities among its students through implementation of various programs like mindful self-compassion (MSC) program (Neff & Germer, 2013) or compassion focused therapy (CFT) (Gilbert & Choden, 2014).

One of the limitations of this study is low reliability of scales focused on LMF (.62) and isolation (.62). Although both scales have already been tested almost all around the world, they were originally designed of English speaking American population. Low reliability may be therefore accounted to both different Central European culture and possible difficulties with translation. However, other parts of the same questionnaires like CMF

or self-judgment showed a good reliability. In consideration with this data and it was decided that.62 is acceptable for the purposes of this study. Another limitation of this study may be represented by the fact that all measures were based on self-report scales (with possibility of self-reporting bias). It is, therefore, acknowledged that future studies might include other methods like peer-report scales, interviews or neuroimaging methods to further validate these initial results. Finally, this study examined effects of both CMF and LMF on one group. It is strongly recommended to future researchers to divide sample on CMF and LMF samples and compare those groups.

Conclusion

Growing need of responsibility in education highlights the essential role of moral development in managerial and business class programs, and also raises some concerns about efficiency of tradition methods of teaching ethics. One of these concerns points to the question of how can contemporary and future leaders learn to cooperate more smoothly with their moral intuitions, as these intuitions seem to determine moral decisions more significantly than any other factors. To contribute to this examination this study focused on the relationship between culturally developed conservative and liberal moral foundations, and personally developed caring capacity. Findings show that both conservative and liberal moral foundations are significantly positively related to others-focused caring capacity and are partially significantly negatively related to self-focused caring capacity (more specifically they are positively related to negative aspects of self-focused caring capacity). These findings suggest individuals who score high on both groups of moral foundations to be culturally pre-equipped to receive and give care others, but also to feel isolation in society and be highly critical towards themselves. Moral development programs might consider those findings, as they show that business students seem to lack developed self-focused caring capacity. Recommendation of this study for moral development programs is therefore to include development of self-focused compassion and kindness into their curriculum. Such individuals may be able to produce and maintain (especially in harsh times) the inner safety, which may be crucial for acting morally in critical situations.

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TEACHER AT THE START OF HIS CAREER AND HIS PERSONAL NEEDS

[1]✉Miluse Viteckova, [2]Miroslav Prochazka, [3]Zdenka Gadusova, [4]Eva Stranovska

[1]Department of Pedagogy and Psychology, Faculty of Education, University of South Bohemia, Jeronýmova 10, České Budějovice, 375 15, Czech Republic, +420 387 773 211, mviteckova@pf.jcu.cz

[2]Department of Pedagogy and Psychology, Faculty of Education, University of South Bohemia, Czech Republic

[3]Department of English and American Studies, Faculty of Arts, Constantine the Philosopher University in Nitra, Slovakia

[4]Department of Germanistics, Faculty of Arts, Constantine the Philosopher University in Nitra, Slovakia

Abstract

The paper is based on the results of two Czech and Slovak research projects carried out in the years 2012-2015. The first project was focused on the role of mentor teacher - *Key Competences of Mentors Necessary for Successful Mentoring of Novice Teachers* (VEGA 1/0677/12). The second project specified the needs of novice teachers - *Personal and professional competences of novice teachers* (MOBILITY 7AMB14SK046, APVV CZ-SK-2013-0192). The research sample within the joint research was formed, in the first case, by 148 Czech novice teachers and 132 of Slovak ones. The second research is not completed; currently we have at our disposal 136 questionnaires filled in by Czech novice teachers and 121 by Slovak ones. The aim of this paper is, in this case on the basis of quantitative data, to point to personal needs, perceived by teachers during their induction phase and the first years of school practice.

Keywords

Novice teacher, personal needs, university teacher education, practice

Introduction

First years at school load a heavy burden on novice teachers, and to a large extent they may affect their decision to stay in the profession or not. Novice teachers face not only new situation with students, but become part of the teaching staff. They have to cope both with professional demands, as well as purely administrative tasks. It often is not the exception that in their first year at school they become class teachers, administrators of a repository, heads of interest groups and so on. The start of teaching at school is a kind of a milestone in the teaching career which begins in the period of undergraduate training and can continue as a long-time teaching work. In this crucial period the results of university studies, professional preparedness and teacher's personality increasingly encounter.

If we were to characterize teaching profession, we would not rely only on its qualifications, but also on the concept of "educational competence" which, according to Průcha (2002: 32), is not only something what is acquired in the process of studying and training, but it also comprises how the worker is personally equipped to perform the activities of a teacher. Educational competence is not represented only by knowledge and skills learned during professional training. It also includes those traits which are embedded in

the personality of the teacher as congenital or acquired features. The actual profession is, according to Walterová (2001), understood as a complex of professional interdisciplinary knowledge. It combines the ability to use the specific professional preparedness while respecting pedagogical and psychological approaches, which include a significant emphasis on ethical and moral qualities of a teacher.

In connection with characterizing the teaching profession and our chosen topic, it is important to mention the notion of competence. In the Czech educational terminology this term is not well defined. In the Anglo-Saxon tradition it has two equivalents: *competence* and *competency*. The difference in their meaning is crucial: the term *competence* is used in association with competent performance in a specific situational context, i.e. it expresses ability, informal qualification. The notion of *competency* then refers to a set of human qualities that are necessary for competent performance. It tells whether and to what extent an individual can handle a certain situation with regard to optimal and expected results. *Competency* is the sum of knowledge, skills, habits, attitudes and values, which in certain situation allow competent performance (Průcha and Veteška, 2014). Generally speaking, it is possible to say that competencies represent a special ability, readiness to perform certain activities, to succeed in a particular profession. Concisely it is explained by Palán (2002: 99) who says that competencies of workers are expressed through the description of their knowledge, abilities, personality traits, attitudes, skills and experiences. Švec (2000) states that teaching competence is the potential of an individual which synchronizes three basic components: behavior, experience, cognition. He places the term competence above the term skill; he perceives this term as substantially wider, regardless of the fact that in common practice both the terms are often used interchangeably. Very important is also the finding (Průcha, Mareš and Walterová, 2003) that the professional competencies relate not only to the content of the profession (knowledge of the content matter of training courses), but today even to communication, control, diagnostic, self-evaluation and other areas of the educational work. Pedagogical dictionary (Průcha, Mareš and Walterová, 2003: 103-104) defines teacher competencies as *a set of professional skills and dispositions* the teacher should be equipped with to be able to effectively perform their profession. These competencies are, according to the authors of the dictionary, mainly personal and professional competencies. Personal competencies include responsibility, creativity, problem-solving ability, team work, being socially perceptive and reflective.

Formation of novice teacher personality relates, or mingles with the personality and professional needs. At the time, when an individual wants to develop further, they consider their unmet needs. However, novice teachers do not always accurately identify their needs, particularly as regards personal needs. Personal dimension is closely connected with the development of teacher's identity in their new role, the growth of social and organizational skills, positive self-esteem, self-confidence, confidence, communication skills etc. In shaping teacher's personality their emotions, perception, motivation, attitudes play an important role. When it comes to shaping the social and personal skills, i.e. the continuation of personal growth and development after finishing university studies, novice teacher needs to have their personality needs saturated. Just as different needs of teachers cannot be separated one from another, neither different personality characteristics, which reflect in different needs, can be separated.

It should also be noted that we perceive coexistence, blending of professional and personal competences, in the same way as the personal and professional needs (what is also based on another of our researches related to corporate training of instructors - see Procházka and Vítečková, 2015).

The paper is based on the foregoing considerations and it presents the results which relate to personality needs of novice teachers. It answers the question: What does a teacher at the outset of their career need? More specifically: What are their personal needs?

Materials and Methods

The presented results are based on the research conducted within the project *Personal and Professional Competences of Novice Teachers* (MOBILITY 7AMB14SK046, APVV CZ - SK - 2013-0192). At the same time they are also based on partial results of the research project *Key Competences of Mentors Necessary for Successful Mentoring of Novice Teachers* (VEGA 1/0677/12) that preceded the former one. The Czech and Slovak VEGA project was carried out in the years 2012-2014, the MOBILITY project, targeted directly at the needs of novice teachers, in the years 2014 - 2015. In both cases it was a mixed research. Below only the results based on questionnaire survey are presented. The research sample consisted of various subject teachers at all levels of school education. Most respondents, however, were teachers from the lower secondary schools (though, in the case of MOBILITY project, in the Czech Republic 52.6 % of primary school teachers participated in the research). The sample was limited only by duration of their teaching practice at schools, from one year to five years (as novice teachers are considered to be teachers with up to five-year teaching experience, the length of their service, as well as their age were not the independent variables). In the Czech Republic the data from 136 novice teachers and in Slovakia from 121 of them were processed (MOBILITY, APVV) – out of the novices 87.5% were women and 12.5% men in the Czech Republic, and in the Slovak Republic 95 % of women and 5 % of men. The data were collected using a structured questionnaire of our own design. The questionnaires of both surveys were divided - except for factual information and the motives for choosing the profession, into three main areas: the reflection of the undergone higher education (perception of preparedness for practical execution of the job), problems in the induction phase of teaching at school and the needs of teachers. The questionnaire VEGA included also questions related to mentoring and mentors. Statements and response options related to the partial results presented in this article are listed directly in the Results section below. Ours was a modified questionnaire which originally was used for the purposes of the above mentioned project VEGA (here the research sample was formed out of 148 novice teachers in the Czech Republic, and 132 in the Slovak Republic - out of these it was 82.4% of females and 17.6% of males in the Czech Republic and in Slovakia 84.09 % of women and 15.91 % of men. But the new version of the questionnaire was extended so that the part identifying the needs of novice teachers could split the identified needs into professional and personal. This way there was an increased range of responses (MOBILITY, APVV). Data were and are assessed using the SPSS program. In this paper, however, we work only with partial results that are presented using relative frequencies, and thus it is only the description.

Results

The structure of the questionnaire in the two projects can be divided into three areas - reflection on higher education training, problems perceived by novice teacher and the needs related to them.

In the Results only partial achievements of the project *Personal and Professional Competences of Novice Teachers* (MOBILITY 7AMB14SK046, APVV CZ - SK - 2013-0192) are presented which identify personal needs of novice teachers. The results are shown in the context with the previous data, identified within the project *Key Competences*

of Mentors Necessary for Successful Mentoring of Novice Teachers (VEGA 1/0677/12).
In the project VEGA 1/0677/12 (2012-2014) the question aimed at the identification of novice teachers' needs (What do I need as a novice teacher?) offered three response options - I need it: "urgently", "to some extent", "not at all". If we determined the order of the needs importance, i.e. with the greatest frequency in the option "urgently", then the order of the novice teachers' needs in the two countries would be as follows – see Table 1:

Needs of novice teachers	Resulting serial item number	
	The Czech Republic	The Slovak Republic
Emotional support of relatives, friends and colleagues	1	1
Acquisition of self-confidence and self-assurance	2	3
Development of organizational skills	3	2
Improvement of communication skills	4	4
Improvement of interpersonal skills	5	5

Table 1: Order of the importance of novice teachers' needs (1 = most frequently stated)

More about the project and its results can be found in the publications Vítečková and Gadušová, 2014a; Vítečková and Gadušová, 2014b, Vítečková, Gadušová and Garabiková-Pártlová, 2014; Vítečková and Gadušová, 2015.
In the questionnaire survey of the project *Personal and Professional Competences of Novice Teachers* (MOBILITY 7AMB14SK046, APVV CZ - SK - 2013-0192) there were among the response options for the same question as in the project VEGA offered the following ones: "urgent", "to a greater extent", " to a lesser extent" and "not at all". Considering the fact that this research, or better to say the questionnaire (compared to the previous one), was directly aimed at identifying the needs of novice teachers, a wider range of possibilities for expression of needs was offered. If we determined the order of the urgency of the listed needs, just like we did it in the previous survey, then we would come to the following results:

<u>The Czech Republic</u>

1. improve the ability to solve difficult, stressful situations (stress, conflict, and so on);
2. develop the ability to motivate students;
3. improve the ability of creativity;
4. build self-confidence and self-assurance;
5. receive emotional support from family members, friends and colleagues;
6. develop organizational skills;
7. improve interpersonal skills (cooperation, assertiveness, empathy, social perception, and so on);
8. improve communication skills;
9. develop the self-representation ability.

<u>Slovak Republic</u>

1. improve the ability to solve difficult, stressful situations (stress, conflict, and so on);
2. receive emotional support from family members, friends and colleagues;
3. develop the ability to motivate students;
4. improve the ability of creativity;
5. develop the self-representation ability;

6. improve communication skills;
7. develop organizational skills;
8. build self-confidence and self-assurance;
9. improve interpersonal skills (cooperation, assertiveness, empathy, social perception, and so on);

Note: if there are two needs stated at the same level, then the order is presented according to the frequency found in the option "to a greater extent".

From the presented results it is very interesting to state that in the Czech Republic more respondents chose the option "urgent" and "not at all". Czech respondents had more clear idea about the need compared to Slovak ones, who referred more often to options "to a greater extent ", " to a lesser extent ". Furthermore, it is interesting that despite the common history of both countries the order of the needs is different.

The Table 2 and 3 give specific relative frequencies determined in the questionnaire survey.

I need…	urgently	to a greater extent	to a lesser extent	not at all
build self-confidence and self-assurance	8,1	19,1	36,0	36,8
develop organizational skills	6,6	21,3	44,9	27,2
improve communication skills	4,4	27,9	40,4	27,2
improve interpersonal skills (cooperation, assertiveness, empathy, social perception, and so on);	5,1	20,6	47,8	26,5
receive emotional support from family members, friends and colleagues;	6,6	23,5	38,2	31,6
develop the self-representation ability	2,2	27,9	44,1	25,7
develop the ability to motivate students	11,8	33,8	39,7	14,7
improve the ability to solve difficult, stressful situations (stress, conflict, and so on);	16,9	44,9	27,9	10,3
improve the ability of creativity	8,1	25,0	47,1	19,9

Table 2: Personal needs perceived by novice teachers in the Czech Republic (The data are presented in the relative frequencies f_i=100, n_i=136)

I need…	urgently	to a greater extent	to a lesser extent	not at all
build self-confidence and self-assurance	2,5	35,5	58,7	3,3
develop organizational skills	2,5	48,8	37,2	11,6
improve communication skills	2,5	48,8	38,0	10,7
improve interpersonal skills (cooperation, assertiveness, empathy, social perception, and so on);	0,0	26,4	57,0	16,5
receive emotional support from family members, friends and colleagues;	7,4	43,8	43,0	5,8
develop the self-representation ability	2,5	48,8	46,3	2,5
develop the ability to motivate students	5,8	46,3	43,8	4,1
improve the ability to solve difficult, stressful situations (stress, conflict, and so on);	20,7	39,7	38,0	1,7
improve the ability of creativity	5,8	41,3	37,2	15,7

Table 3: Personal needs perceived by novice teachers in the Slovak Republic (The data are presented in the relative frequencies f_i=100, n_i=121)

Discussion

Based on different research surveys (Blatný, 2001; Blatný, Urbánek and Osecká, 2008; Stranovská, 2009; and others) perception of the self-value seems to be the key phenomenon. The teacher evaluates themselves differently. Time and different situations can influence changes in their self-ratings. The functioning of the self-image is related to the efficiency of other personality structures, mental functions and personality needs. The positive evaluation of oneself, according to Blatný (2001), Blatný, Urbánek and Osecká (2008), is one of the main preconditions of inner, or intellectual satisfaction. The need for positive self-esteem plays, then, a supporting role in creating and maintaining interpersonal engagement of teacher with pupils, colleagues, superiors, and ultimately with parents. In the self-assessment internal and external sources are also reflected.

Bar-Tal et al. (1994, 1999, 2002) in their research showed that there are some differences in how we make decisions under conditions of uncertainty. Uncertain situations, in this case the situation of novice teachers conditioned by uncertainty (teaching, documentation, communication with parents, students, colleagues, superiors, etc.), are usually dealt with in different ways.

The need for a positive self-assessment influences the need for self-esteem and confidence. These needs are closely interrelated and influence each other. In their research Bar-Tal et al. (1994, 1999, and 2002) showed that there were some differences in how we make decisions under conditions of uncertainty. Uncertain situations, in this case the situation of novice teachers conditioned by uncertainty (as for example, hilling the tasks arising from the demands on teaching, administration, communication with parents, students, colleagues, superiors, and so on), are addressed by teachers in different ways. In this connection one should consider also the phenomenon of defense mechanisms, such as an escape, identification, fixation, regression, resignation which also may discover other defense mechanisms such as aggressiveness, submission (shyness, self-pity), projection (the individual protects themselves from their own failure by attaching it to others) (Stranovská, 2009, 2011; Stranovská and Munková, 2014). In our research, we can see the relationship of the need for a positive self-esteem with the level of emotional uncertainties of a novice teacher. Our respondents consistently called for strengthening their ability to solve problems, tensions and conflicts. Conflict with pupils, parents, colleagues, is a source of uncertainty and tension for them. They believe that only teacher who is self-confident and able to defend the procedures and processes initiated in the educational process can cope with stressful situations.

Based on the research results the discrepancy between the needs of Slovak and Czech teachers in peer support resonates in a special way. Slovak teachers strongly feel the need for emotional support from close persons (51.2 % of Slovak respondents compared to 30.1 % of respondents from the Czech Republic). The differences are surprising also because in the first research study this need was identically listed by respondents from both countries in the first place.

Learning style, questioning, interviewing, discussion, and some other phenomena are affected by communication skills of a teacher. Many researches and special scientific works (Čáp and Mareš, 2001; Kasáčová, 2004; Mikuláštík, 2005; Roche, 2013; Vincejová, 2014, Günzel, Binterová and Suchopárová, 2015 and others) suggest that these skills play an important role, especially at first contact of teacher with pupils, in creating positive atmosphere and climate in the classroom, in connection with promoting activities of students, and so on. Our respondents perceive communication with students as less significant. However, in our opinion, the most important area, namely the need to

cope with difficult and stressful situations, is closely related to communication. In further investigations and research, it would be interesting to observe to what extent novice teachers recognize the relationship between coping with conflicts and communication skills.

From a behavioral perspective the concept of interpersonal and social skills is based on the assumption that identifiable specific skills form the basis for a broader socially competent behavior (Stranovská, 2009). From a number of characteristics and definitions of these skills (Páleník, 1995; Výrost, 2002; Popelková, 2000; Popelková and Zaťková, 2007; Lisá, 2007 and others) it is possible to highlight two aspects: effectiveness (personal dimension, movement towards individual profit) and adaptability (social dimension, movement towards altruism). Gresham (1990 in Gajdošová, 1995) identifies five components of interpersonal skills: cooperation (teacher helps students in collaboration with their peers), assertiveness (teacher guides pupils towards appropriate ways of self-promotion in relation to classmates, teachers and other adults), responsibility (discipleship responsibility), empathy (development of the ability to listen to others and sympathize with others) and self-control (directing students to manage their behaviour and develop appropriate responses in conflict situations).

In both countries these skills appeared among the last in the imaginary list of personal needs, but in some questionnaires there were some comments next to them, as for example: *Empathy cannot be improved*. The question therefore remains whether the individual sees his personal qualities as immutable, or whether he is willing to admit that in connection with the gained experience, they can change. Some respondents, therefore, see this area as a given one, without the need to change anything.

Conclusion

In our research we came to a similar conclusion, which Starý et al. (2012) states on the basis of interviews with head teachers and Hockicková and Žilová (2015) state on the basis of questionnaire research with mentor teachers that novice teachers are better prepared in the subject matter they teach, but are not ready for functioning in everyday school life. In this respect they act uncertainly, lack self-confidence, and are helpless. Furthermore, they experience difficulties and troubles to manage class and class discipline.

The research results confirm that the ability to solve difficult and stressful situations and the ability to motivate the students belong to the most important areas in which teachers identified their personal needs. From the results we feel needs orientation, in which the teachers express relationship to others. Less significant, perhaps unconscious, remain the needs related to the individual themselves. Orientation on the other, on coping with others, is a potential area for forgetting self, their inner needs, which give teachers the strength from themselves, from their awareness of self-consciousness. This question is then connected to the key issue of teacher's authority. Pešková (2005: 129) notes that the real authority has only the one who is able to become the "author" of their own life, sense of life, qualification. Through fulfilling of their inner personality needs also novice teacher, as the "author" of their profession, is becoming someone who is able to see and change things around, form and transform givens.

International comparative research TALIS (2013) presented evidence collected from head teachers, who admitted that in 62 % of cases in the school they do not have a special programme for the induction and training of novice teachers. Although teachers admit to participation in some informal training activities, they are rather an introduction to various forms of the organizational life of the school. For the development and support

of a teacher's personality it would be significant to introduce personal coaching and mentoring, but in Czech schools, for example, hardly one third of teachers have ever had a mentor.

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INTERNATIONAL ECO-SCHOOL PROGRAM IN SERBIA AS A MEAN OF INTEGRATION OF TEACHERS AND STUDENTS IN THE PROCESS OF EDUCATION FOR SUSTAINABLE DEVELOPMENT

[1]Radovan Vladisavljevic, [2]✉Dragan Solesa, [3]Ivan Stanisavljevic

[1]The Faculty of Economics and Engineering Management, University of Business Academy of Novi Sad, Serbia

[2]The Faculty of Economics and Engineering Management, University of Business Academy of Novi Sad, Vuk Karadzic 8, Novi Sad, 21000, Serbia, +38 121 425 944, solesadragan@gmail.com

[3]The Faculty of Economics and Engineering Management, University of Business Academy of Novi Sad, Serbia

Abstract

The scope of this paper is the introduction of model based on empirical research in schools in Serbia. The experience with the program Eco-school in Serbia shows that the existence of a powerful integrator in the form of the program may lead to a higher degree of integration of the participants. International Eco-school program has proven to be a powerful tool for drawing attention to the issue of education for sustainable development and the inclusion of a large number of internal and external stakeholders. The program next to the role of an integrator serves as a mean for penetrating organizational barriers. The cooperation that is achieved with the help of the program leads to the creation of new value for Institutions that are directly involved in the program and all other stakeholders who contribute to the development of the program.

Keywords

International Eco Schools program, education for sustainable development, students, teachers, education system

Introduction

Through this paper we are going to present the experience with program Eco-school in the educational system of the Republic of Serbia with a special emphasis on the integrative function of the program. This program has multiple dimensions and involves far more stakeholders then students and teachers, but for the purposes of this paper, we will focus exclusively on the student-teacher relationship. The program Eco-school is of holistic nature, it allows great freedom to all participants in creation of projects related to ecology and sustainable development.

Program Eco-school is entered in education system of Serbia in 2005. Today it gathered more than frothy school various education level. Logic of program Eko-school is: "Education should include critical understanding of the impact of science on society. Therefore, it is important to systematically include environmental issues in class work" (Krnel and Naglič, 2009, 17).

The power behind program Eco-school is in flexibility, "the development of sustainability conceived as a frame of mind highlights the importance of those aspects of education which are not part of the formal taught curriculum" (Bonnett, 2013, 12). Program offers

projects and other activities for students and teachers to collaborate, program Eco-school is only there to facilitate the management of projects.

Education for sustainable development

Education becomes the central theme in sustainable development. "Education for Sustainable Development allows every human being to acquire the knowledge, skills, attitudes and values necessary to shape a sustainable future" (UNESCO, 2014). Education is considered as a key element in achieving harmony between the needs of society, economy and nature.

Achieving sustainable development is an ongoing effort that involves the active participation of a large number of people and organizations. Ideas and experiences related to sustainable development play the major role. Therefore, representatives of industry, science and society branches must cooperate. Without common goals this task is virtually impossible. The education is the core area of sustainable development, through which knowledge and experiences are shared, so it is easier to create common goals that are acceptable to everyone. It also creates a common language that leads to the understanding of the issues of sustainable development.

"Policies that foster education, knowledge, creativity and skills and create conditions for interactions between various stakeholders generate know-how, which fosters sustainable innovations development" (Krozer, 2016, 184). There are always problems with inclusion of great number of people, especially when they come from different segments of society and professions. Every profession has its own paradigm, symbols and language. Bridging this gap is of great importance for achieving a higher level of sustainability.

The negative impact of developments in technology and increasing population is creating the new specific market conditions. "In the coming decades, engineers will be expected to retrofit, redesign and innovate new products and services that meet rapidly increasing environmental and social criteria" (Desha and Hagroves, 2014, 33). It is no longer enough just to create a new product, today the products must be in the function of sustainability. The concept of sustainability must be adopted even during the study; this applies to all levels of study, and to all professions. "Environmental governance innovation refers to all new and applied institutional and organizational solutions for resolving conflicts over environmental resources" (Carrillo-Hermosilla, González, Könnölä, 2009, 21).

The negative trend of environmental pollution could be prevented. „Eco systems can undergo successions, and be periodically rejuvenated" (Rolston, 2012, 160). However, many of the actions are limited by behavior of people, "…it is important to question behavior with regard to perceived options that may be limited due to education, professional training, group pressure…" (Bizer, Führ, 2016, 282). According to this, education is an important factor for sustainable development.

Student-teacher system

Teacher`s job has become more complex than ever before and demands high level of commitment. "Teaching is a messy business, full of guesswork and intuition…" (Riley, 2011, 109). Teaching is constantly changing and requires lifelong learning. New generations of students, technologies and learning equipment make professorship extremely dynamic. In order to approach more easily to students, teachers must constantly monitor preferences of new generations and the requirements of society. In the past, the educational system could be isolated from the rest of society, but it is no longer possible. "However, the messiness is not easily documented, it is learned experientially, and this

seems to have troubled many politicians and the educational bureaucrats who serve them" (Riley, 2011, 109). It is getting harder to codify knowledge and experiences that are accumulated in the process of education. Teachers must constantly adjust to the new requirements of formal and informal character.

On the other hand, students have access to a large amount of information and knowledge. Interactive technologies are greatly enhancing learning, but the role of the teacher is still important in the educational process.

In the educational system student - teacher relationship is dominant, but it is also very vulnerable. This relationship could be easily violated and it is hard to build, but system student teacher still gives us the best results. The relationship student - teacher becomes one of the most important topics in the educational science. A lifelong education of teachers becomes very important for them in order to increase integration in the educational system. "In the new educational environment with integration of ICT into subject teaching the learning of students gets a new dimension" (Shopova, 2014, 31).

Eco-school in the Republic of Serbia

Unfortunately, the process of education is still very isolated from rest of the society. "Education on its own, however, is no guarantor of success in achieving the goal of 'Sustainable Development' and an intermediary is needed in the form of gainful employment which provides livelihoods and therefore accesses to the material goods which are so essential for modern living" (Teng, 2012, 6). The curriculum in the formal process of education is changing too slowly, in the rapidly changing world; education is still slow to change.

In order to achieve the goals of education for sustainable development it is necessary to engage many actors in the process of education, particularly students. "High involvement of students and much public appreciation indicate that such events also generate educational spin-off entailing capacity building for innovative spur in the future" (Krozer, 2016, 57). The integration within the educational system can lead to the creation of new opportunities for work and learning of all in the process of education.

In practice, the program Eco-school turned out to be good integrator. Program alone is of holistic nature developed and supported by United Nations. The program includes representatives of the local community and allows the possibility of cooperation with foreign schools.

"Programming initiatives are in particular focused to multisectoral and intersectoral cooperation to fulfill goals (Environment Ambassadors for Sustainable Development, 2016):

Development of mutual cooperation and cooperation with relevant international organizations of the same and similar professions; Development of all forms of successful cooperation with other professional organizations and associations in the interest of its members; Initiating and support of those activities and initiatives aimed at preserving the environment and spatial planning,…; Cooperation with relevant scientific, professional, economic and other organizations and bodies on the implementation of tasks of common interest; Affirmation and protection of fundamental values, interest and positions of sustainable development and environment..."

The adoption of the objectives of the Eco-school program, educational institutions receive the framework in which they can work. The framework of the Eco-school program is very flexible "it guides schools on their sustainability journey by providing a simple framework for them to adopt and rewards those that are successful with the prestigious Green Flag"

(World Wildlife Fund, 2016). The framework provided by the Eco-school program allows great freedom in the selection of projects that is the best for students and teachers.
The program Eco-school has included more than frothy schools in the Republic of Serbia so far. Unfortunately, the representation of higher education institutions is still minimal. However, institutions at lower levels of education have entered the program in greater number.

Research methods

For the purposes of this paper, we used a questionnaire that reveals the degree of participation of teachers and students in the Eco-school program. Two questions are focused on preferences of students and the other two are investigating the preferences of teachers towards the Eco-school program. As an independent variable, we have taken the level of education in which subjects are involved. For the processing of data, we shall use Kruskal-Wallis test to determine if there are any differences in the acceptance of Eco-schools in relation to the Education level they come from respondents. The level of education is important because the Republic of Serbia`s laws and regulations and governing the work of different institutions at different levels of education.
The research results will help us to create a model of integration at the student-teacher level. This model can be a guiding principle for the future strategies of education and inclusion of the Institution in the Eco-school program or similar programs. It is expected that we will prove through this research that the Eco-school program is an important integrator between students and teaches.
We have questioned employees in educational institutions that joined the Eco-schools program throughout the Republic of Serbia. Our goal was to get the opinion of those who are directly or indirectly related to the Eco-school program. By the term directly related to the program are those who are given the task of program managers. The respondents that are indirectly related to the Eco-school program are usually decision makers, such as directors, deputy directors and likewise. It is expected that this group of respondents is the most knowledgeable about the functioning of the Eco-schools in their communities.
We have had 42 participants from different institutions in relative to the level of education. There have been 8 (19%) respondents who have come from preschool, 24 (57,1%) respondents from elementary school, 7 (16,7%) from secondary schools, while the least respondents have come from high or higher education fields 3 (7,1%).
For the purpose of the paper, we have had four questions posed in the form of statements where respondents have given us their opinion on five-point scale. The first question relates to the awareness of personnel in the institution towards the program, the question is: *Everyone in the school is aware of the purpose of the implementation of the Eco-school activities*? The second question relates to the behavior of employees in Institution, the question is: *All employees behave according to the principles of eco-school*? The third question is about student's engagement, the question is: *Students actively participate in the activities of the Eco-School*? The fourth and final question relates to the initiative of the students in relation to the Eco-school program, the question is: *Students independently run activities that can be linked with the Eco-School*?
The answers to the first question/statement, which is: *Everyone in the school are aware of the purpose of the implementation of the Eco-school activities* have been the following: *strongly agree* - 25 (59,5%) responses, *agree* - 13 (31%) responses and finally *undecided* (neither agree nor disagree) - 4 (9,5%) responses. The answers to the second question/ statement which is: *All employees behave according to the principles of Eco-schools*,

have been the following: most responses are *strongly agree* 11 (26,2%), respondents have answered *agree* 18 (42,9%) and *neither agree nor disagree* 9 (21,4%), *disagree* 4 (4,5%). The answers to the third question/statement, which is: *Students actively participate in the activities of the Eco-schools*, have been the following: most responses are *strongly agree* 21 (50%), 17 (40,5%) *agree* answers and 4 (9,5%) *undecided* responses (neither agree nor disagree).The results of the fourth question/statement, which is: *Students independently run activities that can be linked with Eco-school*, have been the following: the highest responses are *agree* 17 (40,5%), the number of *undecided* responses is 13 (31%), the number of respondents who answered *strongly agree* 9 (21,4%) and in the end there are 3 (7,1%) of the respondents who answered *disagree*.

In the next part of the paper, we will use non-parametric Kruskal-Wallis test, this statistical analysis will identify the differences between schools of different levels of education. In this way we will identify the weak points of our model. We will use the four research questions to find out any discrepancies between the questions and level of education the respondents engaged (Table 1 and Table 2).

The first research question: Is there statistically significant difference between the question "*everyone in the school are aware of the purpose of the implementation of the Eco-school activities"* and level of education?

The second research question: Is there statistically significant difference between the question "*all employees behave according to the principles of Eco-schools"* and level of education?

The third research question: Is there statistically significant difference between the question "*students actively participate in the activities of the Eco-schools"* and level of education?

The fourth research question: Is there statistically significant difference between the question "*students independently run activities that can be linked with Eco-school"* and level of education?

	Type of institution	N	Mean Rank
Everyone in the school are aware of the purpose of the implementation of the Eco-school activities	pre-school	8	26,56
	School	24	17,06
	high school	7	27,29
	Higher	3	30,00
	Total	42	
All employees behave according to the principles of Eco-schools	pre-school	8	29,88
	School	24	17,04
	high school	7	28,71
	Higher	3	18,00
	Total	42	
Students actively participate in the activities of the Eco-schools	pre-school	8	25,94
	School	24	19,25
	high school	7	29,29
	Higher	3	9,50
	Total	42	
Students independently run activities that can be linked with Eco-school	pre-school	8	20,50
	School	24	20,25
	high school	7	28,71
	Higher	3	17,33
	Total	42	

Table 1: Kruskal-Wallis test (Ranks)

	Everyone in the school are aware of the purpose of the implementation of the Eco-school activities	All employees behave according to the principles of Eco-schools	Students actively participate in the activities of the Eco-schools	Students independently run activities that can be linked with Eco-school
Chi-Square	9,881	10,707	9,333	3,432
Df	3	3	3	3
Asymp. Sig.	,020	,013	,025	,330

Table 2: Test Statistics[a,b]

a. Kruskal Wallis Test

b. Grouping Variable: Type of institution

Results

Kruskal-Wallis test revealed a statistically significant difference in question: Everyone in the school are aware of the purpose of the implementation of the Eco-school activities (pre-school; n=8, school; n=24, high school; n=7, higher; n=3), c2 (3, n=42) =9,88, p = 0,020, All employees behave according to the principles of Eco-schools (pre-school; n=8, school; n=24, high school; n=7, higher; n=3), c2 (3, n=42) =10,707, p = 0,013, Students actively participate in the activities of the Eco-schools (pre-school; n=8, school; n=24, high school; n=7, higher; n=3), c2 (3, n=42) =9,33, p = 0,025.

We found statistically significant differences in the first three questions however we did not found which groups is statistically significant. For this, we use Mann-Whitney U test, we tested each of the questions compared to couples that determine based on an independent variable level of education. The independent variable has four categories, so we did three analyzes. In the first round, we had to compere institutions of preschool

and elementary school type, then elementary school and secondary school, and in the end, we compared the pre-school and secondary institutions. The fourth category was not tested due to the small number of institutions that participated in the research. In the first analysis, we found a statistically significant difference between pre-school and elementary schools in relation to the question: All employees behave according to the principles of Eco-schools, $z = -2{,}548$; $p < 0.5$. Institutions of elementary type have an average rank of 14.17, while preschools have rang 23,50. In the third analysis, we found a statistically significant difference between the elementary and secondary schools in relation to all three questions. For questions: Everyone in the school are aware of the purpose of the implementation of the Eco-school activities, $z = -2{,}201$; $p < 0.5$. Institutions of elementary type have an average rank of 14.20, while secondary schools have the rank of 22.00. For question: All employees behave according to the principles of Eco-schools, $z = -2{,}382$; $p < 0.5$. Institutions of elementary type have an average rank of 14.20, while secondary schools have the rank of 22.79. For question: Students actively participate in the activities of the Eco-schools, $z = -2{,}199$; $p < 0.5$. Institutions of elementary type have an average rank of 14.27, while secondary schools have the rank of 21.93.

Discussion

Based on the research results we can formulate answers to research questions. In the first three questions can the answer is positive and it is that there is statistical significance between the level of education and asked questions. Only in the fourth question, we can determine that there is no statistical significance between levels of education and the question. Based on the research, we can begin forming our model (Figure 1).

Implementation of the new model is considered the innovation in the school system, but any innovation in education must be carefully implemented. “During the adoption of new innovations it is important to take in consideration a mix of innovations and do not separate single innovations from the whole environment.” (Flégl, Tichá, Kvasničková Stanislavská, 2013, 266).

In the center of the model is Eco-Schools program as an integrator for students, teachers, local communities and the governing body of the program (committee of Eco-school). The focus of the model is in the relationship between teachers and students, the program should impact the course of entire formal education. Through the Eco-Schools program educational system is improving by the idea of sustainable development and cooperation with the other educational institutions and the local community.

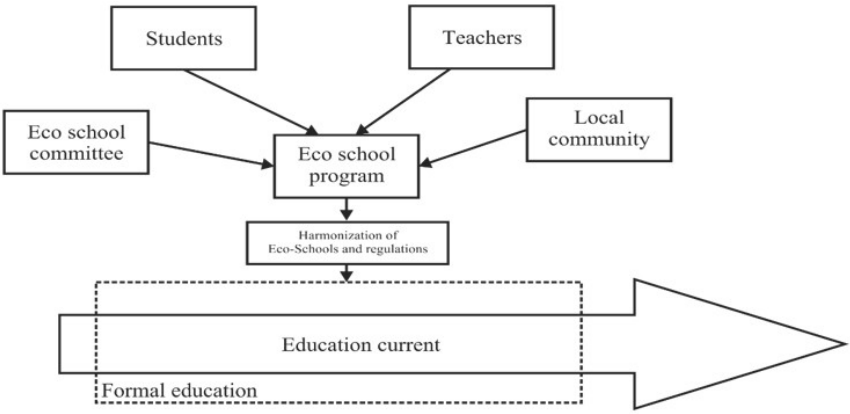

Figure 1: Model integration of students and teachers using the Eco-schools program

Conclusion

The model is based on research and experience gathered over the years working on the implementation and management the program Eco-school. The program is supported by relevant international organizations such as the UN, so thanks to this, the program has strong support in various spheres of society. With the inclusion of new schools to the program experience and knowledge are increasing on daily basis, providing great potential for educational systems around the world.

The limitation of the model is primarily due to a small number of participants in the Eco-school program in the Republic of Serbia. The program is still relatively unknown to many institutions, but every year the program includes more schools. The lack of higher education institutions in particular institution of university levels is also noticeable. The fundamental problem of the model and the Eco-Schools program is that there is an impact on formal segment of education. We are now in the era of lifelong learning, so is this not enough? The scope of the program is relatively modest when you take into account that informal education gain popularity. A large number of people were forced to continue their education after formal education.

Despite all the aggravating circumstances, the program proved to be a good tool for the integration of students and teachers. In most of the schools that joined the program Eco-school teachers and students participated in some of the projects. This leads to better cooperation among students and among the teaching staff.

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EVALUATION OF ENTRANCE EXAMINATION TO THE MASTER´S DEGREE IN ACCOUNTING AND FINANCE MANAGEMENT

[1]✉Miroslava Vlckova, [2]Ludvik Friebel

[1]Department of Accounting and Finance, Faculty of Economics, University of South Bohemia in České Budějovice, Studentská 13, České Budějovice, 370 05, Czech Republic, mvlckova02@ef.jcu.cz

[2]Department of Applied Mathematics and Informatics, Faculty of Economics, University of South Bohemia in České Budějovice, Czech Republic

Abstract

The paper reports on an evaluation of the entrance examinations at the Faculty of Economics at the University of South Bohemia in České Budějovice. Within our faculty the entrance examination on the postgraduate degree is done with the learning management system Moodle. In our contribution we would like to analyse the results of the test of accounting and finance for the last two years. The test is composed from a few parts bounded with a particular subset of questions - banks. These banks contain some rather differential questions in terms of scope, type and weight in overall test score. LMS Moodle provides a number of educational indicators based on a statistical assessment of the results of the test. Now, the statistical evaluation should help the creators of questions in each section for further improvement. We deal with the interpretation of test statistics in order to eliminate problematic questions and to set up the weight of particular test scopes.

Keywords

Accounting and finance master´s degree, entrance examination, LMS Moodle, statistical methods

Introduction

The objective of the manuscript is to evaluate the results of student´s entrance examination to the master´s degree in Accounting and Financial Management, study program N6208 – Economy and Management at the Faculty of Economics, University of South Bohemia in České Budějovice. There is a large excess of demand for master´s degree education in this field of study. The motivation behind the entrance examinations implementation was to ensure the required level of knowledge for acceptance into the master's degree program in Accounting and Finance Management. A similar problem is handled, for example, by Samuel and Hinson (2013) or by Lesage et al. (2013) or by Jančařík and Kostelecká (2015).

It is generally known that education is one of the basic elements of economic growth and that human capital is one of the highest expenses in a business. However, there is still a significant difference between demand on the labour market and the supply of knowledge of graduate students. Maryška and Doucek (2012) say that in the case of students who earned their bachelor's degree with comparison to students who earned their master's degree, the difference is higher. Many authors, for example Kolman, Rymesova and Michalek (2012) and Rymesova (2012) emphasize the importance of the quality of education. Kubanová and Linda (2012) handled an analogical problem – the relation between results of the learning potential tests and study results.

A major goal of testing is to get the student's knowledge of the subject matter from their responses. The test score has to correspond as close as possible to the real level of the student´s knowledge (Lesage et al., 2013). Certainly, testing as an important element of the education system, the entrance examination plays a fundamental role in how to choose the best students and also guides elementary school education. The exam is thus a weighty issue that affects every aspect of education (Haifeng, 2013).
Jančařík and Kostelecká (2015) say that the matching-type test has significant potential and that it is a very good tool for tests that seek to assess the level of knowledge which students have attained. Lucas (2001) has explored the aspects influencing individual transition from a certain educational level to a higher level of education. Particularly, the transition from secondary to tertiary education and the issue of educational aspiration formation and reproduction belong to the keys and are still current topics in the field of educational research.

Materials and Methods

The data used in this study come from the 2014 and 2015 survey of entrance examination results to the master´s degree program in Accounting and Financial Management. The entrance examination consists of two parts. The first part includes the examination of financial accounting and the second part includes the examination of finance. Within the examination of accounting students are required to prove their entrance examination of basic concepts, principles and accounting operations, financial accounting and their application in specific tasks. Thematic content covers the prerequisite courses such as Principles of Accounting, Financial Accounting and Financial Statements. Emphasis is placed on the correct definition of assets and liabilities, profit and loss, understanding the principle of duality and correlation and the financial ability to handle cases. Another focus is the analysis of financial reporting (financial statements) in terms of both the Czech legislation, as well as the context of globalization (particularly IAS/IFRS). Related units are also devoted to basic concepts in auditing financial statements and consolidated financial statements. The main scopes of this part are:

- Introduction to accounting as an information system of enterprise.
- Fixed assets (tangible, intangible). Financial assets.
- Account relations - receivables and liabilities. Equity and liabilities capital.
- Costs and income, profit/loss. Financial statements.
- Consolidation of financial statements. Methods of consolidation.
- Audit of financial statements - basic concepts and audit procedures.
- Regulation and harmonization reporting - approaches to accounting. Financial reporting under IAS/IFRS.

Within the entrance examination of finance, students are required to prove in their entrance examination the basic knowledge for financial management and financial decision-making in market economics, then the main characteristics of investment instruments, legal form of securities, types of securities and upon them sequent discretions and duties, emission terms of various types of securities. Thematic content covers the prerequisite courses such as Financial Analysis, Securities and Corporate Finance I. The main scopes of this part are:

- Time value of money.
- Assets structure and capital structure.
- Financial planning. Cash flow.
- Resources of short-term financing. Evaluation of investment projects.

- Risk in the investment decision-making. Financial analysis.
- Analysis of financial ratios. Systems of financial ratios.
- Securities. Bonds. Bills of exchange. Shares. Portfolio analysis.
- Financial derivatives – forwards, futures, options, swaps.

The entrance examination test of accounting knowledge was composed of three scopes in which there were 90 questions in question bank 2014 and 150 questions in 2015 and the entrance examination test of finance was composed of four scopes in which were 107 questions in question bank 2014 and 131 questions in 2015. They are described in the table 1.

Test	Question banks 2014	Question banks 2015	No. of Questions in Test	Score Questions
Accounting total	90	150	7	50
Counting examples	10	19	1	10
Charging	10	15	1	15
Theory of accounting	70	116	5	5
Finance total	107	131	7	50
Securities	14	14	1	10
Corporate finance	12	12	1	10
Financial analysis	12	15	1	10
Theory of finance	69	90	4	5
Whole test	197	281	14	100

Table 1: Test scope with number of questions and their score, 2014-2015 (own processing)

According to the distribution of thematic scopes given in table 1, for the year 2014 there were 2.1×10^{18} possible variants and for the year 2015 there were 2.9×10^{20} variants.

Here is one of the counting example in accounting scope for 10 points:

The consumer buys at a petrol station 10 litres of diesel for 35 CZK with VAT. The price seemed high, so he went to another petrol station where the price was 30 CZK with VAT per one litre of diesel. Here he purchased an additional 10 litres. What amount of VAT and excise duty was paid by the consumer at every petrol station? Excise duty is 10,950 CZK per 1,000 litres of diesel. Round up to the crown.

Tasks:

Define the following items in CZK:

The first petrol station – Excise duty (3 points for right answer)?

The first petrol station – VAT (2 points for right answer)?

The second petrol station – Excise duty (3 points for right answer)?

The second petrol station – VAT (2 points for right answer)?

Notation and formulas

We have at disposal total $|I|$ questions (items) that can be included in the particular test, i represents a particular item of set I, $i \in I$. I_s is the subset of I that student s saw in test. S_i is the subset of S and represents students that attempted item i. p represents a particular position from set of positions P. s represents a particular student from a group of whole students S, $s \in S$. x_{ps} is score of student s on position p and is measured on the same scale as the score for the whole quiz. x_{is} is score of student s on a particular item i measured out of the default question grade.

Maximal score on particular item i - $x_{i\max}$ equals to default question grade. Minimal score

on item i - $x_{i\min}$ is zero if we do not allow negative marking. $x_{p\max}$ and $x_{p\min}$ are maximal and minimal scores achieved on position p. Student s has a total score:

$$T_s = \sum_{p \in P} x_{ps} \tag{1}$$

Similarly, there are the maximum and minimum possible test scores

$$T_{\max} = \sum_{p \in P} x_{p\max} \tag{2}$$

and

$$T_{\min} = \sum_{p \in P} x_{p\min} \tag{3}$$

The average score of a particular item over all students who attempted them, can be computed by the following way

$$\bar{x}_i \quad \overline{\left| \right|} \sum_{s \in S} x_{is} \tag{4}$$

Variance of score depending on items:

$$V_i = \frac{1}{|S_i| - 1} \sum_{s \in S_i} (x_{is} - \bar{x}_i)^2 \tag{5}$$

Co-variances between score achieved at a particular item i and overall score can be computed by the fallowing way:

$$\tilde{C}_i = \frac{1}{|S_i| - 1} \sum_{s \in S_i} (x_{is} - \bar{x}_i)(X_{is} - \bar{X}_i) \tag{6}$$

where X_{is} is the total score of student s and $\bar{X}_i$ is average score of tests that include item i. Co-variances between score achieved at a particular position s and overall score can be computed by the following way:

$$\tilde{C}_p = \frac{1}{|S| - 1} \sum_{s \in S} (x_{ps} - \bar{x}_p)(X_{ps} - \bar{X}_p) \tag{7}$$

where X_{ps} is total score of student s and $\bar{X}_p$ is average score of tests.

Facility Index

$$F_i = 100 \frac{\bar{x}_l - x_{i\min}}{x_{i\max} - x_{i\min}} \tag{8}$$

The percentage of students that answered the question i correctly.

Standard Deviation

$$SD_i = 100 \frac{\sqrt{V_i}}{x_{i\max} - x_{i\min}} \tag{9}$$

How much variation there was in the scores for this question.

Random guess score

This score the student would get by guessing randomly and is only available for questions that use some form of multiple choice.

If we have J_i as the set of all possible choices for item i. J_{gi} is the subset not zero acceptable scored choices for item i, $J_g \in J$. The random guess score can be computed by:

$$x_{iguess} = \sum_{j \in J_{gi}} p(C_{ij}) C_{ij} \tag{10}$$

Where C_{ij} is score for selecting response j on item i and $p(C_{ij})$ is probability for this score General recommendation is that values above 40% are unsatisfactory.

Intended question weight

This weight is expressed as a percentage of question on position p of the overall test score.

$$IQW_p = 100\frac{x_{p\max} - x_{p\min}}{T_{\max} - T_{\min}} \tag{11}$$

;Intended weight is defined when editing the quiz. If question 1 is worth 2 marks out of a total of 10 for the quiz, the the intended weight is 20%.

Effective question weight

$$EQW_p = 100\frac{\sqrt{\tilde{C}_p}}{\sum_{p\in P}\sqrt{\tilde{C}_p}} \tag{12}$$

The effective weight is an estimate, how question on position p contributes to the overall spread of scores. The effective weights should be similar as the intended weights.

If a score of a particular question varies in the opposite way to the overall score, this would indicate that this is a very odd question which is testing something different from the rest.

Discrimination index

$$D_i = 100\frac{\tilde{C}_i}{\sqrt{V_i V(T)}} \tag{13}$$

It is not possible to define X_i because the same item may have been chosen in different positions with different weights, so we substitute T instead. For the question that fits in with the other questions in the test, students who have scored highly on the other parts of the test should also have scored highly on this question, thus the score for the question and the score for the whole test should be correlated. Values 50% and above signalizes very good discrimination. For less than 30% the question discriminates weakly, for negative values is question probably invalid.

The weakness of this statistic is that, unless the facility index is 50, it is impossible for the discrimination index to be 100%, or, to put it another way, if F_i it is close to 0% or 100%, D_i it will always be very small.

Discriminative efficiency

$$DE_i = 100\frac{C_{i,T}}{C_{\max}(i,T)} \tag{14}$$

This index compares discrimination index D_i to difficulty of item. This gets around that weakness in the discrimination index because level of facility ration does not impact on them.

If most of students get the same score on that question (facility index is very high or very low), it is very difficult to discriminate between students with different ability.

Results and Discussion

In table 2 and 3, we can see item statistics for both years, in which entrance examinations were realized.

Test scope	F_p[%]	SD_p[%]	IQW_p[%]	EQW_p
Theory of finance 1	60.58	49.05	5.00	5.77
Theory of finance 2	58.39	49.47	5.00	5.91
Theory of finance 3	51.82	50.15	5.00	5.82
Theory of finance 4	64.96	47.88	5.00	6.39
Securities	34.38	43.74	10.00	9.29
Corporate finance	33.58	47.40	10.00	8.97
Financial analysis	31.61	32.57	10.00	7.66
Theory of accounting 1	52.55	50.12	5.00	6.08
Theory of accounting 2	56.93	49.70	5.00	6.06
Theory of accounting 3	55.47	49.88	5.00	5.94
Theory of accounting 4	57.66	49.59	5.00	6.13
Theory of accounting 5	43.07	49.70	5.00	6.39
Counting examples	56.44	37.77	10.00	9.26
Charging	63.65	27.81	15.00	10.33

Table 2: Position statistics 2014, where $|S| = 137$ (own processing)

Test scope	F_p[%]	SD_p[%]	IQW_p[%]	EQW_p
Theory of finance 1	56.12	49.88	5	6.40
Theory of finance 2	51.02	50.25	5	6.60
Theory of finance 3	60.20	49.20	5	6.76
Theory of finance 4	51.02	50.25	5	6.70
Securities	41.94	45.38	10	8.18
Corporate finance	36.73	48.46	10	10.86
Financial analysis	33.78	35.57	10	8.97
Theory of accounting 1	52.04	50.22	5	4.67
Theory of accounting 2	50.00	50.26	5	5.10
Theory of accounting 3	46.94	50.16	5	5.76
Theory of accounting 4	40.82	49.40	5	5.72
Theory of accounting 5	44.90	49.99	5	4.75
Counting examples	50.70	39.58	10	8.57
Charging	55.03	31.67	15	10.95

Table 3: Position statistics 2015, where $|S| = 98$ (own processing)

It is obvious that the multiple-choice type of questions are right for the average student because the facility index reaches the level above 50%. Their effective weight is over intended weight and their share in the total score is redundant. In contrast, questions focused on the close type of securities scope and corporate finances scope are of moderate difficulty for students. Based on the data presented in the table, multiple-choice questions of accounting scope are easier than questions related in finance scope. Close questions in the accounting scope are comparable in terms of difficulty with multiple-choice questions. A special category is represented in charging scope. There are numerical tasks, but they do not constitute a significant problem for the student, and there is also a recorded broad agreement of answers.

In terms of future development, there is a more important the item analysis. In the example in table 4, we can see statistics from 2015. Multiple-choice question type 4.34 in the theory of finance scope is in average in terms of difficulty. The same situation

occurred with response variance (standard deviation). It achieves excellent value of discrimination index and discriminative efficiency. Conversely, the question no. 4.44 should be removed out of the test. A detailed analysis shows that 5 out of 7 students which had this questions in the test answered correctly, and it corresponds to facility index 71.43%. This question achieves a negative discrimination index, it means that it does not distinguish between students with good and poor overall test scores. The question no. 13.12 in the counting example scope, comply to required level of indicators from the perspective of discrimination. In terms of difficulty represents rather the questions with a lower facility index. It is a closed type of question, with multiple choice (five) and multiple responses (four). The question no. 14.9 in the charging scope is evaluated as simple with facility index 64%. It is a question to which were complemented 15 numeric values and it is not possible to determine the random guess score. However, the question does not discriminate significantly against students with any knowledge. The reason will be again for simplicity of question for students with elementary knowledge of accounting.

Q#	Question type	$\|S_i\|$	F_i [%]	SD_i [%]	x_{iguess} [%]	IQW_i^p [%]	D_i [%]	DE_i [%]
4.34	Multiple choice	9	55.56	52.70	20.00	5	86.44	100.00
4.44	Multiple choice	7	71.43	48.80	20.00	5	-12.96	-20.69
13.12	Embedded answers (Multiple choice)	7	24.29	11.34	28.32	10	48.78	89.55
14.9	Embedded answers (Numerical answers)	10	64.00	38.39	-	15	38.06	43.16

Table 4: Item statistics, 2015 (own processing)

Within the two years of testing applicants for admission to a master's degree program, the particular banks of questions were improved in terms of their extent banks and in terms of quality contained questions. However, the question banks set still contain the questions that are unsatisfactory because of discrimination and facility.

The results of entrance examination	Year	
	2014 (students)	2015 (students)
Admitted on the basis of the entrance examination	54	23
Admitted without the entrance examination	25	55
Not admitted on the basis of unsuccessful entrance examination	83	75

Table 5: Overall results of entrance examination (own processing)

You can see in table 5, that in terms of the number of admitted students on the basis of entrance examination that were taken in 2015, there were fewer students than in 2014. It would be worth considering stricter limits for the admission of students to follow-up studies without entrance examinations. The current practice leads to the rejection good students from other universities who have achieved outstanding results in the entrance examinations.

Conclusion

The paper reports on an evaluation of the entrance examinations at the Faculty of Economics at University of South Bohemia in České Budějovice. In entrance examination, exams with multiple choice questions are usual because they allow for the testing of large groups while providing quick feedback. One should be that a student can

obtain the correct answer by randomly guessing from the offered alternatives. Based on the statistical analysis, accounting multiple-choice questions are easier than questions in the finance scope. Accounting close questions are comparable in terms of difficulty with multiple-choice questions. In charging scope, there are numerical tasks, which do not constitute a significant problem.

After finishing the admission procedure in year 2014, about 11% of questions were removed based on item statistics. The revision procedure for year 2015 is still in progress. A substantial part of theoretical questions has to be replaced because of legislative changes (Accounting Act). For this reason we are unable to determine how many questions will be eventually removed because of facility index or discrimination efficiency.

Another problem is that through entrance examination only a small portion of students pass. tSricter limits should be considered for the admission of students to master´s studies without entrance examinations. Despite this fact, the above mentioned results of this analysis can be used for the improvement of the entrance examinations at the Faculty of Economics in the following years.

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DROPOUT CALCULATION AND RELATED POLICIES IN CZECH HIGHER EDUCATION

[1]Ales Vlk, [2]Simon Stiburek, [3]✉Vaclav Svec

[1]Department of Management, Faculty of Economics and Management, University of Life sciences Prague, Czech Republic / Tertiary Education & Research Institute, Czech Republic

[2]Department of Management, Faculty of Economics and Management, University of Life sciences Prague, Czech Republic

[3]Department of Management, Faculty of Economics and Management, Czech University of Life Sciences Prague, Kamýcká 129, Prague, 165 21, Czech Republic, +420 224 382 248, svec@pef.czu.cz

ABSTRACT

The completion rate and dropout in higher education have been perceived as important issues by researches, policymakers as well as many individual higher education institutions, especially with respect to public expenditures, accountability, and efficiency. Inefficiencies can be perceived on individual, institutional as well as national level. However, any figures and studies should be read cautiously as the available data on study success differ not only across Europe as showed for example by the HEDOCE study from 2015, but also within individual countries as demonstrated in our Czech case study. We argue that more research is needed in order to define the completion rate and to develop a formula for appropriate calculation.

KEYWORDS

Accountability, completion rate, dropout, higher education, inefficiency, study success

INTRODUCTION

A switch from mass to universal access[1] in higher education (HE) systems of most countries over the last few decades has been accompanied by increasing dropout rates.[2] This situation has also been observed in the European Union (EU) countries. As the number of students not finishing their university studies increased across the EU member states, the European Commission (EC) also became alarmed. High dropout rates and excessive duration of studies were considered as expenditure inefficiencies as well as barriers in human capital development (EC, 2003a, EC, 2003b, EC 2005).

There are many reasons why higher education policymakers as well as researches perceive the increasing dropout rates in higher education to be an issue on various levels. First, dropout is considered to be a barrier to accessing higher education. In some countries, a rapid increase of dropout rates eliminated to a great extent the gain from broadened access to HE over the last two decades leading to a slower increase in the number of

1 According to the well-respected Trow's classification (1972), mass higher education is referred to when it includes at least 15 percent of the relevant cohort. When at least 50 percent of the relevant age cohort participates, we refer to universal higher education. HE in Western Europe reached the mass status in the 1970s, and certain countries (France, Germany, Italy and others) achieved universal access 20 years later (Neave, 1994).

2 In our article we use the term "dropout" instead of wastage, attrition, mortality, dismissal, withdrawal or stopout. At the same time, we have chosen "study success" rather than completion rate, retention, persistence, students' success, completion or graduation.

graduates compared to the number of newly enrolled students. Second, the efficiency of both public and private spending can be questioned. Extensive public funding spent on higher education not leading to graduation and increasing time-to-degree rates are being carefully scrutinized by authorities in many countries as well as by European institutions (Quinn, 2013). Third, consequences for individuals should be also taken into consideration. Quinn et al. (2005) point out that the dropout experience can substantially affect individual attitudes eventually leading to a loss of motivation and self-confidence. This can even turn into apathy and sense of inferiority. Furthermore, dropping out could be seen as a barrier for young people to become active citizens. Their social stigma and other interpersonal consequences could be also related to the dropout experience, in particular in cases when family expectations are not met.

The issue of study success and dropout has been paid considerable attention mainly in the United States (see for example Berger and Loyd, 2005). Dropout studies are rooted as deep as in the 17th century as discussed by Švec and Koláčková (2013). Modern theoretical models started to be developed in the 1970s. Researchers have used various concepts when addressing the topic including multiple perspectives. A model based on academic and social integration by Vincent Tinto (1993) has been the most influential and widespread one.

In the Czech Republic, several studies researching the topic of the study success were conducted after 1990. Some authors focused on factors affecting the study success (for example Höschl and Kožený, 1997, Zvára and Anděl, 2001, Škaloudová, 2003). Other studies discussed study success in a broader context including internal motivation of students for dropping out their studies (Menclová, Baštová and Konrádová, 2003a, 2003b, Mouralová and Tomášková, 2007, Masarykova univerzita, 2013), their social situation (Fučík and Slepičková, 2014) and lifestyle (Vajlent, 2011).

Some authors compared and discussed study success across years (Matějů et al., 2004, Minksová, 2010) or across various institutions (Kleňhová and Vojtěch, 2007, 2011), Pikálková, Vojtěch and Kleňha, 2014, Beneš and Závada, 2009). A few studies (Švec, 2007) focused specifically on business schools.

Only limited space has been devoted to other aspects of the dropout issue. More research should be carried out concerning the definition of the dropout and the way it is calculated as it is relevant for other aspects such as accountability or efficiency. So far it was briefly mentioned by Koláčková and Švec (2013) and elaborated by Stiburek (2015). Also the behaviour of higher education institutions – whether at all and how individual institutions react to the increasing dropout rates in the Czech higher education system – is worth further pursuit. This issue was partly elaborated by Švec, Vlk and Stiburek (2015).

In the Czech context apart from a detailed and intensive discussion concerning the national policy and related issues with respect to the study success and dropout we have also been missing a thorough debate on dropout calculation and comparison with other countries with the exception of Koláčková and Švec (2013). Therefore, the article focuses on the area which in our view requires more attention and further elaboration. We look at how the dropout could be calculated in the Czech Republic on the level of individual study programmes, institutions and the HE system as a whole. We also discuss whether the data are internationally comparable and why.

Our article is structured in the following way. Introductory part includes a short summary of existing literature in the area concerning dropout and our main research questions. It is followed by the description of data and materials we used. In the next part we shortly present main findings of our research. Discussion part includes elaboration of our findings

and the problems involved. In the conclusion we summarise the most important points and suggest some areas to be explored by further research.

Materials and Methods

The methods used to gather data and materials for our research task included desk research, interviews and data analysis conducted between 2014 and 2016. A major source of quantitative data was the national student register.[3] We analysed strategic and analytical materials issued by the Ministry of Education, Youth and Sports (MEYS) such as HE strategic plans and annual reports published by individual higher education institutions (all public HE institutions). Some data were collected and most of interviews were conducted within the HEDOCE project.[4] These interviews with various HE stakeholders were concerned mainly with policies and measures targeted at increasing study success on national as well as institutional level. The authors of this paper contributed to the HEDOCE study as national experts and collected the data while working on the Czech national case study. Results of the HEDOCE project published in 2015 served as secondary source of data for our research.

Results

As a part of our desk research we analysed how much attention has been paid to the drop out calculation on the national (ministerial) and the institutional level (individual higher education institutions). The Ministry of Education, Youth and Sports stressed the topic of dropout in its strategic documents. The HE Strategic Plan for 2000-2005 mentioned the level of dropout as a problem on the national level (in economic terms) as well as for individual students. Individual reorientation was proposed as a solution (MEYS, 2000). In the Strategic plan for 2016-2020, the MEYS considered improving the study success as one of its strategic goals regarding access and diversity in higher education. Sixty percent of bachelor's studies started in 2015 should be successfully completed by 2020 (MEYS, 2015a).

Dropout rates and elementary information on measures implemented on the institutional level in order to improve the study success have been included in the recommended structure of annual reports of higher education institutions as a mean to increase their accountability. However, the report structure designed by the Ministry is not binding, and there is neither a prescribed definition, nor a formula how to calculate the dropout rate. Therefore, the annual reports could not be used as a source for the dropout rate calculation. As far as the dropout rate is considered, the Ministry published an analytical document describing and analysing completion rates and dropout in Czech higher education in 2015 (MEYS, 2015b). The material covered the period between 2003 and 2014 and analysed data regarding public higher education institutions and full-time students.

By analysing relevant documents on the national and institutional level we discovered that no clear definition of study success and dropout has been shared. Data were aggregated on various levels, and corresponding claims and conclusions have been often misleading.

3 Sdružené informace matrik studentů (SIMS).

4 In 2014 the European Commission awarded a research assignment on dropout and completion in higher education to consortium led by the Center for Higher Education Policy Studies (CHEPS) at the University of Twente, the Netherlands and the Nordic Institute for Studies in Innovation (NIFU), Norway. The main task was to conduct a comparative overview of the main policies and measures in 36 countries, including eight in-depth case studies.

The first comprehensive analysis appeared on the national level only in 2015 using study programme level for the calculation.

As a second part of our research we analysed the primary data retrieved from the national student register. Based on the data we can see a steady growth of the dropout rates at bachelor's level over the last decade. While only slightly more than 40% of students who started their study in 2003 discontinued their study during the first four years, the figure exceeded 50% for students who started to study in 2011. The dropout has been dominantly concentrated in the first and second year of studies – 44% of the students who started their study in 2011 discontinued within the two years after their enrolment, compared to only 7% in the following two years. The freshmen year is also the one with the largest increase in the dropout rates, rising from 27% in 2003 to 39% for students who started their studies in 2014. The dropout rates are high in particular in engineering fields, followed by natural sciences, where the dropout rates continue to increase alarmingly. These observations are generally in line with the statistics published by MEYS (2015b).

In contrast, the dropout rates are rather stable for master's level studies with only minor fluctuations and are also much lower – "only" 20% of students discontinued their study within the first four years in 2003-2011 on average. At the postgraduate level, minor increase in the dropout prevalence can be observed which has been rather evenly distributed across individual study years.

Significant differences in the dropout rate can be seen among individual disciplines (study fields) as well as individual institutions (universities) and their parts (faculties). For example for bachelor studies started in 2009 the completion rate can vary from 8.6% at a particular faculty of mechanical engineering to 87.9% at a faculty of health care. A completion rate higher than 70% can be almost exclusively observed in the fields of medicine and fine/performing arts.

Our analysis was based on the data connected with an individual study programme. However, when students drop their study programme they can still successfully complete their degree at their university (another study programme or faculty) or at another higher education institution. The dropout rate on various levels can differ significantly. From the national student register we calculated the following numbers for the year 2014: there were 67 499 dropouts on the study programme level, 58 474 dropouts on the higher education institution level and 46 249 dropouts on the higher education system level. Whereas 67 499 students quitted the studies their originally chose, around 9 000 students stayed in their institutions (probably another study programme) and more than 21 000 students still remained in the Czech higher education system.

Discussion

Taking into account the Czech higher education legislation, we can look at the dropout rate at various levels. First, we can look at the level of an individual study programme. This method was used by the Ministry for their analysis of dropout calculation in the Czech Republic, and we also used this method for our own calculation as the data could be retrieved from the student register with no major obstacles. The dropout level calculated on this level is the highest. The calculation on this level is most relevant for individual faculties or even departments to evaluate and eventually increase the efficiency of their provision.

The second level is the level of faculty or the whole university. Students very often change their study programme within the same faculty or within the same university. It usually happens after their first year. When looking at the institutional level, the dropout rate is

lower than at the level of a study programme. This number is relevant for universities as a whole as well as for faculties competing for students within one university, in particular because of the funding mechanism.

Finally, we can look at the completion rate on the national level. We calculate the number of students entering higher education and the number of higher education graduates not taking into account changes in individual paths. This calculation is most important for the state with respect to the share of population attaining higher education as a mean of human capital building. The dropout rate on the national level is the lowest in comparison with the two previously mentioned.

However, we have to be aware that differences between various levels can be very significant as we demonstrated on the 2014 numbers. Looking at the age cohort entering higher education in 2007, only half of those dropping out their study programme did not graduate by 2014. It means that around 50 percent of those leaving the study programme of their first choice were absorbed by the higher education system and completed their studies later.

The situation is even more complicated on the international level. The HEDOCE comparative study (EC, 2015) underlines the following points:

National government as well as HE institutions use different orientation in their policy-making with respect to study success. There are basically three main approaches:

- Completion – students successfully finish their study programme with a degree;
- Time-to-degree – students finish their study programme within a reasonable time period;
- Dropout (retention) – student re-enrol in a study programme until their finish their degree.

Second, depending on the selected approach, national governments as well as institutions use different indicators and definitions. According to the HEDOCE study only 12 out of 35 European countries regularly publish study success data on the national level, and even fewer report on completion, time-to-degree and dropout. Therefore, international overviews (even such as the Education at a Glance by the OECD) are highly problematic and should be interpreted with care.

The HEDOCE study represents a first thorough comparative study across European countries on the completion rate and dropout. It reveals major deficiencies in the existing knowledge. First, there are various definitions of the phenomena depending on the approach of a national government vis-à-vis study success. Second, available data on the study success across Europe differ depending on availability, data collection methods, definitions and usage.

In a broader context, we can partly look at high dropout rates as a consequence of increasing pressure of societies towards traditional higher education systems. For example Clark (1997) identifies three major sets of demands on higher education:

- A demand for greater access to higher education;
- More qualifications and positions on the labour market require a university degree;
- Government and stakeholders expect more efficiency from institutions.

In this context, many scholars see the dropout as an example of inefficiency in higher education. For example Ozga and Sukhnandan (2004) emphasize the institutional level, whereas Mantz and Bernard (2004) discuss the governmental perspective. Brunsden et al. (2000) argue that the dropout policy affects every aspect of higher education.

We share the above mentioned opinion that the dropout brings inefficiencies on various levels affecting many aspects of higher education. However, any conclusions based on

available data should be subject to cautious scrutiny as demonstrated by the example of the Czech Republic. The same applies to international data and comparing of various national systems. We should be also very careful when analysing and evaluating dropout policies and their impact. The dropout rate itself cannot be perceived as an isolated phenomenon. It should be rather looked upon as a result of other environmental pressures and the setting of the entire higher education system (for further analysis of the Czech HE system see Švec, Vlk and Stiburek, 2015).

Conclusions

The completion rate & dropout in higher education have been perceived as important issues by researches, policymakers as well as many individual higher education institutions. Systematic attention has been paid to various factors influencing student success of individual students by scholarly literature. As the number of students dropping out their studies has been increasing over the past decades, national governments as major sponsors of higher education in many countries have also started to be more alert with respect to efficiency of the whole systems.

Yet, study completion and dropout rates could be calculated on various levels, and differences in figures dependent on calculation chosen are very significant. As there is no shared definition of study completion and dropout rate it makes any comparison – on national as well as international level – very difficult and problematic. Furthermore, the above mentioned shortcomings can hamper implementation and evaluation of policies targeted at increasing the study success in higher education. In this respect we can see for example the results of the HEDOCE project as a starting point for further elaboration of the issue on the EU level.

We also believe that further research in the dropout topic in the Czech Republic is essential – both in quantitative as well as qualitative terms – in order to contribute to better formulation and implementation of adequate measures and instruments to increase the study success and therefore to higher accountability of HE institutions. In the Czech Republic, the national student register is a comprehensive source of data which could be further used for more detailed analysis. However, first of all, there must be a consensus on the definition and appropriate formula to calculate the completion rates and dropout on various levels. Furthermore, we suggest that any quantitative inquiry should be complemented by a survey on major factors influencing students across various disciplines in their decision to change their field of study or drop out of the system completely.

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PERCEPTION OF EDUCATION QUALITY IN SUBJECTS RELATED TO HUMAN RESOURCES BY UNIVERSITY STUDENTS

[1]✉Lucie Vnouckova, [2]Hana Urbancova, [3]Helena Smolova, [4]Julie Smejkalova

[1]Department of Management, University of Economics and Management, Nárožní 2600/9a, Praha 5, 158 00, Czech Republic, +420 245 001 488, lucie.vnouckova@vsem.cz

[2]Department of Management, Faculty of Economics and Management, Czech University of Life Sciences Prague, Czech Republic

[3]Department of Marketing, University of Economics and Management, Czech Republic

[4]Department of Management, University of Economics and Management, Czech Republic

Abstract

Education and its quality perceived by students is currently often discussed topic regarding strategic management of universities. The concept is strategically important in global quality standards. The aim of the article is to evaluate perception of education quality of lectures, subjects and teachers by university students in the area of human resource management in private Czech university and to identify main approaches to academic staff. The results are based on quantitative survey by questionnaire data collection. The results show students evaluate positively subjects, lectures and also lecturers in the area of human resource management. Only perceived difficulty is average compare to other subjects passed in the academic year. Additionally, two dimensional statistics by means of correlation analysis was used to test the results.

Keywords

Education, learning, student, quality, evaluation, university

Introduction

The quality of tertiary education is currently often discussed theme at the state, private and public universities. The importance of quality of education grows accordingly to amount of people who want to study. Due to the continuous globalization is Czech education system confronted with many high standard competitors. While scholars have analyzed global higher education competition, they have largely failed to address how global spaces of equivalence are tied both to region and to competition (Shahjahan and Morgan, 2016). Shahjahan and Morgan (2016) argue that assessment of higher education learning outcomes represent the mediation and internalization of a higher education competition focused on teaching and learning, which reproduces region specifics by valuing characteristics of the enterprising, globally competitive institution. Ashraf, Osman and Ratan (2016) also state that it is crucial to determine the potential influence of education quality in private universities as well as in public universities.

This article aims to evaluate perceptions of education quality of lectures, subjects and teachers by university students in the area of human resource management in selected private Czech university and to identify main approaches to academic staff.

The paper is composed of five sections. The first is Introduction, the second one is Theoretical Background, and this is 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. Last but not least focus on a future research in this area is presented.

Theoretical Background

Recent literature describes changes in higher education in the field of universities' organization and function, due to expansion in the number of students, new systems, technologies and structures in universities' management and organization and international regulations of higher education. The dominant conception, evident in many countries, has indicated the turn to an audit or corporate culture (see Forrester, 2011; Watts and Robertson, 2011) concerned on quality in higher education. *"Universities have been reoriented by performance management techniques towards a competitive, performance culture.*" (Forrester, 2011). Higher education institutions [HEIS] in the global markets have increasingly had to operate under forces of marketization which demand competitiveness, efficiency and consumer satisfaction (Kotler and Armstrong, 2011).

Since the university students are identified as key stakeholders (ACBSP, 2015, AACSB, 2016, IACBE, 2016) or consumers (Zairi, 1995), students' satisfaction should always be considered by the university due to its importance within the educational evaluation, intensive competition among universities, internationalization of higher education institutions and the classification of education as a marketable service (Kwek, Lau and Tan, 2010). Those reasons have prompted the management of the various public and private higher education institutions to pay more attention in assessing the overall students' perceived service quality.

Students as Consumers of Higher Education

Student satisfaction is a complex construct with various antecedents and these are not the same as in the actual customer satisfaction models. Customer satisfaction involves customer expectation of the service delivery, actual delivery of the customer experience, including under or over-fulfillment. If expectations are exceeded, positive results are given, while negative results are given when customer experience is poorer than expected (Kotler and Armstrong, 2011). Customer satisfaction also affects economic returns, i.e. profitability, market share, and return on investment (Anderson et al., 1994).

Students' satisfaction could be presented as overall response not only to the learning experience of a student but also student satisfaction is a changing construct in the higher education environment due to repeated interactions (Elliott and Shin, 2002). *"Focusing on student satisfaction not only enables universities to re-engineer their organizations to adapt to student needs, but also allows them to develop a system for continuous monitoring of how effectively they meet or exceed student needs"* (Elliott and Shin, 2002: 197).

Education quality, according to Cheng (2003) is the character of an input, process and output of the education system that satisfy both internal and external stakeholders by meeting their explicit and implicit expectation.

The national Quality Assurance [QA] evaluation methodology (which is closely following the Guidelines for Quality Assurance in the European Higher Education [HE] Area), includes indicators regarding students' satisfaction: Though satisfaction with the academic programs, students may be disappointed in other aspects, such as career counseling or material conditions (Kotler and Fox, 1995). It is less expensive to maintain a present customer than to recruit a new one (Babin and Griffin, 1998).

Student´s satisfaction survey could bring unique data and sources in identifying problem

areas within the university, and in integrating information and data from students in a broader agenda mediated through institution. Student perception of studies also relate to an important goal of education, that is to develop student learning and engagement (Delaney, 1997). "*The ability to predict what university course a student may select has important quality assurance and economic imperatives. The capacity to determine future course load and student interests provides for increased accuracy in the allocation of resources including curriculum and learning support and career counselling services. The findings suggest that a students' grade point average relative to the grades of the courses they are considering for enrolment was the most important factor in determining future course selections."* (Ognjanovic, Gasevic and Dawson, 2016).

Taking into account the different views, definitions and dimensions of quality are different in their measurement standards. Most researchers on service quality use customer satisfaction as the indicator for quality. The better the quality is, the more satisfied the customers should be. Students' satisfaction survey - identification of the students' satisfaction level concerning a broad range of aspects - it is a relatively new practice. Therefore it is analyzed in this paper.

Materials and Methods

This paper was prepared using a method of an analysis of secondary and primary resources, knowledge synthesis, induction, deduction and comparison. As part of secondary resources, scientific monographs and articles dealing with the theme were analyzed. At the same time, websites of companies that are actively dealing with the issue were analyzed. The primary data were obtained by conducting a quantitative research, through data collection using questionnaires.

The survey was carried out using students and academic staff. The student data set comprised in total 218 students. The evaluated subjects were Human Resource Management, Human Resource Development, Communication, Psychology in Human Resources, Leadership, Managerial Decision Making and Managerial Skills. In total 11 teachers were leading those subjects for evaluated students. Only students who passed the whole education and evaluation process of mentioned selected subjects in the area of human resources were part of the survey to be able to give feedback on all areas of education – lessons, exams, organization, teacher, support and study materials.

The respondents were structured as follows: student category: 65 (30%) men, 153 (70%) women; student professional experience: 128 (58,5%) works in area of study, 89 (41,5%) does not work; student future intention to work in the area of study: 146 (67%) plan to works in area of studied subjects, 12 (0,5%) does not plan to work in area of studied subjects and the rest does not know.

The data collection instrument included questions to measure the activities of education in studied university. The questions were designed based on theories (see theoretical background) and similar researches. The questionnaire addressed three main areas (other than identification questions). Those were lessons and their content, the course/subject and structure and usefulness and teachers quality.

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 five-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 disagree) and 5 (strongly agree) or, provided it was not possible to favor either of the sides, selected a median, neutral

value (the median value was characterized by number 3). The scale permitted not only the specification of respondents' attitudes, but also their intensity.
The data were evaluated using the tools of descriptive statistics (average, modus, median and standard deviation) and absolute and relative frequency. Also two dimensional statistics was used using Pearson´s correlation coefficient to reveal relations between searched attributes. To evaluate the results, Microsoft Excel 2013 and IBM SPSS statistics were used.

Results and Discussion

The objective of this chapter is to evaluate the results obtained from the primary survey. The results of the quantitative research have been statistically evaluated and recommendations have been formulated upon this basis. As the paper focuses on quality evaluation of three areas (subjects, courses and teachers) in human resource management education, the chapter presents results gained in these areas.
Firstly, students' evaluation of subject is presented. The results show students perception of different attributes of subjects. Most of the attributes are evaluated positively (on the scale where 1 is the best and 5 is the worst). Modus and median values are almost always 1, except of the difficulty of studied subjects (evaluated by number 3). Students evaluated difficulty compare to other studied subjects. The most difficult for them is economics and related subjects. On the other hand, management and human resource management are usually evaluated as in the middle of difficultness. The average value of all attributes is 1.79. The perception of quality of lecture is on relatively high level. Additionally, standard deviation maximum value is 0.97.
The subjects studied in the area of human resource management mostly filled students' expectations (average value 1.52, modus and median 1), the subjects studied are valuable (average 1.44, modus and median also 1) and connected with praxis (average 1.66, modus and median 1). As the data were deeply analyzed and the students questioned, they prefer subjects oriented on praxis. The connection of lessons with case studies and projects is evaluated as the best among the surveyed students. They also value experts from companies for workshops and seminars. Evaluated attributes questioned students in the way of their readiness for passing the subject. Again, most of the respondents evaluated it positively, that they had good overall knowledge to be able to handle the learning goals and outcomes. Students also stated that requirements for exams are adequate (average 1.70, modus and median 1). Therefore it is possible to assume that the subjects are well placed in study plans and the content of the subjects is manageable for students who are able to prepare themselves for exams.
The second area studied by the survey is lectures. Similarly to the first evaluated area, lectures are evaluated well by the students (average value is 1.27, modus and median are 1). The results are even better than in the area of lessons. Surveyed students perceive lectures as adequate (average 1.24, modus and median 1), style of explanation seems to be adequate (average 1.27, modus and median 1). Students perceive explanation as understandable, with suitable tempo of discussed topics and way of teaching.
The third area surveyed by questionnaires is lecturers. Students evaluated different attributes related to their teacher and his/her teaching techniques. The results are shown in Table 1. As it is possible to see in the table, students evaluated teachers the best of all studied areas (average value is 1.24, modus and median always 1).

Teacher	AVG	MOD	MED	STD
is an expert	1.21	1	1	0.53
uses modern teaching techniques	1.34	1	1	0.68
uses modern technologies	1.37	1	1	0.69
motivates to learn	1.35	1	1	0.67
is able to attract	1.20	1	1	0.54
creates positive atmosphere	1.09	1	1	0.37
adequately explains	1.17	1	1	0.45
connects theory and praxis	1.31	1	1	0.65
places attention on practicing	1.39	1	1	0.71
cares about students understanding	1.13	1	1	0.47
gives the opportunity to express opinion	1.09	1	1	0.41
AVG	1.24	-	-	-

Tab. 1: Statements of respondents related to teachers

The area of lecturers was studied from more standpoints. Attributes focus on the personality of teacher, his/her abilities, skills and competencies related to positive and stimulus work with students and also their abilities to connect the theory with praxis.

Students perceive their teacher as an expert (average 1.21, modus and median 1). Best of all searched attributes students evaluate the opportunity to express their opinion and ability of teacher to create positive atmosphere (in both cases average value is 1.09). Mentioned attributes are strengths of teachers surveyed in the research. Also positive is the result that teacher cares about students understanding (average 1.13) and can adequately explain theory and related areas (average 1.17).

It is possible to summarize that quality evaluation of teachers shows very good results. Students perceive quality of teachers' skills, abilities and knowledge. Surveyed students evaluate positively also connection with praxis during the lessons and high level of explanation and discussion.

To see, whether there are relations between searched attributes, correlation analysis was used to evaluate the results. Statistically significant results at the significance level 0.05 are shown in Table 2. Interesting finding is that effect of subjects, lectures or teachers on students does not depend on gender or work experience, neither on plans for future work area.

Hypothesis	Correlation coefficient
Cares about students understanding - opportunity to express opinion	0.508
Cares about students understanding - adequately explains	0.507
Place attention on practicing - connects theory and praxis	0.406
Attention on practicing - able to attract	0.443
Attention on practicing - motivates to learn	0.522
Attention on practicing - uses modern teaching techniques	0.438
Motivates to learn - is an expert	0.433
Uses modern technologies - uses modern teaching techniques	0.716

Tab. 2: Hypothesis related to teachers

Correlation analysis revealed relations between effort of teacher about student understanding and his/her willingness to give students an opportunity to express their opinion. Similarly, care of a teacher about students positively correlates with his/her explanation in the course theory. That means students positively perceive when a teacher

shows respect to the students. They seems better understand the theory and they are not afraid to ask questions.

Another correlation was found between connection of theory and practice while teacher is oriented also on practice. This relation is not surprising, but students can better understand theory, when it is shown on examples. Attention on practicing also correlates with students' attraction, motivation for learning and use of modern teaching techniques. This result therefore confirms that practicing in seminars and workshops or even as a part of theoretical lecture leads to higher motivation of students and their attraction. Students perceive their teacher as an expert when he/she is able to motivate them to learn. And vice versa, an expert in the field motivates students to learn. Consequently it is necessary to employ specialists in order to gain students attraction and motivation to learn. The last strong correlation was found between use of modern technologies and modern teaching techniques by a teacher. Students perceive a teacher to be an expert in modern education techniques, as he/she is able to use also new technologies (it is sometimes interconnected). As students are these days straight connected to technique (tablets, PC, mobile technologies etc.), they expect also a teacher to use them and use the opportunities which they offer also in lessons and education.

To summarize, students evaluate the best quality teachers who can connect theory and praxis and cares about students' needs. The best evaluated are also teachers with ability to work with new teaching techniques and technologies. Sarabdeen (2013) according to her results states that understanding of learning styles helps the educators and the trainers to deliver relevant materials in a learning/training process. This creates an enthusiasm and motivation among learners to learn and practice what they have learned. For a successful learning process is very important selection of teaching techniques and technologies. As Keenwe and Georgina (2011) states, the educator should have the understanding of different learners and should be flexible to adapt the trainees' needs. The survey of Borges and Stiubiener (2015) shows, that the information and communication technologies nowadays used in educational process have become increasingly present in education, either as support for classroom learning or in distance learning. Together they support the online systems in education. They also state that the online systems are used for better student-teacher communication and especially for providing instructional materials, activities, assessments and other resources to provide collaborative activities. According to both Sarabdeen (2013) and Cheng (2003) it is very important to correctly combine the selection of the teaching techniques (for example role playing, simulation in the lecture/seminars) and technologies. Well placed combinations of methods will have influence to the results of educational process quality and satisfaction of students and academic staff.

Conclusion

Presented paper analyzed and assessed the education quality of subjects oriented to human resources at the private university. The paper focused on perception of education quality by students and teachers. The results show that students in general find economics more difficult compared to management and human resource management and the perception of quality of lecture is at relatively high level at the university. The students assessed subjects, lectures and academic staff relatively positive, they emphasized that the staff creates positive atmosphere and gives the opportunity to express an opinion which is very important for students at the university.

Research outcomes identified that the effect of subjects, lectures or teachers on students does not depend on gender or work experience, neither on plans for future work area. On

the other hand there is a dependency between the effort of teacher, student understanding and teachers' willingness to give students an opportunity to express an opinion.
The theoretical contribution of the article lies in the emphasis on education quality process in current knowledge economy described by increasing number of public and private universities in the Czech Republic. The practical contribution of this article lies in presenting the actual results from evaluating process at the private university. The results are important base for assessment process of academic staff and preparation of new study program. Besides this study there are several promising directions for further research. It would be useful to include the influence of the students' attendance on the seminars and lectures on successfulness in exams. Also a comparative study of university students from different universities (public, private, state) would be appreciated.

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CONTINUOUS DEVELOPMENT OF PROFESSIONAL STUDY FIELD

Zdenek Vondra

Graphic and multimedia laboratory, Faculty of informatics and statistics, University of economics, Prague, W. Churchill Sq. 1938/4, Prague 3, 130 67, Czech Republic, zdenek.vondra@vse.cz

Abstract

The professional study fields have been settled in Czech higher education by approving the amendment to the Higher Education Act. This brings new need for control and improvement mechanisms based more on connection to industry practice than on academic publications. The aim of this paper is to explain the importance of gathering information from contact with study field's stakeholders. These information lead to form appropriate improvements implemented on time. In the case study, there are presented examples of gathered findings and how they are being handled. They include the student's expectations that underrate theory although it is needed for basic insight to the industry. The students are also motivated to start their own business. What this paper brings is the proposed continuous development mechanism that helped to improve the bachelors study field Multimedia in Economic Practice. The mechanism would be modified and used to any professional oriented study field.

Keywords

Continuous development, education, Multimedia in Economic Practice, professional study field

Introduction

The aim of this paper is to present actual mechanism of continuous development of the professional bachelor's study field Multimedia in Economic Practice. The findings are based on five years of research of the study field's content and its impact on study field's stakeholders like students, graduates and employers. In this paper, in order to make a reference and inspiration for other study fields' long term development, there is presented a mechanism of getting data to answer long term questions evaluating relevancy of the study field to industry demands. This paper is structured into the five parts. First is introduction that presents the studied situation. In the second part, there is presented a professional study field concept in general and then the specific studied example. Third part presents methods of continual development of the study field, especially the processes of gathering information, and the mechanism of their evaluation and implementation of improvements. Fourth part presents findings and discussion in accordance to the asked questions from research. The final fifth part is a conclusion, which generalizes the outputs of the paper.

Professional study fields are based, on the contrary to academic study fields, more on practical knowledge and skills, than on theories and variety of different perspectives. This kind of study was derived from the academic fields as a reaction to the labor market demands. It is a step of universities towards the real practice that will be much deeper than just study field (Sam, van der Sijde, 2014). Professional study fields fulfil the gap between academic higher education and professional society demands by going

straightly towards employability of graduates that is supported by European Science Foundation (Brennan 2008). Professional study fields are focused more on handling practical skills and procedures. Professional study fields, often labelled professional schools or professional studies, are regularly linked to practice communities or industry professionals (Stark, 1998). Academic study fields teach students to develop their points of view and to understand terms in wider consequences. The fact, that professional study fields are circumscribed on narrower service and technical roles, led to their underrating by academic study staff. After approving the amendment to the Higher Education Act in Czech Republic (PSP ČR, 2016), professional study fields are officially an opportunity for universities to develop in close linkage to industry professionals and a new opportunity for students to study. Professional study fields are supposed to be taught close to the practice and must react to the actual reality of the industry little more, than common academic study which bases on long term theories and paradigms. This situation creates the need for regular updates of study content to be able to guarantee an appropriate level of relevant knowledge and skills. That means continual revisions of study plan, its concept as a whole and of the content of individual courses as well. The main goal is employability or graduates, so this paper should be saw as the tool for improving measurements of the University-to-Work transition Success (Oliveira et al., 2016).

About the professional study field

Mentioned bachelor study field Multimedia in Economic Practice is now settled and being taught for five years. Due to its status to be the first of its kind on the university, it has to deal with new kinds of tasks about principles of actualization and continuous development. Graphic and multimedia laboratory of Faculty of informatics and statistics at University of economics, Prague in 2009, as first at the university developed and started the accreditation process of a new professional bachelor's study field, in accordance to expected future progress of tertiary education. The study field was intended from the beginning as professionally oriented and without any relation to a master degree. Its conception was based on corresponding principles from White Paper on Tertiary Education that supposed to be a future base of new Higher Education Act. The situation of developing and approving the new Higher Education Act has continually been complicated by political situations and process has been rapidly slowed down. Real progress in this intention has finally come in 2016 in the final form of the amendment to the Higher Education Act, which brings the term professional study field to practice. In January 2016, Czech chamber of deputies has approved the amendment to the Higher Education Act. The amendment includes, for the first time in Czech law history, the term professional study field and defines its meaning in the system of higher education and its specifics in the process of accreditation (PSP ČR, 2016).

Professional study field Multimedia in Economic Practice teaches its students about production of audio-visual communication tools such as text, computer graphics, digital photography, animation, digital video and sound, in accordance to Tay Vaughan´s multimedia interpretation (2008) completed by web skills and theoretical cognitive background (Mayer, 2009). The study field teaches the abilities of doing analysis, conception, design and processing of multimedia content, for the realization of functional communication (Vondra, Vltavská, 2014). It prepares the students for their future occupation or their own business in advertising, media companies, web or application development or development of graphical user interfaces and its content.

The study plan is divided into several areas (with percent share of credits in study plan):

- Theoretical courses 13%
- Practical production courses 38%
- Conceptual and process courses 9%
- Soft skills and language courses 13%
- Economic courses 27%

Personal experience of pedagogues and industry professional who dealt with students and graduates lead to establishing long-term questions and discussion initiated by the need to meet the industry demands for graduate profiles. This kind of continual improvement process should bring continual innovations needed to keep the study field actual and linked industry. Demands for topicality and connection with practice are the basics of the mechanism of continuous development of the professional bachelor's study field mentioned in this paper. Industry professionals in this paper are understood as both eventual employers of graduates and professional consultants or practice communities (Stark, 1998). In the following text is presented the actual model of the mechanism and the outcomes and findings gained from using it.

Materials and Methods

The mentioned mechanism is based on gaining data, their evaluation and doing appropriate actions as soon as possible. It should be understood as a control mechanism with quick implementation plan. The aim of the research presented in this paper is to improve the setup of the study field by asking the questions to stakeholders with different perspectives, to evaluate the setup and to try to find things to optimize or improve. Relevant data and information are mainly qualitative in nature. They are collected from integrated study information system and from interviews and discussions with study field's stakeholders (students, graduates, pedagogues and industry professionals). The ongoing research consist of surveys, interviews, observations and discussions and so far was conducted on more than 250 students (study field accepts to study approximately from 50 to 60 new students every year), 30 industry professionals, 2 similar university programs and 7 important companies.

Main questions that are asked in the research are:

- What are the occupations of graduates or students?
- What are the future plans for occupation or study of graduates and students?
- What are the evaluations of knowledge and skills graduates gained during their studies?
- What are the evaluations of individual courses contents?
- What are the evaluations of the study field as whole, how does it meet industry needs?

These questions are asked to study field's stakeholders in several ways.

Data about occupations and future plans are gathered by three interviews with each student. First is passed during presentations of first semester projects and is focused on motivations to study. Second checkpoint is an individual interview at the end of third or fourth semester (in the half of study) in the course Management of Multimedia Projects. Students are asked about their planned occupation and about their actual skills. It happens during examination, where their conceptual and process knowledge of production of media outputs is tested. At this time two thirds of students know, what career they want to pursue. The final checkpoint is passed in final course, Multimedia Project Seminar. This course is based on team project that has impact to practice (with real client or realization for public audience). The interview is first value added, but the second is that approximately one or

two projects a year are heading to form real busyness in future. These attempts formed several successful start-ups and also one advertising agency. These projects, that started at the university and continue their life in practice, are a great opportunity for monitoring the graduates and their transition to practice. The mentoring service has been offered to these by pedagogues, in exchange for monitoring of their activities. Mentoring is often spoken relating to medicine study fields (Frei et al., 2010). It has the importance in general for every profession. It is set up to meeting every two weeks for 90 minutes. Discussion is focused on processes and feedback for projects and is now settled with two projects.

In 2014, a survey research has been conducted on 70 students to examine of the meaningfulness and structure of courses taught, in relation to the prospective profession of graduates, their previous experience and success in their studies (Vondra, Vltavská 2014). Outputs of this research have shown how the students see individual courses relevancies to their future occupation. Several are mentioned in the Results and Discussion part of this text. Main output was that practical courses were marked as relevant by students, even if they are not connected to their future occupation. This was considered as significant problem in motivation to study on professional study fields. Students expect practice.

Statistical data like number of students, number of graduates, and success rate of students at individual courses, are accessible from integrated study information system of the university and serve for understand of quantitative scope. From this system, it is also possible to get basic qualitative data like students' opinions on pros and cons and overall thoughts about individual courses. Students are motivated to fulfil these surveys after each semester by getting better position in registration of courses for next semester so the answer rate is nearly 50%.

Data about gained knowledge and skills, individual courses evaluation and evaluation of whole study field are gathered also from interviews and discussions with students and industry professionals. Once a year in autumn there is organized the discussion with graduates. Regularly, there are about 30 graduates and few actual students. Topics of the discussion are their actual occupations, their opinions about gained knowledge and skills, and course settings of the study field. Pedagogues are also presenting them plans for innovations of the study field for instant feedback.

Discussions with pedagogues, industry professionals and deputies of graduates are organized twice a year right after the end of the semester. These discussions are the most important forum of the study field's development. Every time, the actual study plan is presented and all topics and questions are discussed. These discussions are regularly done with 20 to 25 participants, from which a half to two thirds is industry professionals and the rest are pedagogues. During these discussions, the opinions, insights and findings are matched together with industry practice and with the best practices of similar study fields in Europe. Information from study field's stakeholders is also gained by ad hoc individual interviews which work as preparation for this forum.

The findings of all these procedures are implemented into the study field by change of a content of specific courses or by changing the study plan (adding or removing courses or changing their timelines). Accreditation process of courses in line with main panel discussions right after the semester, allows implementing the changes within the following semester.

Results and their discussion

This part of the paper presents the examples of mechanism outputs corresponding to the research questions and their proposed resolving.

1) What are the evaluations of individual courses' contents? What are the future plans for occupation or study of graduates and students? Problem: Production has overtaken insights and concepts: Industry professionals found out that students, and also some of the graduates, would produce multimedia outputs without deeper insight or understanding of the situation, led by false intuition. This situation is happening in average to two thirds of the students. Review in practice showed that both application of technology and of professional knowledge are needed (Paskin, 2013). After evaluating the problem, it has been found out, that it was related to insufficient number of evaluations of insights of students' work by pedagogues. It was revealed that students are able to develop appropriate insight but simply they do not want to. They would rather produce media outputs which they found more entertaining. Chosen solution was to ask students for insights and concepts more often so it becomes natural thing for them. It was implemented to the primary course of the study and also strengthened in other courses. There is prepared a brand new compulsory course about user experience, analysis and forming insights, which will start in winter semester 2016.

This situation was also perceptible in research about students' opinions about relevancy of courses to their future occupation. In this survey based research, it has been discovered that students regularly find almost all production courses relevant, even for occupations that do not need them all. At the same time survey research made in 2014 found out, that students prefer production courses over theoretical and economical and found them more relevant for their future plans even if they are not connected with field they want to do (Vondra, Vltavská 2014). These findings were matched together with opinions of graduates, who found the most theoretical course semiotics very important, especially by those who continue in study.

These findings helped to solve significantly important problem but the control mechanism has to be improved to catch these findings not only from graduates but also from students of all grades. As a solution there is planned to develop voluntary production service team made from students that will work as a simulation of industry practice. This will allow new possibility of monitoring of this problem. It is expectable that this will be the problem of professional study fields in general. Students attend this kind of study expecting practice, which lower their motivation to learn needed theory.

2) What are the occupations of graduates or students? Own business rather than being employed: Graduates would rather start their own business, than be employed. This surprising fact was confirmed by pedagogues and industry professionals from their interviews with graduates. Approximately 30% of graduates are employed, 20% study for master's degree and almost 50% of them works in their own business (measured by answers from 30 graduates of total 59). Fortunately, only one of the graduates was unemployed. These results will be reflected by modifying process courses towards implementation of deeper self-management skills, freelance and start-up business content. For now, freelancing course is being offered from time to time as a voluntary course.

Professional study fields have to deal with decision, whether they prepare students for employment or for doing their own business or both. This will create demand for specific economic and management knowledge and skills. This will be dependent on the university profile, if it is able to fulfil this demand well or if it would be better to outsource professionals for it.

3) What are the evaluations of knowledge and skills graduates gained during the studies? There is much more to teach in individual course: Many individual courses raised their need for hour allocation or to split them into two. This situation has to be evaluated very

carefully, because changing one course's hour allocation could damage consistency of the whole study field. Students proved, that even though they are not taught the skills to maximum level, they can handle it and can professionally continue on in one detailed area (of course with individual effort, for example students that continue to study on master degree of cam-coding, movie directing or editing or marketing). On the other hand, there have been identified missing areas of study, which are social networks (identified by graduates) and user experience (identified by pedagogues and industry professionals). When the study field prepares students for certain profession, there is a demand for knowledge and skills that are limited only by practice, which is very wide and should be seen in use. One course would then want to cover the whole area which would significantly enlarge its content. Situation with academic oriented courses is similar, but the use of wide knowledge is more hypothetical and connected to intellectual outlook, rather than practical use. Ideal state of professional study fields is to be very narrowly focused on one very specific profession which should be taught in detail. Despite mentioned findings, graduates of Multimedia in Economic Practice have very positive feedback from the practice. They, as well as industry professionals, appreciate the overlap of their knowledge and skills acquired in the study field and find it very useful.

4) What are the evaluations of the study field as a whole, how does it meet industry standards? This reaction present discussion on continuous development of professional study filed concept in general: Presented concept of gathering information explains framework for evaluation and implementation of improvements that corresponds with studies about university-to-work transition success that are based on extrinsic and intrinsic outcomes of the study (Oliveira et al., 2016). In comparison, mechanism presented in this paper is focused just on work adjustment and not on social and motivational perspectives. On contrary, it presents more specific ways of collecting information and their evaluation. In the first place there have to be considered information from industry professionals who deal with graduates or who participate on pedagogical process. Experience from practice is the main ingredient which has to be followed by certain levels of insight understood by students. Students need to be able to answer the question: Why does it work? Pedagogues play the role of interface between practice and the university environment.

In creative activities, pedagogues should develop a way of how to better explain or simulate practice. By the research and science activities, they should participate on contract research or application projects to improve the industry practice procedures in general. Of course all these activities need their participation in practice, which is necessary in case of a professional study field. Next to this, the independent view of non-involved industry professionals is also very valuable and needed for better evaluation. In the second place, after industry professionals and pedagogues, there are graduates who bring the information about their integration into the industry practice. Their experience can bring relevant findings, but more about knowledge and skills for integration or starting a business than about the setup of the whole study field. Graduates become professionals after few years of industry practice and then they will be able to critically evaluate the study field setup as a whole. In the third place, insights from actual students are valuable in evaluating individual courses and the pedagogical process, but not in general. Students do not have appropriate experience from industry practice. It happens a lot, that in the practice, or during their studies on another school, they found out that things they considered unnecessary became very helpful.

Conclusion

This paper showed principles how the professional bachelor's study field Multimedia in Economic Practice is being continuously developed and innovated, how the information is gathered and how is the improvements process working. Main benefit of this work is revealing universal principles of continuous development and relevancy of information from stakeholders groups.

Suggested way of continuous development of professional study field is to collect data about individual courses and the knowledge and the skills they give to students. Next data to collect are about students and graduates and their occupations or businesses and finally to collect the data about the study field as whole. Methods used for collecting the data should be interviews or surveys connected with observations by various study field stakeholders. One thing is what people say but another thing is what they really do. This combination should clarify how the students and graduates see themselves, how they are seen by professionals and how it is all seen by pedagogues. If is it possible to do long term monitoring of graduates in practice, it would be very valuable and helpful and bring deeper insight. Opinion of industry professionals is the most important, because they represent employers. All gathered information should be discussed in detail with industry professionals to find potential effect on graduates' integration to the industry.

The mechanism of transforming significant findings to possible improvements, choosing and evaluating the best form, realization and implementation should be done as soon as possible due to the potential changing environment in the industry. Maximal time to this would be six months.

The general recommendation for professional study fields arising from this text is to follow all relevant signals and information to improve and critically implement them as soon as possible. What next? When the amendment to the Higher Education Act is fully implemented with professional study field category and also with institutional accreditation, we can expect development of new study fields that will show more about their nature across industries. That would bring more possibilities to compare them with classic academic study fields and think about their setup for individual occupations. The only obstacle from the past is seeing of bachelor's degree title in Czech society as being not enough, but in time will make it better.

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MATHEMATICS EXAM SUCCESS RATE AT THE COLLEGE OF POLYTECHNICS JIHLAVA (2006-2015)

[1]✉Martina Zamkova, [2]Martin Prokop, [3]Radek Stolin

[1]Department of Mathematics, College of Polytechnics, Tolstého 16, Jihlava, 586 01, Czech Republic, martina.zamkova@vspj.cz

[2]Department of Mathematics, College of Polytechnics, Czech Republic

[3]Department of Mathematics, College of Polytechnics, Czech Republic

Abstract

This paper addresses the exam success rates in Mathematics 1 at the College of Polytechnics in Jihlava (CPJ). Primary data taken from the school information system cover the years 2006–2015. We carried out a detailed success rate analysis based on several criteria (study programme, form of study, the reason for termination of studies, gender) and we observed the dependence of the success rate on the aforementioned criteria and time. The contingency tables analysis and correspondence analysis were used to assess the dependencies. The analysis showed that the success rate in Mathematics 1 has been decreasing over the course of the monitored period of time. The success rate of full-time students is higher compared to the part-time students. Women have higher success rate than men. Technical study programmes show lower success rate in mathematics. The research shows that mathematics may not always be the cause of a complete termination of studies. To reverse the trend of the growing failure rate we introduced an entrance test of high school basic mathematics followed by a course for those who fail at this test. Plus there are plans for the innovation of e-learning modules, creation of textbooks for this course, and the introduction of 5-day intensive summer and winter schools in mathematics.

Keywords

Contingency tables, correspondence analysis, mathematics, success rate

Introduction

It is often said nowadays that the level of mathematical knowledge is decreasing. The objective of our research was, therefore, to assess the development of success rates in Mathematics 1 at the College of Polytechnics in Jihlava over the past 9 academic years. A detailed success rate analysis based on several criteria (study programme, form of study, the reason for termination of studies, gender) was carried out. The success rate of students in mathematics during the monitored period of time was evaluated with regard to the criteria. We used contingency tables analysis and Pearson's test of independence to test the dependency of the success rate on the aforementioned criteria and time. Column relative frequency and the graphic output of correspondence analysis (correspondence maps) were used to test the character of dependence.

A paper by Zámková and Blašková (2014) focused on similar issues. The paper's objective was to assess the Mathematics-1 exam success rate at the Faculty of Business and Economics of Mendel University in Brno. Another article (Fonteyne et al, 2015) assesses the impact of mathematical knowledge and skills on Ghent University students' success rate in a statistics course. Similarly Kučera, Svatošová, and Pelikán (2015)

analysed the relationship between the admissions mathematics test results and the success rate in Mathematics, and Mathematical Methods in Economics.

A publication by Sonnert, Sadler, and Bressoud (2015) deals with the students' attitude toward mathematics in relation to the introductory calculus course and other relevant influential factors. The research shows that a positive attitude is strongly related to professors who offer clarity in presentation and answering questions, useful homework, fair exams, and help outside of class. The positive impact of technologies, such as graphing calculators, was not confirmed. The same applies to the usage of modern pedagogical methods. Majovská and Friedrich (2014) from the Technical University of Ostrava proved that the usage of simple study materials and (contrary to the findings of the previously mentioned paper) modern technologies improved students' success rate and their attitude towards mathematics.

The impact of the decreasing quality of high school mathematical education on university success rates in mathematics was addressed by Kučera, Jindrová, and Vydrová (2013). Universities are accepting less talented students due to the fact that there are fewer eligible candidates. This is a result of decreased population. The authors examined the success rate on courses that require mathematical skills (statistics, operations research) via a questionnaire survey. The survey showed no link between the high school type and the success rate. Kouřilová and Bebčáková (2015) concluded that the mathematical knowledge of students coming from high schools is decreasing each year. They analysed the success rate in mathematics with respect to various factors (high school type, students' behaviour, and overall study results).

Uysal (2007) compared the success rate in mathematics at selected schools in Turkey. The link between entrance mathematics and English language exams was analysed by Doucek and Maryška (2015). A psychologically oriented paper (Simzar et al, 2015) focused on the association between students' motivation for mathematics and their test results. Ulrychová (2015) addressed the relationship between the knowledge of mathematical theory and the ability to solve exercises among the students of University of Economics. The results lead her to question what the ideal ratio of theory to practise is in mathematics courses at non-technical universities.

Materials and Methods

Primary data was taken from the College of Polytechnics information system. The categorical data includes students' success rates in Mathematics 1 for the years 2006–2015 and relevant identification variables. Mathematics 1 is supposed to provide students with basic knowledge of mathematical analysis and linear algebra.

Contingency tables present an easy way to display the relationship between categorical data. We used the Pearson's chi-square test; the null hypothesis of the test assumes independence of variables. The condition that a maximum of 20% of the expected frequencies are less than five must be met; see Agresti (1990).

Correspondence analysis that was used for this study is a multivariate statistical technique, which allows the display and summary of a set of data in two-dimensional graphic form. This analysis aims to reduce the multidimensional space of row and column profiles and to save the original data information as much as possible; see Hebák (2007). Unistat and Statistica software was used for primary data processing.

Results

In the surveyed period of time there were more women (60.8%) than men enrolled in the CPJ study programmes that include maths courses. The majority of students in 2006–2015 studied Finance and Management (FM) (57.8%), followed by the Travel and Tourism (TT) programme (24.4%). The lowest number of students enrolled in the technically oriented programmes of Computer Systems (CS) and Applied Computer Science (ACS) (approx. 9%). These were mostly fulltime students (70.9%). Row relative frequencies (Tab. 1) show that women have higher success rates in Mathematics 1 than men (47.7% to 35.5%). The detected *p*-value is less than 0.001, which implies strong statistical dependence. Tab. 2 shows that the success rate of full-time students is higher compared to the success rate of the part-time students (47.7% and 31.3%). Again, the detected *p*-value is less than 0.001, which implies strong statistical dependence. Hence it is clearly easier to study the demanding full-time course, since this form of study offers students more opportunities to practice solving exercises during seminars.

Row relative frequencies	Succeeded	Failed
Women	47.65%	52.35%
Men	35.48%	64.52%

Tab. 1: Contingency table: Gender and success rate in Mathematics 1, 2006–2015

Row relative frequencies	Succeeded	Failed
Full-time	47.65%	52.35%
Part-time	31.27%	68.73%

Tab. 2: Contingency table: Form of study and success rate in Mathematics 1, 2006–2015

Furthermore, row relative frequencies (Tab. 3) show that the lowest success rate is in the technically oriented programmes (CS and ACS) – about 32%. The success rate in the economic programmes (FM and TT) is higher (around 45%). The observed *p*-value is less than 0.001, which implies strong statistical dependence between the success rate and field of study.

Row relative frequencies	Succeeded	Failed
Finance and Management	44.99%	55.01%
Applied Computer Science	32.15%	67.85%
Computer Systems	32.24%	67.76%
Tourism and Travel	45.70%	54.30%

Tab. 3: Contingency table: Study programme and success rate in Mathematics 1, 2006–2015

Tab. 4 shows that those studying at the moment or those who passed the final state exam have significantly higher success rate in mathematics. Roughly 18% passed the mathematics exam after repeating the course once. Interestingly 20% of expelled students and 14% of drop-outs passed the mathematics exam, therefore mathematics was not the reason of their overall failure, *p*-value is less than 0.001.

Row relative frequencies	Succeeded	Failed
Did not comply with internal regulations / Expelled	20.66%	79.34%
Studying at the moment	70.96%	29.04%
Passed the final state exam / Graduated	82.38%	17.62%
Dropping out of college / Drop-out	13.90%	86.10%

Tab. 4: Contingency table: The reason for termination of studies and the success rate in Mathematics 1, 2006–2015

The graphic output (Fig. 1) shows that the success rate has been continuously decreasing over the course of the monitored period. The initial values of the success rate (70%) drop to 30%. The largest decline occurred in 2008 and 2009. The observed p-value is less than 0.001, which implies strong statistical dependence between the success rate and the monitored period.

Plus, the observed p-value is less than 0.001, which implies a strong statistical dependence between the final grades in Mathematics 1 and the study programme. The correspondence map (Fig. 2) demonstrates that the success rate of FM students is placed approx. in the middle of the graphic output, between the grades. This means that the students' grades are evenly distributed on the scale A–F. The most frequent grade for the ACS and CS students is F (failed); the correspondence map shows that the F grade is placed near these two programmes. The biggest distance is separating the ACS students from A and B grades, which means that they are the ones who achieved good grades the least frequently.

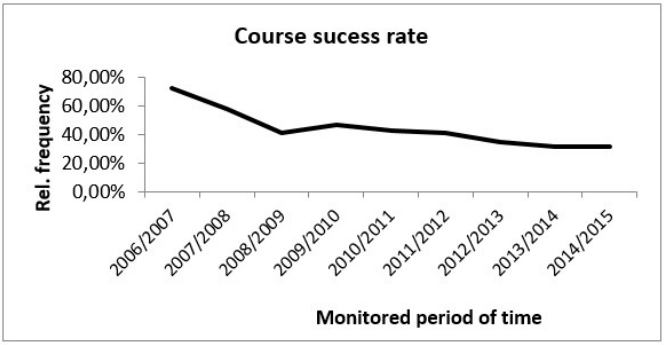

Fig. 1: Students success rate in Mathematics 1, 2006–2015

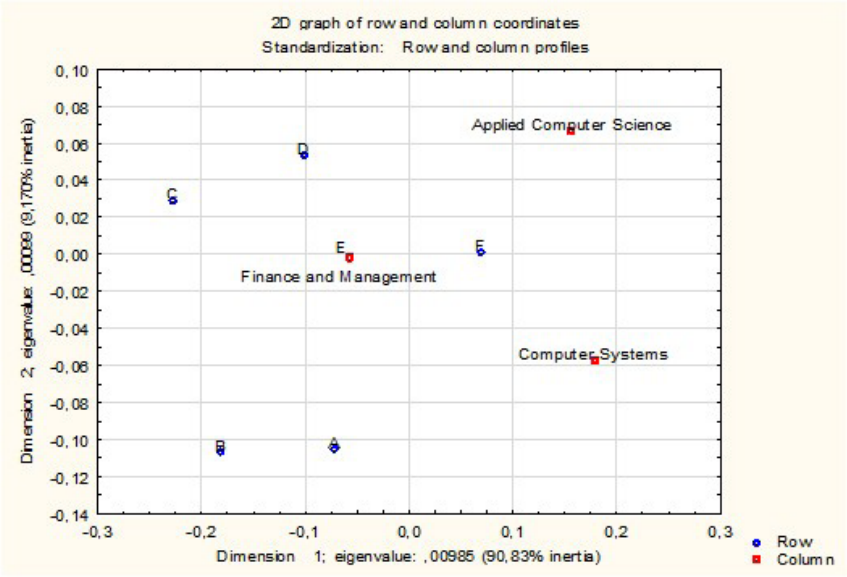

Fig. 2: Correspondence map: Study programme and final grades in Mathematics 1, 2006–2015

Row relative frequencies (Tab. 5) show that full-time students achieved more A–E grades compared to the part-time students, who have most frequent F grades. The detected *p*-value is less than 0.001, which implies strong statistical dependence.

Row relative frequencies	A	B	C	D	E	F
Full-time	3.30%	3.88%	9.45%	8.00%	17.69%	57.68%
Part-time	2.57%	1.98%	5.71%	5.31%	11.95%	72.48%

Tab. 5: Contingency table: Form of study and final grades in Mathematics 1, 2006–2015

A strong statistical dependence (p-value is less than 0.001) was confirmed with regard to gender and final grades in Mathematics 1. Row relative frequencies (Tab. 6) show that women achieved more A–E grades compared to men, who have the majority of F grades, although the differences are not as significant as those between the forms of study.
The correspondence map (Fig. 3) shows clearly a significant increase in the number of students graded with F, especially in the years 2012–2015. Conversely, the beginning of the monitored period of time saw students closer to the rest of the grades. Students from 2006 achieved the best grades.

Row relative frequencies	A	B	C	D	E	F
Women	3.51%	4.05%	9.85%	8.33%	16.96%	57.30%
Men	2.56%	2.40%	6.46%	5.79%	14.66%	68.12%

Tab. 6: Contingency table: Gender and final grades in Mathematics 1, 2006–2015

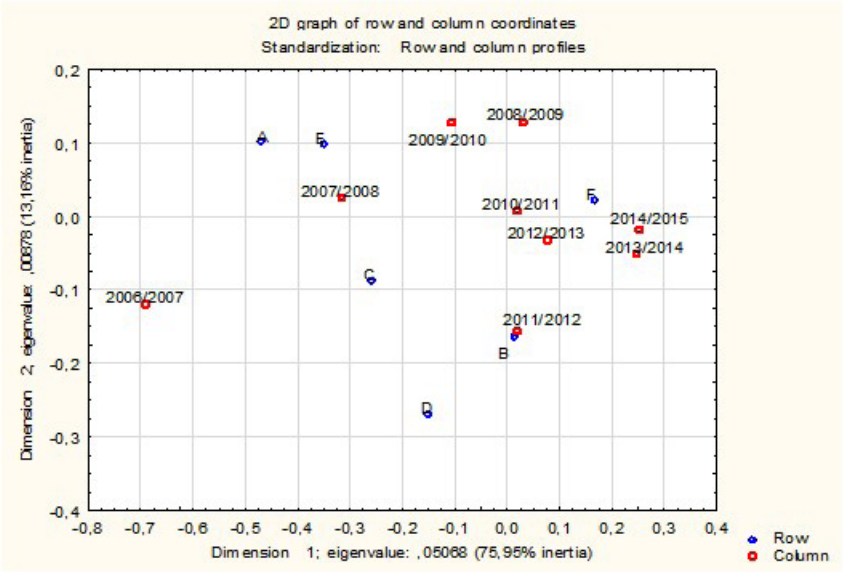

Fig. 3: Correspondence map: School years and final grades in Mathematics 1, 2006–2015

Discussion

The article by Zámková and Blašková (2014) suggests that the most frequent grade obtained in mathematics at the Faculty of Business and Economics of Mendel University in Brno is F, and the same applies to our college. A different publication (Fonteyne et al, 2015) recommends a basic mathematics entrance test to target potentially struggling students and to offer them alternatives. Our school has begun to embrace a similar approach. The first mathematics seminar includes an entrance-level basic high school mathematics test. The students who pass the test start attending the course Mathematics 1. Those who fail are reassigned to a special course called Seminar in Mathematics to practice high school maths.

Authors Kučera, Svatošová and Pelikán (2015) analysed the success rate in mathematics with respect to various factors. One of our objectives was to trace the factors influencing the students' success rate. Our findings show that gender, the form of study, and the study programme all have an impact on the success rate in Mathematics 1. While Uysal (2007) did not confirm the influence of gender, Kučera, Jindrová and Vydrová (2013) proved that there is a correspondence between gender and the success rate in maths. Our research implies strong statistical dependence between the success rate in mathematics and gender. A paper by Kučera, Jindrová and Vydrová (2013) suggests that the type of high school attended does not have any impact on achievement in mathematics. Similarly, Kouřilová and Bebčáková (2015) examine the impact of high school on the success rate in mathematics and they do find a certain dependence – the impact is therefore not positively confirmed.

As mentioned by Ulrychová (2015) we are also looking at to what degree theory should be integrated into mathematical education, and our experience indicates that as much theory as is indispensably needed for solving the exercises should be taught.

In accordance with Sonnert, Sadler and Bressoud's publication (2015), we also believe that students are more likely to accept traditional educational methods based on high-quality professors, rather than special technologies and modern practices. Modern methods are, in our opinion, more efficient in other fields of study, such as the humanities, social sciences etc. We share the idea of the paper by Simzar et al (2015) that the students' motivation matters. Our next research could focus on the comparison of results achieved in maths with those achieved in different courses (Doucek and Maryška, 2015). Should there be proof that good grades in mathematics tend to go hand in hand with good grades in other courses, students might see a verification of the fact that mathematics can be learned through diligent studying just as other subjects. Students are sometimes scared of mathematics beforehand and the findings of such analysis could be used to motivate them to study mathematics. There is an ambiguity of the research results: Majovská and Friedrich (2014) confirmed the positive impact of modern technologies while Sonnert, Sadler and Bressoud (2015) did not. We believe that personality, educational methods, the motivational skills of individual teachers and the overall attitude of students is what matters most with regard to the improvement of students' results. We believe the good results acquired in the city of Ostrava (see Majovská and Friedrich, 2014) are mainly the result of the simplification and clarification of study materials. The College of Polytechnics is following the same path, including the restricted use of modern technologies where they prove to be effective. This concerns the creation and ongoing improvement of elearning modules for mathematics where everything is explained in a simple and clear way, plus the offer of a number of examples of exercises and opportunities to practice.

Our school is currently implementing an internal project aimed at improving the success rate in Mathematics 1 and other mathematically oriented courses. This year we have introduced a compensatory mathematics seminar for students who failed the entrance test. Such students may drop the course Mathematics 1 and therefore will not lose their right to repeat the course. Textbooks for Seminar in Mathematics will be published and the e-learning module is to be updated and it shall include new tests and question banks matched with the topics taught. This course will include intensive summer and winter schools in mathematics.

Conclusion

The analysis showed that the success rate in Mathematics 1 has been decreasing over the course of the monitored period of time. The success rate of full-time students is higher compared to that of part-time students; it is thus clear that full-time studies bring better results in mathematics. Part-time students are missing out on the opportunity for thorough practice with their professors. The research confirmed that women have a higher success rate than men. Technically oriented programmes (ACS and PS) showed lower success rates in mathematics. Roughly 18% of the students passed the mathematics exam after repeating the course. This research also shows that mathematics may not always be the cause of complete termination of studies; about 26% of the students who failed their studies had other reasons (they dropped out or failed other courses). Detailed analysis of grades showed that F grades are more frequent among students enrolled in technically oriented programmes (compared to FM), among part-time students, and among male students. The correspondence map of changes over a certain period of time shows clearly that there has been a significant increase in the number of students graded with F in the past years, especially in the years 2012–2015. The beginning of the monitored period of time saw students obtaining better grades. Students in the academic year of 2006/2007

achieved the best grades. The efficiency of the suggested measures is to be reviewed and further development of the success rate in mathematics at the College of Polytechnics in Jihlava will continue to be observed in the framework of the ongoing internal project.

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