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EFFECT OF CORRUPTION AND POVERTY ON EFFICIENT EDUCATION IN LATIN AMERICA

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Abstract

Countries of the first world have invested many resources into education, which has led to high quality standards of education. What is more, these countries have also been able to solve many social problems, such as corruption, poverty, among others. This success has motivated developing countries, especially in Latin America, to copy this process. Thus, based on the relationship between economic growth and level of education, we constructed an econometric model to analyze probability of efficient education for poor countries in Latin America. The results indicate that if Latin American governments consider eradicating poverty levels and corruption problems, they could opt for a better education and, consequently, reduce excessive spending to get closer to critical level of efficient education.

Keywords

Corruption, econometric modelling, efficient education, excessive spending, poverty

Introduction

During the several past decades, there has been a lot of effort to improve globally the level of education. For example, the number of illiterate people went from 871 million in 1980 to 758 million in 2014 (UNESCO, 1995, UNESCO, 2014). It means that the global effort for improving the level of education has decreased illiteracy by 13%. If the trend in the improvement was linear, then it would take about more than 250 years to eradicate the illiteracy around the world. As Sala-i-Martin (1994) and Barro (1991) pointed out, education is a significant indicator that influences economic growth, and vice versa. That is, from 1980 to 2015 the world economy has grown by 114% (IMF, 2017). This gives us an idea that the economic growth rates have had too little impact on the level of education.

In particular, it has been observed that the poorest countries have the lowest school enrollment rates and, consequently, the highest illiteracy rates. In 2015, there were 61.4 million children in the world who did not attend primary schools. Out of those 61.4 million, 18 million children were in Asia, whereas in Latin America and the Caribbean the number was 3 million (UNESCO, 2014). If we talk about secondary education, in Latin America and the Caribbean there were 7.5 million young people without taking the second year of their studies. In contrast, in North America and Europe, the rate of non-enrollment in primary education was only 2.8% (UNESCO, 2014).

In the 1950s the dispute over developmental theories placed the emphasis on the correlation between education and economic development. What is more, the country's level of education was an indicator of the development degree (UNESCO, 1957; Cipolla, 1969). For others, these theories were only a prerequisite for a country to take off towards a development (Rostow, 1960). From this perspective, education is seen as an independent variable. Mankiw, Romer and Weil (1992) and Barro (1991) presented the most influential model[1] for explaining the level of economic growth by adding a factor that represented education. In this case, this factor was represented as

1 This model was inspired by a model constructed by Solow (1956).

a human capital, which was understood as the workforce formed with tools and skills to improve job performance.

Public policies in many countries focused on reducing illiteracy, achieving several advances in this area. In 1957, Myrdal (1957) presented the theory of "Cumulative Circular Causation", in which he argued that poor countries suffer from a cyclical accumulation effect of the causes of underdevelopment. As a result, the gaps between poor and rich countries are widening. In this way, a country with a high level of poverty will be able to spend less on education. As a consequence, this country would have a low educational level and, therefore, there would be a low level of human resources training in science and technology, a poor development in the productive level, a low added value in the industry. What is more, this country would be unattractive to foreign investments. At the end, the economic growth would slow down and result in a high level of poverty (Jiménez-Bandala and Andrade, 2017).

According to the latest and coinciding with the establishment of neoliberal economic policies, it is logical to ask what has happened, and what are the reasons why it has not been possible to achieve an efficient education globally? The efficient education is an education in which the expenditures into its development does not surpass the achievements in economic growth. Dridi (2014) and Hallak and Poisson (2007) have observed that the stagnation related to the economic growth cannot necessarily exist due to poverty. Rather, there could exist other factors explaining this effect, for example, the level of corruption. Jiménez-Bandala and Andrade (2017) demonstrated on a sample of 128 countries that economic growth alone is not a determining factor for the level of education. There are other variables (such as economic growth, level of corruption, poverty rate, etc.) that could affect the level of education.

The objective of this article is to construct an econometric model to calculate the probabilities that the Latin American countries have for opting for an efficient education. In this sense, the efficient education is defined as an education in which a country is not falling into an excess of spending or a loss of well-being.

The article is divided as following: in the first part, the background of the problem is presented. Then, the second part explains the methodology for constructing an econometric model. The third part is dedicated to a description of the achieved results. The article concludes with some remarks and recommendations.

Materials and Methods

Data

For the purpose of the analysis, we consider several variables. In case of education, we consider the percentage of literate people, as reported by the World Bank statistics, which comes mainly from the census data of each country. Although there is an evidence that such indirect evaluation could overestimate literacy (UNESCO, 2006), we stay with the World Bank's report, as it is the only comparable basis between countries. Economic growth is based on the average real growth rate of the Gross Domestic Product (GDP) of each country for the period 2010-2015 (IMF, 2017). The level of corruption is measured regarding the Corruption Perception Index (CPI) developed by Transparency International (Transparency International, 2016). The values of CPI vary from 0 to 100, where 100 means the lowest possible level of corruption, and vice versa. The level of corruption is related to the year 2015 (Transparency International, 2016). Last but not least, for the poverty rate, we take the percentage of people living on less than USD 1.9 a day (extreme poverty line) by 2015 (World Bank, 2017a). The econometric analyzes then includes following variables:

- Y – Percentage of population with elementary education (education)
- X_1 – Growth of Gross Domestic Product (economic growth)
- X_2 – Corruption Perception Index (CPI)
- X_3 – Poverty rate

The sample size contains of 80 countries worldwide, which is the number of countries that reported complete information for all variables required during the period of study. Out of those, the sample includes 9 countries from South America. All of these countries were declared as poor regarding the World Bank classification (World Bank, 2017a). Table 1 summarizes the descriptive statistics of the dataset.

TOTAL	Education	GDP	CPI	Poverty
Max	99.893	9.608	82.297	39.230
Min	19.103	-20.599	0.000	0.330
Average	78.178	3.275	27.835	8.692
SD	20.837	3.803	21.961	10.268

S. America	Education	GDP	CPI	Poverty
Max	98.090	4.849	82.297	5.300
Min	92.587	-3.800	1.914	0.450
Average	95.205	1.299	26.103	2.237
SD	1.538	3.126	23.351	1.743

Table 1: Descriptive statistics of the sample, Total and South American countries, 2010-2015 (own calculation)

We suppose only these variables in the analysis, as Jiménez-Bandala and Andrade (2017) have proven their significance for explaining level of education. Equation (1) summarizes the significance estimation of the selected variables:

$$\widehat{Y}_i = \underset{}{80.233} - \underset{(.106)}{0.0656 X_{1i}^{\,2}} + \underset{(.011)}{0.2431 X_{2i}} - \underset{(.000)}{0.8264 X_{3i}} \qquad (1)$$

We can observe that with 90% significance, global and individual, the negative quadratic effect of the economic growth, the corruption level and poverty rate are significative for explaining the education level in poor countries.
For the estimation in this article, econometric software ESTATA version 10 was used.

Efficient education

As Jiménez-Bandala and Andrade (2017) have observed, the effect of economic growth on the level of education is in the form of an inverse U (Figure 1). We can notice that from point G* the level of education begins to fall, and then investment to improve the level of education is ineffective. In addition, the value edu^* can be reached with the level Gn much lower than G^*, which results in a loss of social welfare of size: $G^* - Gn$. As a consequence, there is a point where the level of education is moving away from the expected level. That is, a $Gdecr < Gn$ (Figure 2). This difference will be called the "optimal scope of efficient education", i.e. without excessive spending.

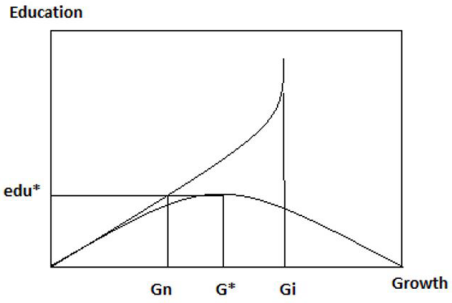

Figure 1: Real and expected effect of economic growth on the education level (Jiménez-Bandala and Andrade, 2017)

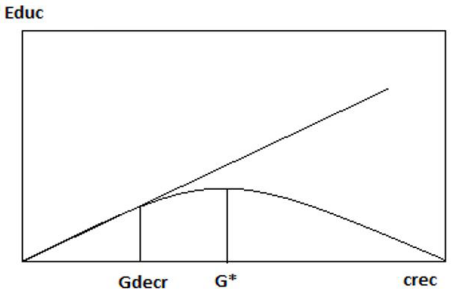

Figure 2: The effect of economic growth on the level of education (Jiménez-Bandala and Andrade, 2017)

Results and Discussion

Optimal education without excessive spending for Latin America

As mentioned before, there is the point *Gdecr* , where the effect of economic growth on the level of education begins to move away from the ideal. To find this point for the Latin American countries, we define,

$$D_i = \begin{cases} 1 & \text{if a country is from Latin America,} \\ 0 & \text{if a country is from other region.} \end{cases}$$

The expected effect of the level of growth on education in a linear form for Latin American countries is estimated as following

$$\widehat{Y}_i = \underset{(.611)}{76.18316} + \underset{}{.3216544 X_{1i}} + \underset{(.22)}{1.732088 D_i X_{1i}} \qquad (2)$$

Estimation (2) shows non-significance of the linear effect on the educational level. The expected effect of the level of growth on education in a quadratic form for Latin American countries is estimated as following,

$$\underset{(.064)}{\widehat{Y}_i = 77.16687 - 0.0840899 X_{1i}{}^2} \underset{(.003)}{+ 17.79451 D_i X_{1i}{}^2} \tag{3}$$

Note that, in this case, both variables are statistically significant. Therefore, we can proceed to find the $Gdecr$ value shown in Figure 2 for the case of the Latin American countries. We simply put $D_i = 1$ in (2) and (3) and solve

$$76.18316 + 2.0537424 X_{1i} = 77.16687 + 17.71042 X_{1i}{}^2$$

which gives us $X_{1i} = 0.05798 = Gdecr$. This level gives us the critical level of economic growth where no excessive spending in education exists.

Probability of efficient education

For the critical level of economic growth, $X = 0.05798 = Gdecr$, the critical level of efficient education in the Latin America is $\widehat{Y}_i = 76.30223616$. In this case, there is no excessive spending, i.e. 76.3% literacy level. Based on this, we define a binary variable that detects the optimal level of education for Latin American countries without excessive spending. Thus,

$$Y = \begin{cases} 0 & \textit{if education is optimal without excessive spendings, with prob} = p \\ 1 & \textit{if education is not optimal without excessive spendings, with prob} = 1 - p \end{cases}$$

formally

$$\begin{cases} 0 & \textit{if education} \geq 76.30223616\textit{, with prob} = p \\ 1 & \textit{if education} < 76.30223616\textit{, with prob} = 1 - p \end{cases}$$

The objective is to estimate the average behavior of binary Y from some explanatory variables, that is

$$\hat{Y} = E\left(Y \middle| X\right) \tag{4}$$

where Y represents a qualitative variable of "success" and "failure" regarding the excessive spending in education, which is nothing more than Bernoulli distribution (that takes two values 0 and 1). Thus

$$E\left(Y\right) = \sum_{i=0}^{1} iP\left(Y = i\right) = 0 * \left(1 - p\right) + 1 * p = p \tag{5}$$

Then, from (4) and (5), we seek to estimate the probability of reaching an optimum level of education in the Latin American countries without having the excessive spending. With accordance to Jiménez-Bandala and Andrade (2017), we maintain corruption and poverty as the explanatory variables. The resulting estimation is as follows

$$\underset{(.043)}{\hat{Y} = 0.6372498 + .0047793 X_{2i}} \underset{(.000)}{- 0.0181523 X_{3i}} \tag{6}$$

Model (6) shows significance and a qualitative effect that the corruption level and poverty have on the probability of efficient education in Latin America. For example, if the corruption rate decreases by 1% (in the case of the Corruption Perception Index it means an increase by 1%, Transparency International, 2016), then the probability of efficient education in Latin America

increases by 0.0047%t. Similarly, if the poverty rate decreases by 1%, then the probability of efficient education increases by 0.0181%. This can be seen as an incentive for the governments to pursue these objectives on poverty and corruption.

For example, Venezuela with corruption level 1.914 (Latin American average 23.351) and poverty rate 5.3 (2.237) is significantly below/above the Latin American average. In this case, if Venezuelan government improves the corruption level by 10 (up to 11.914), then the level of literate people would increase by.0477% (up to 95.4467). Similar effect would have if the government decrease the poverty rate by 3% (to get approximately to Latin American average), then the level of literate people would increase up to 95.4534. Therefore, Venezuelan government should rather pay more attention (and resources) on combating corruption and poverty, instead of spending more in education. This would lead to a growth of literate people, as well as it would lead to efficient education, as the excessive spending would be reduced.

In this article we have analyzed the effect of the level of efficient government's expenditure over the education level. This effect can also be analyzed inversely. Chabbott and Ramírez (2000) showed first the implications of the government expenditure over level of economic development and, next, they showed the effects of government expenditures over education. On the other hand, Gupta, Clements and Tiongson (1998) suggested that the way to improve the efficiency of spending on education is to modify the structure of the allocation of expenditure within educational levels. In addition, speaking of efficient spending, Gupta, Clements and Tiongson showed that Asian countries were the ones that devoted the lowest proportion of expenditures on education. However, these countries have achieved the best social indicators in education. This corresponds with our results in the case of Venezuela. Venezuelan government should allocate more resources to combat corruption and poverty, instead of spending more in education. As Ramírez López and Sánchez Juárez (2013) observed, corrupted environment has negative impact on public sector efficiency and performance. Therefore, combating corruption can later leads to better efficiency in education.

Finally, we were interested in the levels of education because it is a determinant factor over the economic variables. For example, in the models of economic growth the individuals with education formation (human capital) are the main resources for the economic growth. What is more, the education formation can be combined (Lucas, 1988) or not (Mino, 1996) with the physical capital.

Conclusion

The article presented an econometric analysis of efficient education of a sample of 80 poor countries. The main focus was paid to Latin American countries to analyze probabilities of improving level of education by reducing excessive spending. The results indicate that there is a significant effect of corruption (.00477) and poverty level (-.0181) on education. Regarding the definition of efficient education, Latin American governments should combat corruption level and poverty rate to improve the level of education, instead of spending more recourses to education. The problem of excessive spending is very important in Latin America, where many countries have lack of additional recourses.

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CREATING AND EXPERIENCE WITH KNOWLEDGE ASSESSMENT MODULE IN TEACHING PROGRAMMING

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Abstract

We are currently running a system of automatic assessment of student assignments in teaching of the computer programming. We have developed a Bayesian-based module to further automate and streamline testing and provide feedback to students. Tasks are solved by students during the semester. The student inserts this assignment (programming code) or other tests into the system. Student code and answers is then tested and automatic feedback is provided. The auto-test system dramatically reduces the time for teachers to find out whether the student‘s solution is right and puts emphasis on providing counseling and counseling to students. To test the diagnostic capabilities of this Bayesian network, 21 students were evaluated. The results show a high degree of agreement between the teacher‘s assessment and the Bayesian network evaluation.

Keywords

Automatic testing system, bayesian networks, programming education, self-assessment, programming language

Introduction

A knowledge of a programming is a basic discipline for students of computer science. Usually, they have a course of the programming in the first year of study. At our faculty in the study Economic informatics, we teach the C# programming language. An important tool in the teaching of this programming language has become our testing system. Until recently, this testing system only evaluated the correctness of the students' code (Beranek, Remes, 2017). Other criteria such as elegance, readability, code documentation, or efficiency were not taken into account in this system because it would require manual review (Singh, Gulwani and Solar-Lezama, 2013; Ihantola et al., 2010) and others. These criteria are more important for advanced programming courses (Verdu et al., 2012). In the literature, similar automated evaluation systems are described, for example, in Douce, Livingstone and Orwell, 2005, Ihantola et al., 2010). Some have come to the conclusion that automatic evaluation can lead to increased student performance (Woit and Mason, 2003, English, 2002). Work from MIT and Microsoft (Singh, Gulwani and Solar-Lezama, 2013) is a model in which the system refers to an implementation solution, and its error model consists of correcting errors that students may make. It automatically deduces minimal corrections from student mistakes. Another relatively new development is the adoption of a distributed, web-based training and assessment system (Verdu et al., 2012) and increasingly popular MOOC (Masters, 2011). An important ability of automated testing tools is to provide feedback, an effective way to increase student performance and motivation (Beranek, Remes, 2013). As Shute (1995) states, testing systems must be able to achieve three main tasks:

- to evaluate accurately students' level of knowledge using principles rather than pre-programmed responses;

- to decide what to do next and adapt the instructions accordingly;
- to provide feedback.

This type of evaluation and adaptation is usually done using methods of an artificial intelligence. That's why we decided to complete our test system with a Bayesian diagnostic module. The variation of the Bayesian network was chosen because it was a method and methodology for modeling of students, and it was used for this purpose in a number of existing applications (for example one of the first paper of Collins et al., 1996). These previous works have shown that the Bayesian networks can contributes to a thorough and detailed assessment of each student according to the level of granularity properly defined by a teacher. Our plan was to get a more detailed model of student knowledge that would include information about which part of the curriculum the student is not mastering and which parts he has mastered. This information is necessary to provide feedback, corrective actions and personalized guidelines. Our module is mostly based on the approach used in the work of Millán et al. (2010, 2013), which was applied to mathematical discipline testing.

The rest of the text is structured as follows: The following section deals with the description of the test system and the newly created module and its functioning. Section Results and Discussion describes our experience with using the module in the classroom and discusses the results achieved, including the comparison of the results of the newly introduced module with the "manual" evaluation. It also provides a brief view from the point of view of students. Section Conclusions contains assessments of the achieved results and future directions of our work.

Materials and Methods

Using Bayesian networks for learning systems is not new. The authors of various adaptive learning systems also try to build various reasoning modules into their systems. These modules are used to adapt study materials to student's level of knowledge, to test, to predict student knowledge and to determine where students will need help and their probable method of problem solving (e.g., Desmarais & Baker, 2012). For the purpose of an adaptive sequential curriculum, Bayesian networks can represent skills/knowledge in the course (e.g., Al-Muhaideb & Menai, 2011). Adaptive systems for curriculum assessment are among the alternatives, within the problem of the student's model of knowledge and goals, (e.g., Vomlel, 2004, Almond et al., 2015). Bayesian networks are used in these systems to address the different issues within the testing (e.g., Millán et al., 2010, 2013). Their work is from area mathematics, it focuses specifically on first degree equations, using twelve concepts to assess knowledge. Each concept is evaluated in a set of four questions or exercises. They use the Bayesian student model. Other authors using Bayesian networks are, for example, Liu and Wang (2007), who have proposed a knowledge modeling method based on the Bayesian network. Torabi et al. (2012) worked in student grade forecasts based on the history of the student's education. They proposed a Bayesian network model for the inferential process. The results show that the application of the proposed method has primary effects on student quality and can be used as a useful tool for them.

Creating a Bayesian Network Student Assessment Module

The process of building the Bayesian network consists of several steps (Ramírez Noriaga et al., 2015). The first step is to define the Bayesian network structure, that is, its topology. In this step, nodes (representing phenomena, in our case, knowledge represented as concepts, questions, exercises, problems, etc.) and network edges (representing relationships, links) are created. Typically, for the construction of a specialized network structure, an expert needs an area that decides what topics or skills to model the network and how they depend on other skills. Briefly, it is necessary to define the domain knowledge, the selection of the work area, the development

of hierarchical range of knowledge: knowledge classification at various levels, i.e. to create nodes and create relationships between them, including design issues for evaluating knowledge (creating a bank of questions and assignments relations on the concepts contained in nodes).
The second step is to initiate the estimated values of student knowledge and student learning. Bayesian network initialization greatly influences the way the network is updated based on current students. Since student interaction with teachers takes only a short time, and experience with one student is limited, initialization and updating processes are important in generating sufficient information to draw conclusions about a single current student. Estimates of student knowledge can be initialized in a variety of ways, including educated estimates (experts provide the best estimate), the use of average values from past student, and estimates based on various test results. Again, briefly, it's about designing conditional probability tables, assigning probabilities to nodes based on parent relationships.
The third step is to update the probabilities in the Bayesian network. Using past and current information (based on interaction of students on Bayesian network), and the updates the probabilities of the Bayesian network.

Design of our network

To design our network, we have chosen the approach suggested by Millán et al. (2010), who called it The Generic Bayesian Student Model (GSBM). This model (Millán et al., 2010) recognizes two kinds of variables: knowledge variables and evidential variables. Knowledge variables (K) represent student knowledge, evidential variables can be measure disrectly, they represent students' action. The knowledge domain can be further divided into, for example, hierarchically into three levels: basic terms (C) (lower level, further indivisible topics); topics (T) (middle level that represents aggregated concepts) and subject (S) (a higher level that represents aggregated themes). All knowledge variables are modeled as binary: 0 (unknown) and 1 (known). Evidential variables (Q) represent student activity and are directly observable. For example, test results, questions, problem solving, etc. Values of these variables will be used to derive the values of hidden knowledge variables. In GBSM, evidential variables are also considered binary (0 incorrect, 1 correct). Relationships in the GBSM model are defined as the aggregation relationships between knowledge nodes (basic concepts, topics and subject), where part knowledge is assumed to have a causal impact on knowledge of a more general topic. Another type of relationship is the relationship between knowledge and evidence. Knowledge of certain topics has a causal impact on the ability to properly resolve related evidence. The general structure of GBSM is illustrated in Figure 1.

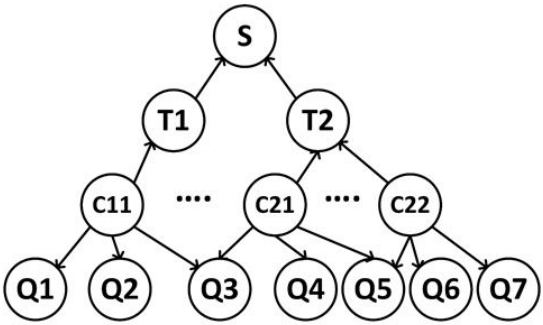

Figure 1: Concept of the GSBM model (Millán et al., 2010)

We determined the parameters required for the proposed Bayesian network based on the procedure described in the work (Millán et al., 2010):

1. For each basic concept C_i: we set prior probabilities $P(C_i)$. They can be determined from available data or estimated on the basis of experiences.
2. For each aggregated knowledge variables K: we determined conditional probability of their components (parts), i.e., $P(K \mid K_1,\ldots, K_n)$.
3. For each Q_i evidential node: we specified conditional probabilities of the Qi evidential nodes (e.g., test question) with respect to the terms $P(Q_i \mid C_1,\ldots, C_m)$ (we assume that the terms are related to Q_i).

To simplify the conditional probability specification, GBSM proposes a probability-based approach using an ad-hoc defined function G, which has four parameters $\{g, s, d, a\}$. These must be specified by experts:

- g represents the probability that a student with no knowledge guesses the correct answer to item Q_i.
- s represents the probability that a student with all the necessary knowledge fails to correctly answer item Q_i.
- d estimates how difficult an item Q_i is.
- a represents the degree to which the item discriminates between students (mostly set to 1.2).

For more details about the G function, see (Millán et a., 2010).

With these parameters determination more question had to be solved: how to choose the concepts and questions to be included in the model? How should these features be linked? How should the models be initialized and updated?

Results and Discussion

Following the above methodology, we have created a Bayesian network that contained hierarchically structured concepts, concepts, procedures, and other topics discussed in the course The Computer Programming in C# in accordance with the above mentioned methodology. As an object, we have entered integrated units of the curriculum (S according to the GBSM model) into the network, e.g., introductory knowledge that includes topics such as program, variable, assignment, command, block, types of variables and others (T and C terms according to of GBSM). Next, we generated questions related to the previous structure. We have assigned values to each question, taking into account the related concepts and values of each. Each test item has been linked to several concepts in the network. Conditional probabilities are calculated from the set of $\{g, s, d, a\}$ parameters we have defined on our estimates. Since there are truth/false questions in this application, the initial factor g is 0.5. The difficulty factor d was defined as a number between 1 and 5. The factor s was set to the initial value of 0.2 and the discrimination factor a to 1.2 for all questions in the test.

For design of our module, we used the GeNIe and SMILE tools (https://dslpitt.org/genie) that are available for free for the academic sphere.

Concepts to be included in the test module are thus obtained directly from the curricular structure of the subject. However, it is necessary to decide on a subset of the concepts to be monitored. This decision should be made on the basis of how the information on the knowledge of these concepts will be incorporated into the instructional process. For example, we included concepts such as composition, inheritance, and delegation, polymorphism, and so on.

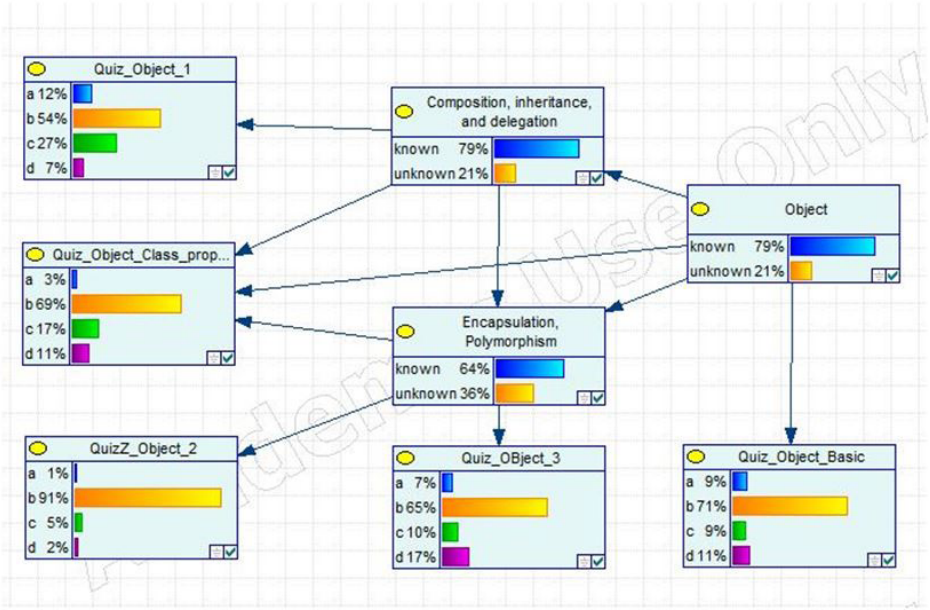

Figure 2: Bayesian Network - Model Student Knowledge in the programming

How to initialize these models? Initialization of the BN model is done by defining the prior probability distributions at all nodes. Specifically, students should have some basic knowledge of the computer programming. This expectation can be expressed using the previous probability, $P(objects = known) = 0.95$ and $P(objects = unknown) = 0.05$. The probability of transition between pairs of concepts is then defined for example in our case $P(Polymorphism = known \mid Object = known) = 0.95$ and $P(Polymorphism = unknown \mid Objects = known) = 0.05$. In other words, if the student knows the concept of an object, then the student should know and use the term polymorphism on the basis of teaching in the course with a high probability. Similarly, statement $P(Polymorphism = unknown \mid Objects = unknown) = 0{,}05$ and $P(Polymorphism = unknown \mid Objects = unknown) = 0{,}95$ is as follows: how do students understand the notion polymorphism when they do not know some basic concepts?. A similar conditional probability can be defined between all linked concepts in the network. When introducing more concepts, the likelihood of the student's knowledge decreases without testing.

For example, the prior probability that polymorphism is known is only 86% without testing. However, the overall objective of this model is to infer from the data whether these terms are actually known or not known to each individual student. This is achieved by Bayes' rule for calculating the posterior probability of terms in relation to the student's answer to various questions. The likelihood of transition between concepts and questions is based on the type of responses provided. The GeNIe / SMILE environment provides knowledge of the conditional probability distribution, including the probabilities of corresponding responses. By modifying the unknown probabilities of conditional concepts, there may be a risk of inconsistent logical relationships on the network for extreme datasets (for example, if all students respond incorrectly). Therefore, manually conditioned probabilities need to be adjusted.

We tested 21 of our students. The data obtained was used to develop the Bayesian knowledge monitoring network. At the beginning of each probability test, they were similar across all

models. However, during testing these probabilities differed for each student, basically providing a knowledge profile for each individual student.
For example, 8 students responded incorrectly to at least one question in Quiz_1, not all of them needed corrective action. Based on posterior probabilities and a level of competence of 75%, only four students were identified who needed some help in Quiz_1 content topics. On the other hand, the performance of other students had increased significantly beyond the level of competence since the last quiz. These results are currently not at the level of claiming any statistical significance, but this pilot study provided valuable insights into the design of Bayesian models, and set out how to further exploit the results of the proposed module.

Conclusion

We introduced a methodology for creating and using knowledge models for assessing student knowledge in large engineering classes. This methodology was informed by an initial pilot study conducted in the winter semester in 2017, containing data collected from 21 students. The main challenge identified during the first pilot study is related to the creation of conditional probabilities of distractors, as the concepts were not known. The reason is that the probability distribution for these cases is very dependent on the question and the type of misconceptions that students have at the time of the evaluation. Preliminary results provide some positive evidence of the feasibility of the proposed approach in monitoring students' knowledge. Future evaluations based on independent interviews are planned to assess the performance of the model.
This article explains the evaluation module to be used in our testing system. It explains how the module was implemented, how it works, and how it is integrated into our system. The Bayesian network is used as an inference engine for student learning decisions. Our testing has shown that the development of software modules based on Bayesian network can reflect poor or good knowledge of students. For this reason, Bayesian networks are a suitable model for assessing the level of cognitive abilities of students.
Future work is planned to improve the theoretical model, to improve the module to make it more usable for different situations, or to include interactivity.

Acknowledgement

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MOBILE TECHNOLOGIES AND THE WAYS OF USE IN TEACHING IT RELATED SUBJECTS

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Abstract

The paper deals with the field of mobile technologies and their use in the educational process at a university level, particularly in the study branches of informatics. In the first part of the paper, the facts about entering mobile technologies into the teaching environment not only in developed countries but also in countries with a low rate of technology support into the monitored environment. The results of the research are shown in forms of diagrams that provide a view on how relevant the actual results are. The next part of the paper focuses on the research of the current status of how students are perceived regarding the use of mobile technologies in learning. Mobile learning is a new form of learning using the unique abilities of mobile devices. In the last part, aside from research evaluation, there is a recommendation of higher accessibility of the technologies for the field of adaptive learning in the given study branches. Despite the attractiveness and modernises of the mobile device use is at the contemporary universities, the students‘ readiness for mobile learning has not reached the proper level.

Keywords

Adaptive learning, elearning, elearning course, mobile learning, personalized learning

Introduction

In the last two decades, an unusual increase of mobile technology level can be observed. People rely on the use of the mobile technologies with emphasis on their efficiency and mobility (Liu, Li and Carlsson, 2010). Their increasingly important role is manifested mainly in the fields of business that cooperates effectively with the field of education and the development of human resources. The importance of contemporary mobile technologies in economy and society are all emphasized by many experts (Garrison, 2000; Quinn, 2000; Kukulska-Hulme and Pettit, 2006; Sharples, Taylor and Vavoula, 2005; etc.). The educational process and human resources development coordination connect to the economical and social level of the country. Although, according to Bhavnani, et al. (2008), in some places of the world, it is necessary to alleviate poverty, support the economical and social growth and to overcome the digital gap. The constant pressure on society caused by quickly changing conditions influences the field of education. Innovations in education are received according to the possibility of their financing. Ensuring lifelong learning is conditioned by the need of technology use that eliminates the boundaries of time and place. Mobile technologies meet these conditions. In the last two decades, the attention of the academic and practical community dominates. This attention is paid to possibilities and abilities of mobile technologies and implementation of educational activities online (Petrova and Li, 2009). Mobile learning or mLearning has been defined by many authors. Originally jemLearning was defined as providing educational activities for students anywhere and anytime (Motiwalla, 2007). MLearning may take place with the use of applications in mobile phones, smart

phones, personal digital assistants (PDA), tablets, and portable multimedia players. According to Park, Nam and Cha (2011), mLearning is a new and separate part of eLearning where the educational content is handled through mobile devices (Hashim, Tan and Rashid, 2014). Other authors describe mobile learning as follows: it enables access to learners around the world to study materials and information anytime from anywhere. Learners do not have to wait for their time to learn or find a place to learn. They can use the technologies not only for a formal but also for informal learning, applicable directly in their lessons or at home, on any PC, laptop, tablet or phone connected to the Internet. It uses an adaptive teaching tool that precisely profiles the state of each learner's knowledge. Subsequently, this information is used to form the learner's personalized content based on his unique needs. Based on these ideas, which are directly related to the knowledge gained with the use of these technologies, the aim of the paper is to analyze the current state of the field in the university.

Is mobile learning that advantageous and efficient?

Even though it may seem that educational supporting systems such as eLearning and mLearning have the same purpose, in fact they do not. ELearning is designated to acquire specific skills and acquiring knowledge in depth. MLearning is about getting access to information in the moment when it is needed or support the running process of learning. This fact is important to remember when designing a mobile application or an electronic course. Although these systems are the opposite of each other, mLearning can be used to support Learning.

The adoption of eLearning and mLearning technologies has an impact on planning, learning, design, control and report of the educational process and on providing educational content to students (Moore, Dickson-Deane and Galyen, 2010). For instance, blended learning is based on this idea (Sharples, Taylor and Vavoula, 2005). According to Liu, Li and Carlsson (2010), challenges to use mLearning efficiency, its advantages and opportunities have created a new era in the information age. Mobile learning can be used to support traditional learning such as distance education (Lowenthal, 2010). There are authors (Hashim, Tan and Rashid, 2014) who claim that even though mLearning is gaining unusual popularity, there are fundamental issues that have to be solved. One of them is the readiness of students to receive and to use mLearning. Researches show that the students' intention to use mLearning is affected by their cognitive, emotional and social needs and attitudes. Mobile learning is a way of providing instant content to students just by the tip of their fingers. Some studies mention that issues occur in the area of mLearning reception by organizations themselves, i.e. academic institutions that ignore the directional trend into considerable extend. Authors (Kim, Mims and Holmes, 2006) point out that although mLearning provides great opportunities, there is a lot of obstacles in front of its successful implementation. Bad connectivity, small display, limited computing power and reduced input properties.

Authors Gikas and Grant (2013) that deal with the issue of introducing mLearning to support learning stated that the actual mLearning literature is focused mainly on factors related to the exploration of technology to accept mLearning. However, just a few studies has dealt with the topic of the users' motivational view and even less has dealt with the view of adult students. The results of the authors show that the intention of adult students to use mLearning is affected by their cognitive, emotional and social needs through their personal attitude.

Wentzel, Barry and Caldwell (2004) mention that omnipresent mobile devices, that shall be recognized more and more in educational institutions, offered new communicational opportunities that changed the students' attitude towards learning.

Observations need to be considered in the current reality. In the era of mobile technology development (1998-2009) the given arguments were legitimate. The direction of its evolution

(2009 until nowadays) overtakes many visions. The importance of mLearning in the advanced world is reaching a rapidly increasing curve that is changing the recent dynamic development of the past to an energetic present.
Spreading of mobile technology at universities increased in the last years. As Seppälä and Alamäki (2003) point out that the possibilities of mobile learning has been accepted and they spread to universities. It has been also explained that there is an increasing number of schools and universities that accept these technologies as teaching aids. Although some authors (Kim, Mims and Holmes, 2006) indicate that while there are academicians and experts recognizing the advantages of mobile technologies in higher educational institutions, there are studies questioning the possibilities to use the technologies in primary education.

ELearning and mLearning in Slovak conditions

Even though that eLearning and mLearning is having its expansive boom in the advanced world, in Slovakia it is just more or less awaking. A wider use of eLearning on the platform LCMS Moodle has been accomplished by universities in Slovakia. They have their own created eLearning portals. But their weak points are the contents of the courses. The content should be filled up by various combinations of multimedia contents and not only static HTML texts, pasted texts created in MS Word, or presentations on MS PowerPoint as it is in real life. At the same time, the documents are the most banal forms of eLearning. They are supposed to work as an additional library of sources to the learning itself. This kind of content is rather far from the real comprehensive eLearning educational programs. The fact already mentioned above that there are no actual teams dealing with the creation of assigned topics just confirm it all. For now, the educational contents have to be composed by university teachers themselves who create them according to their knowledge and skills they are rich in. Teachers teaching informatics are capable to create multimedia contents on the desired level because it is also their duty.
Thus, a question has arisen: how, where and with the help of what and who has a university teacher educate himself to acquire, design, implement, and distribute the knowledge when he did not have the chance to acquire mLearning in the bud at the university? How to adjust the content, the forms and the methods of teaching so that all the needs of integration of the target group are covered. How to accomplish that the education and training would react to requirements and needs of the labour market. The students are perceptively observing the qualities of teachers, their knowledge, skills when acquiring new mLearning activities. Taking into consideration that the use of mobile technologies in the world of education is on a different – a higher – level than in Slovakia.

Materials and Methods

The authors of the paper have decided for the research where they will confirm or disprove the mentioned considerations about the relevance of the use of mobile technologies in education and mLearning level classification in university studies. Students from the Department of Informatics at the Constantine the Philosopher University (CPU) in Nitra studying informatics have been chosen for the research. The research took place in years 2016 – 2017 on a sufficiently wide sample of students. At the beginning, hypotheses have been determined that had to express the attitude of the students to mobile technologies and to the offered teaching support for their study of informatics within LCMS Moodle.
H0 – Students of all forms of studies have identical approach to study materials and communication considering the type of information and communication means.
H1 – Students studying Applied Informatics in full-time are more open to accept mobile technologies in their learning than students studying Applied Informatics in part-time study, as well as students studying full-time in non-informatics subjects.

As a tool of the research, the activity *Feedback* has been used form the eLearning environment LCMS Moodle. 10 items have been chosen. In seven items, the 5 level Likert scale has been used. In two items, the possibility of a short answer and one item with choice of answers have been selected. The first round of *Feedback* has been made accessible in February 2016 and been closed in May 2016. Before the second round, the items have been updated but in meaning the content stayed the same. It has been made accessible in September 2016 and closed in March 2017.
An important item of the research was the choice and number of participants. It was important for the trustworthy collection of data about the opinions of participants to confirm the determined hypotheses. During the examined period, 434 university students have participated the research. They were filling the *Feedback* voluntarily. The questionnaire was anonymous. The age interface has not been verified because there were university students from age 19 to 23. The gender of students has been checked as follows: in Applied Informatics, mainly male students dominated. In each year, 90 - 94% of them were men, and only 6-10% women. In other, non-informatics subjects such as Biology, Environmental Science, Geography, it was as follows: 74% women and 26% men. In the first round of *Feedback*, students of first and fourth year of full-time in Applied Informatics (AI) have been addressed, 113 students altogether. In the second round, students of first and fourth year of full-time in AI (189 students) and students of part-time studies in AI (72 students) participated. Here the students of non-informatics subjects (non-IT) in full-time studies (60 students) participated as well.
In the first item in both researches, students received the item of choice of answers for the question what means they use to access study materials. This item also answered the question what means they own and use in daily communication and for study.
"The mostly frequently I approach the study materials and communications through":

	IT Department				Non- IT Department	
	Full-time Students		Part-time Students		Full-time Students	
(PC) PC	158	52.3%	18	25.0%	10	16.7%
(NO) Notebook	134	44.4%	48	66.7%	43	71.7%
(TA) Tablet	4	1.3%	1	1.4%	0	0.0%
(SM) Smartphone	5	1.7%	3	4.2%	6	10.0%
(MP) Mobile phone	1	0.3%	0	0.0%	1	1.7%
(iP) iPad	0	0.0%	2	2.8%	0	0.0%

Table 1: Indication of number of students in the given research (source: own calculation)

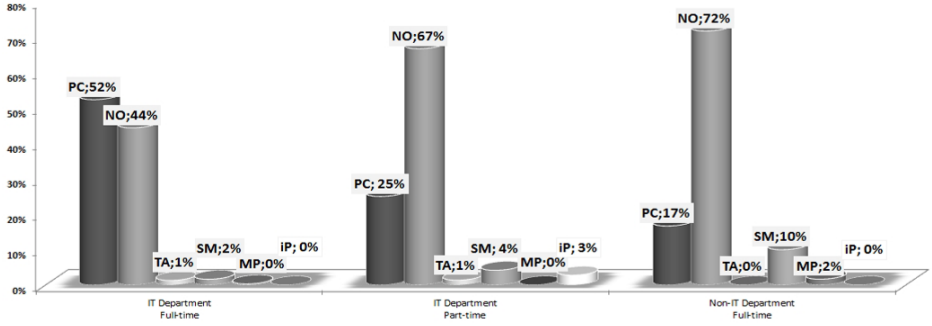

Figure 1: Means of accessing study materials (source: own research)

After evaluation of the research about the means of accessing study materials and communication, the following score implied: students of full-time AI were using to the highest extend a standard

PC with a fixed connection to the Internet – 52%. Only 25% of part-time students used a PC. Surprisingly, the smallest percentage of the use of PC belonged to students from non-IT studies – only 17%. Then the use of notebooks, tablets, smart phones or mobile phone had the following results: the highest percentage of notebook use was 72% for non-IT students. This was comparable to 67% of students of part-time in AI. The smallest score belonged to full-time students with 44%. Smaller displaying units such as tablets, smart phones and mobile phones were used by groups representing 4 - 0%. The first view was very distinctive.

Only 25% of students in part-time AI used PC while 67% used notebook. It was a surprise that even among students in part-time, only 7% used smart phones or iPads.

The biggest surprise has been caused by students from the non-IT department. Only 17% used PC with fixed connection to the Internet while in a larger volume, 84% of students used a notebook, 10% their smart phone and 2% their mobile phone. Thus, *Hypothesis 0* has not been confirmed by this result.

In the next item the students had to express their opinion on the use of mobile application Moodle for learning. The official Moodle mobile application is accessible at CPU in Nitra for all mobile platforms – Google Play, Apple Store, and Windows Phone Store. It is enough to search for the application *Moodle Mobile* from the author *MoodlePtyLtd*.

"To what extent do you use the mobile application LCMS Moodle on the portal EDU UKF for learning:" (note: UKF = CPU, translation)

	IT Department		Non- IT Department
	Full-time	Part-time	Full-time
always	26	4	1
occasionally	49	26	11
not at all, I know about the app	61	25	17
noat at all, I do not know about the app	53	17	31

Table 2: Indication of number of students in the given research (source: own calculation)

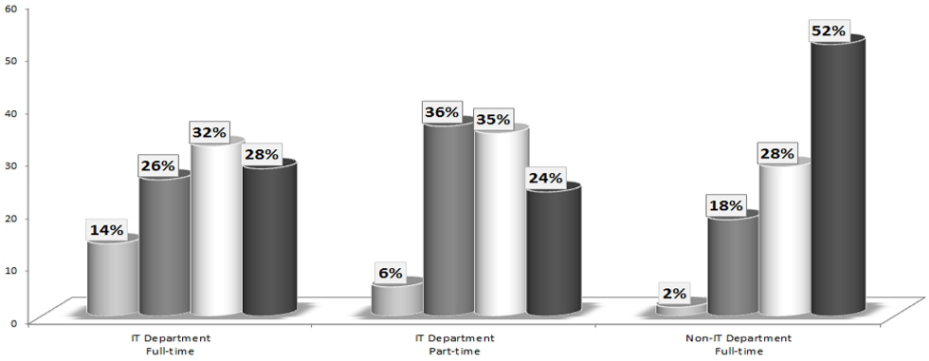

Figure 2: The rate of use of mobile application Moodle for learning (source: own reseach)

The next item was the opinion of students on the use of mobile application Moodle for learning. It could be stated that there was no big difference between students of full-time and part-time studies. A bigger difference occurred at the answer "Always" with 14% of full-time students and 6% of part-time students. Then "Occasionally" has been selected by 26% of full-time AI students, 38% of part-time AI students and 18% of non-IT students. It was not that much positive, compared to the answers stating that they know about the app but they did not use it: 32% of full-time AI students, 35% of part-time AI students and 28% of non-IT students. The answer to the last

item gave the next answer which showed that students had little interest in obtaining the mobile application through LCMS Moodle.

Results and Discussion

The research has been carried out for the purpose to verify the efficiency of mLearning for students at a university level in full-time and part-time studies at the Departments of Informatics in CPU in Nitra. The survey had a form of a research that has been arranged in a way to possibly have a feedback from full-time students, part-time students and non-IT students as well. The survey confirmed that the rhetoric did not have to be relevant in practice. Despite the not that much positive results, there was a correct direction of preparation of study materials at the Department just for the use of mLearning in the coming period.

Thanks to the use of social networks and the application Web 2.0, allegedly within their course students got more information about the content of the course. In addition, it seemed that students preferred the use of application and text messages outside the class which they use in their everyday life. The link between the content of the course and the device had to be defined unambiguously, mainly because of the fact that a successful communication of students with the content of the given course was enabled. The teachers had to use appropriate pedagogical methods and to integrate the curriculum appropriately for technology use. Otherwise, it would not help the students in formal and informal educational opportunities where the learning does not end when leaving the class. Basically, it is possible to say that with the accessibility of mobile devices for cooperation and the use of social networks, the student continued in his study after he had left the class and where he could cooperate with his colleagues and environment.

The aim of the paper was to add meaning and possibilities to mobile communication devices and social media in a university environment. A constant research of mobile learning and social media might determine whether the teaching of the teacher and the student's studying could be reached. Another important note is that even though mobile learning might look like as studying on the Internet since computer devices connect various technologies to exchange information, a mobile device "is a current paradigm for connection, communication and acquisition of the level of personal relation that expands onto the devices". Eventually, the potential long-term impact of mobile devices on higher educational environment is needed to be continuously explored and to evaluate the gained results for next direction of their use.

In relation to the participants' experience, the mobile device has united with the student's identity. While some students perceived their devices as a possible distraction, they admitted that they invested intensively into the use of the devices to support their learning and professional work. Constant connection enabled by devices helped students to access information about the learning course. It also enabled them to communicate with the content that might be a breakthrough in the separation of learning and life.

Conclusion

The topic of mobile technology use for education and thus the quality of education itself provides a wide space for study and a next expert survey. It is important to explore and understand what, why and how it works in formal and informal educational environment. In effect, institutional changes are needed that might simplify and support students and teachers to integrate mobile technologies into everyday teaching and constantly provide support and sources for teachers' and lectors' further training. Positive changes can be accomplished so that they stay noticeable only by these efforts. Experts have been speculating for a longer time how to adjust the methods and processes to different learners so that each of them would acquire the most of the knowledge in the study field. One of the solutions is adaptive learning. The integration of adaptability into

the process of education with the help of e-Learning using mobile technologies would bring the possibility of individual access to education. It would offer a certain choice for students to decide what part should be the next. Thanks to the choice, it creates a feeling of freedom in study and an option of non-linear transition is enabled in the learning system. The adaptive approach of educational system brings to students in an eLearning course more elements of a real educational environment where the teacher often approaches the students individually and takes into consideration their possibilities and abilities.

The main idea to create such an eLearning environment respects and supports the use of different learning styles of students for whom it is possible to prepare an educational environment that is more efficient with an increased user kindness and quality (Kostolányová, Šarmanová and Takács, 2011). A personalized learning might be the solution which is a form of teaching that is tailor-made for the student, flexible to his qualities. This learning is becoming more popular (Kostolányová, Šarmanová and Czeczotková, 2010).

To sum up, the adoption of mobile devices as pedagogical tools is in the country only at its beginning. Not only teachers who are still sceptical and not prepared for mobile learning. It is essential to take into consideration a lot of things such as the viewing of teachers to adopt the educational changes. Their perceptions are important because their willingness and readiness to adopt mLearning is one of the decisive factors of success (Ismail et al., 2013).

Finally, a though: education cannot resist the current trends in technology and should introduce effective tools applying adequate techniques and methods (Burgerová and Cimermanová, 2014). There is a bigger group of academic workers who accept the fact that the current mobile devices are the text books of tomorrow (Kim, Mims and Holmes, 2006).

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PUPILS' ABILITIES TO SOLVE PROBLEMS IN MATHEMATICS AND PHYSICS AND THEIR SCHOOL PERFORMANCE

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Abstract

This paper reports the results of a study whose aim was to find out the correlations among the Culture of problem solving construct, Scientific reasoning construct and a pupil's school performance. Both constructs describe pupil's abilities to solve problems in mathematics and physics. The total of 180 14–15 year old pupils from the Czech Republic took part in this study. The results show that the indicators of the Culture of problem solving and the Scientific reasoning correlate with school performance in mathematics, physics and Czech language.

Keywords

Culture of problem solving, lower secondary school, mathematics education, school performance, science education, scientific reasoning

Introduction

The paper focuses on two constructs that are related to problem solving. The first construct is the modified *Culture of problem solving* (CPS), which was introduced by the authors of this paper as a tool for describing a pupil's ability towards solving mathematical problems (Eisenmann et al., 2015). The other construct is *Scientific reasoning* (SR), which includes the thinking and reasoning skills that are involved in systematic exploration of a problem, formulating and testing hypotheses, evaluating experimental outcomes, etc. (Bao et al., 2009).

A research study was conducted with 180 students aged 14–15 from lower secondary schools in the Czech Republic in 2017 (see the section Materials and Methods). The results of this study describing the relationships among the CPS and the SR constructs are presented in (Cihlář et al., in print). The here presented paper presents a different result of the same research, that is the relationship between both constructs and pupils' school performance. The constructs CPS and SR aim at assessment of pupils' abilities to solve problems, which we believe are developed particularly in mathematics, science (e.g. in physics) and Czech language. Therefore we should expect correlations among pupil's school performance in these subjects and both constructs. This assumption is also supported by research that took place in 2017 (Cihlář et al., 2017).

The Culture of problem solving

The composition of the CPS is described in detail in (Eisenmann et al., 2015). Let us stress that the CPS describes the conditions for success of an individual problem solver and is independent of the problem as such, the solver's knowledge and their attitude to problem solving.

Originally, the above mentioned CPS consisted of four components: Intelligence, Reading comprehension, Creativity and Ability to use the existing knowledge.

The indicator intelligence that corresponded to general intelligence was substituted in the here reported research study by a new indicator *mathematical intelligence* (MI). This indicator was constructed on the background of (Juter and Sriraman, 2011) and (Gardner, 1993). Similarly to

the theory of Multiple intelligence (Gardner, 1993) we selected those components that are related to spatial intelligence. As Chytrý et al. (2016) show logical thinking becomes relatively stable in time at the age of 14–15.
Reading comprehension (RC) is obviously one of the key competences without which successful problem solving would be impossible (Hite 2009; Pape, 2004).
The third component is *creativity* (CREAT). Nadjafikhah, Yaftian and Bakhshalizadeh (2012: 290) speak of creative problem solving. "At the school level, creativity in mathematics is generally related to problem solving and or problem posing."
The *ability to use the existing knowledge (UK)* is the fourth component of the CPS. This ability has been considered as prerequisite to successful solving of non-routine problems. Whilst solving such kinds of problems, knowledge itself is not sufficient; the solver must also be able to use it.
We find the use of the CPS in teaching important in two areas in particular. Firstly, the knowledge of a pupil's CPS can help the teacher select appropriate problems the pupil will be able to solve successfully. In the second place, it may help eliminate a pupil's weaknesses that may be an obstacle to solving problems.

Scientific reasoning

In STEM education (Science, Technology, Engineering and Math), widely accepted teaching goals include not only the development of content knowledge but also the development of general scientific abilities that will enable pupils to successfully handle complicated real-world tasks in their future careers. It has been widely agreed that the development of transferable general abilities is at least as important as the learning of STEM knowledge (Bao et al., 2009; Shayer and Adey, 1993). Scientific reasoning is one such general ability, closely related to a wide range of general cognitive abilities such as critical thinking and reasoning (Han, 2013; Zimmerman, 2007). Existing research (Coletta and Phillips, 2005) has suggested that scientific reasoning skills can be trained and transferred. Training in scientific reasoning may also have a long-term impact on student achievement in the future.

Research questions

The following questions were posed at the beginning of our study:
RQ1: How do individual components of the CPS correlate with school performance in mathematics, physics and Czech language?
RQ2: How do individual dimensions of the SR correlate with school performance in mathematics, physics and Czech language?

Materials and Methods

The following subsections focus on the way of measuring both the constructs and the description of the research sample.

Culture of problem solving

All four CPS components were tested within a single 45-minute lesson. The parts of the test focusing on MI lasted 13 minutes, RC 13 minutes, CREAT 9 minutes and UK 9 minutes. All tested pupils were working independently, they were allowed to use only simple calculators. All parts of the test were evaluated by the authors of this paper.
The test of MI consisted of 8 problems. The problems could be divided according to the studied areas: logical reasoning (2 items); conception of infinity (2 items); spatial imagination – mental transformation (1 item); algebraic thinking (1 item); arithmetic patterns (1 item); geometric imagination in plane (1 item). All the test problems with the exception of problem 3 were closed

multiple-choice tasks with one correct answer. The solver could get 2 points for each problem and the total sum indicated the index of MI.
As far as the component RC is concerned, the pupils were set a short text of 15 lines. Afterwards, their task was to answer 4 closed questions correctly (from 4-item multiple-choice possibilities they were selecting one correct answer) and 2 open questions without any offered answers. The aggregate of all points formed the total score. This means that the test was created on the same principle as the one used in the PISA research (The Programme for International Student Assessment (PISA) is a triennial international survey which aims to evaluate education systems worldwide by testing the skills and knowledge of 15-year-old students. Students were assessed in science, mathematics, reading, collaborative problem solving and financial literacy).
The component CREAT was understood in the context of divergent thinking. The creativity level was measured by Guilford's Alternative Uses Test (GAUT). The pupils proposed as many 'uses of common objects' as possible. What is important here is how logical and practicable the answers were. Qualitative evaluation of each test part was translated into points and the total score indicated an index of creativity. GAUT measures four dimensions of creativity: fluency (how many relevant uses the pupil proposes), originality (how unusual these uses are), flexibility (how many areas the answers refer to) and elaboration (quality and number of details in the answer). Qualitative evaluation of each dimension was translated into points, and the total score indicated an index of creativity. The higher the index, the more creative the pupil is purported to be.
The component UK was assessed on the basis of a set of four problems. At the beginning of each problem, some item of previously learned knowledge was revised. This was followed by a simple application problem whose solution required active use of the particular item of knowledge. The solver could get one point for each problem and the total sum indicated the index of UK.

Scientific reasoning

The SR was tested by the *Lawson's Classroom Test of Scientific reasoning* (Lawson, 1978), which is a practical, well-known tool often used by researchers and teachers for assessing critical thinking skills in the area of scientific reasoning. We used the Czech version (Dvořáková, 2011) of the current version of Lawson's test released in the year 2000, in which we carried out small corrections in items 8a and 8b according to (Han, 2013).
The Lawson's test is a 24-item, two-tier test with multiple-choice questions. Each of the two-tier items consists of a question with some possible answers followed by a second question that gives some reasons for the response to the first question.
The Lawson's test assesses pupils' reasoning abilities in six skill dimensions including conservation of matter and volume (CONSER) (items 1 to 4), proportional reasoning (PROPOR) (items 5 to 8), control of variables (VARIABL) (items 9 to 14), probability reasoning (PROBAB) (items 15 to 18), correlation reasoning (CORREL) (items 19, 20) and hypothetical-deductive reasoning (HYPDED) (items 21 to 24). The items in the test are not of the same difficulty. Their difficulty increases item-by-item.
As far as evaluation of the test is concerned, a pupil would get two points for questions 1 to 22 if they at the same time chose the correct answer to the question and correct justification of the answer. Each of the last two pairs of questions (23 and 24) was evaluated independently, that is the pupil got one point for each correctly answered question or its correct justification. Only problems 23 and 24 are independent and for that reason they are also evaluated independently (Dvořáková, 2011).

Research sample

The total of 180 pupils (76 girls and 104 boys) aged 14–15 from one fourth grade of an eight-year secondary grammar school and from eight classes of the ninth grade from six lower secondary schools took part in our study. All schools were located in Ústí nad Labem Region. In the research sample better, average as well as below average pupils were included.

Statistical evaluation

To assess the dependence or independence of individual quantities, Pearson's χ^2-test for contingency tables and Spearman's correlation coefficient were used. Due to the fact, that the values for all the investigated variables were not found for some pupils, in the tables 2 and 3 there are the actual numbers of pupils for whom the tests were carried out. The level of significance $\alpha = 0.05$ was used in all tests. Calculations were carried out in the programme STATISTICA 12.0.

Results and Discussion

In the Czech Republic, lower secondary school pupils are evaluated by grades 1 to 5 on a school report. Grade 1 corresponds to the best performance, 5 describes insufficient performance, failure. In Table 1 we first present relative frequency of grades 1 to 5 in Czech language, mathematics and physics in the studied sample of pupils. These subjects were selected for the study as they are the three subjects in which abilities included in the CPS and the SR are developed most.
Assessment of pupils' school performance was based on their results on school reports from the school year 2016/2017. The arithmetic mean of the grade achieved in Czech language was 2.3 with standard deviation of 0.96, in mathematics 2.3 with standard deviation of 0.98, in physics 2.1 with standard deviation of 0.94.

Grade	Czech Rel. freq. (%)	Math Rel. freq. (%)	Physics Rel. freq. (%)
1	21.70	21.70	32.78
2	39.51	41.11	33.88
3	25.55	23.32	25.00
4	13.24	12.76	8.34
5	0	1.11	0

Table 1: Relative frequency of grades 1 to 5 in Czech language, mathematics and physics

Table 1 shows that pupils' school grades in Czech language and mathematics are worse than in physics. In comparison with mathematics and Czech language about 10% more pupils have grade 1 and 5% less pupils grade 4.
At first we explored the correlations between the four components of the CPS and pupils' school performance in Czech language, mathematics and physics. Then using the χ^2-test for contingency tables we tested the hypotheses on independence of these quantities. In all pairs of quantities the null hypothesis of the zero-value of the correlation coefficient and independence of quantities was rejected. The results can be seen in Table 2.
Table 2 shows that grades in each of the three subjects and each of the components of the CPS are dependent variables. The weakest correlation is in the component CREAT. This is not surprising. Pupils' creativity is usually not employed in standard problems in mathematics and physics used for assessment of pupils' performance. Similarly, grade from Czech language on lower secondary school is based on knowledge of grammar and literature, where creativity does not play any significant role. The strongest correlation with grades is in the component UK. This is really surprising because this component of the CPS expresses whether a pupil can use knowledge

they already have when solving non-routine problems. These are very rare in Czech lessons of mathematics.

From the three studied subjects, it is the Czech language that has the strongest correlations with all components of the CPS.

Similarly the correlations and χ^2-tests between the dimensions of the SR and pupils' school performances were explored. The null hypothesis of the zero-value of the correlation coefficient and independence of quantities was rejected for all pairs of quantities with the exception of pairs with the dimension HYPDED. The results can be seen in Table 3.

Pairs of indicators	N	Spearman correlation		χ^2-test	
		R	*p*-level	χ^2	*p*-level
RC & CZECH	165	– 0.445044	0.000000	39.0264	0.000011
RC & MATH	165	– 0.348138	0.000005	31.6876	0.001546
RC & PHYS	160	– 0.425912	0.000000	43.3170	0.000002
MI & CZECH	165	– 0.520303	0.000000	54.9073	0.000000
MI & MATH	165	– 0.445764	0.000000	38.7674	0.000115
MI & PHYS	160	– 0.372420	0.000001	32.3304	0.000175
UK & CZECH	165	– 0.606568	0.000000	67.5597	0.000000
UK & MATH	165	– 0.535222	0.000000	65.2935	0.000000
UK & PHYS	160	– 0.481385	0.000000	48.4136	0.000003
CREAT & CZECH	165	– 0.225662	0.003565	35.6869	0.000045
CREAT & MATH	165	– 0.167628	0.031390	32.9638	0.000981
CREAT & PHYS	160	– 0.204736	0.009404	22.7760	0.006719

Table 2: Spearman correlation coefficients and χ^2-tests between the components of the CPS and pupils' school performances

Pairs of indicators	N	Spearman correlation		χ^2-test	
		R	*p*-level	χ^2	*p*-level
CONSER & CZECH	162	– 0.291737	0.000165	17.1102	0.008887
CONSER & MATH	162	– 0.272494	0.000451	19.5118	0.003381
CONSER & PHYS	158	– 0.261675	0.000896	18.8813	0.004369
PROPOR & CZECH	162	– 0.341506	0.000009	21.7167	0.001363
PROPOR & MATH	162	– 0.391750	0.000000	34.0974	0.000006
PROPOR & PHYS	158	– 0.309884	0.000074	17.8821	0.006534
VARIABL & CZECH	162	– 0.396955	0.000000	30.8579	0.000313
VARIABL & MATH	162	– 0.360287	0.000002	27.0774	0.001358
VARIABL & PHYS	158	– 0.263250	0.000832	20.6797	0.014151
PROBAB & CZECH	162	– 0.434019	0.000000	33.1045	0.000010
PROBAB & MATH	162	– 0.337633	0.000011	22.3672	0.001039
PROBAB & PHYS	158	– 0.376852	0.000001	29.6154	0.000047
CORREL & CZECH	162	– 0.251858	0.001225	9.4497	0.023873
CORREL & MATH	162	– 0.285363	0.000233	1.3897	0.003865
CORREL & PHYS	158	– 0.221297	0.005201	11.5168	0.009236
HYPDED & CZECH	162	– 0.099586	0.207363	6.5797	0.884096
HYPDED & MATH	162	– 0.063629	0.421162	12.3993	0.414167
HYPDED & PHYS	158	– 0.047268	0.555351	7.6920	0.808714

Table 3: Spearman correlation coefficients and χ^2-tests between the dimensions of the SR and pupils´ school performances

Table 3 shows that grades in each of the three subjects and each of the dimensions of the SR are dependent variables except the last dimension HYPDED. The strongest correlation was recorded in the dimension PROBAB, the weakest in dimensions CONSER and CORREL. The correlations between school performance and achievement and almost all dimensions of the SR that come out of our research correspond to the findings from international research (Bao et al., 2009; Coletta and Phillips, 2005; Shayer and Adey, 1993) which state that skills developed in individual subjects contribute to development of general skills prerequisite to good SR.

As far as the individual school subjects are concerned, the strongest correlations in dimensions CONSER, VARIABL and PROBAB are with grades in Czech language (similarly as in the case of the CPS). This fact can be attributed to the form of assigning problems in Lawson's test, where texts are relatively long and need good, attentive reading. Moreover, pupils in Czech schools do not come across similar tasks often. This type of tasks is new for them both as far as their content and form of assignment are concerned.

The strongest correlation in dimensions PROPOR and CORREL is with grades in mathematics, which is not surprising as the dimensions PROPOR and CORREL are recognized as fundamental reasoning constructs necessary for mathematics achievement.

Conclusion

In our contribution we focused on the correlation among the CPS, the SR and school performance. The discovered correlations and dependences were analysed in detail and the possible sources of correlations were shown. Our research showed that individual components of the CPS and almost all the dimensions of the SR correlate with school performance in mathematics, physics and Czech language. Undoubtedly, school assessment in the form of grading does not capture all aspects of a pupil's school performance. However, our research shows that key for development of abilities prerequisite to problem solving and scientific reasoning are not only skills developed in mathematics and sciences but also reading literacy (reading with comprehension) that pupils should develop especially in Czech language lessons.

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SARUD – A PROJECT FOR IMPLEMENTATION OF MASTER STUDIES IN RUSSIA AND KAZAKHSTAN

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Abstract

The development and implementation of Masters programs on Sustainable Agriculture and RUural Development (SARUD) in Russia and Kazakhstan is analysed based on the components of the devised programs and the profiles of the enrolled students. The contents of the study programs show differences which are in line with the respective aggregative majors (economics, agronomy, public administration) under which they are implemented. With respect to age and gender ratio of the students, regional aspects seem to be more important than the aggregative majors. Generally, the study programs match to a high degree the situation analyses carried out prior to program development. In order to assess the quality of the study programs student surveys will be a useful tool. The results of our study underline the importance of inter- and transdisciplinary approaches in education.

Keywords

Agriculture, Kazakhstan, Masters program development, Russia, sustainable rural development

Introduction

Most rural areas in the Russian Federation and Kazakhstan are characterized by dramatic changes in the agriculture and food sector, due to privatization, modernization and increasing differences between large-scale agro-holdings and small-holder farms. The effects of the current changes on labour market, quality of life and depopulation in rural areas, exploitation of natural resources, soil degradation, biodiversity and landscape differ from region to region. The central black soil regions close to the Moscow markets have more opportunities for economic diversification and subsequently invest in the development of various economic sectors including tourism and recreation, while the potential for diversification in Western Siberia is more limited. The common denominator for rural development is the great importance of agriculture and natural resources providing for ecosystem services and opportunities towards diversification (Lindner and Vorbrugg, 2012).

State regulations, research and education are already responding to the challenges imposed by the changes outlined, e.g. in Russia through the Policy Concept of Sustainable Rural Development and the RUDECO Vocational Training project (Dieterich and Merzlov, 2013; Russian Government, 2015). In Kazakhstan, issues of sustainable agriculture and rural development are regulated by a Law "On State Regulation of the Development of the Agro-Industrial Complex and Rural Territories" adopted in 2005. According to this regulation, when defining conceptual approaches directed towards drafting of projects, scientific research work and priority directions with respect to development of agricultural science for the period 2018-2020, the priority is attributed to "Sustainable development of agro-industrial complex and safety of agriculture products". However, in Russia and Kazakhstan there is a considerable lack of sustainable rural development strategies and integrated approaches for the regional or local levels. This includes knowledge about up-to-date methods and approaches (e.g. stakeholder involvement) and skilled people to assess and further develop agro-ecosystems services. Beyond agricultural products, such services include environmental and social output. To fill this gap, higher education institutions together with public and private services need to re-define job qualifications and education for (future) decision makers and professionals in agriculture and related areas incorporating principles of sustainable rural development.

The idea of sustainable development evolved from the Conference on the Human Environment in Stockholm in 1972 and was further developed during the following decades (Adams, 2006: 1). It became popularized in the broader political arena through the 1987 report of the World Commission on Environment and Development (WCED, 1987) and subsequently by the United

Nations Conference on Environment and Development (UNCED) held 1992 in Rio de Janeiro, where the Agenda 21 document was produced. Whereas, the traditional concept of sustainability originally coined in forestry has a strong supply-ecological connotation, the mainstream 1987 WCED definition focuses on the demand side and therefore the socio-economic system. Accordingly, over the last decades most research on sustainable development had a strong and often only focus on the economic dimension (Wichaisri and Sopadang, 2018). This has caused the sustainability concept to become rather arbitrary.

In order to tackle the above mentioned tasks, the international project "Sustainable Agriculture and Rural Development (SARUD)" was initiated in 2016 (Sangadieva et al., 2016). The project consortium consists of 28 partners and is coordinated by the University of Hohenheim (Stuttgart, Germany). The major aim of this project is to implement professional Masters programs on sustainable agriculture and rural development in Russia and Kazakhstan tailored to the demand of regions for professionals of public services, local and regional governments and private service providers, so that (future) professionals are educated and trained to adopt theoretical development concepts for specific local conditions, access (international) experiences and apply up-to date methods for the assessment of agro-ecosystems and for natural resource and agriculture land use planning and management. The Masters programs devised in the SARUD context have been implemented at the following universities under the respective aggregative majors: Omsk State Agrarian University named after P.A. Stolypin (OSAU: agronomy major, economics major), Michurinsk State Agrarian University (MSAU: economics major), Buryat State Academy of Agriculture (BSAA: economics major), Novosibirsk State Agrarian University (NSAU: administration major), S. Seifullin Kazakh Agro Technical University (KASU: economics major), A. Baitursynov Kostanay State University (KSU: economics major), and Sh. Ualikhanov Kokshetau State University (KokSU: economics major). Masters programs were launched in the academic year 2017/2018 at all universities.

The first phase of the SARUD project consisted of a situation analysis to identify and describe the needs for the knowledge, skills and competencies of the graduates with a master degree in sustainable rural development in Russia and Kazakhstan and specifically in the geographical regions and territories where universities involved in the project operate. Based on the data from this situation analysis the most needed issues for rural areas of Russia and Kazakhstan related to education were determined (Table 1).

The aim of this paper is to analyse and evaluate the process of the implementation of the master degree programs on sustainable agriculture and rural development in Russia and Kazakhstan. We assess how these programs have been developed in the two countries, what characterizes students enrolled in the Masters programs, and what differences and similarities exist between the two countries and the different programs implemented at the different HEIs with respect to content and student profiles.

The Masters programs were designed to properly integrate agronomy, ecology, economics and socio-cultural issues reflecting the basic pillars of sustainable rural development (interdisciplinarity component). In addition, the programs target the integration of theory and practice (transdisciplinarity). In order to assess the integration of the basic components into the different Masters programs and to classify and compare the backgrounds of students registering for the according programs we reviewed (1) the focus on theoretical and practical aspects, (2) the possibilities for students to take part in shaping the program and (3) the allocation of learning contents to key topics. Concerning student backgrounds the focus was on (1) demographic aspects and (2) the initial qualification when entering the Masters program.

Based on the results we discuss, to what degree the implementation of the Masters programs fits to the situation analysis performed.

Relevant education issues in Russian rural areas
• the graduates should be able to identify the main trajectories of sustainable socio-economic development of rural territories in the context of a transition to market based approaches;
• the graduates should determine main pathways towards sustainable rural territories resulting in socio-economic development in agriculture without harming nature and protecting continued function of ecosystem services;
• the graduates should know how to develop the non-agrarian sector in rural settlements.
Relevant education issues in Kazakh rural areas
• the graduates should know how to prepare and implement development projects in order to achieve sustainable development of rural areas;
• the graduates must be skilled in economic issues (e.g. financial management) when dealing with processing of agricultural production and agricultural commodity sale;
• the graduates should also be able to work in livestock or crop production (the need to have knowledge about the agricultural production sector).

Table 1: Education issues relevant for rural areas of Russia and Kazakhstan identified in the situation analysis.

Materials and Methods

Data regarding the Masters programs were provided by the Russian and Kazakh universities in the form of in-depth study guided by aide memoire (Swain, 2013) forming the questions resulting in the situation analysis. Other needed data were collected by analysing the respective Masters programs and module syllabi. With respect to students enrolled in the study programs, data on age and sex as well as the background qualification were collected from descriptive statistics provided by the participating HEIs.

In order to assess the focus of the study programs on theoretical and practical aspects we compared the total number of ECTS credits and their distribution to the theoretical part (lectures), the practical exercises and the exam related workload. The theoretical segment of the Masters programs was analysed in more detail by comparing the total number of modules (as module is to be understood a single course of the respective program) necessary to be accomplished by the students. In order to assess possibilities for the students to take part in shaping the learning contents, we also compared the share of compulsory and elective modules.

The learning contents of each module were allocated to the four basic topics "economy", "ecology", "society" and "agronomy". We calculated the percentage share of the total learning contents of the study programs dealing with these basic topics to assess the balance and completeness of the study programs. This was done by multiplying percentage shares for the topics in the different modules with the didactic hours of the respective module. The module values were summed up for each basic category by adding the values for the compulsory modules, and values for the required number of elective modules. The total was then divided by the respective number of modules for each study program. Since the percentage shares of the basic topics to be covered in lectures often differed between elective modules, students might reach higher or lower values for each basic topic depending on their choice of electives. Therefore, for each of the key topics the minimum and maximum possible values were calculated.

We compared the total number of students and the share of male and female students between the Masters programs (major agronomy, major economics, major administration). We also compared the age distribution of the students entering the different Masters programs. Due to the low numbers of students enrolled in the Masters programs in Kazakhstan, the data on students from the three Kazakh Universities were pooled. Differences in proportions of male and female students were tested using the Chi-square test. Because of the low number of samples statistical significance was estimated using a Monte-Carlo-estimation (Mehta and Patel, n.d.) (10000 samples, confidence

limit 99 %). Differences in the age of the students between the Masters programs at the different universities were tested using the Median test. The statistical analyses were carried out using IBM SPSS Statistics, version 23.
The initial background qualification was determined for each student based on their bachelor degree and/or current employment. We calculated the share of students with a background according to the chosen master program as well as the share of other backgrounds for each study program in Russia (economics, agronomy, administration) and the study program under the economics major at the Kazakh universities.

Results

The total number of ECTS credits is 120 for the Russian Masters programs and 122 for the according program in Kazakhstan. However the allocation of the ECTS credits to the theoretical study program, the practical part of the study and the exam part differs (Table 2). While in Russia the study programs under the agronomy and economics majors have a very similar distribution of the ECTS credits, a far higher number of credits is assigned to the theoretical part for the Masters program under the major administration. The Masters program under the major economics in Kazakhstan has a higher amount of credits for the exam part. The amount of credits for this part is also elevated for the master under the administration major in Russia. Consequentially, this program has by far the lowest number of credits associated with the practical part.
The total number of modules to be completed by students differs between the Masters programs. The range is between 25 modules for the Russian master under the agronomy major and 16 modules for the Kazakh master under the economics major. In Kazakhstan only 7 modules are compulsory, 9 modules are elective. In Russia, the number of compulsory modules ranges from 14 to 17 and the number of elective modules ranges from 5 to 8 (Table 2).

Characteristic		Russia – Admin.	Russia – Agronom.	Russia – Econom.	Kazakhstan – Econom.
ECTS	theoretical part	84	66	63	63
	practical part	27	48	51	43
	exam	9	6	6	16
Modules	compulsory	17	16	14	7
	elective	8 (16)	5 (10)	5 (10)*	9 (17)
% Economy	min.	29.28	24.02	30.79	19.76
	max.	29.28	30.38	36.27	35.24
% Ecology	min.	24.25	20.38	18.65	16.90
	max.	24.25	25.38	19.84	31.67
% Society	min.	22.56	20.83	26.59	14.52
	max.	22.56	24.92	33.02	28.81
% Agronomy	min.	23.10	22.95	15.87	23.10
	max.	23.10	31.14	18.97	30.00

**Study program „Russia – Economy" offers one optional module. This module was not taken into account when calculating the minimum and maximum values for the learning contents.*

Table 2: Characterization of the Masters programs with respect to numbers and distribution of ECTS credits, number and distribution of modules (total number of elective modules offered in brackets), and minimum and maximum share of contents relating to the basic topics economy, ecology, society and agronomy within the lecture part.

With respect to the percentage share of the learning contents of the study programs on the different key topics the study program in Kazakhstan showed the biggest differences between the topics.

Generally, highest maximum values were in good agreement with the respective aggregative majors (Table 2).

The total number of students and the proportions between male and female students differed between the programs (Figure 1). The highest number of students was recorded in Omsk with 18 students in the program under the agronomy major, and 15 students in the program under the economics major. The study programs in Kazakhstan were chosen by 8 students at all three universities combined. The proportions between male and female students were significantly different between the study programs (Chi-square test, Monte-Carlo-estimated statistical significance $p<0.01$). The proportion of males was particularly high in the study programs at Omsk, whereas at BSAA (economics) only female students inscribed for the study program.

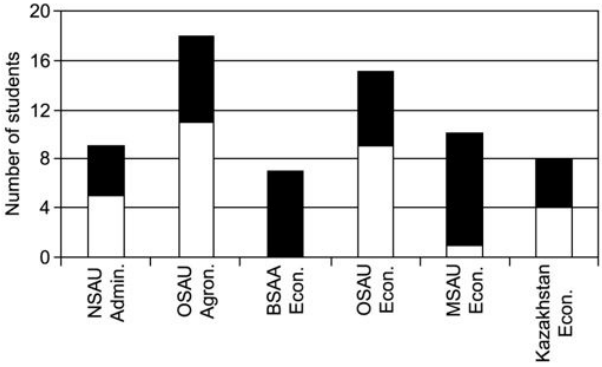

Figure 1: Number and sex of students of the respective study programs. White part of the bars – males, black part of the bars – females (Chi-square test, statistical significance based on Monte-Carlo-estimation, $p<0.01$).

Significant differences were also revealed with respect to the age of the students (Median test, $p<0.05$) (Figure 2). On average the oldest students were recorded in Omsk with median values above 25 years, whereas in all other programs the median value were 22 years. Compared to the age ranges recorded for the Masters programs at other participating universities, narrow ranges in student age were observed for Kazakh universities and those of the economics major at MSAU.

The allocation of the initial background qualifications of the students to the different Masters programs (Table 3) indicates that quite often students had a background that differed from the aggregative major. A fit >50% was reached for three study programs only: Economics in Kazakhstan (75.0 %), agronomy at OSAU (72.2 %) and administration at NSAU (55.6 %). Low or very low values of fit were recorded for economics at BSAU (14.3 %) and OSAU (26.7 %).

Discussion

Awareness of the need for targeted education towards sustainable development is not limited to Russia and Kazakhstan. As early as in 1991, Cornell University (Ithaca, NY) had established a graduate minor in conservation and sustainable development (Shelhas and Lassoie, 2001). Wang (2010) emphasizes the need for advanced ecotourism education in China in order to improve sustainable development. Mulá et al. (2017) mention increasing activities regarding education for sustainable development in higher education worldwide. Education is of high priority among the sustainable development goals adopted by UN member states (Vlidimirova and Le Blanc, 2017). Our study not only stresses the need for developing study programs with a focus on sustainable

rural development, but also revealed differences with respect to both the implemented study programs and the enrolled master students.

The studied parameters of the Masters programs exhibit differences between the respective aggregative majors as well as the countries. The allocation of ECTS and the relationship between compulsory and elective modules is mainly predetermined by the rules of the respective country or university. This highlights the importance of institutions in shaping the educational process. Similarly, the degree of practical content is determined by the major under which a Masters program is launched. Administration requires considerable knowledge in procedures and the legal framework governing activities. Therefore and not surprisingly the practical part of the Masters program under the major administration is comparatively low. Especially interesting is the allocation of the learning contents to the key topics in the Masters programs. The fact that learning contents independent of the selected majors cover basic topics rather well can be considered as a strong indication for appropriately balanced and well-developed study programs.

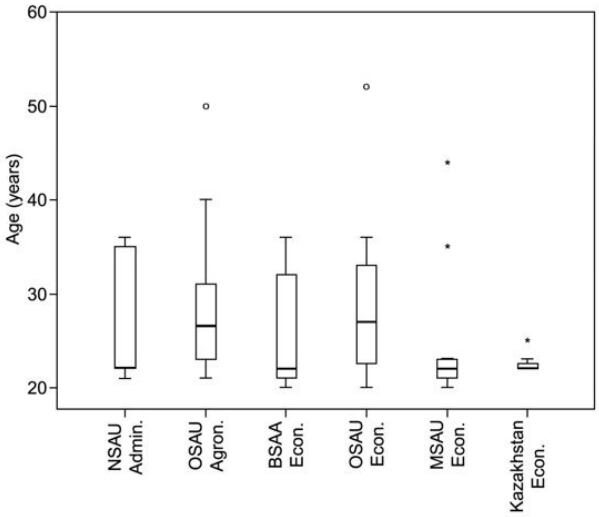

Figure 2: Age distribution of students in the respective Masters programs shown as box-whisker plots. Median values indicated by a bar, the boxes show inter-quartile distances. Whiskers indicate range of data without outliers (distance from the edge of the box between 1.5 and 3 times of box length, shown as circles), and extreme values (distance from the edge of the box more than 3 times of the box length, shown as asterisks).

Background	NSAU – Admin.	OSAU – Agronom.	BSAA – Econom.	OSAU – Econom.	MSAU – Econom.	Kazakhstan – Econom.
Administration	**5 (55.6 %)**	-	1 (14.3 %)	2 (13.3 %)	1 (10.0 %)	-
Agronomy	1 (11.1 %)	**13 (72.2 %)**	4 (57.1 %)	3 (20.0 %)	1 (10.0%)	1 (12.5 %)
Economics	2 (22.2 %)	-	**1 (14.3 %)**	**4 (26.7 %)**	**4 (40.0 %)**	**6 (75.0 %)**
Other	1 (11.1 %)	5 (31.8 %)	1 (14.3 %)	6 (40.0 %)	4 (40.0 %)	1 (12.5 %)

Table 3: Allocation of students with the respective initial background qualification within the Masters programs (Accordance in initial background qualification of students with study program's major printed bold).

With respect to the students age, sex and professional/educational background the results express only limited dependences on the aggregative majors and countries of implementation. We highlight the fact that to some degree regional aspects seem to override the aggregative majors, to which the study programs have been assigned. Students at Omsk differentiated from study programs in other regions of Russia or in Kazakhstan in terms of percentage of male and female students as well as the age of students. However, this situation might be a valid only in the current year and may not describe a regular pattern.

It is difficult to discuss the results with respect to the background of the students, because – on one side – a high number of students with the background of the respective aggregative major may express a good match between profile and topics addressed. On the other hand, students switching fields might express that the respective study program provides them with well elaborated topics in order to enlarge their knowledge base towards additional expertise on sustainable development. In order to gain more detailed information about such aspects and to assess the quality of the study programs future student surveys to accompany program implementation will be useful. For example, Savelyeva and Douglas (2017: 218) conducting questionnaires and collecting reflective narratives discovered an 'increase in the self-perceived knowledge and behavioral aspects of sustainability consciousness of Hong Kong students, who were enrolled in the General Education course'.

For both Russia and Kazakhstan the situation analysis revealed a need for education towards sustainable development with a special focus on economic issues. These aspects are fulfilled by all the Masters programs in both countries. In Russia, a special need was expressed for training the students with respect to development of the non-agrarian sector in rural settlements. Apart from the study program under the major agronomy, which has to have a strong focus on this key topic, the Masters programs in Russia had a comparatively low focus on agronomy. This might be treated as an indicator that non-agrarian aspects indeed play a more dominant role in these programs. In Kazakhstan, however, a special need was identified for training in livestock or crop production, an aspect which is indeed well addressed by the Kazakh study program.

Conclusions

Masters programs dealing with sustainable agriculture and rural development were successfully implemented at Russian and Kazakh universities. Study programmes match well the situation analysis carried out prior to the implementation. With respect to student age and gender, regional aspects seem to override the aggregative majors. In order to assess the quality of the study programs future student surveys will be a useful tool. The programmes developed under an international cooperation, demonstrate the importance of transboundary exchange of knowledge in education, because the experience of EU universities was transposed into Russian and Kazakh universities in such a way they are able to match the needs of their rural areas.

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EMPLOYEE TRAINING AND DEVELOPMENT: ORGANISATIONAL ASPECT

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Abstract

The paper focuses on the training and development of employees in organisations in the Czech Republic and issues associated therewith. The main objective of the paper is to evaluate the use of methods for the measurement of training effectiveness in organisations in the Czech Republic in the period from 10/2013 to 12/2017. The partial objective is to identify the profile of a typical organisation supporting the training and development of its employees. The primary data (n = 1,360) was collected by means of a questionnaire technique. The outcomes of the survey show that despite the fact that 79.7% of organisations support the training and development of their employees, only 40.1% of them systematically evaluate the efficiency thereof. A typical organisation that ensures the training and development of its employees is an organisation that has a human resources department, more than 250 employees and operates within the international market.

Keywords

Development and training, employees, organisation, profile, survey, tree classification model

Introduction

In the 21st century, employee training and development represent a key human resources (HR) activity that any organisation seeking success in the market should focus on. Globalization, technological changes and innovation place high demands on both organisations and their employees and their flexibility to adapt to changes in the labour market. According to Hanaysha (2016), it is possible to survive in these difficult conditions only thanks to a competitive advantage, which is based on employees' knowledge and skills. The importance of knowledge and skills of the workforce as an important factor in achieving organisational goals is also confirmed by Pérez-Bustamante Ilander et al. (2016). Therefore, organisations are aimed at obtaining the competitive advantage realize the importance of training and improving the performance of their employees (Elnaga and Imran, 2013). Cortolezis-Schlager (2016) states three big 'i-factors' - Internet, internationality, and intercultural awareness - that have been making a huge impact on training and development in organisations in recent years. New knowledge and skills are required. That is why employee training and development should form part of a human resource management system (Albrecht et al., 2015). Organisations have to concentrate on building the capacity of employees to do their jobs efficiently and focus on their training and development to attain job satisfaction (Latif, 2012). For these reasons, a long-life training perspective becomes an issue of crucial importance (Aleandri and Refrigeri, 2013). Langmann and Thomas (2017) point out that the evaluation of training remains an indispensable yet incomplete component of human resource training and development. According to Ford (2014), there is an important difference between the training evaluation and the training effectiveness. 'Training evaluation focuses on whether training leads to the desired level of proficiency indicated by the training objectives but

the training effectiveness deals with the broader issues involved in understanding why training did or did not lead to the desired level of proficiency' (Ford, 2014: 12). Arthur et al. (2003) based on their survey found out that the effectiveness of training programs is related to the training methods used, the skill or task characteristic trained, and the choice of evaluation criteria.
The paper focuses on the training and development of employees in organisations in the Czech Republic. The main objective of the paper is to evaluate the use of methods for the measurement of training effectiveness in organisations in the Czech Republic in the period from 10/2013 to 12/2017. The partial objective is to identify the profile of a typical organisation supporting the training and development of its employees. The paper is structured as follows: The first part of the paper concentrates on theoretical background. The second part specifies the particular research methods. The third part is dedicated to an evaluation of outcomes of the survey. The fourth part discusses results. The fifth part focuses on the overall conclusions and the sixth part consists of a list of references used.

Materials and Methods

In the period from 10/2013 to 12/2017, a questionnaire survey focused on the training and development of employees in organisations in the Czech Republic was conducted. The sample comprises 1,360 randomly selected organisations. The structure of the organisations is shown in Table 1.

Sector	Private		Public	Total
	75.7		24.3	100
Area operated (sectoral structure)	Primary	Secondary	Tertiary	Total
	3.6	27.2	28.2	100
Size	Small	Medium-sized	Large	Total
	44.6	27.2	28.2	100
Market	National		International	Total
	60.4		39.6	100

Table 1: Structure of surveyed organisations in percent, 2013-2017 (source: own elaboration)

To enhance the quality of data from the questionnaire survey, it was necessary for the questionnaire to be completed by a specialist from the HR department or an owner of the given organisation. The data were processed by means of absolute and relative frequencies using IBM SPSS Statistics 24. The profile of a typical organisation focusing on the training and development of its employees is based on the predictive model in the form of a tree classification model. The aim of modelling is to develop a tree structure using the CHAID (Chi-Square Automatic Interaction Detection) growing method for categorical data in IBM SPSS Statistics 24. In IBM SPSS Statistics 24 the Decision Tree procedure creates a tree classification model that classifies cases into groups or predicts values of a dependent variable based on values of independent variables. It classifies cases into groups or predicts values of a dependent (target) variable based on values of independent (predictor) variables (IBM, 2018). The tree structure is graphically displayed as a scheme with node and branch elements. Nodes are structured on different levels of growth (tree depth). The highest level consists of one single node (the so-called root). Nodes are classified as non-leaf (these nodes refer to lower levels) and leaf (leaf nodes represent the lowest level) (Řezanková, 2011). The significance level is set to $\alpha = 0.05$.

Results

The outcomes of the survey have found out that 79.7% of organisations concentrate on the training and development of their employees. In the majority of cases, these organisations characterise the training and development of their employees as a series of planned training and development activities scheduled for a certain period of time (30.3%). In addition, 29.2% of organisations describe the training and development of their employees as a non-planned activity which takes place when there is a need. Despite the fact that 79.7% of organisations dedicate themselves to the training and development of their employees, not all of them evaluate the efficiency of these activities systematically. The efficiency of training and development is monitored by only 40.1% (435) of the analysed organisations. To evaluate training efficiency, these organisations most frequently evaluate the following: reactions of employees immediately after training, goals fulfilment defined by the employee training and development plan, informal feedback from immediate superiors and employees involved in the training process, the evidence of the total number of training days per employee, job observation and measurement of job performance before and after training after a certain period of time or immediately. Methods for the measurement of training effectiveness in analysed organisations in the Czech Republic are shown in Figure 1.

Figure 1: Methods for the measurement of training effectiveness, 2013-2017 (source: own elaboration)

The profile of a typical organisation focusing on employee training and development is based on a tree classification model. A typical organisation that ensures the training and development of its employees is an organisation that has an HR department, more than 250 employees and operates within the international market. The profile of such an organisation is based on unilateral dependence within a tree classification model, as shown in Figure 2.

A CHAID tree classification model calculates the predicted target category for each node in the tree. When applying the tree structure to model the dependence of a certain dependent variable on independent variables, the root is represented by the dependent variable - in this case, the dedication to employee training and development. Firstly, the cross tabulations between each of the input fields and the outcome are examined, and tests for significance using a chi-square independence test. If more than one of these relations is statistically significant, CHAID will

select the most significant input field, i.e. the smallest *p*-value (IBM, 2018). In the following steps, an independent variable is selected for each node with the most significant relation to the dependent variable, i.e. the sector and the size of the organisation. As for the size of organisations, the categories that show no differences in the outcome are collapsed together, i.e. small and medium-sized organisations are put in one category (less than or equal to 249 employees). The second category includes large organisations with more than 250 employees. Figure 2 displays the selected independent variables which show the most significant relations to the dependent variable - the dedication to employee training and development - at three levels of growth.

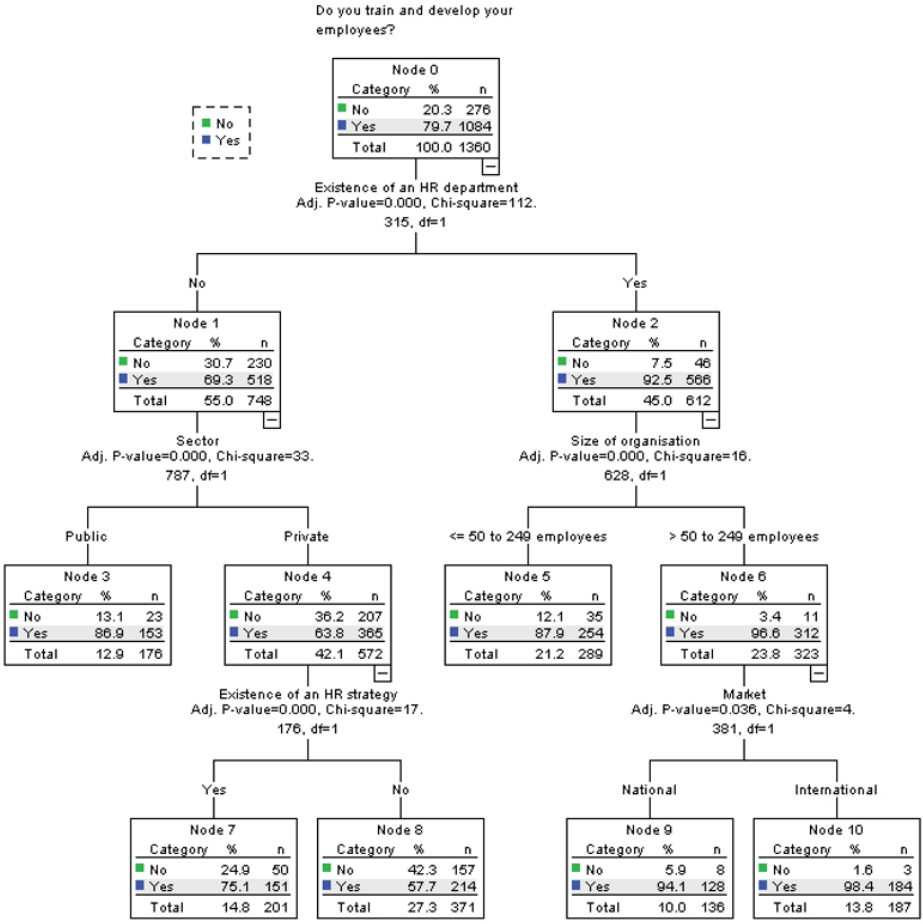

Figure 2: Tree classification model (source: own elaboration)

The root splits into branches leading to two nodes at a lower level. These nodes represent categories of organisations according to the existence of an HR department. Each node specifies the number of responses for the dependent variable. The total sum of responses at nodes 1 and 2 equals *n*. For each of the category the chi-square independence test (of the independent variable and of the variable not yet used) that resulted in a partition is conducted, i.e. the sector and the size of the organisation. If the result of the chi-square independence test is significant, a new node is

created. The same applies to the third level. Again, the interaction between the dependent variable and independent variables yet to be used (i.e. the existence of an HR strategy and the market) is determined.
As far as dedication to employee training and development is concerned, the most significant variable is the existence of an HR department. The largest share of organisations that focus on employee training and development are organisations with HR departments (92.5%). Within this category, it is possible to determine a larger share of organisations with more than 250 employees (96.6%) and also the organisations that operate within the international markets prevail (98.4%). The final classification model shows three levels of growth with 5 independent variables, 11 nodes and 6 terminal nodes.

Discussion

The outcomes of the conducted survey showed that the efficiency of training and development is monitored by only 40.1% of the analysed organisations. Kodwani (2017) confirms that organisations invest heavily in training and development initiatives, however, only a small percentage of what is learnt gets transferred to the job. According to Folwarczná (2010), organisations' investments in employee training and development have a positive impact on the long-term development of their profits and share value. If an organisation's management supports employee training and development, it should also enable its employees to apply the knowledge and skills newly acquired (Steil et al., 2018). Nevertheless, 29.2% of analysed organisations describe the training and development of their employees as a non-planned activity. These results confirm also Elnaga and Imran (2013), who state that some organisations plan and implement training programmes for their employees without defining the purpose and objectives, without knowing what knowledge, skills and abilities their employees should acquire in order to be able to attain the performance targets on the job. If the training and development are approached with regard to the needs of the individuals and the organisation at the same time, it is a significant motivating and indispensable human resource management tool (Staňková and Drdla, 2012). Organisations should understand training and development programs and evaluate their impact in terms of their decision making and business results (Pérez-Bustamante Ilander et al., 2016). A CHAID tree classification model showed a typical organisation that ensures the training and development of its employees. A typical organisation is an organisation that has a human resources department, more than 250 employees and operates within the international market. The results showed the influence of the size of the organisation, which is also confirmed by Asadullah et al. (2015). Asadullah et al. (2015) based on their survey state that training duration mediates the relationship between the size of organisation and the training efficiency evaluation. They also found out that the indirect effect of the size of organisation on training evaluation through training duration differs across different levels of the size of the organisation but not across different levels of the ownership.
The theoretical contribution of the paper lies in the collection of information on the current situation in the area of the methods for the measurement of training effectiveness used in 1,360 organisations in the Czech Republic. Furthermore, the paper identifies the profile of a typical organisation supporting the training and development of its employees. The practical contribution is aimed at experts and managers in the area of human resources who may focus more intensely on activities associated with the evaluation of the efficiency of financial means invested in employee training and development. The paper is limited by the number of sample organisations. The selected sample is suitable for data collection and enables the evaluation of training and development in responding organisations. The findings, however, may not be generalized from

a sample to a population. This, however, is the problem for the majority of published research findings.

Conclusion

Employee training and development is one of the most crucial human resource activities, mainly in organisations that wish to keep pace with current trends and succeed in the market. The paper focuses on the issues of training and development of employees in organisations in the Czech Republic and the methods for the measurement of training effectiveness. The outcomes of the survey show that despite the fact that organisations support the training and development of their employees, 59.9% of organisations do not evaluate the efficiency of employee training and development. A typical organisation that trains and develops its employees is an organisation that has an HR department, more than 250 employees and operates on the international market. It is also interesting that 29.2% of organisations characterise training and development of its employees as a non-planned activity that is implemented when needed. Aspects of employee training and development in organisations in the Czech Republic will also be examined in the subsequent period. Further research will be focusing on the aspects of employee training and development in year-on-year comparisons, the use of training methods and methods for the measurement of training effectiveness and the training costs.

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ONCE BAD PROFESSOR ALWAYS BAD? AN APPLICATION OF MARKOV CHAIN

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Abstract

Many Higher education institutions (HEIs) use internal evaluation systems to capture students' perception of the teaching quality. These evaluations are generally used for solving teaching related problems, as well as for hiring and/or promoting activities. However, the HEIs' authorities should consider several aspects directly related to these evaluations, such as different students' and HEIs' objectives and high volatility in the evaluation. In this article, we construct a Markovian model to analyze professors' performance in the context of the SED 2.0 evaluation system used at La Salle University Mexico. The objective is to find out how professors' performance can evolve over time. The model is based on 1,179 distinctive course evaluations in Management study program from the period December 2010 to December 2017. The results indicate that the lowest evaluated professors are more likely to remain within the lowest evaluated in the future.

Keywords

Markov chain, one-step transition probabilities, professors' evaluation, teaching quality

Introduction

It is of a high importance in education to measure and, consequently, secure a high-quality teaching standard. For this reason, many Higher education institutions (HEIs) have introduced internal evaluation systems. The main purpose of these evaluations is to measure professors' performance and quality, as well as to demonstrate HEIs' excellence in teaching (Davies et al., 2010). The internal evaluations commonly use online questionnaires with diverse set and types of questions divided into several dimensions, such as educative, pedagogic, social, ethics, teaching and learning (Hein, Kroenke and Rodrigues Júnior, 2015; Flegl et al., 2017a). The choice of these dimensions and related questions usually correspond to a university strategy and culture, as well as to the main purpose of the evaluation.

The achieved results from the internal evaluation are usually used to solve teaching related problems, to motivate professors for their personal development, as well as for hiring and promotion decisions (Becker and Watts, 1999). Commonly, the evaluation is done anonymously by students who have direct (daily) contact with the professors. Students' evaluation can then provide a valuable feedback to a teaching quality. However, the HEIs' authorities should not completely rely only on this evaluation, as students' objectives in the evaluation can be different than those of the authorities (Braga, Paccagnella and Pellizzari, 2014; McAuley et al., 2017). In this case, students may evaluate their professors positively, although the teaching quality is not high. Thus, the HEIs' authorities should not make rash decisions as it is necessary to understand well the evaluation system, i.e. what types of results we can get from the system and how the

system can evolve. For example, if there is a high variability within the evaluation from semester to semester.

Markov chains can be used to predict quality in education over time. Shah and Burke (1999) applied Markov chain to model higher education system in Australia. Perdikaris (1992) used a Markovian model to analyze mathematics teachers' decision-making. Hlavatý and Dömeová (2014) used Markov chain to demonstrate how student's achievements during a semester affect the final grade results. Reamer et al. (2015) constructed a Markov chain model to explore elementary and middle school students' performance in mathematics. Moreover, the authors also warned that "Education policy makers can use transition probability matrices of Markov chain to further their understanding of a student's performance in mathematics over time" (Reamer et al., 2015: 14). Markovian model can also be applied in the professors' evaluation systems. Understanding of the transition probabilities would improve prediction power for future development in the evaluation. Therefore, the objective of this article is to develop a Markovian model of professors' performance in the context of the SED 2.0 evaluation (Sistema de Evaluación Docente) used at La Salle University Mexico. This model would enable us to understand a progression within the evaluation to make professors' related decisions.

Materials and Methods

Evaluation system SED 2.0 (Sistema de Evaluación Docente)

Evaluation system SED 2.0 was created at La Salle University Mexico in 2001. The purpose of the creation was a necessity to evaluate professors' performance in a fast, safe and reliable way according to the institutional philosophy centered on a person and its integral training. SED 2.0 is maintained by Department of Teacher Education (DPE), i.e. DPE maintains its design, development, results dissemination, etc.

Evaluation system SED 2.0 includes three dimensions: institutional, educative, and pedagogic. The objective of the institutional dimension is to evaluate professor's profile from the mission of La Salle (La Salle, 2017). This area applies to all professors of study programs with Recognition of Official Validity of Studies (ROVS). The indicators included in this dimension are related to personality, community and society. The objective of the educative dimension is to evaluate professor's profile based on abilities of student's graduation profile. Similarly, this dimension also applies to all professors of study programs with ROVS differentiated by education level (high school, bachelor level, and master level). The indicators included are related to professor's ability of problem solving, social responsibility, ethical judgment, usage of ICT, efficient communication, and information management. The objective of the pedagogic dimension is to evaluate professor's profile based on his/her capability of learning and teaching. This dimension applies to all professors of study programs with ROVS differentiated by education level and type of course, such as common area, laboratories and workshops, courses of initial phase (first two years), and courses of final phase (last 2 years). (Coordinación de Formación Docente, 2010). SED 2.0 consists of 15 questions: institutional dimension (3 questions), educative dimension (6) and pedagogic dimension (6).

Every student evaluates anonymously all his/her professors from all courses at the end of each semester. For this purpose, a scale consisting of five options (Never – Almost never – Sometimes – Almost always – Always) is used in the evaluation in each of the three dimensions. The obtained scores are then transformed to a scale 0 – 10pts. The approximate time to finish an evaluation is around 20 minutes. As the evaluation is fully available online, students can make their evaluations at any computer at the university campus, at home, as well as using their mobile phones. The evaluation is opened for 12 days at the end of each semester. The persons responsible for the evaluation prepare daily reports to inform the university representatives about the progress in the

evaluation (percentage of participation by each study program and group of students). (Flegl et al., 2017a)

Data

The analysis is based on a sample of the SED 2.0 evaluations carried out for 15 semesters during period from December 2010 to December 2017. The analysis is only carried out for the Management study program (Licenciatura en Administración) at Business School, University La Salle Mexico. During this period, 25,786 students evaluated their courses (in average, each course was evaluated by 9.539 students). For the purpose of this analysis, if a professor taught more groups within the same course (and semester), then we consider more groups as one course. The evaluation of this course is given as an average evaluation from the different groups. In total, the sample consists of 1,179 distinctive course evaluations, as same courses were taught by different professors during the analyzed period.

The professors' evaluation at University La Salle Mexico shows a high teaching quality, as the evaluation is significantly skewed to the maximal evaluation. The university average is 8.932 in Institutional area (SD = 1.315), 8.724 in Educative area (SD = 1.419), and 8.970 in Pedagogic area (SD = 1.305) (Flegl et al., 2017a). However, to be able to distinguish different teaching quality, we have calculated quartiles for each semester evaluation. In this case, the quartiles represent *low quality* (1), *regular quality* (2), *high quality* (3) and *excellent quality* (4). Moreover, the analysis is divided regarding three dimensions in the SED 2.0 (institutional, educative and pedagogic) and an overall analysis based on the average evaluation from all three dimensions.

Markov chain

To capture the progression of the professors' evaluation throughout the individual semesters, we will take advantage of Markov chains as a modelling tool to support our case study by exact quantitative means. The Markov chain represents a stochastic process being discrete in both time and state space. This suits the modelled situation well since the observed "states" of professors' evaluations are discrete and the observations is done in discrete time intervals.

Specifically, in our situation, we assume 4 states (1-4) as given above which allows for constructing a transition matrix P expressing the probability of transitions between the individual states. The transition probability of any state is determined as its fraction on the overall number of transitions from that very state in the entire system observed. From the available data, it is possible to observe occurrence of all transitions between all states 1-4 and this frequency can be described using the 4x4 frequency matrix F, with integer entries f_{ij} describing the number of transitions from the state i to j. To obtain the P, we compute its entries as:

$$p_{ij} = \frac{f_{ij}}{\sum_{j=1}^{4} f_{ij}}, \forall i \tag{1}$$

to achieve that the ℓ_1 norm of any row vector of P is equal to 1. The transition matrix P is computed as in (1).

There are two modelling goals based on using transition matrix:

- To determine the steady state probabilities of all states
- To determine the mean "time" of transition from state i to state j

The P serves not only for calculating the individual probabilities after k transitions ($k \in [1,\infty) : k \in \mathbb{Z}$) but can be used to determine the steady state probabilities of the ergodic chain after a sufficient number of steps. Generally, we assume steady state probabilities when $k \to \infty$

but practically, the steadiness can be observed for much smaller k in our case. With P being regular, one is able to compute steady state probabilities vector $q_{\infty}^{T} = (q_1, \ldots, q_4)$ by solving the following linear system:

$$\sum_{j=1}^{4} p_{ji} q_j - q_i = 0, i = 1, \ldots 3$$
$$q^{\infty}{}_1 = 1 \tag{2}$$

In the first set of equations in (2), one equation is omitted due to linear dependency of row vectors of the entire system.

The second goal aims to compute the mean number of transitions from state i to j. A concept of *fundamental matrix* N of a Markov chain will be used for this purpose. Let Q^{nxn} be a steady state matrix defined as:

$$Q = \left(q_{\infty}^{T}, \ldots, q_{\infty}^{T}\right)^{T} \tag{3}$$

Then the fundamental matrix N is defined as:

$$N = \left(I - P + Q\right)^{-1} \tag{4}$$

with I representing identity matrix. It is possible now to use the fundamental matrix for the determination of matrix M^{nxn} containing mean number of transitions from i to j using the following relationship:

$$M = \left(I - N + C\hat{N}\right)\hat{Q} \tag{5}$$

with the $\boldsymbol{C}, \hat{\boldsymbol{N}}, \hat{\boldsymbol{Q}}$ set in the following structure:

$$C : c_{ij} = 1 \forall i, j$$
$$\hat{N} \begin{cases} \hat{n}_{ij} = n_{ij}, \boldsymbol{i = j} \\ \hat{n}_{ij} = 0, \boldsymbol{i \neq j} \end{cases}$$
$$\hat{Q} \begin{cases} \hat{q}_{ij} = q_{ij}^{-1}, i = j \\ \hat{q}_{ij} = 0, i \neq j \end{cases} \tag{6}$$

then all entries $\boldsymbol{m_{ij}}$ of the matrix $\boldsymbol{M}$ gained from (5) represent the mean number of transitions to get from state $\boldsymbol{i}$ to state $\boldsymbol{j}$.

Results and Discussion

In this section, we present the achieved results of the analysis. The results are divided into two parts: first, we discuss the results in overall evaluation and, second, we divide the analysis into institutional, education and pedagogic area. All the achieved results and conclusions made in this section are based on the professors' evaluation of the Management study program at Business School, La Salle University Mexico.

Overall results

The main objective of the analysis is to find out how professors behave regarding their evaluation, i.e. if a well-evaluated professor stays well-evaluated and, vice versa, poorly evaluated professors improves his/her quality of teaching. Figure 1 demonstrates one-step transition probabilities within the SED 2.0 evaluation. If a professor is poorly evaluated in a current semester (quartile 1 - *low quality*), this professor will be evaluated within the same quartile with a probability of 43.7%. Further, this professor will reach the 2nd quartile (*regular quality*) with a probability of 23%, the 3rd quartile (*high quality*) with a probability of 18.4% and will become evaluated in the highest quartile (*excellent quality*) with only 14.9 probability.

On the other hand, the highest evaluated professor (*excellent quality*) will keep the highest evaluation with a probability of 37.8%. Similarly, as in the opposite case, the highest probability of the transitions is to stay within the same evaluation quartile. The highest evaluated professor will decrease to the 3rd quartile with a probability of 27.6%, to the 2nd quartile with a probability of 21.8% and will be within the lowest-evaluated quartile with a probability of 12.8%. If we compare the probabilities of staying in the same quartile in the next evaluation, then the probability is the highest in the lowest quartile (43.7% compare to 30.4% to stay within the 2nd, 29.3% within the 3rd and 37.8% to stay within the 4th one). Although, the transition probabilities between the "next-door" quartiles are between 23% and 30%, we can conclude that the highest probability is to stay within the same evaluation level. What is more, the results indicate that the lowest evaluated professors are supposed to remain among the poorly evaluated.

The steady-state probabilities show that the evaluation distribution will correspond (more or less) to the quartile distribution. More specifically, 24% of professors will be in the *low-quality* level, 25.4% within the *regular quality* level, 25.2% within *high quality* level and 25.4% in the *excellent quality* evaluation. This fact was expected as the quality levels were selected based on the quartiles, and not regarding some fixed thresholds from the evaluation.

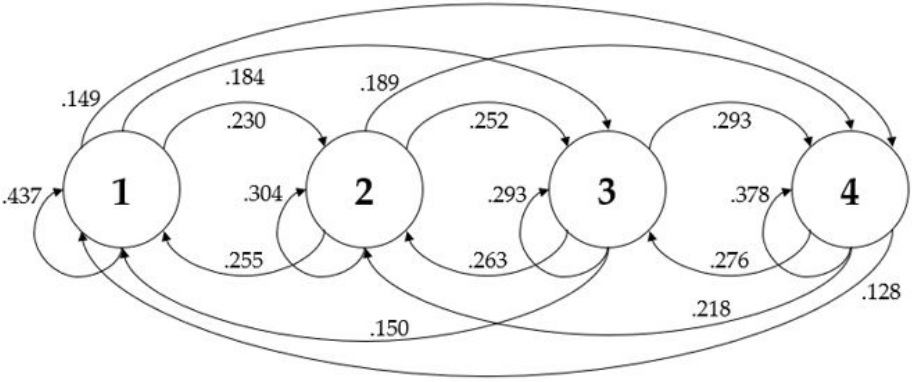

Figure 1: One-step transition probabilities in the SED 2.0 overall evaluation (own calculation)

In addition, we can evaluate how long it might take to change personal evaluation within the quartiles. Table 1 shows that the lowest-evaluated professor needs 5 (5.206) semesters to reach the excellent quality in the evaluation. On the other hand, this professor only needs a bit more than 4 semesters to reach the 2nd or the 3rd quartile. On the other hand, the best-evaluated professor needs 6 (6.018) semesters to worsen his/her evaluation into the "*low quality*". The minimum semesters needed are on the diagonal, i.e. professors are more likely to stay within the same evaluation level.

This result corresponds with the transition probabilities presented in Figure 1.

	1	2	3	4
1	4.167	4.260	4.554	5.206
2	5.190	3.934	4.197	4.921
3	5.844	4.109	3.968	4.355
4	6.018	4.308	4.018	3.940

Table 1: Expected number of transition steps (own calculation)

Results in institutional, educative and pedagogic area

If we analyze the one-step transition probabilities regarding each area, then we get very similar results. Figure 2, Figure 3 and Figure 4 show the possible transitions between the quartiles. In general, we can find the highest probabilities in the case of poorly evaluated professors to stay within the lowest quartiles (slightly over 40%). Similarly, the best evaluated professors are most likely to keep their high-quality evaluation in the following semester (around 38%). However, transitions between "next-door" quartiles are quite common (probabilities vary between 23% and 30%). The highest stability in the transitions, from a brief point of view, can be observed in the pedagogic evaluation.

Further, Table 2 demonstrates needed steps (semesters) to change personal evaluation within the quartiles. In general, professors need 4 semesters to reach a particular evaluation level. For example, a professor evaluated in the *low-quality* level in the institutional area needs 4.065 semesters to be evaluated as *regular*. The "longest distance" to pass from evaluation level is needed for the excellent-evaluated professors to become poorly evaluated (from 5.253 semesters in the institutional area to 6.078 semesters in the pedagogic area). In all three areas the transitions indicate more semesters needed to become poorly evaluated than improve. Therefore, these results confirm the overall result that the poorly evaluated professors are likely to stay poorly evaluated in the future.

	1	2	3	4
1	4.040	4.065	4.659	5.048
2	4.870	3.934	4.243	4.785
3	5.164	4.235	3.968	4.469
4	5.253	4.589	4.055	3.940

a)

	1	2	3	4
1	4.131	3.828	4.685	5.220
2	5.033	3.934	4.040	4.894
3	5.456	4.126	3.968	4.371
4	5.758	4.148	4.089	3.940

b)

	1	2	3	4
1	4.251	4.174	4.849	5.237
2	5.194	3.934	4.384	5.065
3	5.796	4.249	3.968	4.604
4	6.078	4.501	4.119	3.940

c)

Table 2: Expected number of transition steps in: a) institutional, b) educative and c) pedagogic area (own calculation)

Markov chains have a potential to be used to improve understanding of professors' progression over time in the evaluation system. However, according to Reamer et al. (2015), it is important to deal with three challenges: 1) define mutually exclusive states, 2) describe how the states change over time according to time-independent probability distributions and 3) secure access

to statistically significant sample sizes. In our case, all three challenges have been managed appropriately. The sample size corresponds to the whole Management study program throughout 15 semesters, including 1,179 distinctive course evaluations. Moreover, time between transitions is constant (always one semester). In addition, we suppose that professors' evaluation within each quartile represents his/her quality of teaching, as the students are in the front line to assess the quality. However, there are many aspects influencing professors' evaluation, such as gender, attractiveness and age (Marsh and Roche, 1993; Šimsová and Reissová, 2017).

As Becker and Watts (1999) mentioned, the results from the evaluation can serve for hiring and promotion decisions. The achieved results indicate that poorly evaluated professors are most likely to remain poorly evaluated in the future. Therefore, the system for hiring and promoting (awarding) activities can be connected to a Markovian process. For example, professor will not keep teaching a course, if he/she remains poorly evaluated for a several (2-3) consecutive periods (semesters). The same process can be applied to the promoting activities. As Marsh and Roche (1993) and Santibañez (2006) emphasize, improvements of teaching quality are directly connected to educative quality at an institutional level. Furthermore, constructing direct link between the evaluation and hiring or promoting activities can stimulate higher students' interest to evaluate their professors (Flegl et al., 2017b)

Conclusion

The objective of this article was to analyze professors' performance in the context of the SED 2.0 evaluation system used at La Salle University Mexico. To be able to analyze this performance over time, we have constructed a Markovian model based on 1,179 distinctive course evaluations in Management study program from the period December 2010 to December 2017. The results reveal that lowest evaluated professors are more likely (with a probability of 43.7%) to remain within the lowest evaluated in the next semester. This probability is the highest from all transition probabilities in the model. What is more, the same result can be found in institutional, educative and pedagogic sub-models. The constructed model was the first attempt to analyze the SED 2.0 evaluation behavior in order to be able to manage teaching related problems, as well as to secure quality teaching standards.

Acknowledgements

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Appendix

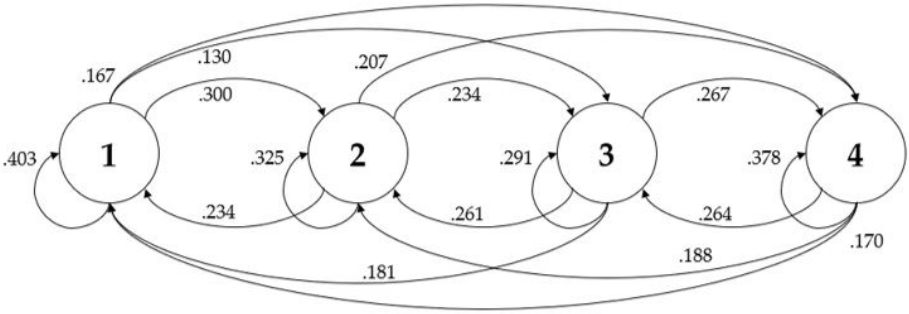

Figure 2: One-step transition probabilities in the SED 2.0 institutional evaluation (own calculation)

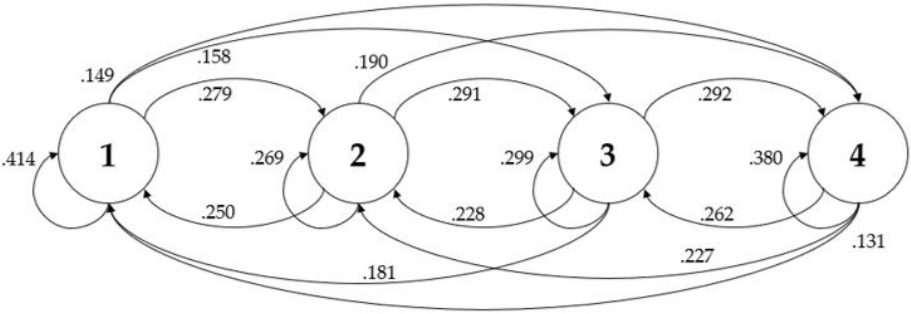

Figure 3: One-step transition probabilities in the SED 2.0 educative evaluation (own calculation)

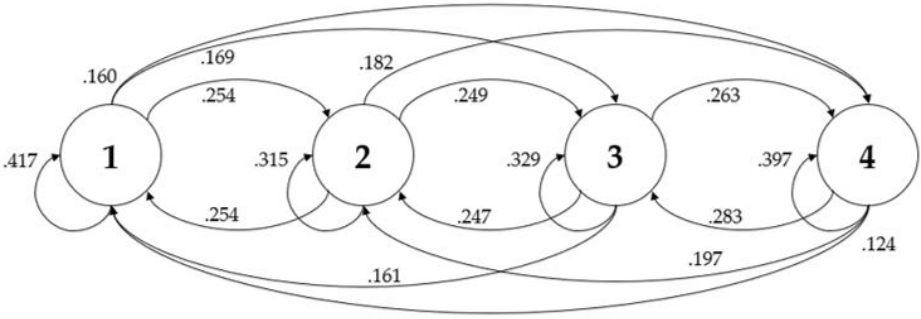

Figure 4: One-step transition probabilities in the SED 2.0 pedagogic evaluation (own calculation)

RESPONSIBLE SELF-ASSESSMENT AS PART OF TEACHER ASSESSMENT

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Abstract

The paper presents the results of piloting the tools (developed within the project APVV-14-0446 for 10 key teachers' professional competences) for assessing the teachers' competence Can identify the psychological factors of pupil learning. It is based on qualitative research using the method of analysis and interpretation of the collected data. Though the piloting is still in progress, the data analysis presented in the paper and its results have shown that neither the management nor the staff of Slovak schools is keen on trying new methods of teacher assessment. They do not like filling in forms which are longer than one page and hate questions which ask them to use theoretical knowledge to solve practical problems. This creates a lot of dilemmas for the research team of the project as any of the closed questions in the sheets would need an open sub-question asking for giving of evidence.

Keywords

Assessment, assessment tool, assessor, professional competence, self-assessment, teacher

Introduction

Evaluation of teacher competences has been one of the most frequently discussed topics in recent years. There are many methods of teacher evaluation (Magová et al., 2016). During the past few years, more and more researchers have started to study self-evaluation as one of the possible methods of teacher-assessment: 'Self-evaluation is not a technical term in philosophy. Rather, it is common to associate this expression with contexts of psychologically oriented supervision where individuals or groups are encouraged to evaluate themselves for the purpose of getting clear about their goals, their motivations and possibilities of improving their performances' (Konzelmann Ziv and Schmid, 2011: 1). This method of assessment is of a psychological nature and offers the chance to re-evaluate teachers' goals and to find possible paths for their future improvement. Furthermore, the fact that people are not judged by other colleagues or by their superiors can be motivating because it focuses not on judging, but on self-reflection, which is very important in education as well as in other fields. From the economic point of view, self-evaluation 'focuses on explicit and controllable choices, self-talk derived from choice-theory, and the emotional component of clients' total behaviour' (Wubbolding, 2017: 7). In comparison with the definition of Konzelmann Ziv, Wubbolding considers the emotional side of self-assessment and the fact that each person can choose, on the basis of some kind of an inner discussion, what the conclusion of the evaluation will be. Another explanation is that 'the self-evaluation is an on-going activity, as compared with evaluation by outsider professionals, and thus it can provide continuous feedback for self-improvement and professional development' (Kremer-Hayon, 1993: 2). Some researchers regard self-assessment to be equal to traditional methods and tools of teacher evaluation that are used in schools, such as observation. They see a great potential for self-improvement and for the development of teachers' personalities. However, this method of evaluating teachers is a complex process. Therefore, it is important to know how to use it in an appropriate and efficient way.

According to Flégl et al. (2017), it is not possible to focus on all aspects of a lesson simultaneously when evaluating a teacher. Despite this, it is always necessary to take into consideration what the aim of the evaluation is. Assessors of teachers should focus only on chosen areas because, otherwise, the whole process would be too superficial and not very efficient. Kasáčová (2006), for example, claims that these areas of interest should be focused on specific competences of teachers. She divides teachers' competences into several sub-categories that can be divided into even smaller units. Moreover, this idea is applicable for the purposes of self-evaluation, too. It is important to have specific aims before starting to reflect on ourselves. Hladík and Vávrová (2011) see self-assessment as a crucial part of a life-long process typical for all humans, which is closely connected with different problems, such as auto regulation of learning, auto regulation of person's behaviour, self-control, and self-directing. Based on this fact, it can be concluded that the process of self-assessment is a tool familiar to every human and being that it accompanies people during their entire lives. It is considered an important part of teacher evaluation, too. The research team of the project APVV-14-0446 has therefore designed a new approach to teacher assessment involving a great deal of teacher self-assessment into the process. The approach is based on the identification of 10 key professional competences of teachers and the development of three assessment tools to evaluate each of the competences separately. The aim of the paper is to present the results of the piloting of tools for assessing the teachers' competence *Can identify the psychological and social factors of pupil learning* to show how the tools have been adopted and used by school staff and which problems staff have encountered.

Materials and Methods

The aim of the research project *Assessment of Teachers' Competences* (APVV-14-0446) undertaken by a team of researchers from Constantine the Philosopher University in Nitra (Slovakia) is to design a new approach in the assessment of teachers' competences and to develop a set of relevant assessment tools. The project started in July 2015 and currently it is in its third year of existence. Based on the identified 10 key teachers' competences (Lomnický et al., 2017) the research team has developed a stratified approach to teachers' competence assessment and designed a set of instruments to assess each of the competences.

The developed stratified approach to teacher assessment is based on a deeper and wider analysis of each of the 10 key competences individually so that the observer/assessor can focus on each occasion on only one aspect of a teacher's work and application of the competence connected with it in the teaching process. In this way the assessment of a teacher's work becomes more particularized, but the analysis of teachers' performance is deeper in all the observed aspects, attempting to better understand what is happening in the observed lessons.

But to make the assessment more objective, it is necessary to know how the process was perceived not only by the evaluator, but also by the teacher who taught the lesson and reach a consensus on the issues at stake through discussion between the two of them. This is why the research team has designed three instruments for each of the key competences of teachers: an *Assessment Sheet* for the evaluator to use during the lesson observation; and a *Self-Assessment Sheet* for the assessed teacher to use within 24 hours of being observed and to be delivered to the assessor. The *Assessment Sheets* for evaluators and *Self-assessment Sheets* for assessed teachers have a similar structure in order for the recorded data to be comparable. Based on the comparison of the data in the two documents, the assessor should invite the assessed teacher for a *Post-Observation Interview* for which the team has designed a set of about 10 questions to be discussed. The questions can be modified depending on the observed lesson and the data in the sheets.

Currently the designed instruments are being piloted in Slovak schools and therefore the paper presents only partial results of the piloting for which the aims were set as follows:

- to find out whether the *Assessment Sheets* are well designed and understandable to evaluators, whether evaluators are able to use them and record what their designers expected them to identify;
- to find out whether the *Self-Assessment Sheets* are well designed and understandable to teachers, whether teachers are able to use them and record what the designers expected them to identify;
- to find out in what way and to what extent the data recorded in the two assessment sheets match or differ.

The paper is based on qualitative research using the method of analysis and interpretation of the data collected from piloting the instruments designed for the teacher competence *Can identify the psychological and social factors of pupil learning* (see Appendix). To be more specific, it deals only with the data from the first part of all the three instruments devoted to the psychological factors of pupil learning.

The part in the *Assessment* and *Self-Assessment Sheets* entitled *To what extent the teacher respected psychological factors of pupil learning* contains 15 closed questions out of which the question number 10 (Q10) has one open sub-question. For the closed questions (Q1 - Q12 and Q15) the scale from 1 to 4, with 1 = yes, 2 = rather yes, 3 = rather no and 4 = no, and the fifth option N/A (to be used if the phenomenon did not occur in the lesson) is provided. Two questions (Q13 and Q14) are designed differently – with 4 options for Q13 and 3 options for Q14.

The piloting has been carried out from the end of November 2017 and it is still in progress (till the end of the school year 2017/2018). However, even the partial results have already provided significant insights. The paper analyses and interprets findings based on 38 pilots of the sheets in 8 schools. The overview of schools and teachers involved is presented in Table 1.

Total	School location		Type of school			Number of years of teaching at school		
	rural	urban	primary*	lower secondary*	upper secondary*	1-5	6-25	26 and more
8 schools	5	3						
38 teachers			9	23	6	8	25	5

** primary school (pupils at the age 6-10), lower secondary school (pupils at the age 10-15), and upper secondary school (pupils at the age 15-18)*

Table 1: Overview of schools and teachers involved in piloting, 2018 (source: own data)

Results

Though the research sample is not large, and, needless to say for qualitative research it cannot be very large, it is necessary to say that neither head teachers nor teachers themselves were very keen on taking part in the piloting. It took considerable time and effort for the researchers to persuade them to try something new. Head teachers' usual excuses (without even seeing the sheets) were that they had their own system and tools for assessing teachers, that they were too busy to learn something new and apply it in their schools or (after seeing the sheets) that it was too complicated and time consuming, impossible to capture all the required phenomena in a lesson, and others.

The resistance towards any innovation can also be seen from the way the involved respondents used and filled in the sheets. From the scale 1-4 both the assessors (A, for assessment) as well as the assessed teachers (S-A, for self-assessment) in most cases circled either number 1 or number 2 (but dominantly number 1) to show that the assessed factor has been respected and taken into consideration in the lesson (see Table 2).

This is especially true for Q10 (*Did the teacher approach learners tactfully?*), Q2 (*Did the teacher pay enough attention to practising and revising of school curriculum?*) and Q4 (*Was the teacher patient enough? Was the teacher willing, for example, to explain the subject matter or answer*

pupils' questions once again?) as well as Q5 (*Was the teacher able to formulate appropriate and clear questions?*) and Q6 (*Was the teacher able to instruct the learners clearly and appropriate to their age, topic discussed and their intellectual level?*).
However, if we look at the comments of evaluators (E) and teachers (T) in Q10, whose open sub-question required *specifying how it (i.e. tactfulness) was shown*, we can read such comments as, E: *Teacher was able to explain the subject matter/material in an understandable way., Teacher objectively assessed learners. Teacher respected individual pace of learners' work., Teacher respected questions of learners., Teacher enabled bright students to revise the subject matter/ materials from previous lesson.,* and T: *The learner who needed more time to compete a task, was given it., In each lesson I ask pupils how they are., I know my learners well, their positives and negatives. I tried to create an atmosphere of calmness in the class so that learners were not scared to speak their minds.* Such comments suggest that the respondents did not consider very much how the teacher's tactful approach to pupils was demonstrated in their behaviour, but rather they used references to what the subject of the previous questions was. Comments like: *Teacher encouraged pupils; they praised them for well done work and effort;* or that the tactful approach was demonstrated through *teacher's goodwill, helpfulness, pleasant demeanor* are also very general, not specific and concrete enough to know how and when (in which situations) these qualities helped the teacher to demonstrate their tactful approach to a learner.

Scale	1		2		3		4		N/A	
Question Nº	A	S-A	A	S-A	A	S-A	A	S-A	A	S-A
1	21	20	17	16	-	1	-	-	-	1
2	27	**32**	10	6	-	-	-	-	1	-
3	17	20	15	13	1	1	-	-	5	4
4	**31**	28	7	10	-	-	-	-	-	-
5	28	27	10	9	-	2	-	-	-	-
6	27	28	10	10	1	-	-	-	-	-
7	28	23	8	11	-	2	-	-	2	2
8	22	19	12	18	4	1	-	-	-	-
9	27	23	7	11	3	2	-	1	1	1
10	**37**	**33**	1	5	-	-	-	-	-	-
11	26	16	12	20	-	-	-	-	-	2
12	26	18	12	17	-	-	-	-	-	3
15	12	15	20	19	3	3	1	-	2	1

Table 2: Number of responses in the *Assessment Sheets* (A) and *Self-Assessment Sheets* (S-A) for the questions on the scale 1-4, 2018 (source: own data)

The lack of respondents' consistency in judging the factors stated in different questions is clearly seen also from the very high score in Q5 (*Was the teacher able to formulate appropriate and clear questions?*) and Q6 (*Was the teacher able to instruct the learners clearly and adequately to their age, topic discussed and their intellectual level?*) and much lower score in Q3 (*Was the teacher able to explain what the purpose/aim of the school curriculum is and what they expect from the learners?*) and Q15 (*Did the teacher develop creativity and critical thinking of learners during the presentation and practice phase of teaching new material/subject matter?*). If somebody is able to ask clear and appropriate questions and instruct the learners (taking into consideration their age and intellectual abilities) in the same way, he should naturally be able to explain the purpose/aim of learners learning and to develop their critical thinking and creativity. That is why we are quite doubtful about the reliability of respondents' answers in the sheets.
But if we could rely on the data we collected from the sheets so far, another interesting tendency

can be seen. As stated above, one of the aims of piloting the sheets is also to find out in what way and to what extent the data recorded in the two assessment sheets match or differ. In Table 3 we present how many teachers scored them lower or higher than their assessors did for each of the questions.

Question Nº	Primary school teachers self-assessment (9)		Lower secondary school teachers self-assessment (23)		Upper secondary school teachers self-assessment (6)	
	lower	higher	lower	higher	lower	higher
1	1	-	3	2	1	2
2	2	-	3	6	-	2
3	-	1	2	4	1	1
4	2	-	4	-	-	3
5	1	-	5	2	-	2
6	1	-	5	3	-	3
7	2	-	6	2	2	2
8	2	-	2	2	2	1
9	2	-	4	2	1	1
10	1	-	3	1	1	-
11	4	1	7	1	1	2
12	3	-	5	1	1	2
15	4	2	2	6	-	1
Total	**25**	**4**	**51**	**32**	**10**	**22**

Table 3: Differences in the self-assessment of teachers as compared to their assessment by assessors, 2018 (source: own data)

We present the data for primary, lower secondary and upper secondary school teachers separately on purpose, as the levels of self-confidence among these different groups of teachers are clearly visible. Primary school teachers are more self-critical and many of them see some drawbacks in their work. They scored themselves at a lower level than their assessors did 25 times and only 4 times better. In comparison with the lower secondary teachers it is 6 to 1.5, as lower secondary teachers scored themselves at a lower level than their assessors did 51 times but 32 times better. Though the number of respondents in both groups of teachers is not very high, it still shows proportional data. The highest self-confidence can be seen in upper secondary teachers, whose data show that they scored themselves at a lower level than their assessors did 10 times and 22 times better.

As to Q13 (*Did the teacher respect learners' attitudes and their learning styles according to their sensory preferences?* with 4 options to mark: visual, auditory, visual and auditory, kinaesthetic) and Q 14 (*Did the teacher consider learners' internal strategy for the use of their learning styles?* with 4 options to mark: superficial, deep and strategic strategy) the collected data are very similar (see Table 4) - possibly the questions were answered in cooperation of both respondents. Those respondents who were more honest stated that it was not possible to give a proper answer after observing just one lesson.

	Q13 Respect to sensory preferences				Q14 Learner internal strategy		
	visual	auditory	visual & auditory	kinesthetic	superficial	deep	strategic
A	15	9	23	9	1	28	4
S-A	15	15	26	7	6	33	7

Table 4: Numerical data for Q13 and Q14 collected from the Assessment (A) and Self-Assessment (S-A) Sheets, 2018 (source: own data)

Discussion

Though the piloting is still in progress and the data and their analysis presented in the paper are related to the assessment of just one competence of teachers (*Can identify the psychological factors of pupil learning*), the results have shown that neither the management nor the staff of Slovak schools are keen on trying new innovative methods of teacher assessment. They do not like filling in forms which are longer than one page and hate questions which ask them to use theoretical knowledge to solve practical problems. This creates a lot of dilemmas for the research team as any of the closed questions on the sheets would need an open sub-question asking for giving of evidence. Only in such a way could the data from sheets become more reliable, if at all. This would, however, make the sheets even longer and less liked by their respondents. However, very few things have been popular immediately on their introduction into life. The research team believes that once the users of the tools see the practical and positive results of their use (being praised for their strengths, getting advice on improvement, and others), they can change their minds and start to think about them in a more positive way. Currently similar findings on teachers' assessment (Hašková and Dovalová, 2017; Gadušová et al., 2017a) and the approach of school managers to teachers' assessment can be seen and are also presented in other publications (Fandelová et al., 2016; Stranovská et al., 2017). The same applies to other piloted tools designed to assess other key professional competences of teachers (Gadušová et al., 2017b; Predanocyová et al., 2017).

Conclusion

Preliminary findings and evidence suggest that the research team, despite their strong belief in the track they have chosen, will have to do a lot of educational and training work to persuade stakeholders about the advantages of the stratified approach to the assessment of teachers' key competences and the designed tools involving self-assessment. Bearing this in mind they have already published a textbook written by Boboňová et al. (2017) to be used as training material for future and current teachers in order to develop their observation and analytical skills to become more creative assessors of themselves and the teaching process. The team, of course, will have to reconsider all the designed tools, reflecting their findings from piloting and the comments of teachers and school managers. The findings of the team will undoubtedly have both a theoretical impact on the theory and practice of teacher training and carrying out assessment processes in schools and on practical procedures and aspects of assessing teachers' competence.

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Apendix

ASSESSMENT SHEET

Identification of psychological and social factors of learning

School (name and place)**:** .....
Date: ..... **Subject:** .....
Class: ..... **Order of the lesson in the timetable**: .....
Topic: .....
Teacher (name): ..... **Number of years of teaching experience:** .....
Assessor (name): .....

To what extent did the teacher respect psychological factors of pupils' learning?
(Use the rating scale: 1 = yes, 2 = rather yes, 3 = rather no, 4 = no, NP = cannot be judged (the phenomenon did not occur during the lesson).

1. Was the teacher able to motivate their learners sufficiently? 1 – 2 – 3 – 4 –NP
2. Did the teacher pay enough attention to practising and revising of school curriculum? 1 – 2 – 3 – 4 – NP
3. Was the teacher able to explain what the purpose/aim of the school curriculum is and what they expect from the learners? 1 – 2 – 3 – 4 – NP
4. Was the teacher patient enough? Was the teacher willing, for example, to explain the subject matter or answer pupils' questions once again? 1 – 2 – 3 – 4 – NP
5. Was the teacher able to formulate appropriate and clear questions? 1 – 2 – 3 – 4 – NP
6. Was the teacher able to instruct the learners clearly and appropriate to their age, topic discussed and their intellectual level? 1 – 2 – 3 – 4 – NP
7. Did the teacher provide the learners with enough of time for completing their tasks, and for thinking about their answers while examining them? Did the teacher constantly interrupt their answers? 1 – 2 – 3 – 4 – NP
8. Did the teacher use a variety of teaching methods? 1 – 2 – 3 – 4 – NP
9. Did the teacher vary and use innovative work forms in the lesson? 1 – 2 – 3 – 4 – NP
10. Did the teacher approach learners tactfully? 1 – 2 – 3 – 4 – NP
Specify how it was shown: ….....
.....
11. Was the teacher able to grasp the attention of learners by means of their speech? 1 – 2 – 3 – 4 – NP
12. Was the teacher able to empathize with their learners? 1 – 2 – 3 – 4 – NP
13. Did the teacher respect learners' attitudes and their learning styles according to their sensory preferences? Mark with a cross.

☐ Visual ☐ Auditory ☐ Visual and auditory ☐ Kinaesthetic

14. Did the teacher consider learners' internal strategy for the use of their learning styles? Mark with a cross.

☐ superficial strategy (learner just passively memorizes the subject matter);
☐ deep strategy (learner understands and actively thinks about the topic);
☐ strategic strategy (learner learns to be loved and praised by their teacher).

15. Did the teacher develop creativity and critical thinking of learners during presentation and practice phase of teaching new material/subject matter? 1 – 2 – 3 – 4 – NP

KNOWLEDGE MANAGEMENT IN INDIAN HIGHER EDUCATIONAL INSTITUTIONS – PERCEPTION AND ISSUES

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Abstract

Knowledge Management (KM) requires a serious thought in emerging economies like India, where the quest for knowledge is a differentiator in business and society. A large number of studies have established the need for developing a knowledge culture in Indian Higher Educational Institutions (HEIs). However, reports of various global agencies indicate that Indian HEIs are far lacking in building an effective KM system compared to the global counterparts. Accordingly, in this paper, we examine the current perception of academicians towards KM inventions in various spheres of operations of Indian HEIs that can throw light on the issues relating to KM implementation. Our results of surveys of academicians in selected Indian HEIs show that a significant number of respondents do not visualize the benefits of KM interventions. We also find that KM perception varies across respondent groups. We establish that KM implementation process at a broader national level by the policy implemented is a difficult task that may require a customization rather than generalization.

Keywords

Higher education, KM implementation, KM interventions, KM perception, knowledge acquisition, knowledge management, policymakers

Introduction

KM is evolving as an emerging need in the era of globalization defining new frontiers for industry and academics. Knowledge Management (KM) perceived today is all inclusive of technological application to the development of intellectual capital (Sallis and Jones, 2002:17) with an integration of various fields of study (Rowley, 1998: 367). Many authors and researchers have expressed their enthusiasm for the introduction of knowledge management in the field of education. Though KM has wide applications in industry with varying domains (Knorr-Cetina, 1999:37), Higher Educational Institutions (HEIs) have significant opportunities to apply knowledge management practices to support their value chain and the level of awareness of the importance of KM is growing tremendously in universities worldwide. Many legislators have discerned to demand information that can be linked to academic outcomes, and the reason being rising public accountability. The urgency for HEIs is to galvanize data that are more reliable and repositories, as fragmented information can affect the overall sustainability and decision-making processes (Petrides and Nordine, 2004: 100-108). Knowledge is no more germane to only academia, but also increasingly broadening its structure by public organizations, industry think tanks and is also confronted with a pool of smart, competitive force (Kidwell, Linde and Johnson, 2000: 28-33; Graham, 2001: 11; Oliver, Handzic and Christine, 2003: 141).

Globalization and knowledge society is indispensable for the policy makers in higher education (Mehralizadeh, Pakseresht, Baradaran and Shahi, 2007: 352-368). Rapid globalization has forced the structure of higher education to cascade the strategies to gratify the needs of the changing scenario in terms of market and stakeholder demands. In many developing countries, institutions

of higher education face the problem of scarcity of quality faculty, outdated course curriculum, poor infrastructure absence of learning and collaborative environment. Researchers have observed that internal accountability is a major issue for these institutions. Executing KM strategies and practices, yet needs to coherent policy for educational institutions to examine the processes and technology functions within it. All organizations need knowledge assets that essentially require a robust knowledge management (KM) strategy. Research evidences have shown that KM is has emanated from informal forms of management and can reap benefits in higher education. Globalization and fast changing in information technology is affecting technical education, which ultimately results in the creation of skilled work force and contribute to the social and economic development of the country.

In India, though knowledge management areas and concepts are widely discussed with both national and international researchers, yet the adoption of KM culture is at nascent stage (Kumar, 2017: 18). In India, the number and quality of faculty is not up to the standards as desired by the governing bodies such as All India Council of Technical Education (AICTE), University Grants Commission (UGC), the curriculum is outdated and does not cater to the needs of the industry, pedagogy is old and outdated and needs to be improved. *Institutions of higher technical education India have no place in the first 25 global ranked institutions.* Emerging economies like China has improved in terms of the gross enrollment ratio in the recent decade in spite of large headcounts (Goswami, 2010: 11-13) and its 8 institutions are in top 200 as per QS rankings 2018. Rajnish and Thiruvenkadam (2015: 621-627) highlight that for industries to develop a competitive advantage a KM strategy is essential. Universities are (still) intrinsic to the knowledge business as they are irreplaceable with knowledge creation, dissemination and learning.

Whereas the KM in IHE are a nascent stage in India (Bhusry and Rajan, 2011: 35), the KM ideas are stellar, but also fairly both expensive and risky propositions according to Sinha, Arora and Mishra (2012:98). Improvement of computer-based facilities is essential to improve the KM (Laal, 2011: 546-547). According to the Planning Commission Working Group Report 2011 there are 13 regulatory bodies for higher education in India that act in isolations with differing regulatory provisions created at different periods by different ministries thus bringing *inefficiency and breed corruption and malpractices*. Joshi and Ahir (2013:22-29) have argued, “regulators associated with governance are overlapping and entangled across various ministries and regulatory bodies”. Sudha (2015:3) has shown that the entry of foreign institutions in India is likely to threaten the survival of poor performing institutions. This indicates the needed for immediate strengthening of the intellect capitals of the institutions. We find that though the importance of effective KM in higher education is well accepted, the current KM practices have not yielded any significant contributions to industry and academia in India. The main aim of the paper is to examine the perception of academicians in higher educational institutions towards KM interventions in academics and assigning implementation issues.

Material and Methods

To examine the perception towards KM in in Indian Higher Educational Institutions (IHEs) we have developed a structured questionnaire that has been administered on 440 respondents who, apparently having good experience in academics with fairly good know-how in IHE system. The respondents primarily have undertaken specialized training or attended knowledge programs organized by their parent institution. The samples have been collected using quota-judgmental sampling methodology from primarily 7 universities and 12 autonomous institutions that represent the ones obtained from government, institutes of national eminence and others like state government, owned institutions as Government and privately funded IHE institutions during February 2017 to September 2017. We have designed a questionnaire to examine the

perception of respondents towards various aspects of KM intervention in IHEs. We have classified the respondents based on (a) age, (b) gender, (c) highest degree, (d) specialization, (e) work experience, (f) place of work and (g) designation. We have used descriptive statistics and ANOVA to examine their perception on selected parameters.

Results and Discussion

Knowledge management is a strong concern for higher education in India to improve the competitiveness conditions for the faculties and institutions. We present the results of the survey inquiring the perception of respondents towards KM intervention in academics on selected parameters and a comparison of this perception across respondent groups.

KM adoption in Academics

Of the respondents who have participated in the survey, 63% place importance of knowledge that resides in wisdom and insight of faculties and *KM act as a catalyst in work performance* as indicated by 56% respondents (Table 1). The majority of respondents believe that *KM is important for industry and academia interface.* Also relatively larger number believes that KM investigates both technology and information culture in an academic institution.

Statements	Very Important	Quite Important	Somewhat Important	Not very Important	Not important at all
Knowledge resides in wisdom and insight of faculties by the usage of data.	17.46%	26.07%	20.86%	20.18%	15.42%
KM acts as a catalyst of the know-how embedded in work with a stronger capacity of execution.	25.62%	30.15%	10.20%	15.87%	18.14%
KM fairly investigates both technology cultures as well as the information culture at an institution	30.68%	27.72%	9.77%	14.77%	17.04%
KM is important for industry-academia interface	64.09%	33.40%	1.59%	0.68%	0.22%

Table 1: KM Adoption in Academics, February-September 2017 (Source: own calculation)

Results in Table 2 show that opinions on various parameters of KM intervention in academics differ significantly with respect to variables – information and interface classified for place of work. Also, interface differs significantly with respect to designation. *This implies that place of work and designations have an important role in KM adoption in academics*.

Respondents Classifiers >Parameters	F-Ratios						
	Age	Gender	Degree	Specialization	Experience	Place	Designation
Information	0.766	0.111	2.496	2.956	1.378	8.105	2.463
Leverage	2.245	0.927	1.711	1.289	0.562	2.635	1.313
Technology culture	1.024	0.084	1.160	1.160	0.970	0.907	1.399
Interface	0.590	0.243	1.629	3.019	3.554	10.010	7.863

Table 2: ANNOVA on KM intervention and adoption in Academics (Source: own calculation

Knowledge Capture and Acquisition

We find equal affirmative and negative opinions from respondents on about the procedure that their organization follows in managing knowledge capture and acquisition. It is also difficult to establish that knowledge capture and acquisition had encouraged faculties to participate in research projects with external experts (Table 3).

Statements	Yes	No
Stores and effective use of knowledge obtained from other sources such as industrial; associations, competitors etc.	56.69%	43.31%
Extracts and uses knowledge obtained from public research institutions, including universities and government laboratories	56.00%	43.99%
Dedicates all resources to detecting and obtaining external knowledge and communicating within your institute	60.54%	39.46%
Instills research orientation in faculties to participate in research projects with external experts	48.29%	51.70%

Table 3: Knowledge Capture and Acquisition, February-September 2017 (Source: own calculation

KM Interventions in Institutional R&D

On the subject, whether KM intervention in the R&D of institutions, we find that respondents are split. Mixed opinions are observed for reduction in turnaround time and shift of research resources to administrative tasks. 53% of the respondents think that they would facilitate interdisciplinary research and large number (72%) believes that KM can help in leveraging for research and proposal efforts (Table 4).

Statements	Useful	Not Useful	Can't Say
Reduced turnaround time for research	42.63%	45.57%	11.79%
Moderate devotion of research resources to administrative tasks and processes	42.40%	48.98%	8.61%
Facilitation of Interdisciplinary approach	53.51%	40.81%	5.66%
Leveraging for research and proposal efforts	72.10%	25.39%	2.49%

Table 4: KM intervention in Institutional R&D, February-September 2017 (Source: own calculation)

Further, results indicate that opinions on various parameters of KM intervention in institutional R & D do not differ significantly across respondents groups (Table 5).

Respondents Classifiers >Parameters	F-Ratios						
	Age	Gender	Degree	Specialization	Experience	Place	Designation
Reduced time	2.489	1.700	1.966	1.118	2.980	1.672	0.441
Resources	1.845	1.129	1.971	0.888	1.974	2.593	0.917
Facilitation	1.714	0.057	1.871	0.890	2.514	0.643	0.859
Proposal efforts	1.785	0.008	1.355	1.389	0.631	2.972	3.467

Table 5 - ANNOVA on best use and applications of KM in Institutional R&D (Source: own calculation)

KM Interventions in Curriculum Development

The benefits of IT based KM interventions can reasonably have an impact over the curriculum development process of higher education institutions in terms of speed of curriculum revision as well as improved monitoring and feedback from all stakeholders as indicated by a higher number of respondents (Table 6).

Statements	Yes	No
Improved speed of Curriculum revision	56.96%	42.85%
Improved pace of new faculty development	63.71%	36.05%
Enhanced quality of Curriculum and programs	59.41%	40.36%
Increased Interdisciplinary curriculum designing	66.21%	33.56%

Table 6: IT based KM intervention in Curriculum Development, February-September 2017 (Source: own calculation)

Relatively large numbers of respondents believe that interventions can improve administrative services related to teaching and learning with technology and assist in catering the needs of new faculty development programs.

KM Interventions in Institutional Administration

Relatively higher numbers of respondents have indicated that KM interventions can help in institutional administration, but we received mixed responses on the parameters of improved compliance with administrative policies and practices shown in Table 7.

Statements	Yes	No
Improved effectiveness and efficiency of administrative services	67.12%	32.88%
Increased consistency in decision making	64.17%	35.82%
Improved compliance with administrative policies and practices	55.78%	44.21%
Enhanced responsiveness and communication capabilities	62.35%	37.64%

Table 7: KM intervention in Institutional Administration, February-September 2017 (Source: own calculation)

KM Interventions in Student Affairs

KM can improve the quality of services to students, graduates and teaching and non-teaching staff, but doubts are set up about accessibility to institutional resources and facilities (Table 8).

Statements	Yes	No
Improve the fulsome quality of services given to students	64.85%	35.14%
Improve the services offered to alumni	57.14%	42.85%
Improving the services capability of related faculty, officers and staff	60.54%	39.45%
Improving the accessibility to institutional resources	33.10%	66.89%

Table 8: KM in Student Affairs, February-September 2017 (Source: own calculation)

On further inquiry, we find that respondent in general, are in favor of KM implementation of improving student related affairs.

KM Implementation Impacts

Opinions on the KM implementation and its perceived impact or mixed. For assessing the success of KM in the institutions (46%) believed that they need collaboration with other prestigious institutions. Increased knowledge should be shared horizontally and vertically with across departments and up the institutional hierarchy (Table 9).

Statements	No. of respondents		
Likewise to KM realization in your organization?	164 (High Impact)	197 (No Impact)	79 (Can't Say)
Does KM cater as an important asset to your institution?	186 (High Impact)	228 (No Impact)	26 (Can't Say)
How do you rectify the success of KM (or similar program) in your institution?	202 (Accreditation)	199 (Collaboration)	30 (Other) 9 (No response)
How long has your institution been implementing the idea of KM (or likewise ideology)?	218 (1-2 years)	185 (2-3 years)	25 (3 and above) 2 (No response)
Do you fairly deal with the issues of KM with any delegated position?	9 (Yes)	429 (No)	2 (No response)

Table 9: KM Implementation Impacts, February-September 2017 (Source: own calculation)

Without any assigned delegated position it is not possible to deal with the issues of KM (Table 9). People believe in both accreditation and collaboration as KM resultants and the time elapsed since

KM implementation is a small period. *Also, a large number of respondents do not recognize that KM is an important asset to their institution*.

Table 10 shows that opinions on the various influences of KM intervention on assessment parameters and realized in various areas *differ significantly* across an area of specialization, place of work and designation.

Respondents Classifiers >Parameters	F-Ratios						
	Age	Gender	Degree	Specialization	Experience	Place	Designation
KM Idea	0.105	0.024	1.162	0.996	0.950	6.780	1.042
Important Asset	2.118	1.958	1.345	5.107	0.592	10.135	4.322
Assessing Success	1.799	1.075	1.830	1.148	0.509	1.870	0.788
Years of Implementation	1.906	0.110	3.418	3.093	1.163	2.409	0.860
Respondents Classifiers> Parameters	F-Ratios						
	Age	Gender	Degree	Specialization	Experience	Place	Designation
Knowledge horizontally (C6)	0.452	0.088	0.481	6.630	0.761	3.370	3.510
Knowledge vertically (C7)	0.106	0.403	.259	6.189	2.242	3.250	2.408
Improved skills (C8)	1.215	0.173	2.869	5.812	2.250	10.938	6.725
Research & Development (C9)	1.710	0.058	2.224	4.131	2.620	5.642	3.092
Workplace (C10)	0.419	6.412	5.019	16.138	4.419	63.650	10.277

Table 10: ANNOVA results in Perceived Impacts of KM (Source: own calculation)

We infer from the results that though KM interventions are visualized in Indian HEIs, yet a significant number is not convinced of its benefits. A significant proportion of respondents believe that KM is important for industry–academia interface. However, this interface is missing in Indian HEIs leading to a high skill gap (Agarwal, 2017). Use of IT based KM interventions can improve the speed of curriculum development in the institutions is agreed upon by a large number of respondents, but the use of IT in educational institutions in India is fairly low as also suggested by Bhusry and Rajan (2011, p. 347: Gill, 2017:436). Our results differ from the study of Sharma and Kaur (2016:554) who establish that the importance of KM in institutional administration is fully interpreted and recognized in Indian HEIs. Technology can play a crucial role in minimizing the barriers and increase the propensity to share knowledge in Indian HEIs. This may produce a bottleneck in the effective KM implementation. We also find that the perception varies across the respondent groups. This implies that KM implementation process at a broader national level by the policy implementers is a difficult task that may require a customization rather than generalization.

Conclusion

In this paper, we have analyzed the perception of academicians in Indian HEIs towards KM interventions. Previous studies have only highlighted the usefulness of KM in these institutions indicating that they are in a transition phase. An analysis of perception towards the perceived usefulness of KM in these institutions, we find mixed responses. On various parameters KM, we find that still a large number of respondents are unclear of KM interventions in academics, particularly the industry-academia interface which is extremely important for knowledge generation that eventually depends on the working philosophy of the institution. The perception towards KM varies significantly across academicians in Indian HEIs. This requires effective communication and a carefully defined universal national policy for effective KM implementation.

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GEN Z IN THE WORKPLACE: EXPECTATIONS, COMMUNICATION AND RELATIONSHIPS

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Abstract

Stereotypes about generation Z (GEN Z), born between 1997 and 2005, depict them as self-centred, unmotivated, disrespectful, and disloyal. On the other hand, they work well in teams, are motivated to have an impact on their organizations, favour open and frequent communication with their supervisors, and are at ease with communication technologies. The study presents a selection from a large-scale survey focussing on communication and relationships abilities of GEN Z graduates on the workplaces, involving 596 graduates from 7 European countries: Czech Republic, Hungary, Cyprus, United Kingdom, Poland, Portugal, Spain. We found a clear distinction between the views of students before graduation from schools and the reality after joining the occupation. The research rated communication abilities for development of relationships on the workplace as significantly important in all seven countries.

Keywords

Communication, Generation Z, entrepreneurial education, organizational membership, organisational commitment, soft competences

Introduction

Communicative interactions in the workplace serve to create and maintain work relationships among a team and organizational members, and between those members and key organizational stakeholders. In particular, communication that reveals shared values and reflects common commitments to organizational goals enables co-workers to forge and sustain productive relationships in organizations. Communication can also have direct and indirect effects on team and organizational performance (Deal et al, 2010).

GEN Z continues to enter the workplace after graduation and thus, it is also interesting how the education institutions cultivate GEN Z predispositions to communicate and create functional work relationships with older employees and to enhance organizational performance (Pinto and Ramalheira, 2017). On the other hand, the success of GEN Z communication on the workplace depends on how management will motivate youngsters to organizational membership and commitment (Nilforooshan and Salimi, 2016).

In practice-oriented teaching that supports the student's decision to establish their own business, the gaps between entrepreneurial knowledge and students' acquired competencies seems to be less then in teaching oriented to educate good employees (Havlicek et al, 2014).

The skills that employers require are changing, with soft skills replacing technical ones. The new skills may polarize the workforces. Youngsters highly skilled in IT were advantaged as soft skills gave them an additional dimension to their job since soft skills were presented as an alternative to technical competences (Grugulis and Vincent, 2009).

Employers are greatly aware of the impact that the digital communication has on the general population's presence during face-to-face interactions. Generation Z's reliance on the social

media will have an impact on their ability to use interpersonal communication skills to establish relationships with future supervisors and employers. The relationship between employees and their supervisors is essential to ensure that an organization delivers its mission and reaches its strategic goals (Kick et al, 2015).
The attention should be given to the women workers suffering a double penalty, as not only were their technical skills devalued but many were confined to traditionally "feminine" and unskilled work at the reception desk. Soft skills certainly aided the acknowledgement of women's skills but they did nothing to increase their value (Grugulis and Vincent, 2009) .
The goal of the research based on a wide survey and discussions in 7 European countries was to investigate how the member of the Z generation evaluate the education they have got and what are their expectation for the future work positions.

Research questions

R1: How does the education support students' preparation for occupation?
R2: What are the preferences in the work places?

Materials and methods

The study presents a selection of large-scale survey concerning communication and relationships abilities of GEN Z graduates in the workplaces, involving 596 graduates from 7 European countries: Czech Republic, Hungary, Cyprus, United Kingdom, Poland, Portugal, Spain.
The research, based on questioning, presents contemporary European young generation with regards to the preferences and expectations they believe before graduation and real working experience after joining the occupation. Table 1 shows the distribution of respondents by the involved countries:

	Research institution involved		No. of respondents	Type of research organization
1	Czech Republic	CZ	199	University
2	Hungary	HU	107	Project management
3	Cyprus	CY	49	Business services
4	United Kingdom	UK	62	Training and coaching
5	Poland	PL	46	Development studio
6	Portugal	PT	68	University
7	Spain	SP	65	Project management
	Total		596	

Table 1: Distribution of respondents in involved European countries, 2017, own research

The questioning was conducted from December 2016 until February 2017. The respondents were newly employed youngsters, graduated from VET (Vocational Education and Training) schools and partly students of bachelor levels of higher education.
The surveys use the methods of focus group sessions, semi-structured interviews and questionnaires involving members of GEN Z between 16-21 years with relevant work experience. All participants were able to compare their expectations with the existing conditions on the workplace. Additional descriptive data were obtained from follow-up interviews.
Organisation of questioning
The questioning procedure was proposed in three steps: 1) Questioning using standard questionnaires. 2) Managed interview with Focus group. 3) Managed interview with Semi-structured group.
A questionnaire was developed comprising of 20 questions. From the original English version

the identical versions in seven national languages were developed. An online questionnaire was distributed to graduates of VET schools and/or bachelor level institutions that collaborate with involved European research teams. Only respondents who had a reasonable practical experience from longer-term occupations were interviewed (6 months at least). A total of 596 completely answered questionnaires was gathered at the end of the data-collection process. The sample size in standard questioning makes the data statistically representative.

Focus group sessions and interviews

Data were also collected through a semi-structured interview guide, however the discussion remained flexible and open. The interviews were organised in each of seven involved European countries and was consisted of 10 questions, which were designed to draw information from the participants' personal experiences on occupation and their expectations of the future job position. The interviews began with introductory questions asking whether they are employed, whether they use smart technologies, followed by subsequent questions related to functions of communication in organizations and work groups, including information sharing, decision making, influence, coordination, motivation, and identification. The interview lasted approximately 90 min. The interviews were recorded to increase the accuracy of the data set. The data was analysed using thematic analysis. Following the approach described by Ryan and Bernard (2003)and when they are, they are often relegated to appendices or footnotes. Techniques are shared among small groups of social scientists, but sharing is impeded by disciplinary or epistemological boundaries. The techniques described here are drawn from across epistemological and disciplinary boundaries. They include both observational and manipulative techniques and range from quick word counts to laborious, in-depth, line-by-line scrutiny. Techniques are compared on six dimensions: (1, the information gathered was processed into categories or themes, and the data were divided into categories to be analysed. This method also helped to compare information and data from seven European countries.

Data analysis

The statistical data analysis techniques selected for this study were descriptive statistics (evaluation of weighted symmetric and non-symmetric Lippert scales) and non-parametric Kruskal-Wallis test (equivalent Mann-Whitney tests) to compare different medians among groups of participants. Ranking of questions among seven European nations proved with high signification ($\alpha < 0,05$; $\chi^2(k-1) = 2.99$) that all seven groups of GEN Z are identical. Living in the global world the GEN Z population identify similar expectations and similar problems when joining the first occupation.

Results

General characteristics of the respondent

The majority of responders were born in 1996 – 1999 (73%), minor differences are between males (42%) and females (58%). The majority of respondents graduated from VET, apprentice and technical schools (67%), a smaller number are bachelors (33%).

1. Respondents´ prerequisites to successful job performance. Following questions map the situation.

   1) Which skills the former education should strengthen in order to prepare you successfully enter the job market?

When asked about the skills they believe they need to strengthen to enter the job market, *public speaking, problem solving, language skills and decision-making* were the most frequently cited

skills by young people. Skills such as intercultural skills, meeting deadlines and being proactive were cited by only one quarter of respondents, Table 2.

	A	B	C	D	E	F	G	H	I	J	K	L
CY	27	19	22	15	13	9	17	20	13	7	12	11
CZ	95	45	60	111	113	74	74	82	105	32	63	25
HU	38	27	14	10	22	12	22	20	3	12	34	18
PL	7	2	5	7	4	5	6	2	5	1	10	0
PT	33	11	20	17	4	6	15	29	4	15	42	13
SP	17	10	13	20	5	6	13	13	6	7	13	7
UK	28	16	15	12	11	15	25	18	11	11	18	18

A: Public speaking, B: Developing relationships, C: Technical skills, D: Problem solving, E: Proactivity, F: Meeting deadlines, G: Decision making, H: Negotiating, I: Collaborating, J: Intercultural skills, K: Language skills, L: Coping with repetitive tasks

Table 2: The skills youngsters say need to develop (in % of population), 2017, own research

2) What kind of training practices do you prefer?

	A	B	C	D	E	F	G	H	I	J	K
CY	32	17	20	12	20	4	10	20	17	4	10
CZ	93	12	34	34	66	14	23	33	17	37	61
HU	42	18	15	26	30	21	18	32	24	15	33
PL	14	5	6	7	7	7	8	8	5	11	5
PT	62	3	24	16	31	10	17	18	34	7	39
SP	18	6	15	13	40	19	10	9	7	9	8
UK	0	6	19	13	23	18	19	24	22	15	19

A: Experiential learning, B: Role-play games, C: Simulation, D: Learning games, E: Team practices, F: Case studies, G: Presentations, H: Discussions, I: Brainstorming, J: Video analysis, K: Field visit

Table 3: What kind of training practices GEN Z prefer (in % of population), 2017, own research

The analysis per country shows that the most of the respondents in the different countries prefer Experiential learning except those from Spain that prefer Team practices and those from UK that prefer discussions.

3) How well do you feel your school prepared you for work?

Respondents were asked to indicate how well they believed they were prepared for the world of work and about their skills. Nearly 55% reported that they believed they were "more or less" prepared for the world of work. Great evaluation is given by 28% of respondents and 17% did not believe they were prepared for work at all.

When asked about how they could have been better prepared, 64% per cent suggested that learning through "real life" scenarios (i.e. experience); 88% by taking part in an internship; and 40% believed access to a careers service would have helped to prepare them better for the world of work.

2. GEN Z's Expectations, Communication, and Team Relationships on the workplace.

Research indicated that GEN Z preferences are likely to be especially significant for the workplace interactions and work relationships. They expect close relationships and frequent feedback from supervisors, open communication from their supervisors and mentors (even about matters normally reserved for more senior employees), and prefer to work in smaller teams, in part because they perceive group-based work to be more fun, but also because they like to avoid risk (Kumpikaitė and Duoba, 2013).

Two selected questions map the expectations about the situation on the workplace.

1) Which personal traits do you value the most about the person you work with?

Respondents had to rank each of the following activities on the 8-grade Lippert scale: 1 is the most important, 8 is the less important. See Table 5.
Members of GEN Z would like to work with colleagues who respect them, like to collaborate and help if they have difficulties. On the other hand, competiveness and personal interventions have not high rates.

Questions	Ranking
Workers who like to collaborate	3,8
Workers who help you if you have difficulties in your job	4,2
Workers who respect you	2,7
Workers who listen to your ideas and suggestions	4,9
Workers who cover you if you did something wrong	7,0
Workers who are professionally more experienced than you, and you can learn from them	5,0
Workers who like to cheer you up during the work	5,4
Workers who are friends in personal life	6,7
Workers who challenge you	6,2
Workers who are competitive and make you achieve more	7,8

Table 4: What kind of training practices GEN Z prefer, 2017, own research

2) How do you prefer to work?

Table 5 presents the preferences. The youngsters prefer to work in smaller groups.

	Alone	Mostly alone	Mostly in teams	In a small group	In a bigger team
CZ	12	17	18	44	9
HU	14	22	9	50	5
CY	6	24	12	52	6
UK	6	23	0	61	10
PL	2	34	17	37	10
PT	16	18	16	45	5
SP	11	31	15	36	7

Table 5: What work practices GEN Z prefer (in % of responses), 2017, own research

Discussion

R1: How does the education support students' preparation for occupation?

The matters of GEN Z were discussed in two major aspects. First, the opinions of GEN Z towards current education system and in the second stage, it was their attitude to the potential work environment and the circumstances of being employed. As for the matter of education, it occurred that the school in a wider sense prepared them well for work. How well do schools prepare GEN Z for occupation? European VET and bachelor schools have got a good evaluation: 83% of respondents report "more or less" (of it 28% excellent). When asked about how they could have been better prepared, 64% suggested that learning through "real life" scenarios (i.e. experience); 88% by taking part in an internship; and 40% believed access to a careers service would have helped to prepare them better for the world of work. Skills such as intercultural skills, meeting deadlines and being proactive were cited by only one quarter of respondents (Table 3).
As GEN Z enter the workplace, like generations before them, the first significant obstacle they encounter is their socialization into the organization. The newcomers learn about tasks and social norm expectations through socialization processes, as well as how to adapt to and negotiate their roles, and how to gain others' acceptance of them as participating members in the workplace. Taylor (2014) describes that the communication process is thus crucial. More than any of the

current generations, GEN Z learns by observation and practice, not by reading and listening to PowerPoint presentations. The analysis per 7 countries shows that the young generation prefers experiential learning and team practices (Table 3). The main difficulty of teaching the GEN Z is in linking theory with the actual practice and using more lectures than other methods.
When asked about the skills they believe they need to strengthen to enter the job market, *public speaking, problem solving, language skills and decision-making* were the most frequently cited skills by young people. Skills such as intercultural skills, meeting deadlines and being proactive were cited by one quarter of respondents (Table 2).
Fernández-Cruz and Fernández-Díaz (2016) summarize the further characteristics of GEN Z as being experts and open to the use of IT technology. It turned out from the Focus group discussion on the working environment that generally they are quick, impatient, resilient and interactive – but when communicating at the workplace, GEN Z prefers oral face to face communication. But, GEN Z's reliance on IT and social media will have an impact on their ability to use interpersonal communication skills to establish relationships with the future supervisors and employers. The relationship between employees and their supervisors is essential to ensure that the organization delivers its mission and reaches its strategic goals (Kick et al, 2015).
The communication on the workplace is highly stressed. When asked about the kind of co-workers they would prefer, then "co-workers who listen to your ideas and suggestions", "co-workers who respect you", "co-workers who like to collaborate" and "co-workers who challenge you" were mentioned. Similar results refer also Fernández-Cruz and Fernández-Díaz (2016) who summarize the characteristics of this generation as being experts and open to the use of technology: quick, impatient, resilient and interactive.

R2: What are the preferences in the work places?

The skills that employers require are changing, with soft skills replacing technical ones. The new skills may polarize the workforces. Youngsters highly skilled in IT were advantaged as soft skills gave them an additional dimension to their job since soft skills were presented as an alternative to technical competences.
Although GEN Z is perceived as a digital, global and self-confident generation with high expectations about their carriers, on the other hand they may have the problem to work in teams. Z people are extremely self-confident, tends not to resist authority relationships but feel a strong need for human connection (Tulgan, 2013).
First, the idea of the lack of practice is common. The responders feel lack in some soft skills like an ability to control tension, to work in teams, public speaking, an ability to put arguments together and logically express their opinion, social skills, a global perspective, how to prepare themselves for a job interview and how to "sell" themselves (Hlavatý and Dömeová, 2014).
They have learned a lot of theoretical material, while they lack practical skills such as organizing tasks, solving problems, collecting and analysing data.
Secondly, it turned from the discussion on the working environment that generally, youngsters referred they like a working environment that stimulates them while working with their peers, with whom they can exchange views. They prefer workplaces where there is a good climate ("good professional and personal relations" with colleagues, "to have the possibility to ask them for doubts and questions", "to learn and find new stimuli" thanks to the team) and a good relation with the boss (interviews, Table 4). Interviewees prefer to work alone or in a small group because they consider it more effective and easier to communicate and manage.

Conclusion

An inspection on GEN Z was conducted in the cooperation of seven European countries with the different geographical and economical setting. Nevertheless, the research done in three stages (questionnaires, focus groups and semi-structured interviews) has shown that there are only minor differences in GEN Z opinions throughout different countries towards their present and future relations to both education system and occupation. More importantly, the findings point out to the necessary need for a change in attitude of education institutions and employers. It is known that any systemic change in the education institutions is a painful process but at least the awareness should be raised among the pedagogical staff. And more importantly, the employers should rather pay attention to the oncoming GEN Z as they are still mostly too un-opened to accepting new ways of leadership that this generation will need.

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THE CHALLENGES OF ROMA MINORITY EDUCATION IN THE CZECH REPUBLIC FROM THE HUMAN RIGHTS PERSPECTIVE

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Abstract

This paper is focused on the challenges of Roma minority education in Czechia. Specifically, it will review international conventions which Czechia ratified and will analyze their violation regarding to minority educational rights. In addition, the article will focus on the Czech legislation and programs which were created to address the issue. Based on the analysis of violations of conventions with respect of the existing programs and legislations a number of recommendations for a successful policy development will be offered. A variety of programs addressing the Roma educational issue is evidence that Czechia is trying to improve their situation. A needs assessment of the Roma children would be an effective start to provide sufficient information on how an ethnically effective program would be formulated. In addition, there should be financial benefits connected to the Roma education, for example, child cash benefits will become conditional cash transfers dependent on a child's school attendance or academic performance.

Keywords

Czech Republic, education, human rights, minority education, Roma

Introduction

The situation of the Roma minority is one of the major issues of the development of the Czech Republic after the fall of the communist regime in 1989 and is a common point of criticism for the violation of human rights of Czechia (UNICEF, 2012). The Roma were officially recognized as a minority for the first time after the Czech Republic become an independent state in 1993 (Igarashi, 2005). One third of the Roma minority is living in socially excluded localities, facing issues such as low-education, lack of skills, long-term unemployment, and poverty (Government of the Czech Republic, 2015). The inclusive education of the minority is recognized as one of the key areas for their successful integration into society (Arabadjieva, 2016; Golubeva and Austers, 2011). The main problem in the education of the Roma is that the Czech government cannot find a consensus for the appropriate approach to minority education which has led to a stalemate and only small changes over the years (Cashman, 2017). Even though there is a number of studies which are focused on the Roma minority in Czechia (Koupilová, Epstein, Holčík, Hajioff, and McKee, 2001; Ruzicka, 2012), there is a limited number of studies which focus on Roma minority education; the vast majority of information available about this issue are accessible through external and international organizations (UNICEF, 2012).

The aim of the paper is to review international conventions which Czechia ratified and to analyze any possible violations of the conventions regarding minority educational rights. In addition, the article will focus on the Czech legislation and programs which were created to address the issue of Roma education. Based on the analysis of the violations of various conventions with respect to existing programs and legislations, the article will offer recommendations for

a successful policy development. Specifically, this research paper will answer the following questions: Which international conventions focused on minority rights and minority education were violated by the Czech government? What legislation has the Czech government adopted to improve the Roma situation? How does the Czech government address the issues related to violations of the Roma's minority educational rights? What recommendations can be made from the analysis for the development of a more successful policy of Roma education?

Materials and Methods

The legal analysis (Issue, Rule, Analysis, and Conclusion formula) was used to analyze primary law sources issued by international official bodies and by the Czech government. The author searched the Interactive Dashboard of the Office of the United Nations High Commissioner for Human Rights to identify the international documents which have been ratified by Czechia. The search resulted in 15 international documents which were reviewed. Four treaties met the criteria (minority and educational focus) for inclusion into the study. The second search was conducted among UNESCO treaties. The search resulted in 29 documents which were reviewed for their content and the ratification status. Only one treaty met the inclusion criteria. The third search was focused on the Council of Europe's treaties. The search resulted in 224 treaties and only three treaties were included in this study. The last search was conducted on the Constitution of the Czech Republic and in the Collection of Laws of the Czech Republic. The result was eight laws including the constitution. In addition, a review of the secondary law sources was used to understand the Roma minority educational issue in Czechia. Specifically, the sources were searched on the Clemson library website which allows searching in 548 different databases in one search, including, for example, databases such as Web of Science, Scopus, and ERIC. "Roma", "human rights", "Czech Republic", and "education" were used as a set of keywords for searching the literature. Nine peer-reviewed articles with a focus on Roma education in Czechia were included out of 418 articles which were excluded due to a different focus of the topics.

Results

Issue: Roma Minority Education in the Czech Republic

According to the last census in Czechia (2011), there were 5,135 people who reported to be Roma which was 0.0% of the entire 10 million population (Czech Statistical Office, 2014). However, professionals believe these numbers are underestimated (ERRC, 2013). The Czech government estimated that there was 245,800 Roma in 2016 (Government of the Czech Republic, 2017). This difference is probably given by the struggle with Roma identity in Czechia and by the Roma's fear of further discrimination and reprisal (Vermeersch, 2003). According to ROMEA (2011), there is no curriculum or textbook for teaching the Romani language in the Czech educational system. The majority of the Roma population has only completed primary education, 62.2% in 2011. This is in stark contrast to the majority population where the proportion of those whose primary education was the highest education achieved was 17.7% in 2011. Only 9% of the Roma completed a university education, while 13.8% of the majority population completed a university education in 2011 (Czech Statistical Office, 2014). There can be seen an increasing trend in educating the Roma minority but the percentage of Roma that only complete a primary education is still very high.

The Roma people face discrimination not only among the general public but also by the media, police, teachers, and doctors which leads to the fact that even children perceive the discriminatory behavior towards their ethnicity (UNICEF, 2012). The Open Society (2012) showed that in many cases the teachers do not deal equally with Roma students relative to the

general student body which results in that they send the Roma students to special schools. The discrimination is creating a social exclusion of the minority. Roughly one third of the minority in Czechia live in socially excluded localities (Government of the Czech Republic, 2015). There are 606 socially excluded localities where about 120 thousand Roma people live (Čada, 2015). The percentage of Roma people in these localities is between 85% and 90% (Kaleja and Zezulková, 2015). This housing exclusion is also creating an educational discrimination because children are assigned to specific schools based on their school district which is given by their place of residence. However, children could be signed into a school from a different school district if their parents ask for it and if the school has free capacity (Act No. 561/2004 Coll., 2004).

The educational system in Czechia is universal, meaning that education is free for all students who are able to study in the Czech language. Regardless of the universal education, families are experiencing inequality in income, health, housing, culture, and family environment. This inequality is perceptible especially for families which are socially excluded (Igarashi, 2005).

According to the European Roma Rights Center (ERRC, 1998), there was 70% of Roma children who were educated in practical schools or in segregated schools in Czechia in 1998. The curriculum in practical schools is modified for children with non-severe mental disabilities which results in an educational disadvantage to Roma children (ERRC, 2009). The re-examination of placement of Roma children into practical school is possible after a parent's request. However, there is lack of culturally appropriate information for parents and children about this process (ERRC, 2009). According to the European Commission (2012), 30% of Roma children were educated in practical schools in 2012. About 40% of Roma children who were educated in standard schools did not complete the compulsory primary education in 1998 (ERRC,1998; Amnesty International, 2012).

Rule: Human Rights and Roma Minority in the Czech Republic

The Czech government officially recognizes the educational right for minorities by the ratification of a number of international documents. Despite the official recognition of equal rights to education, the Czech Republic is violating this right through a number of ways.

Universal Declaration of Human Rights (UDHR)

Article 26 (the right to education) of the UDHR was violated by not providing education which would fully develop the potential human development of Roma children because the curriculum of practical schools is created to develop the potential of children with disabilities. This negatively influences the Roma children's ability to successfully enter secondary and higher education because of a lack of knowledge which they missed through their basic education. Secondly, the Czech government has not been promoting an understanding, tolerance and friendship among all racial groups in the country by segregating Roma children into racially segregated classes and schools. The government is not providing sufficient contact between the majority and minority children to promote the integration of the minority. The Czech government was not promoting respect for human rights and fundamental freedoms by not effectively educating the teachers in multiculturalism and minority history. Additionally, they are violating the parents' prior right to choose the children's education that should be offered by forcing them to request a re-examination of the disabilities the children have if they were enrolled in practical schools without any previous diagnosis (UN, 1948).

International Covenant on Economic, Social and Cultural Rights (ICESCR)

The violations of rights defined by UDHR are mirrored in Article 13 of the ICESCR since this latter document covers many aspects of the UDHR. Czechia violated Article 13 by assigning Roma children to practical schools without clinical diagnosis of their disability which influences the development of their dignity. The designation of "ethnic group" is not part of UDHR but it is more suitable for the Roma situation in Czechia than "racial group" which is stated in UDHR. Secondly, the government was violating the right to provide fundamental education to people who did not complete their primary education which primary impacts the Roma minority because about 40% of Roma children who were educated in standard basic schools did not complete the compulsory primary education in 1998. The ICESCR expand the right to legal guardians to decide which type of education they want for their children which is violated by the Czech government in same way as was previously stated for the violations of the UDHR (UN, 1966).

Convention on the Rights of the Child (CRC)

Article 28 of the CRC guarantees education on the basis of equal opportunity which Czechia violated by assigning Roma children into practical schools and segregated schools. Even when they gain standard primary education in the segregated schools, the quality of these schools is not comparable to the majority schools and it does not prepare them for secondary education as they would be prepared in standard schools. By violating this right, Czechia also did not make the secondary education available and accessible to every Roma child. Secondly, the right for educational and vocational information and guidance available and accessible to all children was violated by not informing the children in a culturally appropriate way about their re-examination of their disability if they want to change from a practical school to a standard school (UN, 1989).

International Convention on the Elimination of All Forms of Racial Discrimination (ICERD)

The Article 5 (v) of the ICERD is violated by the discrimination of the Roma minority by preventing them access to quality education by assigning them to practical schools or by segregating them in lower quality schools. In addition, Czechia is not taking effective measures which would stop teacher discrimination towards Roma children even when there is information about the Roma minority (UN, 1969).

Convention against Discrimination in Education (CADE)

Article 5 of the CADE recognizes the right of members of national minorities to carry on their own educational activities, including the maintenance of schools and, depending on the educational policy of each state, the use or the teaching of their own language. Regardless of the recognition of this right and the optional attendance of such educational settings, Czechia is not taking ethnically appropriate measures to encourage the Roma minority to get engaged in this activities. The minority which has a weak collective identity needs more effort from the majority to maintain their culture, especially in country where the minority culture was suppressed for decades (UNESCO, 1960).

European Convention on Human Rights (ECHR)

The European Court of Human Rights found in the case of D.H. and others v. the Czech Republic that Roma children were discriminated against in the Czech educational system. Roma children

were not exactly denied the right to education but they were assigned educational practices which resulted in their disadvantage and were still over-represented in special schools. The applicants submitted an application to the European Court of Human Rights in 2000. The applicants argued that Czechia violated Article 14 (prohibition of discrimination) and Article 2 (right to education) of the ECHR. The Second Section of the Court and within that section the Chamber declared the application partially admissible in 2005. In 2006, the Chamber declared that there had been no violations of Article 14 or Article 2. In 2007, the applicants requested referral of the case to the Grand Chamber. In 2007, the Grand Chamber declared for the application that there had been violations of Article 14 and Article 2 (Council of Europe, 1994; European Court of Human Rights, 2007).

European Charter for Regional or Minority Languages (ECRML)

Czechia is violating the Article 7 by discouraging Roma children to use the Romani language in schools and by excluding Roma children from the majority education. Even though the government is offering special classes for the Romani language, the attempt in not effectively supporting the maintenance and development of the Romani language. Article 8 is violated by not making available pre-school, primary, secondary, technical, and university education in the Romany language (Council of Europe, 1992).

Framework Convention for the Protection of National Minorities (FCPNM)

Article 6 of the FCPNM was violated by not encouraging the intercultural dialogue and co-operation among all persons because the Czech educational system is segregating the Roma minority. This violation is not just against the minority but also the rights of majority children who are violated by not learning skills for intercultural dialogue and co-operation which is crucial in a modern globalized world. In addition, the Czech government is not taking sufficient measures to protect Roma children from discrimination in school settings from other children and teachers. The government is also violating Article 12 by not supporting research on Roma culture, history, and language. There are not available Romani language textbooks and Roma history books which would support the maintenance and development of the Romani language (Council of Europe, 1995).

Czech Legislation on Roma Education

In addition to the ratification of these international treaties, the Czech government recognized the necessity of guaranteed special rights for minority education and has been adopting a number of laws over the years to protect the minority as well as to address the minority education issues. Primarily, the minority rights are recognized in the Czech Charter of Fundamental Rights and Freedoms Resolution which was adopted in 1993. Specifically, chapter three recognize the right of national and ethnic minorities by Article 24 and 25 which recognize the right to develop minority culture, receive information in minority language, education in minority language, to use minority language in official matters, and to participate in the resolution of affairs that concern the minority.

Law no. 273/2001 Coll. on the Rights of Members of National Minorities and Amendment of Other Acts was adopted in 2001 and established the Council for National Minorities which is competent but not limited to preparing recommendations for specifying the needs of minorities in the educational system. Additionally, Article 11 recognizes the right to education and an upbringing in the language of a national minority. Traditional minorities or minorities which are living for a long time in the territory can establish private pre-schools or school institutions using the minority language or teaching the language as a school subject.

After a number of international criticisms for the discrimination of Roma children in the Czech educational system, the Czech government made an effort to improve the education situation in 2005 when new legislation went into force. Specifically, the biggest legislation was law no. 561/2004 Coll., refer to as a Schools Act. This law aimed to improve the whole Czech educational system including the Roma situation. Equal access to education to all citizens without any discrimination based on race, color, ethnic or social origin is guaranteed by Article 2. In addition, this article articulates the formation of national and state citizenship awareness and the respect for the ethnic, national, cultural, language and religious identity of every person is identified as a general goal of education. Article 16(1) introduced a new subcategory of socio-culturally disadvantaged child which falls under the bigger category of children with special educational needs. Children with special educational needs could be, for instance, a student who is disabled or disadvantaged in social position and disability is understood besides others language deficiency concurrent with more deficiencies, development deficiency in learning or behavior. In addition, the School Act defines social disadvantage as a family environment with a low social and cultural status, threat of pathological social phenomena, institutional education ordered or protective education imposed, or the status of asylum seeker. The special education needs of children should be ensured by school in content, form, and methods of which correspond to their special educational needs. In addition, teachers need to take into account the disability or disadvantage during the student's evaluation (Ministry of the Interior of the Czech Republic, 2004).

In addition to School Act, following laws have come into force. Law No. 562/2004 Coll., which is called Amending Certain Laws in Connection with the Adoption of the School Act. This law defines the percentage of subsidy for different types of schools where the highest subsidy is 80% for purposes of practical basic schools and of high schools which are educating students with disabilities. The subsidy can be increased up to 100%. While other basic schools and high schools are eligible for 60% of the subsidy.

Law no. 563/2004 Coll., called the Act on Educational Staff and the Amendment of Some Acts and defines different types of teaching and school staff. Special education teachers which are teaching mainly in practical schools are required to have professional qualifications obtained by studying pedagogical science at the master level. This law also defines the assistant teacher who is present in the classroom with students with special needs. The requirements for this job is a college degree in pedagogical science, certificate from lifelong learning program, pedagogy, or graduation from educational program for teacher assistants. Assistant teachers can perform direct pedagogical activity consisting of auxiliary educational work at school, in a school for special education, in a school educational and accommodation facility, in a school for the institution of institutional or protective education, or in a school for preventive educational care.

Decree no. 72/2005 Coll., on the Provision of Counselling Services at Schools and Educational Counseling Facilities defines the goal of counselling services. In addition, the decree allows school counselling facilities to choose the procedures, tools and methods appropriate to the purpose of the examination, based on the state of knowledge of the relevant discipline, and work in accordance with these findings; in the case of essential decisions in terms of educational needs, decisions need to be based on the use of several procedures. Procedures, tools, and methods of psychological or special pedagogical diagnostics must be standardized. If this is not possible, the counseling facility chooses those procedures, tools, and methods that have proven benefits for diagnostic and intervention care in child education and is used to identify children's educational needs and tailor their work practices in both school and home settings.

Decree no. 27/2016 Coll., on the Education of Pupils with Special Educational Needs and Gifted

Pupils is the last decree which is important for the Roma education issue. The description of job of teacher assistant is specified. Article 20 defines the process of placement of children where children can be placed into practical schools or practical school settings only based on a request of an adult student, legal guardian, or based on recommendation of a school counseling office with condition to be in accordance with the student's interest. The recommendation has to include the reasoning for the placement of children into this type of school setting. In addition, the request needs to include the impact of education on the possibilities of developing the child's potentials and possibilities of further education and professional career. The counselling service office is obligated to inform adult student or legal guardians about differences in educational programs and about expected outcomes of education and their impact on the possibilities for further education or professional career. Re-examination of student conditions should be carried out no later than one year after the classification for special needs and a further examination is should be carried out within two years after the previous examination.

The Schools Act was amended as a law no. 82/2015 Coll. in 2016. The children with special needs were specified as children who need supportive aid to fulfill their educational opportunities or to exercise or use their rights on an equal basis with others. This is based on the definition of their educational needs and the provision of support measures to help them in their education. In addition, this law is aimed to reduce the number of children without disabilities or with mild disabilities in practical schools (Government of the Czech Republic, 2017).

Programs for Roma Education

There are several programs which were developed specifically for Roma students. The Ministry of Education, Youth and Sports has developed a 'preparatory class for children from socially and cultural disadvantaged families', 'Roma Teaching Assistants', and 'modified educational programs in the primary school curriculum for Romani children with special needs'. The last program allows Roma children to take classes such as 'Family Education' or practical classes instead of physics or chemistry which are compulsory in primary education (Ministry of Education, Youth, and Sports, 2017).

The Czech government adopted the National Action Plan for Inclusive Education in 2010. This plan was intended to improve the Roma's equal access to education by inclusion and to prevent discrimination. This plan is still being updated; the current version is the National Action Plan for Inclusive Education 2016 – 2018. The goal is to support and prepare institutions for changes connected to the novelized Schools Act and for creating a strategy for data collection. This plan is an addition to previous goals and includes the prevention and correction of drop-outs (Ministry of Education, Youth, and Sports, 2017).

The government also adopted the Roma Integration Strategy for 2015-2020. The Strategy implements the Common European Framework for Action adopted by the recommendation of the Council of the EU on Effective Measures for Roma Inclusion in the Member States. This strategy should improve the situation of the Roma in the areas of education, employment, housing, and social affairs. The strategy should bring equal opportunity of quality education for the minority children. This strategy again supports Romani language classes and educating the majority population about the Roma minority is the new element for this strategy (Government of the Czech Republic, 2015).

The Local Engagement for Roma Inclusion (LERI) project is a qualitative action research project which brings together local authorities and Roma residents. This project is under the European Union Agency for Fundamental Rights and was developed as a response to the EU Framework for National Roma integration strategy up to 2020. The project focuses on finding how best they can be involved in Roma integration and help identify which aspects of the

project works well and which does not work (European Union Agency for Fundamental Rights, 2017).

Discussion - Analysis

Czechia ratified a number of international conventions which are protecting minority rights and minority education rights. Notwithstanding the international law, Czechia has been criticized for its violation (UNICEF, 2012). In order to address this issue, Czech government has issued and changed the legislation and adopted several programs to improve the educational situation of the Roma children.

However, the legislation has been often made without consideration of cultural appropriateness of the change and without research and theory to support it. Specifically, law no. 273/2001 Coll. and the Roma Integration Strategy recognize the right to education in a minority language or right to teach the minority language as a school subject. Roma children can attend optional classes for learning the Romani language. However, these classes can be held by the schools only if the minority has its own minority committee in that particular municipality. Igarashi (2005) pointed out that the Romani language classes are optional and not many students are willing to have additional classes. In addition to minority language classes, the Roma minority can establish private schools using the minority language. However, taking advantage of this recognition will be hard for a minority which has a high percentage of unemployment 47.7% and the biggest number of the minority is living in regions with the lowest wages in Czechia (Czech Statistical Office, 2016). Since 2005, the schools which would offer the Romani language class can receive subsidies from the Ministry of Education from a program which is focused on the support for disadvantaged children or multicultural education. Notwithstanding, there has not been any school which has offered a language class because there has to be at least seven students enrolled in the class for the class to be offered. Even though the Czech government has made progress in the recognition of this minority right, this is not a culturally appropriate measure because Roma children do not want to attend additional classes. The Czech government should adopt measures which would encourage students in taking those classes. In this issue, the discrepancy between theory and practice can be seen. Even though the government is officially offering language classes, they do not offer classes on Roma history or culture. By not educating the children about Roma history, they are violating the development of a Roma cultural identity. Lack of information about Roma history also influences Czech children who are not being prepared for a responsible life in a free diverse society, in the spirit of understanding, peace, tolerance, equality of sexes, and friendship among all peoples, ethnic, national and religious groups and persons of indigenous origin because they do not receive information about other ethnic groups other than about the majority in the Czech Republic.

A number of laws (law no. 561/2004 Coll., law no. 562/2004 Coll., law no. 563/2004 coll., law no. 82/2015 Coll. and Decree no. 27/2016) have tried to address the situation of over-representation of Roma children in special schools. According to the European Roma Rights Center (2009), one of the reasons for the ongoing discrimination is the fact that children who have been placed in practical schools before 2005 had not been re-examined by the Pedagogical-Psychological Counseling Centers for their placement in the practical schools unless their parents asked for a re-examination. In addition, there was a lack of information for parents and children about the new legislation and the parental rights to make decision in which school their children should be educated in. One of the intervention promotion material for teachers was made by the NGO “People in Need” (2002) and includes the history of the Roma minority, problems of Roma children before and after enrolling in school, relationship info between school and family, Roma children in practical schools, and affirmative action to

support education. However, the situation was still dismal in 2016. The Czech Government reported in its 'Report on the Condition of the Roma Minority in the Czech Republic for 2016' that still 30.9% of students are Roma children in practical schools. There were no statistical data about Roma children in secondary education (Government of the Czech Republic, 2017). Currently, Roma children can attend three different types of schools after the reforms which were mentioned previously. New and Merry (2010) distinguished those types of school as follow, the first option is to attend a practical school; the second option is to attend a school with a predominant Roma population which is often low quality school and leads to segregation; the third option is to attend a standard school with a predominant majority population which does not recognize Roma children as culturally different and often may result in bullying.

Even when Roma children are assign to standard schools, recent research conducted by Open Society (2012) indicates that Roma children have difficulty to be accepted into a higher-quality high school from a lower-quality primary education. Kaleja and Zezulková (2015) found that less than half of Roma children attend pre-school and the number is even lower in socially excluded localities in 2015. According to Rostas (2012), about 80% of Roma children attend pre-school in standard schools which gives them a higher chance to attend standards schools than practical schools. Švec and Hrdinová (2016) showed that currently, in the Usti nad Labem Region, every one child from ten does not finish primary education because compulsory education is for nine years regardless if the child finished ninth grade or if they had to repeat lower grades for more years. Additionally, the government is not taking sufficient measures to encourage regular attendance at schools and the reduction of the drop-out rates especially among the Roma minority.

To improve this situation cooperation between parents and school is necessary because education is necessary for improving the well-being for an individual as well as for the entire community. However, according to Zychová (2017), education is not a priority for Roma parents. There is a need for increasing parents and children motivation to sufficiently participate in the education and to successfully finish at least primary education. To this end, the welfare and child cash benefits which Roma parents obtain should be disbursed only with the condition that their children attend school. This form of conditional cash transfer would raise the perception about the importance of education among the minority. In addition to this intervention, the government should promote the importance of education of Roma children to prevent hatred directed from the majority towards the minority for increasing government expenses on Roma education and not on majority education. There should be a general understanding of the fact that if the Roma minority will get educated than they will not have to rely on the Czech welfare system. In addition, it is necessary to have available tutors who can help to prepare children for school work and for entrance exams for high schools. Lower quality schools and schools with majority of Roma students should be targeted for this benefit. There would be less take up if the parents would have to request to obtain this type of benefit. Another strategy which could increase Roma students' motivation for education could use of a benefit stipendium which a Roma student would only obtain if they have high academic performance. The support and motivation of Roma education is one of the most important issues that the Czech government should improve in the field of education. The information system of the Roma educational policy is not sufficient. It is difficult to obtain information about what are the benefits and who is eligible for them. There should be an accessible handbook with information about what to do as a Roma parent to improve the educational situation for their children. In addition, there should be available social workers to the Roma parents who would explain all details and necessary steps which need to be taken.

Part of the Roma educational problem is that there is a lack of evaluations and monitoring of programs and research on the Roma minority which would help with developing an appropriate approach to Roma education. Czechia does not collect disaggregated data on minorities which complicates the development of policies for the minorities and the assessment of policies and programs to determine if they are successful. There is discrepancy between policy and practice which leads to the fact that there is no evidence about why they are addressing the specific issues which they are addressing, what should be the outcomes of the policy, and how will they evaluate the policy. Needs assessment research on the Roma would help them to discover crucial issues for the Roma minority and help them to develop the ethnically specific approaches which would culturally fit to their needs. The evaluation of existing programs and policies is more difficult because the goals and indicator settings are not sufficient. The evaluation of programs is necessary for future policy development.

Conclusion

The Czech government violated a number of international conventions (UDHR, ICESCR, CRC, ICERD, CADE, ECHR, ECRML, FCPNM). The violation of Roma minority rights was the reason for numerous international critiques. The variety of legislation (e.g. Schools Act) and programs (e.g. National Action Plan for Inclusive Education) were developed to address the issue of violations of Roma minority educational rights. This is evidence that the Czech government is trying to improve this situation. However, there is a discrepancy between the theory and practice which occurs due to a lack of information about the current educational programs and their goals. The Czech government needs to adopt ethnically appropriate measures to improve the situation. Needs assessment of the Roma children would be an effective start to provide sufficient information about how ethnically effective programs should be formulated. In addition to the needs assessment, there is a necessity for a complex evaluation of the current programs to identify programs' inputs, activities, outputs, short-term and long-term outcomes. There should be an accessible handbook with information about what to do as a Roma parent to improve the educational situation for their children. It is necessary to have available tutors who can help to prepare children for entrance exams for high schools from lower quality middle schools. In addition, there should be financial benefits connected to the Roma education. One of them could be that welfare and child cash benefits will become conditional cash transfers dependent on child's school attendance. The additional financial benefits could have a form of academic performance stipendiums to stimulate higher academic performance among the Roma students.

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THE STUDY OF THE REASONS OF EARLY TERMINATION OF STUDY AT DISTANCE EDUCATION STUDENTS

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Abstract

This paper presents the results of a survey conducted to identify the underlying causes that led to the early termination of the study of distance students at Faculty of Economics, the University of South Bohemia. We focused primarily on the study program Economic Informatics, where there is a large number of distance education students who finish their studies prematurely. However, we also obtained data from distance study students in another study program to compare the causes of early termination of the study. A comparative analysis of these two different disciplines showed similarities in the percentage of early termination of the study and the reasons given by students. At the same time, the analysis also revealed some differences. This article presents the results of a survey designed to examine the relationship between premature termination of studies and internal (student) factors such as illness, problems in occupation, and extraordinary (institutionally related) factors such as study methods or study materials.

Keywords

Causes of failure, distance study, early termination of the study, higher education

Introduction

Nowadays, in many countries, there is a growing trend in adult participation in higher education. The data from the Organization for Economic Cooperation and Development (OECD) (2017) for example indicate that between 2002 and 2016, the number of students enrolled in distance education at different types of higher education institutions increased by more than 12% in most OECD countries. These students usually prefer this type of education because they need to earn a living or care for dependents (Gibney, 2010). Despite the relatively high numbers of students in distance education, the number of graduates from these students remains significantly lower than those of full-time students. For example, the Higher Education Financing Council in England (2009) stated that 59% of students studying distance learning at university institutions in the UK in 1996-97 did not finish their studies. Similarly, in the United States between 2000 and 2001, 73% of the distance learning students did not complete (Gibney, 2010) their studies. In achieving their learning goals, students of distance study have to hold more roles. Sometimes, these roles are relatively conflicting between duties of the role of student and other duties, such as family, work and social life. This places great demands on these students and influences the success of their studies. On the other hand, students of distance education bring their life experiences to their class (Kasworm, Rose and Ross-Gordon, 2010; Simpson, 2013; Mega, Ronconi and De Beni, 2014). Their academic studies and life experiences, such as social and work responsibilities, are closely interrelated (Kasworm, Rose and Ross-Gordon, 2010; Simpson, 2013). Factors cited by students as the reason for early termination of their studies include, for example, busy work and lack of time to study; health problems (Yuen, Lee and Tsang, 2011); family problems and others (Pierrakeas et al., 2004; Yukselturk, Ozekes and Türel, 2014).

The aim of this work is to understand the factors that could facilitate or hinder the study success of students in distance education. Understanding these factors can help educators and organizers

of studies in designing courses, ways and arrangements of teaching, design of electronic courses (Ala-Mutka, 2005, Beranek and Remes, 2013) and other needs of distance learning students to increase the success of distance learning students (Drlik and Beranek, 2015).
The study should, to a certain extent, "identify" endangered students or student groups. We focused mainly on students in the study program Economic Informatics, where several dozen students enter the first bachelor study in distance education, but only a few individuals complete them. Compared to other study programs (here we are also examining the study program Management of Commerce) at the Faculty of Economics, the University of South Bohemia, this ratio of graduates to the number of incoming students is the worst. The research issues examined in this document are:

- To what extent do students of a distance education early terminate due to internal (student-related) factors and to what extent is this due to external (non-student) factors? (e.g., study methods and study materials)
- To what extent do work experiences and job positions students of a distance education help to study successfully?
- Are there any similarities/differences in rates/causes of failure at different study programs? And at what level?

In the following paragraphs, we describe the methodology, the results of our research and the concise conclusions which result from our research.

Materials and Methods

Faculty of Economics offers study in several bachelor and magister studies. In these study programs, it offers the possibility of studying both in full-time and distant form. In distant form, lessons are taught in the form of several (eight or more) regular teaching modules with an hourly grant for each subject of the relevant semester of 4 to 12 hours. Each module consists of three or four courses. Educational material is based on the use of the Moodle LMS, which contains the vast majority of teaching material. This means lectures on the subject, exercises (can be supplemented by audiovisual materials), supplementary material, links to other teaching materials and more. In each subject the student carries out tasks and tests, and must meet the same requirements as students of the full-time study.
The sample was drawn from students enrolled in two study programs offered by the Faculty of Economics, the University of South Bohemia 1) a three-year bachelor's degree in Economic Informatics, and 2) a three-year bachelor study Business Business. Table 1 shows the total number of students enrolled in these branches in 2016 and the number of students who have successfully completed a semester or school year.

	Economic informatics	Percentage of original count [%]	Management of Commerce	Percentage of original count [%]
Number of enrolled students	42	100	229	100
Number of students after 1st semester	12	28.6	161	70.4
Number of students after 1 year	6	14.3	129	56.3
Number of students after 2nd year	4	9.5	102	44.5
Number of graduates	3	7.1	80	34.9

Table 1: The number of students in distance study in the analyzed study programs in particular years

Three different sources were used for the data for our survey. The first data source comes from student registers containing demographic data commonly collected at registration (e.g., age, gender, prior education, marital status, etc.) along with the number and type of selected student

courses for each study model. The second source of data came from the records made by the teacher in the given group (e.g., the number of students who passed the optional meetings and the marks of the student's recorded tasks). The third data source came from short structured interviews that were held with students at the end of each semester. The number of students interviewed in the distance study was 57, of which 36 were students of the study Economic Informatics and 21 of the study Management of Commerce. The average age of distance learning students was 32.6 years. Structured interviews were designed to gather qualitative results, i.e., information about the "reasons" why students chose to finish their studies. During these brief interviews, the students were also asked for their views on the performance of their teachers or their view on study material used and in general about the Faculty of Economics, University of South Bohemia. These interviews usually lasted about ten minutes. Students were asked to answer a set of structured open questions in a predetermined order expressing in particular their views were on three main issues concerning their study: their reason(s) for terminating their studies; their views on the educational materials used; whether their work experience helped them at their study. After each interview has been completed, each response has been rewritten and subjected to content analysis to classify students' responses. Responses were encoded and processed in Atlas software. All data were analyzed using proper statistical methods.

Results and Discussion

Profiles of early study leavers

The age of students studying distance learning ranges from 21 to 50 years. More than 60% of students who terminated their study are aged between 30 and 39, at the most productive age. It should be noted that in the two study programs studied, these students must balance comparatively demanding job responsibilities and often also family responsibilities with student duties. Differences were also observed among other age groups. Percentage of early study leaving is slightly higher among younger students (≤30), unlike older students (≥39). One possible explanation for this phenomenon is that younger students (≤30) usually study for the first time and therefore have little or no prior experience studying at university level. As such, these students are more likely to underestimate this effort, and workload required by higher education. Moreover, many of these students do not have background knowledge to meet the requirements of their studies. Along with professional duties and family responsibilities, leaving the study is understandable for this age group. However, older students (≥35 years old) are usually more entrenched in their professional career, making it easier for them to leave if they feel that their education is interfering with their professional duties. For both programs the numbers of early study leavers were similar.

In the study program Management of Commerce, the number of women was 71.5% in the sample; 69.2% of them terminated prematurely their study. Similar results were found in students of the Economic Informatics program, where women make up 32.7% of the sample and 33.3% of them terminated prematurely out. Given that the differences in the two study programs are not statistically significant (x^2, $p > 0.05$), the correlation between outgoing and gender shows that the overall rate of early school leaving is similar for men and women.

Economic informatics			Management of Commerce		
	N	%		N	%
Related to informatics	5	13.9	Related to business	12	57.1
Not related to informatics	31	86.1	Not related to business	9	42.9
Total	36	100		21	100

Table 2: Distribution of distance-learning students who finished their studies prematurely by occupation

Table 2 illustrates the relationship between graduation and the professions of students in both study programs. A high percentage (86.1%) of dropout students whose professional activity / occupation is not related to informatics indicate a statistically significant correlation between student leaving and their profession directly or indirectly associated with computer science (x^2, $p < 0.001$). Of course, a profession indirectly or directly related to computer science (for example, an advanced computer user, programmer or technician) provides these students with a considerable amount of background knowledge that usually increases their learning success. In addition, they can engage their colleagues (get advice, help from them) and use the knowledge gained in their everyday working life (such as professional interaction with their colleagues and colleagues). For the study program Management of Commerce, the difference is not statistically significant (x^2, $p > 0.05$).

Number of handed-in assignment	Number	Per cent
0	9	29.0
1	9	29.0
2	8	25.8
≥3	5	16.2
all	31	100

Table 3: The number of submitted assignments of distance study students in the program Economics Informatics in the course Programming in the first semester of study (students who terminated prematurely after the first semester of their study)

Table 3 focuses only on the study program Economic Informatics and shows how many tasks from the course Programming the distance learning students worked out and submitted (the total number of assignment was 10). The aim was to determine the degree of student participation in learning in this course, and to find out at which stage students tended to terminate their study effort. From Table 3, we can see that 29% of our sample failed to provide any work, and the same number, i.e., 29%, completed only one assignment. This finding revealed that 60% of students terminated their study efford practically right at the beginning. 16% of the students did the assignments, but they gave them quite a few, some finished shortly before the final exam.

Causes of students' failure

The reasons why students drop out of their studies can be divided into four main categories: professional reasons, family and personal reasons, health and academic reasons and incorrect choice of study program (Kasworm, Rose and Ross-Gordon, 2010):

(a) Professional reasons. These are reasons when students underestimate the amount of time that is needed to master the studies. Students of distance learning have primarily professional duties that take up most of their time. This category also includes changes that occur in their working life (i.e., change of employment or promotion at work).

b) Family and personal reasons include, for example, pregnancy, childbirth, travel problems, or other personal reasons.

c) Health reasons concern personal health problems or family health problems (i.e., children's illnesses).

d) Academic reasons for lack of (real or perceived) help from teachers, inappropriate learning materials, inappropriate learning methods.

e) Incorrect choice of the study program. Some students admit that they have found out that the chosen study program is boring or of not being interested in the subject. This is especially true for students of the study program Economic Informatics

None of the students surveyed said that they would not have sufficient prerequisites to graduate

the chosen specific field of study. It can be seen from Table 4 that the reasons for dropping out of university studies are different for both study programs.

The professional reasons for early termination of study represent 62.2% of the cases presented by students in the study program of Management of Commerce and 27.8% of Business Informatics. Learning burden versus job requirements is an urgent and unpredictable factor. On closer examination, however, the reasons that students declare to be the cause of early study termination tend to rely on their incorrect evaluation of the time they actually have available for study versus what is needed. These are necessary learning requirements that many students do not realize when they enroll in the Faculty of Economics, the University of South Bohemia.

Reasons	Economic informatics				Management of Commerce			
	Total number of early terminating students		The number of women out of it		Total number of early terminating students		The number of women out of it	
	N	%	N	%	N	%	N	%
Professional reasons	10	27.8	4	40.0	12	57.2	8	66.7
Personal and family reasons	3	8.3	3	100.0	5	23.8	5	100.0
Health reasons	2	5.5	1	50.0	2	9.5	1	50.0
Study reasons	21	58.4	4	19.0	2	9.5	1	50.0
Total	36	100	12	-	21	100	15	-

Table 4: Reasons for early termination of studies, given by distance learning students

Personal reasons for early study leaving include reasons such as marriage, divorce, child care, socio-economic issues, and other relevant factors. The reasons given by the student in this case are usually "unexpected" factors that led to the early termination of studies. These changes are to a large extent the typical events occurring in the everyday life of adults - some of which have immediate consequences that affect their daily routine and thus the disruption of their study. 10% of students in the study program Management of Commerce who dropped out of distance education (8.3% in the field of Economic Informatics) said they had decided to leave for family reasons. Some event changed their daily routines and did not allow them to take part in the study. Similarly to the cited professional reasons, these students stated that they failed to balance their time for their study and family responsibilities. Health problems can also be included in unexpected events that have forced students to drop out of their studies prematurely. 9.5% of students in the study program Management of Commerce and 5.5% of Business Informatics students reported health complications as the main reason for their early termination. These were the health complications of either these students or their family members.

Study grounds are categories that are directly related to students' experience with the study. 9.5% of students who finished their studies in the study program Management of Commerce, but 58.4% of Economic Informatics students said they had decided to finish studying for study reasons. In short, it was a "bad choice" of students that led to their decision to stop studying. Of these students, 48% finally admitted that they did not have the required knowledge for the subject, especially in the field of mathematics and programming, and that they did not have time to catch up with this basic knowledge (in secondary school mathematics) to continue studying at our faculty. So, they decided to finish the study. The approximately 12% said that the way of study is the reason why they decided to give up their studies (they said that managing the subject of programming is basically impossible in a distance study). The rest of the students said they imagined study of informatics in other way, and that they wanted to study something else. They said they choose this study program incorrectly.

Our analysis of early termination of study aimed at students of distance learning of two different study programs revealed some similarities in terms of the reasons for which students decide to terminate prematurely their study. There is no statistically significant difference between employed and unemployed students, although most of them are employed (most of the distance learning students are employed). According to the gathered data, it seems that the training materials provided to the distance learning students were sufficient and even interaction with the teachers was not a reason for early termination. The analysis shows that students aged 30-39 are the group with the highest number of early termination of their distance study. They face the daily challenge of balancing family and work problems with their education duties. According to information from distance learning students, it seems that educational materials and interaction with teachers have not made it so difficult for students to lead them to terminate prematurely. Only a very small percentage of students reported teachers or educational materials as a reason for early school leaving. Important information was obtained about early-stage studies for students of distance study in the field of Economic Informatics. The content of this study and the study of full-time students are basically the same. Nevertheless, the number of students dropping out of education is far higher at distance learning students, even in comparison with the study program Management of Commerce in distance education mode. According to student information, the standard scenario is as follows: Students know that the study of computer science will essentially ensure future good job. Adult students are motivated then to try to begin the study program Economic Informatics in distance study. However this field assumes some knowledge of mathematics and especially continuous work if the students have to master the subject of Programming. However, students do not have much time, as Table 4 also shows. 99% of economics students who finished their studies after the first semester did not submit any task in the subject of Programming Basics and the same number of percentages completed only one assignment. As we have already mentioned, almost 60% of students have finished their study shortly after the beginning. For several weeks, they used to go to school to find out that they lacked time or knowledge.

Conclusion

Our study revealed that the most significant reasons given by students for early termination of their studies were their under-estimation of the actual time they have available for study compared to other payables, including their workload, and unforeseen changes (e.g., business travel, illness, pregnancy) that affected their ability to continue studying. These are mostly reasons that the faculty cannot influence as well as accepting students to study under current conditions.

However, universities must find some ways of the support of distance learning students by various ways, e.g., multimedia materials, additional educational material, Skype consultation offer, online courses etc. For example we provide students in the distance study of the study program of Economic Informatics with additional programming courses and with multimedia materials. To sum up, ways of supporting distant students are not easy, and usually individual approach is necessary.

In our future work, we want to expand our research, include more students and more study programs into our analysis. We assume the creation of a structural model that would demonstrate which factors most likely cause the premature termination of distance learning.

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EDUCATION OF HUMAN RESOURCES FOR CONTEMPORARY TECHNICAL SOCIETY

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Abstract

The paper deals with an attempt to uncover especially the role of programming knowledge gained in time before entering a technical faculty. The described questionnaire survey was realised at the Faculty of Military Technology (FMT) of the University of Defence (UoD) in the winter semester of the academic year 2017/2018. Additional data to those from paper forms were added from the university information system after the end of semester exam period. These provided a suitable data sample for verifying authors' hypotheses. The results are documented and interpreted. The authors mean that the research in the formation of students' algorithmic thinking deserves more attention in the future.

Keywords

Algorithmic thinking, cyber defence, programming, study results expectations, technical education

Introduction

The increasing demands for technically educated workflow in the Czech Republic calls for searching the ways and approaches which could lead to the suitable solutions in the Czech educational system. The authors are convinced that the process of acquiring required style of technical thinking should be started in time and by emphasizing the role of a few key subjects taught by suitable teaching methods.

Generally, a key point for technical education is a high school science, technology, engineering, and mathematics (STEM) education. Mullet, Kettler and Sabatini (2018) explored gifted students' conceptions of their high school STEM education. New horizons and possibilities of STEM education are described by Slovák (2015).

Hromkovič et al (2017) emphasize that students should get core of programming education as early as possible. Hrubý and Huclová (2014) stated that the upper level of Czech elementary schools plays a key role in later professional focus of youths and the age interval from 12 to 15 is a crucial period for the acquisition of basic knowledge and skills in the field of ICT. Romero, Lepage and Lille (2017) introduce computational thinking in the context of Higher Education creative programming activities. Educational strategies for higher education programming courses are discussed by Rojas-Lopez (2017).

Otavová and Sýkorová (2017), Svatošová and Pelikán (2017) and Hošková-Mayerová and Potůček (2017) explored students' performance with respect to their admission test. On the other hand, Stareček et al. (2017) or Zámková, Prokop and Stolín (2016) studied factors influencing students' success rate in Mathematics.

The Faculty of Military Technology (FMT) of the University of Defence (UoD) is a technically oriented faculty of a state military university. The FMT realizes its specific study programs for both military and civilian students but separately. The new tasks connected with preparation of specialists in Cyber Defence lead to the searching suitable human resources.

In winter term 2017/2018 a questionnaire survey was realised. The respondents were all new

civilian students of the FMT who started the full-time civilian Bachelor's degree study program 'Technologies for Defence and Security'. This study program covers five fields of study:

- Aircraft Technology;
- Communication and Information Technologies;
- Geography and Meteorology for Defence and Security;
- Technologies for Protection of Assets and People;
- Weapons and Ammunition.

The winter semester is divided into three parts: teaching (12 weeks), exam period (6 weeks) holidays (2 weeks). Duties are the same for all students. Students have to pass exams in five subjects: Physics, Information Technology, Mathematics, Basic of Electrical Engineering and Basic of Mechanical Engineering. The sixth subject An Introduction to Study of Security Technologies is finished by a credit.

The authors' hypotheses were stated as follows:

H1: FMT civilian students from grammar schools (in Czech known as "gymnázium") have better study prerequisites for university studies – namely, their continuation of study is more probable;

H2: education in programming before entering the university contributes to the successful study at the technical faculty;

H3: education in programming before the secondary school leaving exam is provided insufficiently.

The key point of the authors' contribution was to uncover the role of programming for a successful study at a technical faculty. Relevant data have been missing and from the authors' point of view a research at this field can be beneficial.

Materials and Methods

Firstly, available resources connected with the topic were analysed, then knowledge synthesis, induction, deduction and comparison were used. Secondly, the questionnaire survey was prepared, data sample was analysed and evaluated.

Data acquisition

The questionnaire survey was carried out in the frame of the first lecture of the subject Information Technology (at the beginning of October 2017). It is the time when all students are present in the lecture room. The subject Information Technology is mandatory for all students and is finished by an exam. The student dataset comprised in total 63 students. The data were collected using a paper form. Students were informed why every question was asked and teacher explained possible uncertainties. Additional data to those from paper forms were added from the university information system after the end of semester exam period (at the end of February 2018).

The key data items gained from paper forms are as follows:

- Gender;
- Nationality;
- Study field;
- Type of secondary school;
- Possible study or working activity between secondary school and the current study at the FMT UoD;
- Availability of an own computer;
- Possible education in programming before current study at the FMT;
- Current subjective feeling from the previous programming education – students' self-perceptions of their current programming capability;
- Current feeling towards programming.

Key additional data gained from the UoD information system (valid data on the first day after the exam period) are as follows:

- Study at the FMT is stopped/continuing;
- Current number of credits gained;
- Current number of exams passed;
- Achieved study average.

Statistical methods

Apart from the standard descriptive statistic for categorical data (e.g., a frequency distribution and corresponding tests of a distribution family), we used Pearson's χ^2 test, which is the best tool to assess questionnaire data set with categorical variables (Hendl, 2009). The chi-squared test, also known as a goodness-of-fit test, evaluates how likely it is that any observed difference between the groups arose by chance. The formula takes the following form

$$\chi^2 = \sum\sum(o_{ij} - e_{ij})^2/e_{ij},$$

where o_{ij} denote the observed absolute frequencies and e_{ij} are the expected absolute frequencies, the sum is taken over all rows and columns of the corresponding contingency table (Řezanková, 2011). Providing that each expected absolute frequency is greater than five, the χ^2 statistics has asymptotically Pearson's χ^2 distribution with $(r - 1)(c - 1)$ degrees of freedom, where r and c stand for number of rows and columns, respectively, of the contingency table. If the frequency condition is not fulfilled, we merge some rows or columns into one row or column, respectively. In other cases, we calculate the Fisher exact test to assess the dependence (Agresti, 1992). We also employed the odds ratio statistic (for 2×2 contingency tables) to decide which particular pair of attributes is significantly different from the other pair (Anděl, 2005). The significance level (α) of all tests was set at 0.05.

Metrics

For the individual hypotheses, the following metrics were set.
H1: The type of the secondary school and percentage of completion of the study.
H2: Education in programming before entering the university and percentage of completion of the study.
H3: Education in programming before entering the university and subjective possibility to continue in studying programming.
The value of credit percentage used in hypotheses is given by the UoD Study and Examination Regulations and is equal to 70 %.

Results and Discussion

In the surveyed group of students, there were 79 % of men and 21 % of women, 79 % of students were from the Czech Republic, 10 % were from the Slovak Republic and 11 % were from other countries (Vietnam, Ukraine and Turkey). Regarding the type of the secondary school attended, we can divide the students into three groups – those who attended a grammar school 38 %, a technical secondary school 44 % and other types of a secondary school 18 %. Almost 15 % of respondents had worked or studied another school between the secondary school leaving exam and entering the FMT. 95 % of students had their own computer – either a laptop or desktop.
The secondary school education system is almost the same in the Czech and Slovak Republic, but quite different in those countries where other students came from. Therefore, we continued only with the questionnaires of Czech and Slovak students. After discarding two incomplete

questionnaires, we had 54 respondents in the study. Now, we can turn our attention to the results of the respective hypotheses.

H1: The absolute frequencies in Tab. 1 indicate that students from a grammar or technical secondary school have higher chance to continue their university study. Since some of the absolute frequencies are smaller than 5, we employ the Fisher exact test. With the resulting p-value of 0.0073 being smaller than α, we can confirm that there is an association between the type of a secondary school and the continuation of students' study.

school completion	grammar	technical	non-technical	sum
more than 70 %	11	17	3	31
less than 70 %	3	9	2	14
quit	2	1	6	9
sum	16	27	11	54

Table 1: Contingency table with absolute frequencies – types of the secondary school and levels of completion of the first semester

By merging some rows and columns, we obtain a 2×2 contingency table (Tab. 2), in which we can compare students from grammar and technical schools with students from other types of the secondary school. We use a right-tail alternative hypothesis – students from grammar and technical schools have better study prerequisites than students from other schools. Using the odds ratio statistics, we obtain the test value $b = \ln(28 \cdot 8/(15 \cdot 3)) = 1.6050$ with the corresponding p-value of 0.0274. The p-value, smaller than the significance level α, confirms the alternative hypothesis, i.e., it is more likely for students to continue their study if they came from a grammar or a technical secondary school.

school completion	grammar + technical	other
more than 70 %	28	3
less than 70 % or quit	15	8

Table 2: Four-fold table – school and completion

H2: As we can see from Tab. 3, education in programming before entering the university does not influence a success in studying at the technical faculty, which was proved by the chi-squared statistic p-value of 0.3630 that is larger than the significance level α.

programming completion	yes	no
more than 70 %	16	15
less than 70 % or quit	9	14

Table 3: Contingency table comparing completion of the first semester and education in programming before entering the university

Although we can narrow the respondents down to those who did not quit their studies, still the hypothesis of independence between the education in programming and students' study results (i.e., their weighted averaged exam mark) is not rejected. The corresponding p-value is 0.3390; again, it is larger than α.

H3: Only 46.3 % of respondents studied programming at the secondary school. And only a half of the students from grammar schools had some subjects concerning programming, which is highly interesting, since the Ministry of Education, Youth and Sports (2007) provided a general study plan for grammar schools to have at least one lesson on information technology per week per year on average.

Nevertheless, from the statistical point of view, we are interested in relations between education in programming before the secondary school leaving exam and students' self-perceptions of their

current programming capability. The frequency distribution is displayed in Fig. 1, where we can see that out of a nearly half students having programming only 40 % feel that they can have a good base to continue in programming.

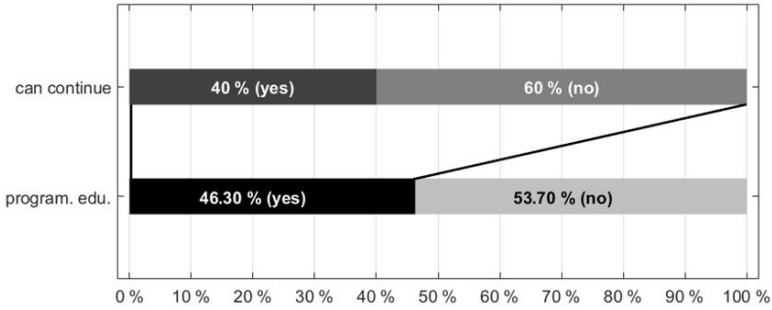

Figure 1: Education in programming at the secondary school and subjective possibility to continue in studying programming

Thus, we test two simpler hypotheses: H3a: the education in programming is different from a so-called random design; and similarly, H3b: the subjective possibility to continue in programming is different from the random design. Mathematically speaking, we test that the ratio of positive answers compared to all answers is different from the value 0.5.
In both cases, we have not obtained significant results. Namely, for the hypothesis H3a, we calculated *p*-value of 0.3417, and for the hypothesis H3b 0.2122. Therefore, the results are not different from the random design.

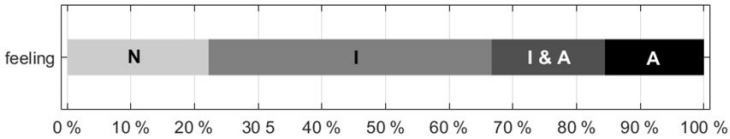

Figure 2: Feelings towards programming

We found the response distribution of the last question of the questionnaire – current feeling towards programming with possible answers: 'interested', 'neutral', 'afraid' and 'interested and afraid at the same time' – very interesting. Results are shown in Fig. 2 and we can see that almost 80 % of students have some feelings about programming and that is something we, as teachers, can build on.

Summary of findings

The hypothesis tests have showed that students from grammar and technical secondary schools have better study prerequisites, i.e. their continuation of study is more probable (hypothesis H1). Hypotheses H2 and H3 have not been confirmed, there is no statistically significant dependence between education in programming and study results at the university.

Recommendations

The algorithmic thinking is a style of thinking which is necessary for the contemporary technical professionals. The research in the formation of students' algorithmic thinking and its influence on the study results at technically focused faculties should be continued. Leaving exam at the secondary schools should verify that students are familiar with the programming basic terms

and structures. Next research should be focused on formulation suitable hypotheses and metrics, dataset extension – not only the first semester students, comparing military and civilian students.

Conclusion

The research above is based on data which were valid immediately after the exam period, i.e. two weeks before starting new semester. Nevertheless, the data obtained can be considered relevant for the given hypotheses.

According to the UoD Study and Examination Regulations, students are required to meet 100 % of the study requirements and duties by the end of the fourth week after beginning of the next semester. The research will be continued because it is expected that the number of students could be hardly affected by this rule.

The analysis showed that it is more likely for students coming from grammar and technical schools to continue their study. Although, other dependencies stated in hypotheses were not confirmed, we can assume that there is a hidden factor influencing students' performance during their university study.

We conjecture the factor to be programming or, more generally, an ICT subject taught at the secondary schools. Such a relationship was proposed by Saeli et al. (2011): '… *when students program, they first need to find a solution to a problem, and then they need to reflect on how to communicate their solution to the machine, using syntax and grammar, through an exact way of thinking*'. We will continue assessing students' results at the technical faculty with respect to their programming education both from the secondary school and from the subject Information Technology.

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SOCIODEMOGRAPHIC FACTORS FOR THE DEVELOPMENT OF RURAL COMMUNITY SCHOOLS IN THE CZECH REPUBLIC

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Abstract

The paper is based on the concepts of learning regions and endogenous rural development, with a specific focus on community education in rural areas in the Czech Republic. The research question is connected with the identification of the significance of sociodemographic factors for the localisation of Rural Community Schools within particular rural municipalities. The aim is achieved through a secondary analysis of sociodemographic data and rural community school (RCS) websites and also through primary research carried out by semi-standardised interviews conducted with community coordinators. The results of the study show that objective sociodemographic conditions are not very important for the localisation of RCSs. Only size of the municipality, educational structure and, to a certain extent, level of unemployment slightly affect the activity and successful development of RCSs. The results of our research show the predominance of subjective over objective conditions for the development of RCSs.

Keywords

Community education, learning society, local development, rural community school, sociodemographic factors

Introduction

The paper is based on three levels of theoretical concepts. The most general are the concepts dealing with regional development theories. These concepts make it possible to divide this paper into two parts. The first part is formed by the concept of learning regions, which is obviously used as basic background for community education (Lam, 2002; Morgan, 2007). The second part is formed by concepts dealing with optimal localisation of activities within regional development (Malmberg and Maskell, 2002).

The second level is formed by the concepts of emphasising endogenous development and the "bottom-up" approach to rural development (Atterton, 2007; Lee et al., 2005; Shucksmith, 2000), which perfectly connect the learning process through community education with the collaboration of local actors (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, which is also suitable for rural areas (Coleman, 1987; Heers et al., 2011; Sanders, 2003). The concept of community education can be examined in terms of three main dimensions. Firstly, community education is strongly connected to a lifelong learning process (Staykova, 2012), and in this context it connects young people and adults in the educational process and also uses the local environment for educational activities (Krupar and Prins, 2016). Secondly, community education involves both students and other members of the community in the educational process (Amalba et al., 2016). Thirdly, community education is significant not only for educational activities but also for rural community development (Heers et al., 2014). In this context, Varvazovska and Jarkovska (2017) state that an important part of

education supporting rural development should also be environmental education with regard to local objective conditions. The concept of community education originates from the Anglo-Saxon environment (Heers et al., 2011), but it is also widespread in other regions. Until the end of 20th century, these were mainly European states, but since then it also occurs in Egypt, China and other Asian countries (Langsten, 2015; Efird, 2015; Maber, 2016).

As community education has been applied in the Czech Republic for only a relatively short time, there is no appropriate interpretative framework available (Kalenda and Smekalova, 2015). Community education in the rural areas of the Czech Republic is realised through rural community schools. However, there is still no generally acknowledged definition of rural community schools. The most common definition – which is also used in our long-term research into community education – of a rural community school is "an educational facility which is located at a municipality of less than 5000 inhabitants, with prescribed legal form (NGOs, municipal contributory organization, secondary economic activity of the local school), which offers lifelong education to adult residents of the catchment area, and regularly participates in community development activities and community life, managing its own budget and respecting the principles of financial self-sufficiency and sustainability" (Hudeckova and Husak, 2015).

Within this context, this paper is aimed at deepening the knowledge of rural community schools in the Czech Republic. The paper, which is based on both secondary and primary research, deals with the following research questions: Are sociodemographic factors concerning the localisation of rural community schools significant for their successful development? In this context, which sociodemographic factors are the most significant? The main aim of the paper is to identify the key sociodemographic factors that are significant for the advantageous localisation of newly established rural community schools (RCSs).

Materials and Methods

From the methodological perspective, the paper is based both on secondary and primary research techniques. A secondary approach is used for the analysis of two types of data. To fulfil the main aim of the paper, publicly available databases (especially databases of sociodemographic data relating to municipalities) of the Czech Statistical Office are used. Unemployment statistics produced by the Ministry of Labour and Social Affairs are also used. In addition, websites of RCSs are used to update the typology of the RCSs from the perspective of their activity or inactivity. The level of activity of RCSs is used for the evaluation of the significance of sociodemographic factors for the development of RCSs. According to the indicator of the average number of courses provided in the years 2015-2017, it is possible to identify 10 very active RCSs (which provide eight or more courses during the year); 12 less active RCSs (which provide fewer than eight courses during the year) and 10 inactive RCSs (which provide courses only occasionally or intermittently). The remaining RCSs discontinued their activities during the monitoring period.

Moreover, the paper stems from the authors' long-term focus on the issues of education and, especially, community schools that are located within rural areas. First of all, the authors examined education in rural areas 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). During the ensuing seven years, the authors' research focus (under the three other research projects supported by IGA FEM CULS) concentrated on various aspects of rural community education, particularly in the 2012 project called "Rural community school – institute for education and innovation workshop (case study of rural municipalities in the territory of Local Action Group – LAG Pošumaví)", which focused on establishing a network of RCSs within the LAG Pošumaví. The project that started in 2014 and was called "Appreciation of Natural and Sociocultural Potential

of Rural Areas through Activities Contributing to Social Inclusion" focused on the inclusive activities of RCSs and, like the aforementioned projects, on the supply side of RCSs in the Czech Republic. The project that started in 2016 and was called "Development of Family and Community at the Intersection of Regional Family Policy" focused on the demand side of RCSs (participants' perspectives). This paper, and also ongoing research (see Acknowledgements), focuses on the objective conditions (localisation factors) for the functioning of RCSs. The experience of the authors demonstrates their ability to evaluate the objective conditions for the development of RCSs in the Czech Republic.

The proposed primary research is based on the above-mentioned experience. The primary research consists of six semi-standardised interviews (each with a duration of approximately 60 minutes) with the community coordinators of RCSs. The interviewed community coordinators represent all types of RCSs with regard to their activity (see above) – two respondents represent very active RCSs, two represent less active RCSs and two represent inactive RCSs. The interviews focused mainly on the evaluation of the significance of objective (localisation) conditions for the development of RCSs from the perspectives of the community coordinators. Therefore, the results section of the paper consists of the hard data from databases, as well as of the soft data from the interviews.

Results

The concept of community education and community schools is relatively new in the Czech Republic, where the first RCSs were established in 2005 (NNRCS, 2016). During the 13 years of the existence of RCSs in the Czech Republic, the number of rural schools that implement community education has been relatively stable. However, as the concept of community-led local development started being implemented in 2014, there was an increasing interest in establishing RCSs in other rural municipalities. These are the reasons for the focus of this paper on the evaluation of the objective conditions for the localisation of RCSs. The subjective conditions were the aim of previous study published by the authors (e.g. Husak and Hudeckova, 2017).

Number of inhabitants (2017)	Very active RCSs	Less active RCSs	Inactive RCSs
Min.	207	431	62
Median	1341	1046	1016
Max.	2785	2387	5242*

*one exception from the definition of RCSs

Table 1: The size of the municipalities with RCSs (source: www.czso.cz, own calculation)

One of the most important factors for the localisation of RCSs is the size of the municipality. This factor is also often mentioned by community coordinators as important for the successful development of RCSs. Table 1 shows the minimal, maximal and median number of inhabitants of municipalities where RCSs are located. The data shows (using the median criterion) that very active RCSs are usually located in larger municipalities than inactive RCSs are. There is one exception, namely the largest municipality, where inactive RCSs are located. However, this is specifically the situation of a municipality that is too large for the existence of a functioning local community. This also acknowledges the fact that a municipality with 5000 inhabitants is really the maximum size of municipality for establishing RCSs. The optimal size is between 500 and 3000 inhabitants, as is also acknowledged by the community coordinators. They state that municipalities up to 500 inhabitants are too small to create a sufficient demand for RCS courses. On the other hand, municipalities larger than 3000 could have problems with activating the local community to support RCSs.

Age structure within the municipalities (2017; %)	Very active RCSs			Less active RCSs			Inactive RCSs		
	0-14	15-64	65+	0-14	15-64	65+	0-14	15-64	65+
Min.	13.2	65.9	13.8	11.9	65.6	12.5	8.1	63.6	12.9
Median	14.8	67.9	16.4	15.4	67.3	15.5	15.8	67.0	17.4
Max.	17.1	71.0	20.9	17.6	71.0	20.8	18.7	70.3	24.2

Table 2: Age structure within the municipalities with RCSs (source: www.czso.cz, own calculation)

Table 2 shows data on the age structure of the population in municipalities with RCSs. The assumption (as also acknowledged by community coordinators) was that for the successful functioning of RCSs, it is necessary to have a relatively higher proportion of the younger generation, together with older generations. Community coordinators state that the participants in courses provided by RCSs usually come from the ranks of the young, but there are also retired people, as a result of the successful cooperation of RCSs with Universities of the Third Age. However, this is not proved by objective data on age structure. On the contrary, inactive RCSs are often located in municipalities with a higher proportion of potential participants. So, subjective factors (motivation, active citizenship and, especially, an active community coordinator) are more important for the successful development of RCSs than a favourable age structure is.

Educational structure within the municipalities (2011; %)	Very active RCSs			Less active RCSs			Inactive RCSs		
	PE	SE	TE	PE	SE	TE	PE	SE	TE
Min.	15.5	65.7	3.6	14.4	64.3	3.4	15.9	56.2	5.8
Median	19.8	69.8	7.2	21.3	71.7	6.5	22.1	73.0	6.1
Max.	30.7	76.5	10.7	32.3	73.8	12.3	25.7	74.5	13.6

*PE – primary education; SE – secondary education; TE – tertiary education

Table 3: Educational structure within the municipalities with RCSs (source: www.czso.cz, own calculation)

Table 3 shows data on the educational structure of the population within municipalities with RCSs. The assumption was that a higher level of education within the municipality is an important factor for the development of RCSs. The data shows that there is a wide range of values between the municipalities with all types of RCSs. However, with the median criterion, in municipalities with very active RCSs, there is a higher proportion of people with a tertiary education compared to people with a primary education. The opposite situation holds for municipalities with inactive RCSs. So, the educational structure influences the functioning of the RCSs positively, but the dependency is only low.

The proportion of unemployed persons (2017; %)	Very active RCSs	Less active RCSs	Inactive RCSs
Min.	1.6	1.3	1.6
Median	4.0	3.8	3.2
Max.	5.0	6.3	16.3

Table 4: The proportion of unemployed persons within the municipalities with RCSs (source: www.portal.mpsv.cz, own calculation)

Table 4 shows data on the proportion of unemployed persons within municipalities with RCSs. The lower level of unemployment should reflect the activity of the population. Community coordinators also mention that unemployed people make up a minority of the participants of courses provided by RCSs (despite the fact that they might need further education). This is acknowledged only with regard to the maximisation criterion. Municipalities with very or less active RCSs do not have extreme levels of unemployment. However, the evaluation of this factor is made more difficult by the generally low level of unemployment in the Czech Republic.

The number of public transport connections (weekday; 2017)	Very active RCSs	Less active RCSs	Inactive RCSs
Min.	16	17	22
Median	38	35	60
Max.	118	101	140

Table 5: The number of public transport connections within the municipalities with RCSs (source: www.idos.cz, own calculation)

Table 5 shows data on the number of public transport connections in municipalities with RCSs. Easy accessibility to RCSs is mentioned most often (by community coordinators) as a precondition for the successful development of RCSs. This is due to the assumption that the activities of the RCSs are intended not only for the inhabitants of a particular municipality, but also for neighbouring rural municipalities. However, the data does not confirm this fact. Inactive RCSs are located in municipalities with better public transport conditions, in contrast to very active RCSs. On the other hand, a minimal level of public transport connection should be ensured, especially with regard to children and students as participants in the courses provided by RCSs.

Discussion

The evaluation of the sociodemographic conditions for the localisation of RCSs within rural municipalities in the Czech Republic is quite diverse. Community coordinators emphasise the significance of suitable local social, demographic, economic and transport conditions for the successful development of RCSs. However, the data shows something else. According to relevant sociodemographic data, the activity/inactivity of RCSs is only marginally dependent on objective conditions for the localisation of RCSs. This fact differs from the results of Malmberg and Maskell (2002), who showed the importance of objective factors for the localisation of educational activities in general. The main reason for this difference is (according to the authors of this paper) the focus of the research conducted on rural communities. The specificity of small rural communities is also mentioned by Amalba et al. (2016) and Lee et al. (2005), according to whom the subjective conditions (e.g. motivation, activity, public participation) are more important for community development than objective conditions are. This is also acknowledged by Varvazovska and Jarkovska (2016) with regard to the importance of individuals' interest in and motivation for lifelong learning within the non-profit sector. The results of our research emphasise the predominance of the subjective over objective conditions for the development of RCSs. This confirms the results of Kalenda and Smekalova (2015), who point out the significance of local partnerships, a good reputation among the local population and a cooperative approach as crucial conditions for the successful development of RCSs in the Czech Republic. However, at least some basic objective conditions for the localisation of RCSs should be taken into account, as stated by Laudams (2013). These are the size of the municipality, the educational structure and, to a certain extent, also the accessibility of the municipality (despite the above-mentioned data, but in agreement with the community coordinators' views).

Conclusion

This paper has focused on the identification of the key sociodemographic factors regarding the localisation of RCSs. The issue is topical because RCSs have existed in the Czech Republic for more than 10 years and because of the growing interest in establishing new RCSs in other rural municipalities. In the light of the main findings of our research, it can be stated that objective sociodemographic factors are not as important as community coordinators assume. There are only two objective localisation factors that positively influence the activity and development of RCSs. These are the optimal size of the municipality and the age structure of the population where

RCSs are located. The activity of RCSs is also partly influenced by the level of unemployment. However, this influence is only marginal. On the other hand, age structure and easy access to the municipality are not significant localisation factors. As far as the accessibility of the municipality is concerned, this is particularly surprising, because the community coordinators evaluate this factor as very important. As a main result of the paper, it is possible to state that the importance of the objective conditions for the localisation of RCSs is lower than the subjective conditions (mainly the presence of active and motivated people within the municipality). It is important especially with regard to decision-making about localisation of newly established RCSs.
Research focusing on the evaluation of the above-mentioned assumptions in particular municipalities where new RCSs are currently being established will start in the spring of 2018.

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SPATIAL ANALYSIS OF THE TERTIARY EDUCATIONAL ATTAINMENT IN EUROPEAN UNION

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Abstract

Considering the Europe 2020 strategy's target to achieve at least 40 % of 30-34-year-olds completing tertiary education, this paper deals with the analysis of regional disparities in tertiary educational attainment across the 251 NUTS 2 (Nomenclature of Units for Territorial Statistics) regions of the European Union during the period 2010-2016 using the tools of spatial analysis. Since the individual EU regions do not act as isolated entities, the paper highlights the importance of the spatial interaction and geographical location. The exploratory spatial data analysis (ESDA) enabled to detect huge disparities among analysed regions both at national and subnational level indicating some regions with already achieved target as well as regions fairly below the target of 40 %. The global and local Moran's *I* tests permitted to identify the spatial patterns in the analysed area (without dramatical change during the analysed period) as well as the existence and persistence of regional disparities.

Keywords

Disparity, Europe 2020, spatial analysis, tertiary education

Introduction

In 2010 the European Union (EU) launched a strategy for smart, sustainable and inclusive growth: Europe 2020 strategy (European Commission, 2010). The short-term challenge is to achieve a successful exit from the crisis. To ensure a sustainable future, to boost growth and jobs, the EU has defined five objectives on: employment, innovation, education, social inclusion and climate/energy, to be reached by 2020. All these targets are mutually linked, e.g. in the context of education it seems to be obvious that better educated population is easier employable which further implies reduction of poverty.

However, one has to bear in mind that there are huge differences among the individual Member States both at national and subnational level. Various approaches can be used to identify the existing disparities and to propose solutions to eliminate them (see e.g., Hančlová and Tvrdý, 2004). One of the approaches that has become very popular in recent years is the use of spatial data analysis tools and spatial econometrics, which also allow for the possible spatial dependencies among regions. From a practical point of view, to solve the problem of regional disparities, this means that support for the development of one region can significantly affect not only this region but also geographically close regions. Instruments and methods of spatial statistics and spatial econometrics in the analysis of regional disparities in the area of education can be found e.g., in Rodríguez-Pose and Tselios (2007), Elias and Rey (2011), Chocholatá and Furková (2015), Chocholatá and Furková (2017). Concerning the issue of tertiary education attainment in the context of the Europe 2020 strategy, there is a valuable study presented by Dragomirescu-Gaina, Elia and Weber (2015) who posed the question whether the Europe 2020 target on tertiary education could be achieved. Based on a panel data approach they concluded that Europe is likely to achieve its target, but they presented also some doubts with respect to real economic convergence. Pagliacci (2014) analysed the Europe 2020 challenges and regional disparities (with

concentration on two components – smart and inclusive growth; and role of tertiary education) based on principal component analysis and spatial analysis. He proved huge territorial imbalances throughout the EU-27 and pointed out the fact that geography plays a key role in the achievement of Europe 2020 strategy's targets.

Regarding the Europe 2020 strategy's target to achieve at least 40 % of 30-34-year-olds completing tertiary education, the subject of this paper is the analysis of regional disparities in tertiary educational attainment across the 251 NUTS 2 (Nomenclature of Units for Territorial Statistics) regions of the European Union during the period 2010-2016 using the tools of spatial analysis. In section *Methodology*, we briefly describe the methodology used, section *Results* based on graphs and maps presents the data used for analysis as well as the results of the spatial analysis of the tertiary educational attainment indicator, section *Discussion* compares the results with the other relevant researches and last section concludes with challenges for the future research.

Methodology

Different approaches can be used to analyse the regional disparities, in this paper we will focus on the spatial data analysis. Currently there exists a wide range of available software, including freely available software, GeoDa (Geographic Data Analysis) and R. The conventionally used approach to explore the spatial structure of regional data is the exploratory spatial data analysis (ESDA) approach that includes, in addition to graphical representation of analysed data and calculation of different inequality measures[1], using of the several types of maps (e.g., percentile map, box map, quantile map). Based on the so-called Tobler's first law of geography: 'Everything is related to everything else, but near things are more related than distant things' (Tobler, 1970: 234), the analysis should also consider the so-called spatial effects, in particular the spatial autocorrelation. The concept of spatial autocorrelation is an analogy of temporal autocorrelation. However, it is not a correlation over time, but a correlation of the variable with itself through the space, and thus the assessment of the extent to which events in one region may have an impact on events in another region. To express interactions between regions, it is necessary to specify the spatial weight matrix **W** of dimension ($n \times n$), where n is the number of regions in the data set. The most commonly used is the contiguity matrix **W** where the contiguous neighbours are defined analogously as in the game of chess, i.e., the rook's case, the bishop's case and the queen's case.[2] ESDA also includes testing of spatial autocorrelation using various global and local statistics. Since the global statistics provide us a measurement of the global spatial autocorrelation, local statistics assess the spatial autocorrelation for one spatial unit (region). The most well-known indicators include global and local Moran's *I* statistics, which GeoDa software also provides. The local Moran's *I* statistic for individual regions can be calculated as follows (Anselin, 1995):

$$I_i = \frac{(x_i - \bar{x}) \sum_{j=1}^{n} w_{ij}(x_j - \bar{x})}{\frac{1}{n} \sum_{i=1}^{n} (x_i - \bar{x})^2} \qquad i \neq j \qquad (1)$$

1 In general, different inequality measures can be employed (Kutscherauer et al., 2010), e.g., max/min ratio, coefficient of variation.

2 For more information on different specifications of spatial weights see e.g., Getis (2010) and Furková (2016).

where I_i denotes a decomposition of the global Moran's *I* statistics, x_i represents the underlying variable for region *i*, $\bar{x}$ denotes the sample mean, *n* is the number of regions in the data set and w_{ij} are the elements of spatial weight matrix. GeoDa software enables also to visualise the spatial pattern and spatial clustering based on the Moran's scatterplot capturing both the global (in the form of the slope of the regression line) and the local measures. With values divided into four quadrants it enables to identify regions with positive spatial autocorrelation (high-high and low-low) and with negative spatial autocorrelation (low-high and high-low), respectively. Positive spatial autocorrelation means that the region is "similar" to its neighbours while the negative spatial autocorrelation indicates that the region "differs" from its neighbouring regions. An essential information about the clusters as well as about the so-called spatial outliers is provided by the LISA (Local Indicators of Spatial Association) cluster map. The use of GeoDa software also enables to calculate the differential Moran's *I* to find out if an analysed variable's change over time in a given region is statistically related to that of its neighbours.

Results

The empirical part of the paper uses the data on the tertiary educational attainment[3] across the 251 NUTS 2 regions of the European Union for the period 2010-2016, which were obtained from the REGIO database of the Eurostat (Eurostat, 2017a). From a shapefile containing the regions of Europe (Eurostat, 2017b), a set of 251 NUTS 2 regions of the EU Member States was extracted in GeoDa. The original data set containing 272 NUTS 2 regions of the 28 EU Member States was reduced by excluding of the 20 island regions of Cyprus, Malta, France, Finland, Spain, Greece, Portugal and Italy and 1 Italian region more due to the missing data.

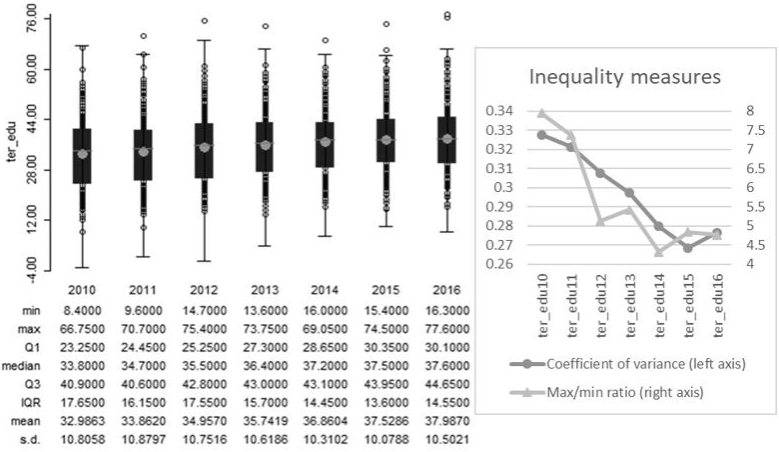
The box plot of the tertiary educational attainment for the analysed NUTS 2 regions of the EU Member States together with the graphical illustration of the two inequality measures for the period 2010-2016 are depicted in Figure 1. As the mean values gradually increased from 32.99% to 37.99 % over the period analysed, the diminishing of disparities among the analysed regions is indicated by the declining values of the coefficient of variance[4] during 2010-2015 period followed by a moderate rise in 2016. Based on the max/min ratio (i.e., concerning only the extreme values) no straightforward evidence of diminishing of disparities was proved. The mean values of the analysed indicator during the period 2010-2016 for all the 28 EU Member States as well as for the EU as a whole[5] can be found in Figure 2.

Highest share of those aged 30-34 with tertiary education during 2010-2016 period is in Lithuania, lowest in Romania and Italy. On average, in the EU28 the proportion of those aged 30-34 having completed tertiary education increased from 33.8% in 2010 to 39.1% in 2016. In eleven Member States (Belgium, Denmark, Ireland, Spain, France, Cyprus, Lithuania, Luxemburg, Finland, Sweden and UK) the target of 40% of 30-34-year-olds who had completed tertiary education was fulfilled during the whole analysed period 2010-2016. In the majority of Member States, the proportion of population aged 30 to 34 with completed tertiary education during the analysed period increased.

3 The analysed indicator 'is defined as the percentage of the population aged 30-34 who have successfully completed tertiary studies (e.g. university, higher technical institution, etc.). This educational attainment refers to ISCED (International Standard Classification of Education) 2011 level 5-8 for data from 2014 onwards and to ISCED 1997 level 5-6 for data up to 2013. The change of ISCED has no impact on the comparability over time of this indicator for all Member States, except Austria' (Eurostat, 2018b: 4). The indicator is based on the EU Labour Force Survey.

4 Calculated as a ratio of the standard deviation and mean.

5 The data were retrieved from (Eurostat, 2018a).



	2010	2011	2012	2013	2014	2015	2016
min	8.4000	9.6000	14.7000	13.6000	16.0000	15.4000	16.3000
max	66.7500	70.7000	75.4000	73.7500	69.0500	74.5000	77.6000
Q1	23.2500	24.4500	25.2500	27.3000	28.6500	30.3500	30.1000
median	33.8000	34.7000	35.5000	36.4000	37.2000	37.5000	37.6000
Q3	40.9000	40.6000	42.8000	43.0000	43.1000	43.9500	44.6500
IQR	17.6500	16.1500	17.5500	15.7000	14.4500	13.6000	14.5500
mean	32.9863	33.8620	34.9570	35.7419	36.8604	37.5286	37.9870
s.d.	10.8058	10.8797	10.7516	10.6186	10.3102	10.0788	10.5021

Figure 1: Box plot and inequality measures for the tertiary educational attainment (in %), age group 30-34, 2010-2016 (source: own calculation)

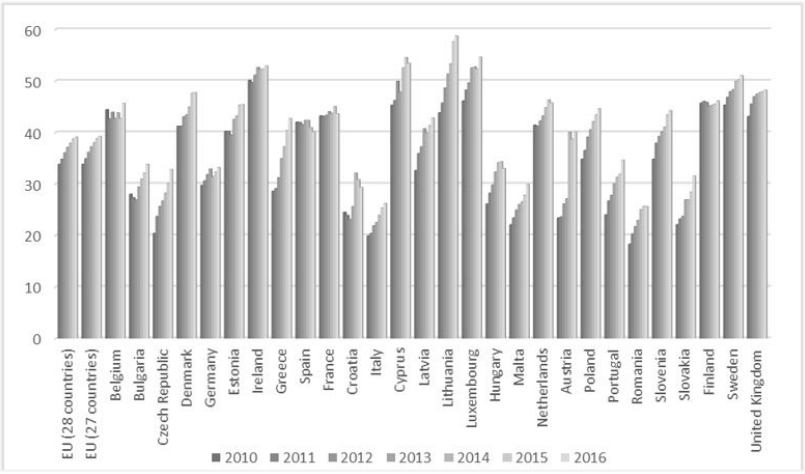
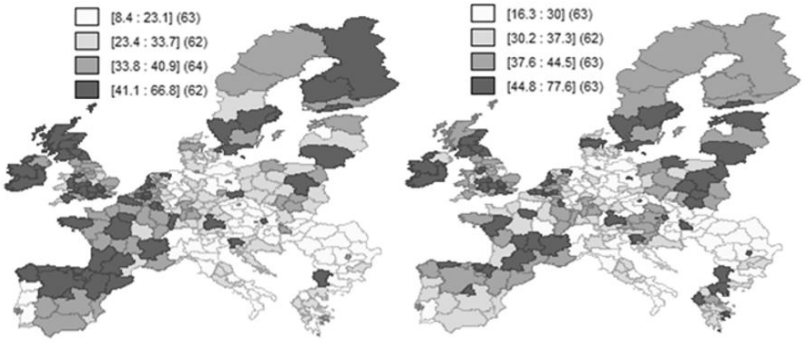


Figure 2: Tertiary educational attainment (in %, age group 30-34) in individual EU Member States, 2010-2016 (source: own calculation)

Quantile maps (Figure 3) enable to further display the disparities among regions both at the national and subnational level. In 2010, regions with the lowest proportion of the population aged 30-34 with completed tertiary education were situated in the Czech Republic, Italy and Romania; however, some other regions in central, eastern and southern parts of the EU belong to this category as well. Since in 2016, the proportion of those aged 30 to 34 who had completed tertiary education increased compared with 2010, still very low values were detected for regions in Romania and Bulgaria. On the other hand, the highest share of tertiary educated people aged 30-34 (year 2010) was detected in French, Belgic and UK region as well as in some other regions located mainly in western and northern Europe. Danish and the UK regions were the

best in 2016. In comparison to 2010, more regions in eastern and southern Europe (e.g., Polish and Greek regions) could be included into the group of regions with the highest proportion of tertiary educated population. Although the quantile map visualization provides information on the possible existence of spatial clusters of regions with a similar proportion of those aged 30-34 having completed tertiary education, this approach does not indicate anything about the statistical significance or insignificance of the clusters. This shortcoming can be solved by the application of other spatial data analysis tools, namely by testing whether the region's location affects the share of tertiary educated population. Before testing for spatial autocorrelation, it is necessary to specify which regions will be considered as neighbours. In this paper we used the queen contiguity weight matrix in which two regions are considered as neighbours if they share any part of a common border. With the use of the GeoDa software we computed the global Moran's *I* statistics for each year of the analysed period 2010-2016. The dynamics of the Moran' *I* statistics during 2010-2016 period together with the Moran's scatterplot reflecting the spatial pattern in 2016 are captured in Figure 4. Using the randomization approach based on 999 permutations we proved the statistically significant positive spatial autocorrelation during the whole analysed period. It is much more likely that regions with high (low) proportion of population with completed tertiary education will have neighbours with also high (low) share of tertiary educated population than in case of pure randomness.



(a) 2010 (b) 2016

Figure 3: Quantile maps for the tertiary educational attainment (in %), age group 30-34, (a) 2010 and (b) 2016 (source: own calculation)

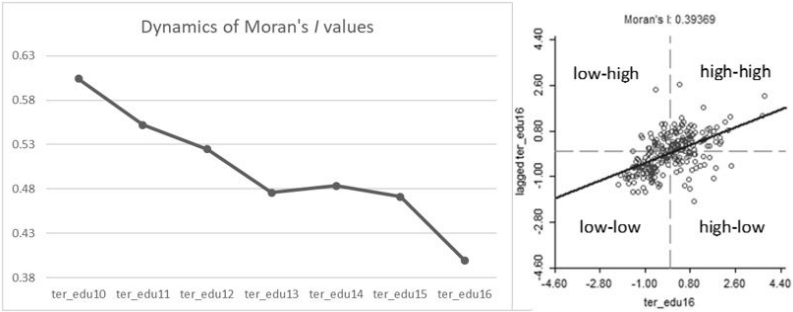


Figure 4: Dynamics of Moran's *I* values, 2010-2016 and Moran's scatterplot, 2016 (source: own calculation)

Regarding the regions' specific details, the LISA cluster maps (Figure 5) indicated many regions with statistically significant positive spatial autocorrelation (high-high, low-low) and only few regions with the statistically significant negative spatial autocorrelation (high-low, low-high). The statistically significant positive spatial autocorrelation of high-high type means that regions as well as their neighbours have had the above-average values. In 2010, we can identify 45 regions with this type of spatial autocorrelation. These regions were located in Belgium, Denmark, Spain, Finland, France, Ireland, Netherland, Sweden and the UK. The 52 regions of the low-low type positive spatial autocorrelation, i.e., regions as well as their neighbours with the below-average values, belonged to Austria, Bulgaria, the Czech Republic, Germany, Greece, Croatia, Hungary, Italy, Romania, Slovenia and Slovakia. In 2016, regarding the statistically significant positive autocorrelation, only 21 regions of high-high type and 43 regions of low-low type can be identified. Concerning the high-high type of spatial autocorrelation it is interesting to mention the significance of 3 Polish regions and a Latvian region. The statistically significant negative autocorrelation of high-low type indicating the above-average values in a region surrounded by neighbours with below-average values was detected mostly for regions of some capital cities or regions with universities and research centres (e.g., in Romania both in 2010 and 2016, Slovakia in 2010, Germany in 2016), since these regions attract highly qualified population, enable better opportunities for further education and better career prospects. In case of low-high type autocorrelation are the values in analysed region lower than average while the values in neighbouring regions are above the average. Furthermore, the value of the global differential Moran's *I* of 0.374 confirms the existence of positive spatial autocorrelation, i.e., that the change in the share of those aged 30-34 with tertiary education between 2010 and 2016 in a given region is statistically related to that of its neighbouring regions[6].

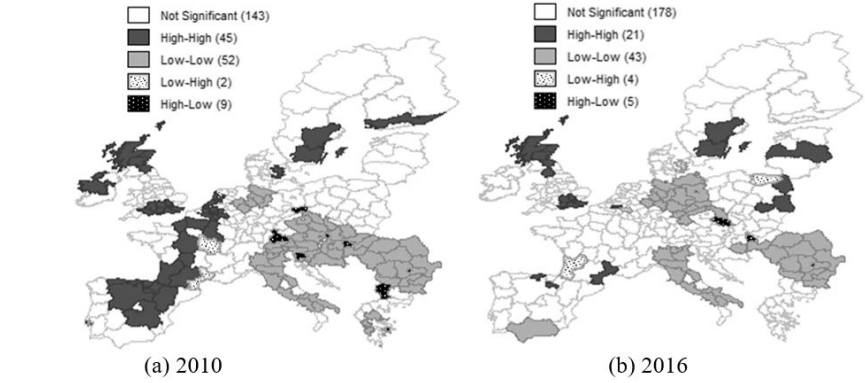


Figure 5: LISA cluster maps for the tertiary educational attainment (in %), age group 30-34, (a) 2010 and (b) 2016 (source: own calculation)

Discussion

This paper, similarly as some other studies dealing with the education attainment in European regions (Pagliacci, 2014; Rodríguez-Pose and Tselios, 2007; Chocholatá and Furková, 2017), confirms that geography plays a vital role regarding the Europe 2020 strategy's targets. These

6 Differential Moran's scatterplot and LISA cluster map for the change in the share of those aged 30-34 with tertiary education between 2010 and 2016 are available from the author upon request.

studies revealed that the EU, both at the national and subnational level, must cope with huge territorial disparities. The positive spatial autocorrelation indicates that the regions with a high (low) proportion of population aged 30-34 with the tertiary education tend to be located nearby to and clustered with other regions that have also high (low) proportion of those aged 30-34 having completed tertiary education. Our results are in line with Pagliacci (2014) who states that it is problematic to consider the EU to be a homogenous area with regard to the Europe 2020 strategy. Furthermore, we proved that the territorial disparities tend to persist over time (in line with results of Rodríguez-Pose and Tselios, 2007; Chocholatá and Furková, 2017) and we identified some regions of capital cities as „well educated" and some rural regions performing not so well. However, the problem of capital cities and big cities with the centralisation of the main services is a general problem mentioned by e.g. Elias and Rey (2011) while analysing Peruvian regions. Spatial analysis can therefore serve as a useful support for policy makers to make proper decisions considering the presence of spatial spill-overs among regions.

Conclusion

The aim of the paper was to point out the extent and dynamics of disparities in the proportion of population aged 30-34 with the tertiary education among the individual NUTS 2 regions of the EU during 2010-2016 period. Based on the spatial data analysis tools, significant differences in the level of the analysed indicator were confirmed as well as a considerable spatial dependence and the persistence of these disparities over time. To achieve the Europe 2020 strategy's target of at least 40 % of 30-34-year-olds with completed tertiary education by 2020, the spatial analysis proved that educational policies both at the EU and national levels should take into account the spill-over effects between neighbouring regions. Policy makers should thus concentrate on more place-based policies and think in long-term perspectives to make the Europe 2020 strategy more effective (Pagliacci, 2014). Analysing the relationships between the proportion of those aged 30-34 having completed tertiary education and the economic growth of the corresponding region and income of households, respectively could be the interesting topics for the future work.

Acknowledgement

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PERSONALITY AND STRESS COPING AT CZECH UNIVERSITY OF LIFE SCIENCES STUDENTS

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Abstract

Lessons dedicated to mental health issues are important part of a curriculum. Authors of this paper are concerned with the efficiency of the lessons with the special focus on an effect of personality variables, namely extraversion and neuroticism, on preference of stress coping strategies. The issue of relationship between extraversion resp. neuroticism and use of stress coping strategies by undergraduate students at Czech University of Life Sciences (CULS) (n=109) was investigated. The data were collected with the use of standardised questionnaires SVF 78 and EOD. The mutual relationship of the variables was tested by Spearman's correlation coefficient. The results indicate association of negative coping strategies in general with neuroticism and positive strategies in general with extraversion. Practical implications of the findings are discussed and interventions for mental health reinforcement are recommended.

Keywords

Coping strategies, education, mental health, personality variables, stress, undergraduate students

Introduction

Significance of lessons dedicated to mental health in a university curriculum is not questioned any more. Mental health and the care of it has got into the focus of modern society, therefore it comes as no surprise that nowadays, lessons dedicated to mental health and well-being awareness belong to the essential part of education curricula for adolescents. One of the reasons is, as Holte (2015) points out that the inclusion of mental health in educational policies has a very favourable cost-benefit ratio - it releases large societal resources, which again have a broad range of positive impacts, including educational ones.

All young adults have to undergo numerous important life changes connected with their stage of life, those who study at a university have even larger number of stressful events to cope with. Particularities of coping with stress by undergraduate university students with regard to the gender, age and role conflicts were previously examined by Chýlová and Natovová (2012) or Natovová and Chýlová (2012).

The deeper knowledge of preferred stress coping strategies could be considered to be the crucial moment on a way to better the mental health and well-being awareness. There might be expressed various opinions on a way certain coping strategy is chosen – whether the principal role in this decision making play the circumstances or the personality traits (more details in Chýlová and Natovová, 2012). Balcar, Trnka and Kuška (2011) answer the previously asked question that their results support usefulness of common factor of stress coping strategies as a habitual trait. Windle and Windle (1996) concluded their findings that task-oriented copings are general in their predictive relations to the outcome variables, whereas emotion-focused copings are highly specific. We follow the concept of coping conceived mainly as a habitual trait.

Some researchers referred about the larger role of personality determinants of the coping response

than has been traditionally held. For example, Balcar, Trnka and Kuška (2011) stress that coping strategies belong undoubtedly to the most relevant variables for human performance and health. Slavíková, Blatný and Kohoutek (2008) studied the personality context of preference of stress coping strategies at university students. Amirkhan et al. (1995) examined the influence of personality on the use of social support and other coping strategies at students. Brougham et al. (2009) found that women reported greater use of emotion-focused coping strategies than men, however, the use of emotion-focused coping strategies dominated over problem-solving strategies for all the students. Friedlander et al. (2007) examined the joint effects of stress, social support, and self-esteem on adjustment to university. The research revealed that increased social support predicted decreased stress and better overall adjustment to the university.

Next to the general influence of stress and coping responses to the adjustment to the university, certain personality variables were thoroughly scrutinised in order to yield the answer to the question about its connection to the coping. The most often examined one is neuroticism. Gunther et al. (1999) studied the influence of neuroticism on the occurrence of different types of daily events, appraisals of those events and use of specific coping strategies. Individuals with high level of neuroticism reported more interpersonal stressors and reacted with more distress in response to increasingly negative appraisals while they used less-adaptive coping strategies. However, Paulík et al. (2009) argue that the relationship between personality traits and stress coping on a basis of the general characteristics could be predicted only partially and only on a general level. Tichý (2011) concludes that reliable prediction of a coping only on the basis of personality traits is apparently not possible so the issue should be studied in its complexity.

More detailed view on a neuroticism from the sex differences revealed negative correlation with positive emotional-focused coping style and positive correlation with negative emotional-focused coping style in female students, while it was positively correlated with negative emotional-focused coping styles in male students (Karimzade, 2011). As a positive impact of the high level of neuroticism its positive relationship to very strong work commitment could be mentioned (Clark, Lelchook and Taylor, 2010).

The second most often mentioned personality characteristic in connection with coping strategies is extraversion, though the frequency of its appearance in researches is markedly less frequent. Extraversion was positively correlated with problem-focused and positive emotional-focused coping style in students in a study by Karimzade (2011).

Because of the high complexity of the issue the goal of our study is to describe and analyse the effect of personality variables (neuroticism and extraversion) on preference of various types of stress coping strategies at a specific group of students from CULS. The null hypothesis of a non-existence of any association between extraversion or neuroticism and coping strategies is postulated and will be tested.

After the brief description of the current state of the art in the research field in Introduction, above, in section Materials and methods group of respondents and methods for data collection and analysis are described. Following section, Results, is dedicated to the most important findings arisen from the statistical analysis of the data. Next, the section Discussion offers comparison of our results with other similar researches. The paper is finished with practical implications of such findings and interventions to the mental health lessons in the section Conclusion.

Materials and Methods

A nonexperimental research design was used for the purpose of this study, the data collection was realised during the winter semester 2017/ 2018.

Research sample

The research sample consisted of 109 undergraduate students of Faculty of Economics and Management at the Czech University of Life Sciences, from bachelor (49 students) as well as master (60 students) study programmes. The sample consisted of 35 males (32 %) and 74 females (68 %). The mean age of the respondents was 28.3 years (std. dev. 7.8), with quite a wide extent, ranging from 19 years to 54 years of age.

Method

Czech version of the Eysenck Personal Inventory (Rocklin and Revele, 1981) called EOD (Miglierini and Vonkomer, 1979) was used in order to decide on the personality variables of the sample – extraversion and neuroticism. The inventory consists of 57 items, with the answers yes/no. Next to it Czech version of the Stress Coping Style Questionnaire SVF 78 (Janke and Erdmann, 2003) was used. It is a questionnaire based on the trait approach, it is constructed of 13 scales (each consists of 6 questions with answers on a Likert type scale 0-4 = very likely-very improbable), which can be divided into groups of positive and negative stress coping strategies.

Statistical analysis

In order to test the null hypothesis of a non-existence of any association between personality variables (extraversion and neuroticism) and preferred stress coping strategies following statistical procedures were used:
Firstly, to describe the group of respondents and descriptive characteristics of studied variables the descriptive statistic was run.
Consequently, the hypothesis of the normal distribution of the variables was tested with the use of Kolmogorov-Smirnov normality test and also with the Shapiro-Wilk's modification, which is recommended for smaller samples. With regard to the results, the use of particular correlation coefficient method was decided – because of non-normal distribution of more than half of the variables the Spearman's rank correlation was run.
The IBM SPSS 21 statistics program will be used for its computation (Norušis, 2012).

Results

The descriptive analyses of the sample and tested variables in accord with the tested hypothesis was run, its results are displayed at Table 1.
Following the description of the data, the normal distribution hypothesis of the variables was tested, with the use of Kolmogorov – Smirnov as well as Shapiro-Wilk tests (more appropriate for smaller samples) (shown in Table 2).

Descriptive Statistics					
	Mean	Std. dev.	n	Minimum	Maximum
Age	28.28	7.76	109	19.00	54.00
Extraversion	12.33	3.68	102	2.00	21.00
Neuroticism	11.27	5.47	102	2.00	23.00
Minimization	11.02	5.65	109	0.00	24.00
Denial of Guilt	11.28	3.81	109	0.00	22.00
Distraction	13.02	4.12	109	0.00	22.00
Substitute Gratification	11.95	5.26	109	1.00	24.00
Situation Control	16.78	3.91	109	5.00	24.00
Reaction Control	15.67	3.79	109	6.00	24.00
Positive Self - Instructions	16.26	4.38	109	1.00	24.00
Need for Social Support	15.56	5.05	109	4.00	24.00
Avoidance	14.36	4.99	109	0.00	32.00
Escape	11.07	10.57	109	2.00	110.00
Rumination	15.33	5.80	109	0.00	24.00
Resignation	8.66	4.36	109	0.00	22.00
Self-blame	10.38	4.76	109	0.00	22.00
POSITIVE - total	13.88	2.72	109	6.42	22.29
NEGATIVE - total	11.12	3.93	109	1.00	21.00

Table 1: Descriptive statistics, 2018 (source: own calculation)

	Test of normality – Kolmogorov-Smirnov		Test of normality – Shapiro Wilk		Spearman's Rho - Extraversion		Spearman's Rho - Neuroticism	
	Stat.	Sig.	Stat.	Sig.	Correl. Coeff.	Sig. (1-tail.)	Correl. Coeff.	Sig. (1- tail.)
Age	-	-	-	-	-0.112	0.131	**-0.176***	0.039
Extraversion	0.112	0.003	0.976	**0.064**	1.00	-	**-0.190***	0.028
Neuroticism	0.082	0.087	0.968	0.013	**-0.190***	0.028	1.00	-
Minimization	0.062	**0.200**	0.986	**0.338**	**0.256****	0.005	**-0.499****	0.000
Denial of Guilt	0.108	0.005	0.972	0.031	0.072	0.235	-0.091	0.183
Distraction	0.067	**0.200**	0.989	**0.556**	0.010	0.460	-0.098	0.163
Substitute Gratification	0.078	0.138	0.981	**0.140**	0.090	0.185	**0.277****	0.002
Situation Control	0.114	0.002	0.973	0.034	0.000	0.499	-0.131	0.095
Reaction Control	0.086	0.059	0.984	**0.243**	0.128	0.100	**-0.245****	0.006
Positive Self-Instructions	0.080	0.111	0.961	0.004	**0.201***	0.021	**-0.266****	0.003
Need for Soc. Support	0.103	0.010	0.971	0.025	0.001	0.498	**0.354****	0.000
Avoidance	0.092	0.034	0.982	**0.189**	**-0.194***	0.026	0.041	0.342
Escape	0.239	0.000	0.409	0.000	-0.157	0.057	**0.428****	0.000
Rumination	0.132	0.000	0.952	0.001	-0.110	0.136	**0.488****	0.000
Resignation	0.127	0.000	0.958	0.003	**-0.165***	0.048	**0.487****	0.000
Self-blame	0.074	0.188	0.986	**0.366**	-0.115	0.124	**0.567****	0.000
POSITIVE - total	0.044	**0.200**	0.989	**0.551**	**0.202***	0.021	**-0.242****	0.007
NEGATIVE - total	0.064	**0.200**	0.979	**0.108**	-0.133	0.091	**0.635****	0.000

**-sig at 0.05; ** - sig. at 0.01; df = 102, n = 102*

Table 2: Tests of normality and Spearman's correlation, 2018 (source: own calculation)

According to the results of tests of normality, we conclude that most of the data does not come from a normal distribution. Therefore the Spearman's rank correlation will be used in order to

ascertain the hypothesis of the relationship between personality variables and coping strategies. The results of the correlations are shown in Table 2.

The results indicate statistically significant (sig. at 0.01) relationship between neuroticism and negative stress coping strategies, as well as negative association with positive strategies. Neuroticism seems to be important personality variable in connection with stress coping, particularly the negative ones – it displays statistically significant correlation with each of the individual scale from the negative spectrum of strategies. Besides, it was proved that there is strong negative relationship between the neuroticism and the constructive group of positive strategies (Situation Control: -0.13.; Reaction Control: -0.245; Positive Self-Instructions: - 0.266), which are considered to be the most useful ones from the longer time perspective. It could be seen, that students with higher level of neuroticism reported significantly higher level of Substitute gratification, which is Positive stress coping strategy (0.277). The results also revealed quite surprisingly significantly higher level of the Need for social support (0.354) at students with high neuroticism than at extraverts. Social support is widely perceived as a strong protective factor when coping with stress.

The extraversion does not show any statistically significant relationship to overall negative strategies, whereas there could be seen association with positive stress coping strategies in total. Higher level of extraversion is associated with Minimization of the stress situation, Positive Self-Instructions – which belong to the most effective strategies. Negatively is correlated with Avoidance and Resignation, which testify against the negative coping responses.

The null hypothesis of a non-existence of any association between extraversion resp. neuroticism and coping strategies was tested. In accordance with the above described results, it may be concluded that there exists a relationship between both studied personality variables and used stress coping strategies, which is especially manifested in a case of neuroticism and the preference of negative stress coping strategies.

Besides answering the main objective of this study, the results point to the relationship of the age and neuroticism, which is going to be thoroughly explored in another study.

Discussion

In line with previously described researches, the results from our study point to the stronger connection between coping strategies and neuroticism than between extraversion and these strategies at our research sample. Neuroticism seems to prove to be important predictor of the way students respond to the stress events in a negative way. That result is supported by the findings of Gunthert et al. (1999), who expect the chronic negative affectivity associated with neuroticism to be possibly explained by the negative appraisal of stress situations.

As an amendment to the main objective of our study, the negative association of neuroticism to the age of respondents was revealed. Similarly, Donnellan and Lucas (2008) declared neuroticism to be slightly negatively associated with age. They described also negative association of extraversion with age, which was not proved significant in our sample.

It was proved that the level of perceived distress and maladaptive stress coping strategies is associated with adjustment problems of the students (Hampel et al., 2005). Quite surprisingly Windle and Windle (1996) discovered that positive daily events predicted higher levels of alcohol use and delinquent activity, as well as higher academic performance, which could be possibly connected to the high level of sensitivity of neurotics and their work commitment (in Clark, Lelchook and Taylor, 2010).

With regard to the evident influence of personality characteristics on the coping with stress, we believe that they should be taken into account while designing syllabi for the lessons dedicated to mental health. One possibility would be to create smaller groups to correspond better with the needs and personality traits induced preferences. Association of school and college leaders in the

UK stress that schools nowadays offer a wide range of support dedicated to mental health and well-being awareness, including lessons and small group work (ASCL, 2016).

Conclusion

Our results point to the strong relationship between neuroticism and the use of negative stress coping strategies, as well as to the negative association with the positive strategies. Neuroticism therefore seems to be highly important personality variable in connection with stress coping, particularly the negative one – it displays statistically significant correlation with each of the individual scale from the negative spectrum of strategies. Neuroticism display stronger association with coping strategies than extraversion, which shows certain association with positive stress coping strategies in total. Neuroticism should not be considered to be strictly negative personality traits – it has its advantages and disadvantages even when coping with stress, which makes the insight into choice of particular coping strategies interesting.

The matter of concern to the authors is the way of incorporation of these findings into better practical utilisation in lessons dedicated to mental health and its awareness; to improve the current form of the lessons to be more beneficial for the students with different needs (for example in a way of training different stress reducing techniques).

From the previous experience, we may strongly recommend to focus on preventive programs and to strengthen the proactive coping awareness. As Holte (2015) states, positive mental health and well-being is a key factor for social cohesion, economic progress and sustainable development in the EU.

The results of this study have implications also for designing stress reduction workshops that build on the existing adaptive emotion-focused strategies of students. These programs can promote better mental health through the curriculum. Next to it, initial counselling for those experiencing difficulties should also be provided.

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TAX COURSES EXAMS RESULTS AT FEM CULS PRAGUE EVALUATION

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Abstract

This paper deals with students' success rate of exams in tax courses taught at the Faculty of Economics and Management, Czech University of Life Sciences Prague. One of the objectives of the research is to verify whether there is a statistically significant difference in the exam success rate among students of different courses of study. The main objective having a practical impact was to establish a model which, based on the number of enrolled students, will provide information on the needed number of places to be open for students during the exam period. The data were drawn from the FEM CULS information system for the academic years 2014/2015–2017/2018. The results of testing statistical hypotheses show that there is no statistically significant difference in the success rate in the examinations among students of different courses who successfully passed the exam on the first attempt, on the second attempt or on the third attempt. The results of the model of the number of places for exam terms show that the need of places is 1.42 multiple of the number of students enrolled in the given courses.

Keywords

Exam, student, success, tax education, university

Introduction

Knowledge of the tax system is certainly one of the basic knowledge of a student and university graduate focusing on economics. In the Czech Republic, attention is now paid to financial literacy (e.g. Beranová et al., 2017), this issue is dealt with in other countries as well (Ergun, 2018; Garg and Singh, 2018). Financial literacy is also related to knowledge of the tax system because taxes reduce disposable income (CZSO, 2013). Higher level of tax literacy is also motivated by the country's legislation. The failure to comply with tax laws results in sanctions or punishment, and this also affects the increase of the level of tax literacy and voluntary fulfillment of tax obligations (Ionel, 2014). Researches show that a higher level of education positively affects the future behaviour of taxpayers. An important factor is the influence of parents and surroundings, which motivates the student to need of higher education at university (Chitu et al., 2014). Tax education can change behaviour and attitudes to taxes not only of students but also of citizens (Neto and Marcondes, 2013). An example may be a project that tested the adequacy of the Irish education system in relation to tax payments (Keogh and Tynan, 2012). Tax motivation is influenced by many factors, the aim of the Turkish study from 2015 was to determine the impact of education of university students on their future behaviour as taxpayers (Goksu and Sahpaz, 2015). Assessment of the impact of tax knowledge on taxpayers' behaviour in Malaysia solves study by Palil and Mustapha (2012).

The survey from 2013 in six Southeast European countries shows that a black economy can be tackled with the help of increased tax literacy (and tax education campaigns) (Williams and Horodnic, 2015). Some studies assess the influence of teachers' attitudes on teaching students. E.g. Aragones-Jerico, Lopaz-Perey and Campos-Aparicio (2015) stated that knowledge of the

importance of ethical values should motivate teachers to complement tax literacy. The ways of teaching and eventual focus on practice are important. Best and Schafer (2017) state that active teaching approaches are used to enable students to use communication, critical thinking and interpersonal skills. In another study, the students take on the role of accountants, the students have been given all the necessary documents to communicate with the client in order to compile a tax return for income tax (Morrow and Stinson, 2016).

Subjects on basic principles of the Czech tax system are included in the group of courses taught at the Faculty of Economics and Management (FEM) of the Czech University of Life Sciences Prague (CULS), in both full-time and combined form of study. The content and way of teaching in the tax courses are the same for all students in both full-time and combined form of study. Verification of acquired knowledge is also done in the same way, especially in the form of a written test and an additional oral exam. The exam results from these subjects have not yet been evaluated comprehensively, so they have become the subject of our research. In the past, in some of the subjects at FEM CULS Prague, the success rate of students has already been evaluated. E.g. Šánová et al. (2014) evaluated the success rate of students in the Food Goods Knowledge Subject in relation to the reduction in the amount of teaching hours, or Kučera, Svatošová and Pelikán (2015) who evaluated the relationship between the results of admission tests in mathematics and the results of tests in two subjects taught during the first year of the bachelor study.

Our research is aimed at verifying the fact whether there is a statistically significant difference in the success rate of the exams among students of different courses. The main objective with a practical impact is to create a model, which based on the number of enrolled students, will provide information on the need of number of places to be open for student of tax courses during the exam period.

Materials and Methods

Our research is focused on the courses covering basic principles of the tax system in the Czech Republic in both full-time and combined form of study. The data are drawn from the FEM CULS Prague internal information system for academic years 2014/2015–2017/2018 (T=4). The choice of the period is related to the changes in the tax system from 1 January 2014 and the unification of the concept of teaching these subjects from the academic year 2014/2015. The data have five cross-sectional units (I=5). Table 1 show the number of students who have enrolled in the subject, the number of students completing the exam – of which on first, second or third attempt. The last column is the number of students who have failed the exam.

The Table 1 shows the number of student passed successfully the exam during the numbered attempts and the number of failed ones. Nevertheless, the percentage success rate was used as a valid indicator during testing the hypothesis.

Year	Code	Number of students	First	Second	Third	Failed
2014/2015	EUE40E	157	128	12	6	11
2015/2016	EUE40E	146	105	27	10	4
2016/2017	EUE40E	128	77	42	6	3
2017/2018	EUE40E	99	64	26	6	3
2014/2015	EUEH3E	37	28	3	5	1
2015/2016	EUEH3E	34	21	8	1	3
2016/2017	EUEH3E	40	22	5	4	9
2017/2018	EUEH3E	43	24	7	6	6
2014/2015	EUEK3E	42	35	5	1	1
2015/2016	EUEK3E	49	30	10	6	3
2016/2017	EUEK3E	36	18	7	5	6
2017/2018	EUEK3E	37	18	6	5	8
2014/2015	EUEL3E	37	29	5	2	1
2015/2016	EUEL3E	44	29	7	4	4
2016/2017	EUEL3E	50	30	10	6	4
2017/2018	EUEL3E	37	22	6	5	3
2014/2015	EUES3E	31	24	3	3	1
2015/2016	EUES3E	21	12	4	1	4
2016/2017	EUES3E	19	9	5	2	3
2017/2018	EUES3E	19	18	1	0	0

Table 1: Number and Success rate of Students in the Exams, 2014-2017 (source: CULS)

Analysis of Variance (ANOVA)

The data were tested for normality distribution using the Kolmogorov-Smirnov test to check the structure of dataset for next steps consideration. The test of homogeneity of variances was realized with satisfying results. The Kolmogorov-Smirnov test shows normal data distribution at 5% significance level. Based on Levene's homogeneity test of variances, the assumption of equal variances is also not violated.

Exam attempt	Kolmogorov-Smirnov		
	Statistic	Df	Sig.
First	.165	20	.160
Second	.111	20	.200
Third	.122	20	.200

Table 2: Kolmogorov-Smirnov test of normality (source: own calculation, SPSS)

	Levene Statistic	df1	df2	Sig.
First	1.850	4	15	.172
Second	2.793	4	15	.065
Third	1.410	4	15	.278

Table 3: Levene's homogeneity of variances test (source: own calculation, SPSS)

The authors constructed three statistical hypotheses to test whether there is a statistically significant difference in the success rate of examinations among students of different courses.

- H01: There is no statistically significant difference among relative frequency of students of different courses who have passed the exam on the first attempt.
- H02: There is no statistically significant difference among relative frequency of students of different courses who have passed the exam on the second attempt.

- H03: There is no statistically significant difference among relative frequency of students of different courses who have passed the exam on the third attempt.

Model of number of places on exam time table

The model determines the required number of places on the exam time table on the basis of the number of students enrolled in the subject. The panel data has 20 records, based on which the coefficients of overall success rates are estimated. Linear regression through the origin was used for the calculation. If the independent variable is the number of students enrolled in the subject and the dependent variable is the number of students who passed the exam on the first attempt, then the slope of the curve tells the student's success rate on the first attempt. Equation in general form can be written as

$$y_j = \beta x_i + \mu. \tag{1}$$

Where y_j is a dependent variable, β is a regression coefficient (slope of the curve), xi is independent variable and i is a stochastic variable.
Declaration of variables:

$y_1 \ldots Number\ of\ students\ who\ passed\ the\ exam\ on\ the\ first\ attempt$

$y_2 \ldots$ *Number of students who passed the exam on the second attempt*

$y_3 \ldots Number\ of\ students\ who\ passed\ the\ exam\ on\ the\ third\ attempt$

$y_4 \ldots Number\ of\ students\ who\ failed\ the\ exam$

$x_1 \ldots Number\ of\ students\ who\ enrolled\ the\ subject$

Function (1) is no-intercept model because based on the logic of researched problem there can be no constant success (a) if no student is present (x). The authors have created four models, the declaration of which can be found in Table 4.

Model	Independent variable	Dependent variable
Model 1	Number of total students (x_1)	Passed the exam on 1st attempt (y_1)
Model 2	Number of total students (x_1)	Passed the exam on 2nd attempt (y_2)
Model 3	Number of total students (x_1)	Passed the exam on 3rd attempt (y_3)
Model 4	Number of total students (x_1)	Failed the exam (y_4)

Table 4: Description of models (source: own work)

Models are specified as follows:

$$y_1 = \beta_1 x_1 + \mu, \tag{2}$$

$$y_2 = \beta_2 x_1 + \mu, \tag{3}$$

$$y_3 = \beta_3 x_1 + \mu, \tag{4}$$

$$y_4 = \beta_4 x_1 + \mu. \tag{5}$$

The slope of the functions determines the distributional arrangement of the individual events, the sum of the coefficients being 1. The parameters are estimated through ordinary least squares method.

Required number of exam terms is then estimated as follows:

$$z_1 = \beta_1 x_1 + 2\beta_2 x_1 + 3\beta_3 x_1 + 3\beta_4 x_1. \quad (6)$$

Results

The results of one-way ANOVA implicate that we don't reject null hypotheses (H01, H02, H03) and thus there is no statistically significant difference among relative frequency of students of different courses who have passed the exam on the first, the second or the third attempt. Results are shown in the Table 5.

Attempt number	Passed Exams Rate Evaluation	Sum of Squares	df	Mean Squares	F	Sig.
First	Between Courses	256.090	4	64.022	0.333	.851
	Within Courses	2881.610	15	192.107		
	Total	3137.700	19			
Second	Between Courses	104.627	4	26.157	0.483	.748
	Within Courses	812.916	15	54.194		
	Total	917.544	19			
Third	Between Courses	115.916	4	28.979	1.603	.225
	Within Courses	271.231	15	18.082		
	Total	387.148	19			

Table 5: Analysis of Variance (source: own calculation)

Model of number of places on exam terms

From the course of linear functions, it is clear that 69.71% of students will successfully pass the exam on the first attempt, more than 18.39% of students on the second attempt, 6.43% on the third attempt, and almost 5.46% fail the exam. The results are summarized in Table 6.

	Coefficient	Standard error	p-value	R squared	p-value (F)
Model 1	0.697131	0.0221336	<0.0001	0.981207	<0.0001
Model 2	0.183975	0.0203400	<0.0001	0.811530	<0.0001
Model 3	0.0642957	0.00718189	<0.0001	0.808365	<0.0001
Model 4	0.0545983	0.00999884	<0.0001	0.610789	<0.0001

Table 6: Results of second analysis (source: own calculation)

All models and coefficients are statistically significant at 1% level of significance, so the confidence interval for predicted values of places for the exam is 99%. The coefficient of determination reaches values ranging from 61% to 98%.

The regression coefficients will allow, based on the knowledge of the success rate of previous years, to estimate the required number of exam places.

$$y_1 = 0.697 x_1 \quad (7)$$

$$y_2 = 0.184 x_1 \quad (8)$$

$$y_3 = 0.064 x_1 \quad (9)$$

$$y_4 = 0.055 x_1 \quad (10)$$

Where x_1 is the total number of students enrolled in the subject.

The practical significance of the given model was verified through a simulated scenario: Determination of the number of places for the exam terms from the subject Tax System in the

summer semester of the academic year 2017/2018. In the summer semester 2017/2018 the ammount of 383 (x_1) students is enrolled in the subject Tax System. Based on the number of students and knowledge of the coefficients, an estimate of the need for places for the exam terms was made. The number of places for the exam terms is determined as follows

$$z_1 = 0.697 * x_1 + 2 * 0.184 * x_1 + 3 * 0.064 * x_1 + 3 * 0.055 * x_1, \quad (11)$$

and then

$$545 = 0.697 * 383 + 2 * 0.184 * 383 + 3 * 0.064 * 383 + 3 * 0.055 * 383. \quad (12)$$

Of the total number of 383 students, 267 students will pass the exam on the first attempt, 70 for the second attempt, 25 for the third attempt and 21 will fail the exam.
If the success rate is comparable to the previous four years, the required number of places for the exam terms is 545. The number of places for the exam terms reaches 1.42 multiple of the number of students who have enrolled in the subject.

Discussion

A number of studies and researches in the field of tax education deals with the impact of education on increase of tax literacy (e.g., Keogh and Tynan, 2012), future taxpayers' behaviour (e.g., Goksu and Sahpaz, 2015, or Neto and Marcondes, 2013). None of the known research has evaluated the success rate of students in the framework of such education. One of the goals of our research was to evaluate students' success rate in examinations in two tax-related subjects. The evaluation of the success rate of students in other subjects in the Czech Republic was inveastigeted. Otavová and Sýkorová (2017) evaluated, if the way in which students were admitted could predict results in mathematics or students´ performance in general at University of Economics Prague. Klůfa (2015, 2016) studied dependence of the results of entrance examinations in mathematics on test variants at University of Egonomics Prague. Linda and Kubanová (2013) analysed relation between results of the entrance examination test in mathematics and examination in mathematics at University of Pardubice.
The evaluation of the success rate of students in specific subjects at FEM CULS Prague was also investigated. Svatošová and Pelikán (2017) evaluated, how strong is the impact of admission exam results upon the university study success at FEM CULS Prague. Šánová et al. (2014) evaluated the success rate of students in the Food Goods Knowledge subject in relation to reduction of teaching hours and placement of the subject among optional subjects. Kučera, Svatošová and Pelikán (2015) conducted the evaluation in terms of the relationship between the results of mathematics admission tests and the results in the two subjects (Mathematics and Mathematical Methods in Economics) taught in the 1st year of the bachelor study.
Our assessment of student success rate in the exam was focused on the differences among students of different courses. The results of testing statistical hypotheses were interesting to us. The study also included students of combined forms of study taking place in consultation centers. There is no statistically significant difference in success rate in given subjects among the students who passed the exam on the first, second or third attempt.
From the results of analyses of the students' success rate in exams we created a model for determining the number of places for the exam terms. The model will be used in practice to determine the number of places for exams in the summer semester 2017/2018, in the subject of the Tax System 545 places will be fixed for 383 students. This output can help to schedule the number of exam terms during the exam period efficiently and preciously.

Conclusion

The results show that there is no statistically significant difference among students of different courses who have passed the exam on the first or the second or the third attempt. The zero hypothesis H01, H02 and H03 are not rejected at the significance level α=0.01.

The established model, based on the number of students enrolled in the tax courses, provides information on the needed number of slots for the examination period. The model was compiled using the data from the internal University Information System of CULS Prague for academic years 2014/2015-2017/2018. Based on the panel data, the models estimate the success rates of students passing the exam on the first, second or third attempt and the confidence interval for predicted values of places for the exam is 99%. The coefficients of successful exam passing were created and currently applied to determine the required number of places for exam terms in the subject Tax System during the summer semester of the academic year 2017/2018. The results show that the total number of exam places, needed for the exam period reaches 1.42 multiple of the number of students enrolled in this subject. The result is important for practical application within the planning of the number of places to be offered to students during the examination period to keep the long term level of successfully passed exams.

Acknowledgement

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EDUCATION-JOB MATCH: LABOR MARKET DILEMMAS FOR DEVELOPING COUNTRIES

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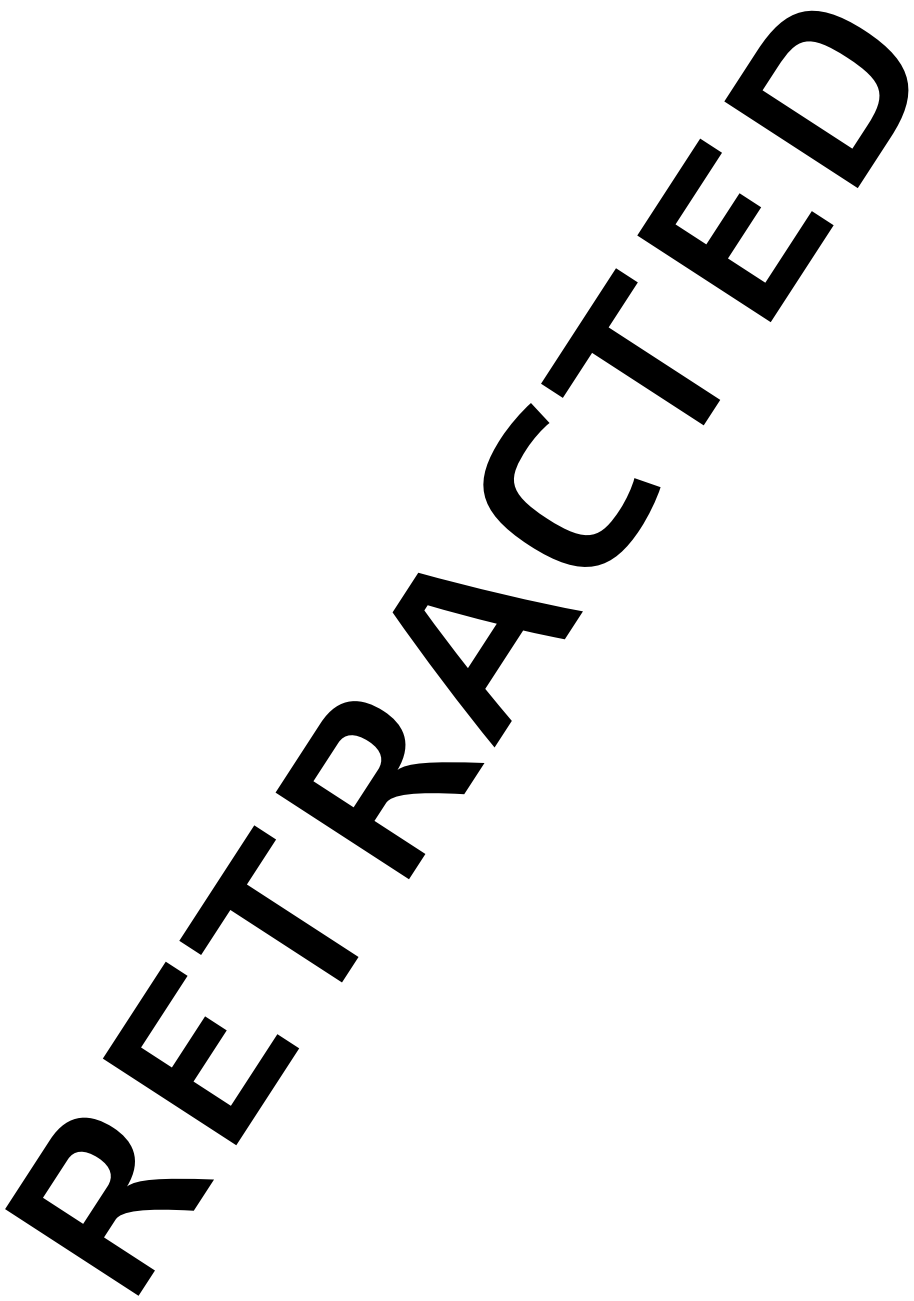
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COMPARISON OF THE LEVELS OF FINANCIAL LITERACY AMONG HIGH SCHOOL STUDENTS

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Abstract

In the Czech Republic, financial literacy education is currently included in educational programmes of all secondary schools. Upon a closer look, differences in its implementation can be found. In case of education at grammar schools, financial literacy is integrated into the branches of education such as civics and mathematics. On the other hand, secondary vocational schools integrate financial literacy into the branch of education such as economics. The paper deals with the question whether economics component of secondary vocational education influences a higher level of financial literacy. In addition, the paper deals with the issue concerning the choice of an appropriate method in settlement of the problems emerged in real life.

Keywords

Financial literacy, financial education, measuring of financial literacy

Introduction

Pupils of the upper secondary schools in the Czech Republic reach the age of 18 during their studies, when they become the persons of legal age and thus they can conclude binding contracts. In comparison with an older generation, today's pupils establish financial relations at a much more earlier age and rather soon they have to settle the problems pertaining to their money management (Smyczek, 2015: 19). Due to a continuously changing financial market they can hardly compare provided products and services and consequently to use them effectively in specific life situations, especially in the situations regarding their future. For these young adults it is necessary to acquire basic knowledge and skills in their early education, which will help them to adapt to ever-changing conditions of financial market that is an integral part of their lives.

The benefits of financial education are shown in a lot of studies (Tokar – Asaad, 2015, Lusardi, 2008). Aprea et al. (2016) provides an overview of initiatives in the field of financial education in ten countries[1], which in their entirety represent four different continents. In order to foster cross-national comparison and learning, the publication specifically focuses on conformities and differences of various national experience.

The need for coordination of financial education in the Czech Republic gripped attention of the Czech government authorities. The process of financial education was based on dialog between the public, consumers and financial market to achieve the largest possible reach. An established working group for financial education created a document called the National Strategy of Financial Education (updated version of document Strategy of Financial Education dated 2007) that was approved by the Czech government in 2010 (MFCR, 2010). This document indicates the

1 Austria, Germany, Indonesia, Mexico, Netherlands, Romania, South Africa, Switzerland, the UK, the United States

main problems and related priority tasks in this field including specific tasks of key participants with the focus on the role of public administration bodies.

The goal of this strategy is to develop and increase the levels of financial literacy through a comprehensive system of financial education. The document for a target group named System of Developing Financial Literacy at Primary and Secondary Schools (MEYSCR, 2007), which specifies the necessary curriculum for financial literacy as well as needed pupil's outputs, was already created in 2007.

System of Developing Financial Literacy at Primary and Secondary Schools defines Standards of Financial Literacy (NIE, 2012)[2] according to the levels of education for primary education and for both levels of secondary education so that their content is mutually interconnected. The level for the upper secondary education includes the topics regarding money, household management, financial products and customer protection. Their intention is that pupils will be provided with desirable key competences and they will achieve expected results of financial education after completing those topics. Therefore, financial literacy is a part of key competences. For this reason, Standards of Financial Literacy are included in the Framework Education Programmes (FEPs). Schools are obliged to implement the declared outputs into their School Educational Programmes (SEP).

FEP for grammar schools implements Standards of Financial Literacy into educational branch Human and the world of labour. Curriculum itself and expected outputs are very often integrated into educational branches Human and society and Mathematics and its application (MEYSCR, 2006).

FEP for vocational education introduces Standards of Financial Literacy into the branches of education such as civics, economics and mathematics. In case of educational categories Economics and administration they are also included in FEP for vocational education (NIVE, 2012).

From the above text it is evident that the pupils of vocational secondary schools are provided with more space to increase their level of financial literacy during their studies in comparison to the pupils of grammar schools. The question arises whether those students have a better understanding of the basic financial concepts and whether they are better at applying numeracy skills in financial decisions.

The upper secondary schools settle these demands in different ways, which was shown in research conducted by one of the authors. The results of this research can be found in Kazda (2013). The most demanded curriculum and expected outcomes were integrated by schools into already offered subjects (mathematics, civics, economics). However, some schools provide their pupils with a single subject exclusively dealing with financial education. In terms of financial education in the world, according to Aprea et al. (2016) education leading to strengthening of financial literacy is included in various subjects such as mathematics, history, economics and geography. For example, financial education in Austria is integrated into subject "Geography and Economics" but the curriculum clearly focuses on geography, particularly in the first two years. In terms of financial education, the curriculum for the third grade seems to be interesting. So there is a potential to foster students' understanding of economics and financial matters on this level. Nevertheless, if the teacher does not explicitly emphasize this economic content (which he/she can naturally do), only a very little economic education on this level of schooling can be provided (Aprea et al., 2016: 253). However, there are also many countries where this issue is discussed in a separate subject (e.g. Iceland, Italy, Spain, etc.). One of the countries with long-time experience in this issue is Australia where financial literacy of pupils is developed in the form of a separate

2 Document was revised by the Czech Ministry of Finance in 2017, but it has not been implemented into Framework Educational Programmes yet.

subject. Australia ranks among the countries that hold the top positions in international survey of the level of financial literacy (see survey of OECD, 2014; Klapper, Lusardi and Van Oudheusden, 2015; Jappelli, 2010).
To identify potential desires and gaps in financial education it is necessary to measure the levels of financial knowledge and understanding of the upper secondary school pupils regularly. Evaluation and comparison of the levels of financial literacy in each type of the upper secondary school can provide important information based on which the schools can choose an appropriate approach to improvement of financial education.
The paper indicates the results of the research whose goal was to examine the factors that affect the level of financial literacy. The first factor that was examined was an increased hourly subsidy of economics subjects, the second examined factor was the method used for settlement of particular tasks.

Materials and Methods

The main research goal was to compare grammar schools and secondary vocational schools with enhanced teaching of economics subjects. Knowledge of key financial concepts and capability of using numeracy skills in various financial situations were compared. The secondary goal was to find out whether the methods of solution and the type of school are interdependent.
For these purposes, the methods of quantitative research (didactic test and questionnaire) were selected. The methods were used to check pupil's knowledge and skills in the field of financial literacy. The test, which was followed by the questionnaire, was submitted to pupils from the fourth grade as a part of the dissertation project implementation.

Hypotheses

Hypothesis 1

H_0: Pupils of secondary vocational schools with enhanced teaching of economics subjects will achieve the same results in didactic test of financial literacy as pupils of grammar schools

Against

H_1: $\neg H_0$

Hypothesis 2

H_0: Method of solution and type of school are independent.

Against

H_1: $\neg H_0$

Research sample

423 pupils of the upper secondary school, the fourth grade, in the Czech Republic participated. 175 of them were female and 248 were male but the research has shown that sex did not affect the score. In terms of regions, the most pupils were from Central Bohemian Region – i.e. 131 pupils. The other represented regions were Prague with 80 pupils, Vysočina Region with 47 pupils, South Bohemian Region with 77 pupils, Ústí Region with 51 students and Karlovy Vary Region with 37 pupils. In terms of the type of school, 245 of them were the pupils of grammar schools and 178 of secondary vocational schools with graduation exam. Based on the number of participants, the level of reliability is 95 % with interval of reliability 5 % (calculated using Sample Size Calculator).

Methodology

The objective of the authors was to compare collected data with their assumption that the pupils of secondary vocational schools with enhanced teaching of economics subjects have better knowledge of the basic financial concepts and that they are more capable to apply numeracy skills in a simulated financial decision.
For the purposes of the research goal it was necessary to verify the ability to apply the acquired financial knowledge and skills of the pupils in specific situations from everyday life. In order to generalize the obtained conclusions, it was necessary to collect a large amount of data through a didactic test. For a deeper analysis of the obtained data it was necessary to find a probable level of financial literacy of the respondent. A questionnaire survey was chosen for this purpose.

Didactic test

The didactic test includes six tasks in total and all of them are related to expected outputs from System of Developing Financial Literacy at Primary and Secondary Schools. Each task is linked to one of the financial literacy topics (in this case prices, money, savings, lending, loans and insurance) and it is formulated in the way closest to everyday life problems: discounts, orientation in exchange rate, time deposits and returns at different interest rates, influence of parameters such as interest rate, maturity and interest rate on the mortgage loan price, comparison of bank and non-bank consumer credit including Annual Percentage Rate (APR), supplementary pension savings.
The test was standardized during pilot study with 78 pupils. By analysing the properties of the test tasks it was found that all the tasks met the standards that are mentioned in the publication by Chráska (2007). In addition, the test has a high degree of validity. The subject of each of the tasks was a different financial product. The pupils demonstrated their knowledge of the problem and the ability to apply their financial skills. The degree of reliability was determined by the value of the coefficient determined by Kuder-Richardson formula. The test reached an acceptable degree of reliability (value of 0.57).

Questionnaire for pupils and teachers

In addition to the didactic test, pupils completed a questionnaire. The questionnaire found out the views of pupils on the teaching of financial literacy at respective school, the difficulty of the didactic test tasks and the way of settlement of the given tasks (estimation, logical reasoning, use of mathematical relations etc.). Another questionnaire was submitted to teachers. This questionnaire was divided into two parts. In the first part, the questions about teaching of financial literacy at respective school were asked. The second part focused on the questions about pupils' didactic test. The questions were both of an open type and a closed type and scales. In addition to the above text, the two questionnaires identified the topics of financial literacy that pupils learned during their studies and the types of tasks they dealt with. This means both the pupil's and the teacher's points of view.
Based on the analysis of particular answers of the pilot study pupils, the questionnaires were found to be sufficiently valid.
Research evaluation: Research was evaluated based on results of the didactic test, results of both questionnaires and statements of participating teachers.

Data processing

Hypothesis 1 was verified using Mann-Whitney test as Shapiro-Wilk test declined normality of the data. For further clarification of the situation, box-whisker diagrams showing relative frequencies were used.

For the purposes of testing, each task of the test was evaluated according to these rules:

- 0 points – nothing was stated
- 1 point – result without explanation / guess
- 2 points – correct approach with a wrong result
- 3 points – task solved correctly with the stated approach

In the didactic test, the pupil could receive the maximum amount of 18 points.

To verify *Hypothesis 2* Pearson's chi-squared test and contingency coefficient were used. Pupils task-solving methods were classified as follows: did not solve, used mathematical instruments, other calculation method (estimate, logical reasoning,…).

In both cases, the hypothesis testing was performed at a significance level $\alpha = 0.05$. All numerical calculations were performed using R 3.3.3 programming environment, statistical software STATISTICA and MS Excel spreadsheet. The above tests can be found, e.g., in Anděl (1985).

Results

To verify null hypothesis (*Hypothesis 1*) Mann-Whitney test with continuity correction was used. Due to the fact that p-value is 2.1826×10^{-7} it is evident that with 99% certainty null hypothesis can be rejected in favour of alternative hypothesis. In other words, the pupils of grammar schools achieve a statistically significantly higher score in the didactic test than the pupils of the other studied upper secondary schools. Figure 1 shows the overall score depending on the type of school (notation indicates 95% confidence interval for medians). The figure shows the difference between the medians of both groups.

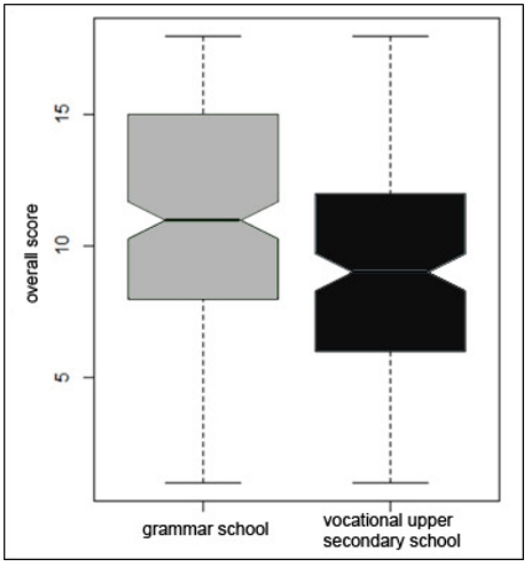

Figure 1: Overall score depending on the type of school (notation indicates 95% confidence interval for medians) (source: own calculation)

Due to the fact that the p-value = 1.354×10^{-7}, null hypothesis (Hypothesis 2) was rejected at the significance level $\alpha = 0.05$. In other words, it can be said that the method of settlement of didactic tests was influenced by the type of school. The value of the contingent coefficient K = 0.11 indicates a very low dependence.

Figure 2 shows absolute frequencies of task-solving methods in relation to the type of school. From graphical representation it is evident that the biggest difference is in the category of "used mathematical instruments". This method was far more used by grammar school pupils.

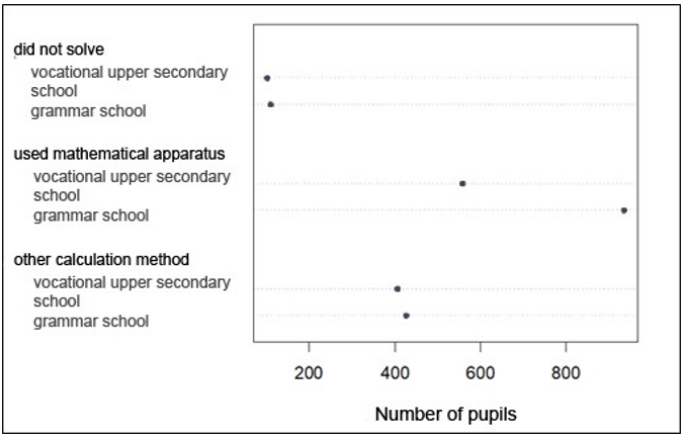

Figure 2: Graphical representation of absolute frequencies of task-solving method in relation to the school type (source: own calculation)

Discussion

Based on the analysis of pupils' answers to the didactic test and questionnaires, the authors came to the following findings:

1. By comparing the levels of financial literacy of the fourth-grade pupils of various types of the upper secondary schools it is possible to identify differences. Although secondary vocational schools allocate more time to financial education than grammar schools, their pupils did not score more points in didactic test.
2. Pupils at secondary vocational schools do not regularly encounter simulated financial decisions in their education (the nature of the tasks in the didactic test).
3. The topics of financial literacy are taught mainly theoretically (i.e. formally communicated information). A number of studies have shown that the use of activating methods in teaching contributed to increasing financial literacy. One of these methods is, e.g., project teaching. In Kazda, Petrášková and Rosa (2016: 277), it is stated: "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."
4. In settlement of the tasks, the pupils of secondary vocational schools used to a lesser extent the mathematical instruments than the pupils of grammar schools. The question arises whether this could have affected their worse results. Huston (2010: 307). states that "if some individual has rather weak arithmetic skills, this will certainly have a negative impact on his/her financial literacy." PISA 2012 survey, which was the first international survey of its kind to assess the level of financial literacy of 15-year-old pupils at the end of compulsory schooling (18 countries were involved in this survey), showed that the level of financial literacy of Spanish and Czech pupils was more (positively) influenced by their mathematical literacy skills than in other countries (CSI, 2014). Schiefele and Csikszentmihalyi (1995) suggested that teachers can place settlement of the problems in real life context as a way to increase motivation of their students in mathematics.

It should be noted that a number of world studies also deal with the issue of financial literacy among young people. Regecová and Slavíčková achieved similar results when examining Slovakian financial education. Regecová and Slavíčková (2010: 140) state that they found illogical calculations in many solutions that pose using of different mathematical operations with the given numbers.

Conclusion

Financial literacy education is at national level ensured mainly thanks to integration of Standards of Financial Literacy into Framework Educational Programmes. Their aim is for pupils to use their acquired knowledge and skills to make adequate decisions and to act appropriately in financial market in their everyday practice with regard to their future.

However, the conducted research shows differences in the levels of financial literacy among the pupils of various types of schools. Surprisingly, the pupils with higher hourly subsidies for economic subjects (pupils of secondary vocational schools) had worse results than pupils without increased hourly subsidies (pupils of grammar schools). We can discuss the level of these two types of schools. It is recognized that "better" pupils attend grammar school, and therefore, as another factor influencing the level of financial literacy, we can take into account the inherent abilities of the pupils. According to PISA 2012 (2012), the level of financial literacy is also influenced by the family and social environment. Collected data demonstrate that pupils from both types of schools do not regularly make simulated financial decisions based on everyday reality in their studies.

The research also showed that the pupils who used mathematical instruments to solve the didactic test tasks were more successful than the pupils who took advantage of another approach. As the pupils of grammar schools have a higher hourly subsidy in mathematics, we can say that they had the advantage in settlement of the problems. The fact that mathematical knowledge contributed in the test to better results corresponds to the conclusions of PISA 2012 international survey and the research by Huston (Huston, 2010).

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PROBABILITY COMPARISON WAYS OF ACCEPTANCE STUDENTS AT UNIVERSITY

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Abstract

Entrance examinations at University of Economics in Prague are analysed in this paper. The admission process at University of Economics contents test in English and test in mathematics. Two different tests in English are used for acceptance students at the university in present time. The aim of this paper is to compare these ways of acceptance students. The probability approach is applied for comparison tests in English (the tests in English are the multiple choice question tests). We shall compare distribution of the number of points in the test in English. The results of present paper can be used for improvement of admission process at University of Economics.

Keywords

Entrance exams, probability distributions, tests in English, University of Economics Prague

Introduction

Students of University of Economics in Prague are accepted to study on the basis of tests in English and mathematics. Two different tests (the multiple choice question tests) in English at the university are applied in admission process in present time:
Test 1. The test has 50 questions for 2 points (100 points total). Questions are independent. Each question has 4 answers (one answer is correct), wrong answer is not penalized.
Test 2. The test has 40 questions for 2.5 points (100 points total). Questions are independent. Each question has 4 answers (one answer is correct), wrong answer is not penalized.
The Test 2 is applied in admission process at the Faculty of International Relations, the Test 1 is applied in admission process at the Faculty of Informatics and Statistics, at the Faculty of Business Administration and at the Faculty of Finance and Accounting.
The multiple choice question tests are suitable for the admission process at Prague University of Economics (statistical analysis of these tests we can find in Klůfa (2016)). The tests are objective, results can be evaluated easily for large number of students. On the other hand, a student can obtain certain number of points in the test purely by guessing the right answers. The problem is solved in Zhao (2005), Premadasa (1993), Zhao (2006) - this article studies the probability of obtaining a certain score by pure guesswork and introduces a conversion scheme which converts raw test scores into standard percentage marks (the probabilistic analysis shows that the optimum number of choices of answers is four). The admission process is addressed e.g. in following education research. Dependence of the results of entrance examinations on test variants is analysed in Klůfa (2015a). Relation between results of the entrance exam test and university study results at Charles University (Faculty of Mathematics and Physics) is studied in Zvára and Anděl (2001). The same problem at Czech University of Life Sciences is studied in Poláčková and Svatošová (2013). Similar problems are solved in Hrubý (2016), Bartoška, Brožová, Šubrt and Rydval (2013). Comparison of the Test 1 in English and the Test 2 in English at University of Economics from probability point of view is provided in this paper.

Material and Methods

The tests in English correspond to the following general model: Let us consider n independent random trials having two possible outcomes, say "success" (right answer) and "failure" (wrong answer) with probabilities p and $(1-p)$ respectively. The probability of correctly answered question p (under assumption that each of m answers in particular question has the same probability and just one answer is correct) is $p=1/m$.

Let us denote X as number of successes (right answers) that occur in n independent random trials. X is discrete random variable distributed according to the binomial law with parameters n and p. Probability that number of successes is k (k=0, 1, 2,…,n) is (see e.g. Rao (1973))

$$P(X=k)=\binom{n}{k}p^k(1-p)^{n-k} \tag{1}$$

The expected value and the standard deviation of random variable X distributed according the binomial law with parameters n and p is

$$E(X)=np,\quad \sigma(X)=\sqrt{D(X)}=\sqrt{np(1-p)} \tag{2}$$

where $D(X)$ is dispersion of random variable X.

The distribution function F of random variable X is a real function of one real variable defined for x in interval $(-\infty, \infty)$ by formula

$$F(x) = P(X \leq x)$$

i.e. $F(x)$ is a probability that number of correct answers is less or equal to x. In our case, the distribution function F of random variable X distributed according to the binomial law with parameters n and p is

$$F(x)=0, x<0,\ F(x)=\sum_{k=0}^{[x]}\binom{n}{k}p^k(1-p)^{n-k}, x\geq 0 \tag{3}$$

where $[x]$ is integer part of x. The median of random variable X is the central value $\tilde{x}$ ($F(\tilde{x})=0.5$), for the binomial distribution is not uniquely determined. The mode of random variable X is the most probable value $\hat{x}$ of random variable X.

Results and Discussion

Distribution of the number of points in the test 1 in English

Now we shall study the distribution of the number of points in the test 1 (the test has 50 questions for 2 points) in English. Discrete random variable

Z_1 = number of points in the test 1 in English

can take values

0, 2, 4, 6, 8, 10, 12, 14,…, 98, 100.

For determination of distribution random variable $Z1$ we must find the probability $P(Z_1=k)$ for k=0, 2, 4, 6, 8,…, 98, 100. For example we shall find probability that number of points in test 1 in English is 20. Let us denote

S = number of right answers in the 50 issues.

Under assumption that each answer has a same probability (the random choice of answers), probability of right answer is p=1/4. Therefore, random variable S has binomial distribution with parameters n=50 and p=0.25. According to (1) we obtain

$$P(Z_1 = 20) = P(S = 10) = \binom{50}{10} 0.25^{10}\, 0.75^{40} = 0.098518.$$

Other probabilities are in Table 1 (only for k=0,…, 66, other probabilities are less than 10^{-9}) and corresponding polygon is in Figure 1.

Points in test 1	Probability	Points in test 1	Probability
0	0.000001	36	0.026390
2	0.000009	38	0.014816
4	0.000077	40	0.007655
6	0.000411	42	0.003645
8	0.001610	44	0.001602
10	0.004938	46	0.000650
12	0.012345	48	0.000244
14	0.025865	50	0.000084
16	0.046341	52	0.000027
18	0.072087	54	0.000008
20	0.098518	56	0.000002
22	0.119416	58	0.000001
24	0.129368	60	1×10^{-7}
26	0.126050	62	3×10^{-8}
28	0.111044	64	6×10^{-9}
30	0.088836	66	1×10^{-9}
32	0.064776	***	***
34	0.043184	Sum	1.000000

Table 1: Distribution of **number of points in test 1 in English**

Now we shall find the distribution function F_1 of random variable Z_1 (number of points in the test 1 in English). For example we shall find the probability that number of points in test 1 in English is less or equal 30, i.e. the function value F_1 (30). We have

$$F_1(30) = P(Z_1 \leq 30) = P[(Z_1=0) \cup (Z_1=2) \cup (Z_1=4) \cup \ldots \cup (Z_1=28) \cup (Z_1=30)]$$

Random events $(Z_1=0)$, $(Z_1=2)$, $(Z_1=4)$,..., $(Z_1=28)$, $(Z_1=30)$ are disjoint (i.e. these random events cannot occur simultaneously), therefore

$$P(Z_1 \leq 30) = P(Z_1=0) + P(Z_1=2) + P(Z_1=4) + \ldots + P(Z_1=28) + P(Z_1=30)$$

Finally from Table 1 we obtain

$$F_1(30) = P(Z_1 \leq 30) = 0.836916,$$

i.e. under assumption of random choice of answers approximately 83.7% of students get the test score less or equal 30. Similarly we can find other values of distribution function F_1 – see Tab. 2.

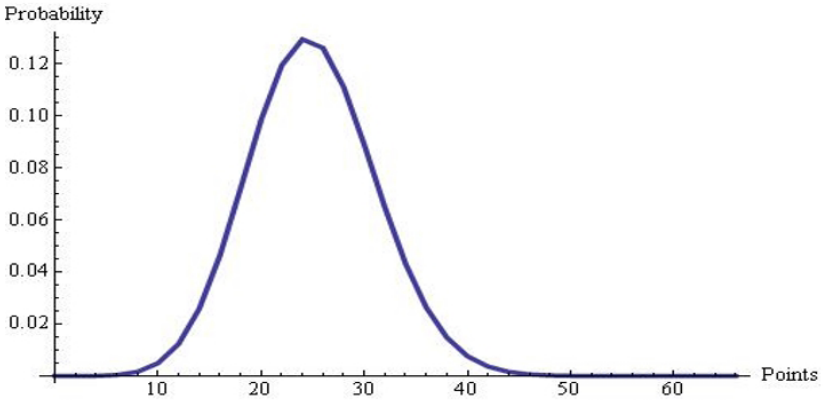

Figure 1: Distribution of **number of points in test 1 in English (polygon)**

Interval of values z	F_1 (z)	Interval of values z	F_1 (z)
(-∞, 0)	0	[34, 36)	0.944876
[0, 2)	0.000001	[36, 38)	0.971266
[2, 4)	0.000010	[38, 40)	0.986082
[4, 6)	0.000087	[40, 42)	0.993737
[6,8)	0.000498	[42, 44)	0.997382
[8, 10)	0.002108	[44, 46)	0.998984
[10, 12)	0.007046	[46, 48)	0.999634
[12, 14)	0.019391	[48, 50)	0.999878
[14, 16)	0.045256	[50, 52)	0.999962
[16, 18)	0.091597	[52, 54)	0.999989
[18, 20)	0.163684	[54, 56)	0.999997
[20, 22)	0.262202	[56, 58)	0.999999
[22, 24)	0.381618	[58, 60)	1.000000
[24, 26)	0.510986	[60, 62)	1.000000
[26, 28)	0.637036	[62, 64)	1.000000
[28, 30)	0.748080	[64, 66)	1.000000
[30, 32)	0.836916	***	***
[32, 34)	0.901692	[100, ∞)	1

Table 2: Distribution function of **number of points in test 1 in English**

Finally we shall find a basic descriptive statistics of the distribution of the number of points in the test 1 in English. According to (2) we obtain the expected number of points in test 1 in English. Since $Z_1 = 2S$ we have

$$E(Z_1) = E(2S) = 2\,E(S) = 2.\ 12.5 = 25.$$

Expected number of points in test 1 in English is 25. The mode of this distribution is the most probable number of points in test 1 in English. From Table 1 is $\hat{z}_1 = 24$. Similarly, we find the median (central value, $F(z)=0.5$) of number of points in test 1. From Tab. 2 is $\tilde{z} \approx 24$.

Dispersion of number of points in test 1 in English is according to (2)

$$D(Z_1) = D(2S) = 2^2\,D(S) = 4.\ 9.375 = 37.5$$

and the standard deviation of number of points in test 1 in English is $\sigma_1 = 6.124$.

Distribution of the number of points in the test 2 in English

Now we shall study the distribution of the number of points in the test 2 (the test has 40 questions for 2.5 points) in English. Discrete random variable

$$Z_2 = \text{number of points in the test 2 in English}$$

can take values

$$0, 2.5, 5, 7.5, 10, 12.5, 15, 17.5, \ldots, 97.5, 100.$$

For determination of distribution random variable *Z2* we must find the probability $P(Z_2=k)$ for k=0, 2.5, 5, 7.5,…, 97.5, 100. For example we shall find probability that number of points in test 2 in English is 20. Let us denote

$$T = \text{number of right answers in the 40 issues.}$$

Under assumption that each answer has a same probability (the random choice of answers), probability of right answer is p=1/4. Therefore, random variable T has binomial distribution with parameters n=40 and p=0.25. According to (1) we obtain

$$P(Z_2 = 20) = P(T = 8) = \binom{40}{8} 0.25^8\, 0.75^{32} = 0.117878\,.$$

Analogously, we can calculate the probability $P(Z2=k)$ for other k=0, 2,5, 5,…, 97,5, 100 - see Table 3 (only for k=0,…, 67,5, other probabilities are less than 10-8) and Figure 2.

Points in test 2	Probability	Points in test 2	Probability
0	0.000010	37.5	0.028192
2.5	0.000134	40	0.014684
5	0.000872	42.5	0.006910
7.5	0.003680	45	0.002943
10	0.011347	47.5	0.001136
12.5	0.027232	50	0.000398
15	0.052951	52.5	0.000126
17.5	0.085730	55	0.000036
20	0.117878	57.5	0.000009
22.5	0.139707	60	0.000002
25	0.144364	62.5	5×10^{-7}
27.5	0.131240	65	9×10^{-8}
30	0.105721	67.5	2×10^{-8}
32.5	0.075903	***	***
35	0.048795	Sum	1.000000

Table 3: Distribution of **number of points in test 2 in English**

Now we shall find the distribution function F_2 of random variable Z_2 (number of points in the test 2 in English). For example we shall calculate the probability that number of points in test 2 in English is less or equal 30, i.e. the function value $F_2(30)$. We have

$$F_2(30) = P(Z_2 \le 30) = P(Z_2=0) + P(Z_2=2.5) + P(Z_2=5) + \ldots + P(Z_2=27.5) + P(Z_2=30)$$

Finally from Table 3 we obtain

$$F_2(30) = P(Z_2 \le 30) = 0.820866,$$

i.e. under assumption of random choice of answers approximately 82.1% of students get the test score less or equal 30. Similarly we can find other values of distribution function F_2 - see Table 4.

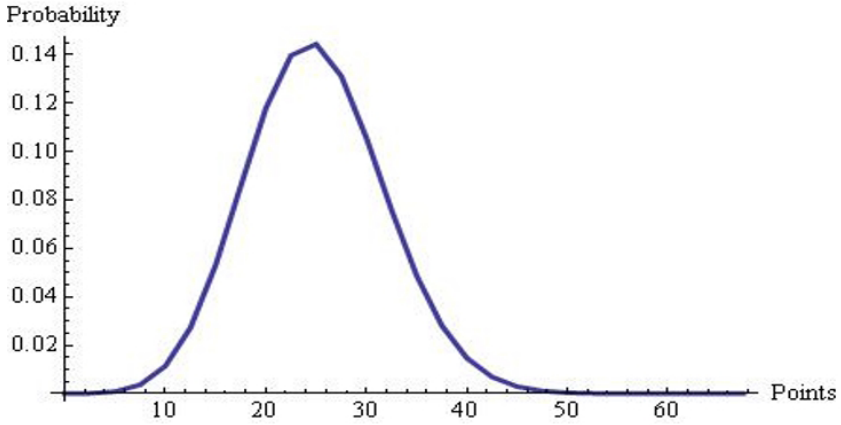

Figure 2: Distribution of **number of points in test 2 in English (polygon)**

Interval of values z	$F_2(z)$	Interval of values z	$F_2(z)$
(-∞, 0)	0	[35, 37.5)	0.945564
[0, 2.5)	0.000010	[37.5, 40)	0.973756
[2.5, 5)	0.000144	[40, 42.5)	0.988440
[5, 7.5)	0.001016	[42.5, 45)	0.995350
[7.5, 10)	0.004696	[45, 47.5)	0.998293
[10, 12.5)	0.016043	[47.5, 50)	0.999429
[12.5, 15)	0.043275	[50, 52.5)	0.999827
[15, 17.5)	0.096226	[52.5, 55)	0.999953
[17.5, 20)	0.181956	[55, 57.5)	0.999989
[20, 22.5)	0.299834	[57.5, 60)	0.999998
[22.5, 25)	0.439541	[60, 62.5)	1.000000
[25, 27.5)	0.583905	[62.5, 65)	1.000000
[27.5, 30)	0.715145	[65, 67.5)	1.000000
[30, 32.5)	0.820866	***	***
[32.5, 35)	0.896769	[100, ∞)	1

Table 4: Distribution function of **number of points in test 2 in English**

Finally we shall find a basic descriptive statistics of the distribution of the number of points in the test 2 in English. According to (2) we obtain the expected number of points in test 2 in English. Since $Z_2 = 2.5\ T$ we have

$$E(Z_2) = E(2.5\ T) = 2.5\ E(T) = 2.5.\ 10 = 25.$$

Expected number of points in test 2 in English is 25. The mode is the most probable number of points. From Tab. 3 is $\hat{z} = 25$. Similarly, we find the median of number of points in test 2 in English. From Tab. 4 is $\tilde{z} \approx 24$.

Dispersion of number of points in test 2 in English is according to (2)

$$D(Z_2) = D(2.5\ T) = 2.5^2\ D(T) = 6.25.\ 7.5 = 46.875$$

and the standard deviation of number of points in test 2 in English is $\sigma_2 = 6.847$.

Comparison of the Test 1 and the Test 2 in English is in Table 5. For example, test score more than 30 points in Test 1 has 16.3% of students, since (see Tab. 2)

$$P(Z_1 > 30) = 1 - F_1(30) = 1 - 0.836916 = 0.\ 163084$$

Entrance examination in English	Test 1	Test 2
Expected number of points in test	25	25
Mode	24	25
Standard deviation	6.124	6.847
Test score more than 20 points	73.8% of students	70.0% of students
Test score more than 30 points	16.3% of students	17.9% of students
Test score more than 40 points	0.62% of students	1.16% of students

Table 5: Comparison of the tests in English (random choice of answers)

Similar problems as in present paper was solved in Klůfa (2015b). There is a comparison of the ways of acceptance students at Prague University of Economics from statistical point of view. Analysis of the entrance exams at Czech University of Life Sciences we can find in Kučera, Svatošová and Pelikán (2015) – relation between results of the entrance exam test and university study results. Analysis of the entrance tests at Comenius University in Bratislava we can find in Kohanová (2012). Correlation between results of the entrance tests (learning potential tests) and study results at University of Pardubice we can find in Kubanová and Linda (2012). The aim of these papers was a little different.

Conclusion

The number of questions in the test in English was reduced from 50 to 40 to shorten the test run time. The Distribution 1 (the distribution of number of points in the Test 1 in English) and the Distribution 2 (the distribution of number of points in the Test 2 in English) have the same expected value (see Tab. 5). Standard deviation of the Distribution 2 is greater than standard deviation of the Distribution 1 (the mode is greater as well). Due to greater variability of the Distribution 2 e.g. the probability that number of points in Test 2 in English exceeds 40 is approximately two times greater (see Tab. 5) than the probability that number of points in Test 1 in English exceeds 40 (both probabilities are near to 0).

From the results of this paper it seems that the Test 1 in English is a bit better than the Test 2 in English from probability point of view. However the differences between these tests are not significant. A shorter English test can also be used for admissions at University of Economics.

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WHY TO BECOME A TEACHER? FACTORS OF PROSPECTIVE TEACHERS' MOTIVATION

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Abstract

The paper deals with a motivation to a teacher's profession. With an intention to research main factors that influence a decision to become a teacher, we used a qualitative analysis of prospective teachers' written self-reflections called 'Why am I going to be a good teacher?' From various methods of qualitative text analysis, we decided to use a grounded theory, because it is most appropriate to describe characteristics of processes. Apart from revealing of isolated concepts, the grounded theory should specify their mutual relations. With this intention, we used a causal loop diagram. Our findings can help to support and maintain the motivation of young people who want to be a teacher. Specifically, they emphasize importance of positive expectations, positive experiences, perceived advantages of a teacher's profession, a sensitivity to models and a prospective teacher's self-efficacy.

Keywords

Causal loop diagram, grounded theory method, motivation of prospective teacher, self-reflection, teachers' education

Introduction

Every unit of human behavior is motivated – internally or externally, consciously or unconsciously, positively or negatively. Filling of a tax return, application of make-up before a date, scribbling during a boring lecture has an aim or a reason. Even 'slips of a tongue' (Freud, 2010) are specifically motivated.

Motivation can be defined as a summarization of forces that energize and organize behavior and mental functioning of an individual with a goal to change an unsatisfying situation, to reach something positive or avoid something negative (Plháková, 2010). These forces arise from individuals' needs, specific units of motivation and their relationships that can be expressed in a form of hierarchy (Maslow, 1954).

What needs lead an individual to a decision to become a teacher? An answer depends to a large extent on a kind of age-related specifics of pupils or students (a motivation to be a teacher in a kindergarten differs from a motivation of prospective university teacher), but also on socioeconomic specifics of a country. Bastick (2000) compared motivation of prospective teachers in metropolitan and developing countries. In English speaking metropolitan countries, teachers' salaries get behind middle management in commercial sectors. Consequently, a motivation to teachers' profession tends to be more intrinsic and altruistic compared with developing countries with lesser amount of competitive working opportunities. In author's study in Jamaica, an extrinsic motivation was considerably more important than other kinds of motivation.

According to analysis of Ministry of Education, Youth and Sports (MŠMT ČR, 2009), Czech teachers choose their profession mainly because of a need for: working with children and youth; freedom and creativity; 'young' environment; mediation of experiences. In correspondence with findings of Bastick (2000), low competitive working opportunities have only moderate significance. The study also monitored reasons why teachers leave their profession, whereas

the most important factors were difficultness of teacher's work; lack of interest and respect by students; bad salaries; little difference between financial evaluation of 'good work' and 'bad work', complicated cooperation with parents.

Probably all teachers face some (or all) mentioned disadvantages of their profession. According to the study, similar factors also lead to the fact that young people do not choose the profession of a teacher. In our research, we ask an opposite question: why young people tend to choose this profession? We tried to avoid to a reduction of responses by prescribed list of questions or categories, therefore we chose qualitative design of research, based on qualitative analysis of written self-reflection by prospective teachers.

According to Švancarová (2010), a self-reflection is a part of social intelligence, respectively its intrapersonal dimension. It is closely connected with a self-efficacy that determines people's aspirations and persistence in reaching their goals (Bandura, 1977). Moving back to the personality of teacher, self-reflection or auto-evaluation appears in various categorizations of teachers' professional skills (Sternberg and Horvath, 1995; Kyriacou, 1998; Gillernová, 2008). The self-reflective or auto-diagnostic skills in a context of teachers' profession could be defined as the teachers' ability to understand their personalities, recognize their weaknesses as well as strengths that help them to develop high level of self-awareness (Zeren, 2012).

Many studies monitored a function of the systematic self-reflection in teachers' education (Caires, Almeida and Vieira, 2012; Furlong, 2013; Sternberg et al., 2014; Lamote and Engels, 2010; Zeren, 2012) emphasizing a fact that 'teachers' ability to understand themselves and to have awareness about their inner selves may affect their attitudes and behaviors towards their students' (Zeren, 2012: 2445). Moreover, a teacher with developed self-awareness is able to mediate self-reflective processes to his/her student and use them effectively in teaching process (Freddano, Siri, 2012; Körpülü, 2012). Another important relation is an interaction between self-reflection and metacognition. According to a study of Mogonea and Mogonea (2013), development of metacognitive processes by prospective teachers significantly supports their self-reflective skills.

In our previous research, we monitored psychological categories that prospective teachers use in their self-reflection (Krejčová, 2015) and gender differences in chosen expressions (Krejčová and Horáková, 2017). In the current paper, our goal is to go behind a level of descriptive analysis and to identify crucial categories that influence the motivation to be a secondary school teacher. In our qualitative analysis, we use a grounded-theory approach (Holton, 2010; Řiháček et al., 2013). The results contribute to understanding to prospective teachers' motivation, respectively to main motivational factors including their relations. They also help to clarify the fact that a substantial proportion of students of pedagogical faculties do not become a teacher after finishing of their studies.

Materials and Methods

To research crucial factors of prospective teachers' motivation, we used qualitative analysis of written self-reflection called 'Why am I going to be a good teacher?' These essays are part of the final assessment in a course of educational psychology at Department of Economic Teaching Methodology (University of Economics in Prague).

Each researcher faces a dilemma – he/she can get the limited amount of information about the huge amount of respondents, or a lot of information about limited sample of respondents (Disman, 2011). We chose the second strategy that is typical for a qualitative research. From the various method of qualitative text analysis, we decided to use a grounded theory method (GTM), because it is most appropriate to describe characteristics of processes (Řiháček et al., 2013) and by its nature, the motivation belongs to psychological processes (Nakonečný, 1998).

Application of GTM begins with a searching for meaningful units by open coding. In the

following stadium of selective coding, a researcher tries to identify the most crucial concepts that are relevant to a research question. During this processes, we should use a constant comparison that ensures logical consistency with other concepts and their relations. A moment when a new research material does not bring new information to the coding process is called a theoretical saturation of a research sample (Holton, 2010). However, this is not a final stage of GTM. Apart from revealing of isolated concepts, we should specify their mutual relations; identify a core concept and formulate a theory (Řiháček et al., 2013).

Our research deals with a motivation of prospective teachers. By using of GTM, we reached theoretical saturation after analysis of essays from 12 respondents. However, the concept was observed in all available essays (118 respondents). With regard to the method and a specification of our research sample (prospective teachers of economics subjects at secondary schools), our findings cannot be generalized. However, a generalization is not a goal of qualitative research. Our goal is to reveal crucial motivational factors of prospective teachers and their relations.

Results

According to GTM procedure, categories created on the basis of the selected-coding process should be presented with specification of their relations. In correspondence with this idea, we use an approach of system dynamics to create a causal loop diagram of prospective teachers' motivation (Meadows, 2008; Šusta, 2015). In the diagram, we can observe 'R' loops – feedback loops that are reinforcing or self-multiplying. 'A reinforcing feedback loop enhances whatever direction or change is imposed on it' (Meadows, 2008: 31). 'B' loops are balancing loops that can be also described as goal seeking or stability seeking.

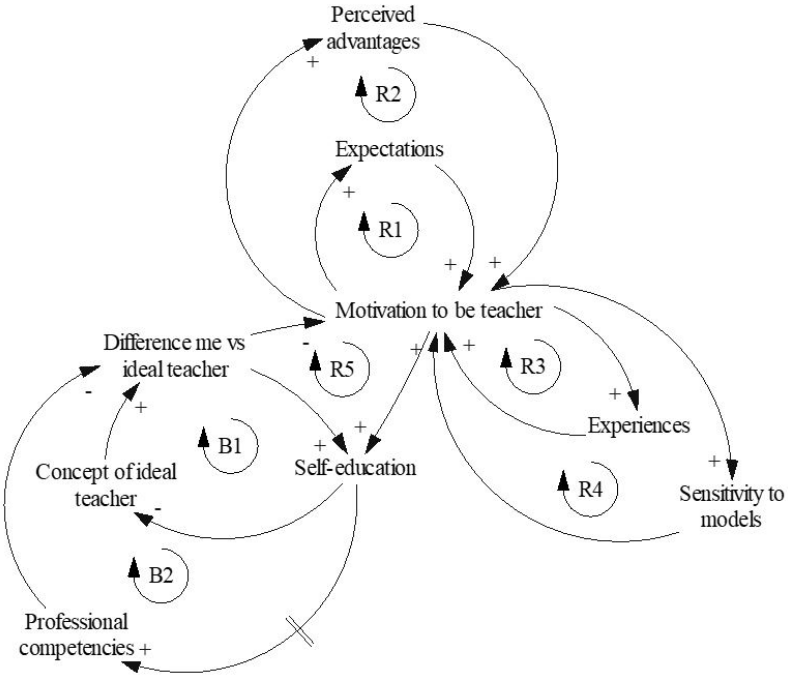

Figure 1: Causal loop diagram of motivational factors

Expectations

Respondents expressed their ideas of themselves succeeding in a role of teacher. 'I wish to be a teacher that is popular between students. I want them to trust me, to confide me and to turn to me when they need.' 'It would be a huge challenge for me to be a teacher because of possibility to mediate my experiences and knowledge to others.' In the diagram we can see that this loop is reinforcing (R1) – positive expectations increase the desire to be a teacher. The stronger the motivation is, the more positive expectations a prospective teacher has.

Perceived advantages of teacher's profession

The more advantages prospective teacher sees, the higher the motivation to become a teacher is. We can also observe that a desire to be a teacher influences a perception of advantages of a teacher's profession. A person who refuses to be a teacher would hardly see more advantages of this profession than a prospective teacher. A feedback loop is also reinforcing (R2). In our sample, respondents noticed various advantages from 'higher' goals (a possibility to educate and influence young students) to organizational aspects of teacher's work: 'In my opinion, the most attractive aspect of teacher's profession is the fact that it is not very time-consuming'.

Experiences

One of most obvious connections in the essays is some kind of positive experience of self in a role of an educator. No matter whether it was a role of an instructor of skiing, some kind of coaching or taking care of children at summer camp, these experiences motivate respondents to become a teacher. The motivation to be a teacher also lead them to this kind of activities. Consequently, we can designate a feedback loop as reinforcing (R3).

Sensitivity to models

Respondents often mentioned important teachers-personalities that influence their decision to be a teacher. 'My decision to study at University of Economics was influenced by our teachers of economic and accounting at a secondary school. Both ladies supported me very much, I am grateful for that'.

In the first stadium of the analysis, this category concerned positive examples of teachers. During the coding process, we found out that negative examples were also motivating for our respondents. 'From my own experiences, I know that teachers on a high school are not able to mediate knowledge despite their high specialization. (..) These experiences are valuable because they taught me how not to behave to students in education.' Obviously, prospective teachers can be motivated by both – positive and negative models of teaching. We can observe that they are more sensitive to their experiences with teachers and this sensitivity increases with their motivation to be a teacher, the feedback loop is reinforcing again (R4). 'Why am I going to be a good teacher? Because I have a vision how it could look like and experiences telling me how it shouldn't look like.'

A specific topic in this category are teachers in respondents' families, no matter whether they support respondents' motivation to be a teacher or not. 'Despite my mother persuaded me not to be a teacher, I know how much of pleasure brings her the profession.' 'I know that if I am I good teacher, I will be proud of myself as I was on my grandparents.'

Perceived difference 'me versus ideal teacher'

Even for an experienced teacher, a high sense for professionalism is typical as well as a feeling of their own insufficiency. This antagonism is even one of the stressful influences in the teacher's

profession (Fontana, 2014). 'When I should consider my strengths, it is not easy at all, because I am the self-critical person looking for opportunities to improvement.' 'I see an ideal teacher as a superhero that has to manage everything, has all professional and social competencies, is creative and funny.' 'I hate unjustness and I would be very disappointed if I were not able to have same attitudes to problematic students as to perfect ones.' '

A desire to be a teacher leads to seeking of relevant self-education that increases competences of a teacher (apparently, with a certain delay depending on a goal of this education). The growing competencies than decrease perceived difference 'me vs. ideal teacher'. Consequently, the motivation to be a teacher grows (R5).

A perception of an 'ideal teacher' increases the perceived conflict 'me versus ideal teacher' that leads to a need for an education. The self-education than decreases a concept of the ideal teacher, resp. makes this ideal less unreachable. In this case, the loop is balancing (B1).

Apparently, the difference 'me versus ideal teacher' decreases also with increasing competences that are reinforced by an education. Again, the need for education growths with the perceived difference 'me versus ideal teacher'. These relations are expressed by another balancing feedback loop (B2). This part of the diagram explains an importance of further education for teachers, respectively for the motivation to their profession.

Discussion

Our analysis is based on written self-reflection of prospective teachers. Therefore, it cannot explain why other people do not want to become a teacher. Nevertheless, it can help to support and maintain a motivation of young people who want to be a teacher or of the so-called 'teacher novices', who have started their pedagogical career recently. One of the crucial moments could be a work with perceived conflict 'me versus ideal teacher', respectively with an unrealistic imagination about an ideal teacher, with an inappropriate self-assessment of prospective teacher's own abilities and with unrealistic self-expectation. This kind of work – no matter if in a form of coaching, group supervision or psychotherapy – should lead to reinforcement of the self-esteem in a teacher's role. More preciously, a conflict 'me versus ideal teacher' could be described as 'lack of self-efficacy' (Bandura, 1977).

Moreover, we are aware of the fact that we obtain our findings from the specific group of prospective teachers. Our respondents are students of University of Economics who in majority chose a pedagogical study program as their second specialization. The validity of our findings for students of pedagogical faculties is an objective for further research.

Hypothetically, our findings could help to inspire students of secondary schools to become a teacher. An importance of creating positive expectation and supporting of positive experiences with an education or care about children are undoubtable. Our findings also emphasize a role of secondary school teachers in motivating of future teachers, because Czech teachers choose their profession mainly on a secondary school (MŠMT ČR, 2009). The teachers should realize that they serve as an important model for all their students who once decide to be (or not to be) a teacher and that they can even support this decision. Moreover, teachers create or modulate students' attitude towards teacher profession. Therefore, they can significantly influence if students perceived more of pros or cons of the teacher's profession. Similarly, although our respondents were motivated by both positive and negative models, we can hardly imagine that only negative models could be sufficient for the motivation to be a teacher.

According to a study of Ministry of Education, Youth and Sports (MŠMT ČR, 2009) based on interviews with 1002 Czech teachers, 38% would probably choose a different profession if they had a possibility to travel back in time. The considering this fact, the substantial part of Czech teachers mediates their students above all the negatives of the profession. Under these

circumstances, we cannot be surprised that many of Czech students, in general, are not very motivated to become a teacher. Many of them choose a pedagogical faculty as an easier way to get a university degree, many of absolvents of these faculties will never become a teacher. These facts belong to crucial problems of Czech educational system.

In the same study, the majority of teachers reflected that they choose their profession because they wish to work with children and youth. In our diagram, this reason corresponds to 'experiences'. The next reasons are a possibility to be freedom and creative ('perceived advantages' in our study), work in 'young environment' (we didn't detect this factor in our study, probably because young prospective teachers do not realize this need) and 'a need to mediate experiences' (in our study, this factor belongs to 'positive expectations'). Among other important factors, respondents mentioned a need for self-education. Similarly as 'young environment', this need may not be perceived by our respondents, who are current university students and they need for self-education is richly satisfied. However, an importance of the self-education is obvious in our diagram. The next factor of 'sufficient amount of free time' also emerged in our study as a part of 'perceived advantages of teacher's profession'.

Compared with the study of Bastick (2000), we can confirm that our respondents are not motivated by external rewards (excepting the free time). Similarly, in metropolitan English speaking countries in the study, the motivation is mainly altruistic and internal. On the other hand, low salaries in teacher's profession are the third most important reason for leaving the profession in the Czech Republic (MŠMT ČR, 2009).

As we already explain, we can use our findings to support secondary school students to choose a high school program dealing with education with the intention to become a teacher. The high school students that have already chosen this specialization probably already have certain motivation to be a teacher, however, our findings can enrich their professional preparation as well. We can maintain their motivation and prevent from a frustration shortly after a beginning of their pedagogical career. We can ask them what advantages their perceived by the teacher's profession and discuss about their real contexts (if a teacher really has more free time than other professions etc.). We should talk about important teachers that they met during their education, we can analyze pros and cons of these models and help students to realize which patterns of their behavior (or ideas, attitudes etc.) they would like to adopt. Moreover, we shouldn't forget that as high school teachers, we also serve as models to our students. The next inspiring part of our results is the option to work with students' self-perception of their professional competencies, with a perceived possibility to enrich them by education and with their own concept of ideal teacher. In general, we can observe if students' self-assessment and their concept of ideal teacher are realistic and how we can help them to reduce a gap between them.

Conclusion

Our research based on qualitative analysis of self-reflective essays of prospective teachers brings findings that help to understand prospective teachers' motivation to become a teacher. Thanks to the system dynamic approach, we can see interconnections between categories obtained by the GTM. We can see which factors are crucial for prospective teachers at the Department of Economic Teaching methodology. In subsequent research, we intend to verify a general validity of our diagram for students of pedagogical faculties. Further, we would like to research which factors are crucial for staying in the profession.

To support young people's decision to become a teacher, we should consider a great importance of current teachers mainly at secondary school. As teachers, we cannot directly influence a level of our financial evaluation. We cannot directly influence parents of our students although we know that a role of parents is crucial in our students' lives. However, we should realize that we are

unforgettable models for our students and we create their attitudes towards teacher's profession. Consequently, if we want to have good and enthusiastic teachers in future (and if we want to have a society that will adequately respect teacher's profession), we have to be the best teachers today.

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RESULTS ANALYSIS OF THE EXAM IN ACCOUNTING THEORY

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Abstract

The paper analyses exam results in the Accounting Theory subject in the Business and Administration (BA) and Public Administration and Regional Development (PARD) study fields from 2014-2017. In order to obtain a credit, students must score at least 70% in individual self-tests taken at home using learning materials and satisfy the conditions in the continuous credit tests taken at university without learning materials. Students who have been granted the credit may take the exam, which is divided into two parts. The written (Moodle) test examines theoretical knowledge, including accounting operations. Students achieving 70% or more can take the oral exam which requires being able to explain relationships, logic and mutual interconnections in accounting. Due to poor and deteriorating results in the subject, an analysis has been conducted on recent results of students' continuous work. Based on this analysis, this paper puts forward proposals to improve students' knowledge of accounting.

Keywords

Accounting, Czech University of Life Sciences Prague, statistical analysis, study results

Introduction

The origin of the study was significantly influenced by an article analyzing test results in the subject of Applied Mathematics for IT at the Czech University of Life Sciences (CULS) Prague (Brožová and Rydval, 2014), which emphasizes the importance of student testing as an integral part of pedagogical work, in addition to the importance of the precise formulation of exam questions. A similar issue is dealt with in Ulrychová's article (2016), in which she analyzes the relationship between the theoretical knowledge tested in students and their ability to solve practical mathematical problems and underlines the importance of taking an oral examination after completion of the written test in order to verify the student's depth of understanding and his/her ability to draw the correct conclusions. Therefore, it is also interesting for accounting subject lecturers to analyze the results of the study, draw conclusions from its findings and take follow-up measures. In addition to the didactic accuracy of the tests set (Slavík, 2012), learning outcomes are also influenced by student motivation, the purpose of which is to create conditions in which students have the desire to learn. This can be based on a student's own interest, the student and his/her family's aspirations, the student's relationship with the teacher and the subject, and on an advanced awareness of prospects or on the need to play an active role (Kolář and Vališová, 2009). Pacáková (2013) found that the proportion of students who were successful in the exam on their first attempt increased significantly if the results of the credit tests were incorporated into the final examination result, calculated as the weighted average of the results of the credit tests and of the written tests. The introduction of this system can have a positive impact on student motivation. Nonetheless, this involves combining the assessment of two separate 'activities' into one result

whereby the student is essentially "rewarded" twice for one activity, i.e. he/she is granted a credit and also a better result in the oral exam. This would make it possible to choose an assessment in the case of a classified credit, but not in the case of an oral exam in which the student is required to demonstrate a level of knowledge which significantly exceeds the requirements for a credit.
In the area of e-learning tools, Moravec and Valenta (2015) demonstrated that enabling students to work online during the course of the semester had a positive impact on results obtained in the final exam. Students who wish to gain new knowledge by monitoring the results of their continuous assessments online and by taking an independent approach to their studies better prepared for the exam using e-learning (Manocher, 2006). In their empirical study on university students, Yeboah and Sarpong (2017) reached the same conclusion.

Material and Methods

Content and test structure

The subject of the research is the exam results from 2014-2017 for the Accounting Theory subject taught in two full-time fields of study at the Faculty of Economics and Management of the Czech University of Life Sciences (CULS), that is, Business and Administration in Year 2 and Public Administration and Regional Development in Year 1. A credit can only be granted on two conditions. First, that the required grade (70%) is achieved from the individual partial test (self-tests) in Moodle which examines the student's knowledge of the topics presented and, second, provided that he/she fulfills the conditions for passing the continuous partial credit tests in Moodle, whereby an average result of 70% is required in the credit tests. Students are permitted to take an unlimited number of self-tests, enabling them to constantly improve their performance. Students have two attempts at each of the continuous credits tests.
After obtaining the credit, the student can then go on to take the exam, which is divided into two parts. First, the student takes a written test in Moodle comprising 45 questions which examines the entire content of the presented theory and requires answers to practical accounting operations. Only students who achieve 70% are allowed to proceed to the oral exam. In the ensuing oral exam, the student must be able to explain relationships, links, logic and mutual interconnections in accounting.
During the academic year, all student testing takes place in the LMS Moodle environment. For each type of test, a database of questions is formed from which specific tests are created. A total of 490 questions are used for self-tests, with a total of 306 questions used for credit tests. Some questions from the self-test database are part of the credit test database in order to enable students to utilize the knowledge acquired during self-study, for which 30 hours is accredited during the semester in accordance with the accreditation form. The written tests database is created independently of the other two databases and contains a total of 511 additional new questions which focus on individual accounting topics.
All questions are updated annually to take into account changes to the Accounting Act and applicable tax laws.
The written tests have a total of 45 questions with a time allocation of 45 minutes. Accounting operations questions that require the student to write down the accounting regulations carry double the weight of the other questions which are multiple choice. Electronic testing makes it possible to generate questions from a specific database of questions and thus makes each test unique. Students who pass the written test are allowed to proceed to the oral exam. From the lecturer's point of view, the written test result has no impact on the overall exam outcome. However, it is a necessary condition for passing the oral exam. The overriding emphasis is put on the oral examination and on the student's precision in formulating the answers to the questions asked.
Data from the LMS Moodle archive was used to evaluate the test results based on the results

of self-tests, credit tests and written tests. The final examination result was taken from the UIS. Students who failed to meet the requirements for obtaining the credit and were unable to take the exam were deliberately excluded from the study. Only results for students who passed the exams right up to the written test stage were left in the file, whereby the student had successfully passed the written test stage, but could have obtained a "fail" in the end-of-semester test, thus making it possible to quantify the impact of self-tests and credit tests on the overall result of the end-of-semester test. The number of students used in the analysis of study results in specific academic years is shown in Table 1.

Academic Year	BA Field of Study	PARD Field of Study
2014/2015	233	188
2015/2016	307	149
2016/2017	296	180
Total	836	517

Table 1: Number of students assessed for analysis (source: own data)

Methods used for analysis

The results of self-tests (X_1), credit tests (X_2), written tests (X_3) and oral exams (Y) for the individual years from 2014-2017 were described using descriptive statistical characteristics, and multiple regression and correlation analysis were used to *evaluate mutual relationships* and dependencies between variables. The underlying data was processed in the Statistica 12 software. Given the structure of the underlying data, a multiple linear regression function was chosen to evaluate the relationship between the oral exam result (Y) and other three factors (x_1, x_2, x_3). The estimation of the regression function can be written in the general form (Hindls, 2007):

$$Y = b_0 + b_1 x_1 + b_2 x_2 + \cdots + b_p x_p \tag{1}$$

where: Y is the estimated regression function

$b_0, b_1, b_2 \cdots b_p$ are the partial regression coefficients

$x_1, x_2, \cdots x_p$ are explanatory variables

The suitability of the function was verified using the F-test.
Statistical analyses enabled the following research tasks to be addressed:

- the disciplines demonstrate similar results for each preparation component and in the final evaluation;
- assessing the impact of individual components of student preparation for the exam;
- determining the level of the current influence of all preparatory components on the result of the end-of-semester exam;
- seeking ways to increase student knowledge of the subject.

Results

Description of the results in time by field

Table 2 and Table 3 show the average partial results for each study activity and the variation coefficient for the BA and PARD study fields.

Study activity	Arithmetic average (points) in the academic year			Variation coefficient (%)		
	14/15	15/16	16/17	14/15	15/16	16/17
Self-test	93.03	93.19	94.32	5.09	4.28	4.74
Credit test	82.78	87.00	86.86	9.17	9.81	11.71
Written test	77.49	79.81	78.19	11.08	10.85	10.32
Oral exam	2.49	2.29	2.64	38.29	31.69	30.70

Table 2: Description of the data file for the Business and Administration study field (source: own calculation)

Study activity	Arithmetic average (points) in the academic year			Variation coefficient (%)		
	14/15	15/16	16/17	14/15	15/16	16/17
Self-test	89.43	84.13	88.62	7.24	5.81	5.73
Credit test	83.08	85.30	83.99	9.03	11.14	7.87
Written test	78.94	77.79	75.58	11.45	11.25	12.69
Oral exam	2.22	2.41	2.46	43.46	42.61	40.14

Table 3: Description of data set in the study field of Public Administration and Regional Development (source: own calculation)

The findings in the descriptive characteristics demonstrate the different focus of the students in the individual fields of study and their efforts in the subject. Based on the arithmetic average and the variation coefficient, BA students devote more time to home preparation and continuous semester work than PARD students. However, their test results are worse with higher levels of variability.

Distribution of final marks by field of study

A box plot was chosen to evaluate the average value and variability in the overall exam results in the case of students from the individual fields. Figure 1 depicts data distribution on the basis of the arithmetic average of the resulting grades in the case of BA students. The results for the 2014/15 academic year show the highest degree of dispersal and a median of 3.00 points to weaker learning outcomes.

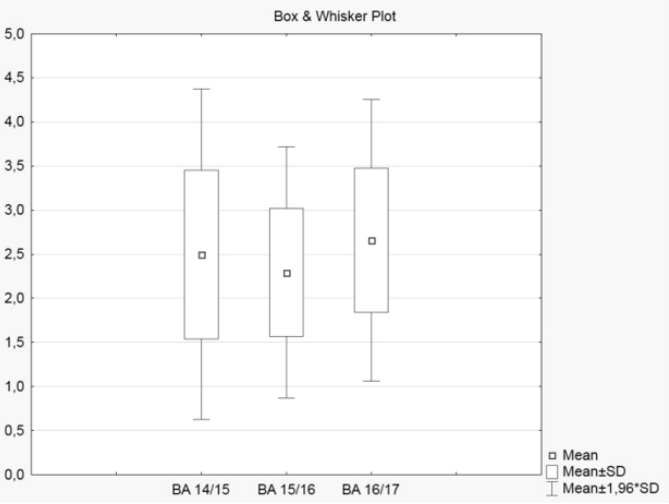

Figure 1: Box plot for the average test results in 2014-2016 – BA field of study (source: own processing)

In 2015/16, the oral exam results for PARD students were significantly statistically different from results in 14/15 and 16/17, as illustrated in Figure 2. The layout of the graphs shows the symmetrical results of the oral exams in the individual years when the average results differed only marginally. The medians in all three academic years under analysis are 2.00. A more detailed graphical summary demonstrates a lower representation of C grades (Czech equivalent: good or 3).

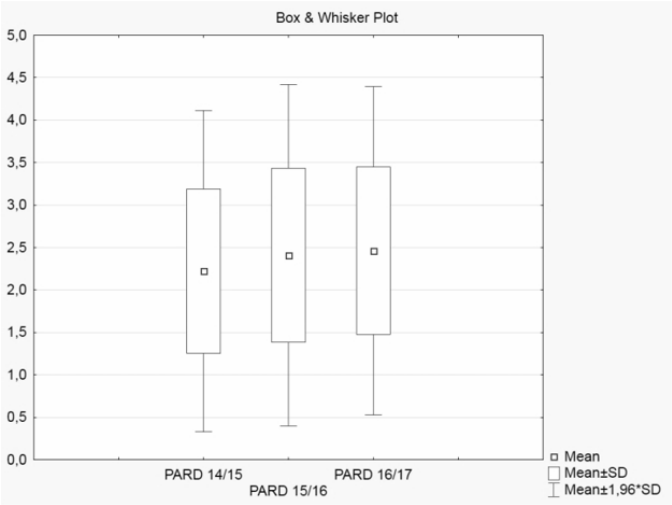

Figure 2: Box plot for the average exam results in 2014-2016 – PARD field of study (source: own processing)

The average end-of-semester exam results did not differ over the years with a probability of 95%. Nevertheless, the tendency points to a gradual deterioration in results.

Impact of the results of partial study activities on the oral exam result

In order to determine the existence of the dependence of partial results on the overall grade, it was necessary to choose a suitable regression function. Multiple linear regression was chosen on the basis of the level of strength of dependency, decisive regression coefficient and F-test errors. The shape of the regression functions for the individual fields of study is shown in Table 4 (for BA) and Table 6 (for PARD). The test result (Y) and three factors are entered in order to evaluate the relationship. This is the result of home preparation, expressed in the number of points obtained in the self-test, provided that at least 70 points have been achieved (X_1), the credit test (X_2) and the written test (X_3).

Academic Year	Shape of the regression function	Determination coefficient	F-test	p-value
2014/15	$y'=10.3049-0.0133x_1-0.0229x_2-0.0603x_3$	0.3949	49.810	<0.0000
2015/16	$y'=8.4447-0.0050x_1-0.0159x_2-0.00539x_3$	0.5549	125.93	<0.0000
2016/17	$y'=11.2400-0.0220x_1-0.0186x_2-0.0626x_3$	0.5521	119.95	<0.0000

Table 4: Multiple regression model for the BA field of study (source: own calculation)

Academic Year	Self-tests	Credit test	Written test
2014/15	-0.1080	-0.3604	-0.5948
2015/16	-0.0645	-0.4759	-0.7237
2016/17	-0.2768	-0.4094	-0.6849

Table 5: Pair correlation coefficients for the influence of other factors on final exam outcomes in the case of BA (source: own calculation)

Based on the determination coefficients in Table 4, it can be concluded that more than 55% of grade variability in the BA field of study over the past two years can be attributed to factors X_1–X_3. Other factors account for 45% of the exam result. The pair correlation coefficient table highlights the importance of written tests in relation to the final grade, while self-tests plays a minor role in the resulting grade. This does not mean, however, that self-tests are useless. On the contrary, self-tests play an important role in the oral exam result because each student has to achieve at least 70 points in the self-test to be allowed to sit the exam. The limit for the self-test is set satisfactorily and by taking them students have demonstrated a basic knowledge of the subject.

Academic Year	Shape of the regression function	Determination coefficient	F-test	p-value
2014/15	$y'=11.0417-0.0077x_1-0.0457x_2-0.0549x_3$	0.6032	93.238	<0.0000
2015/16	$y'=11.0958-0.0362x_1-0.0277x_2-0.0421x_3$	0.3672	28.048	<0.0000
2016/17	$y'=10.0123-0.0289x_1-0.0138x_2-0.0507x_3$	0.3525	31.944	<0.0000

Table 6: Multiple regression model for the PARD field of study (source: own calculation)

Academic Year	Self-tests	Credit test	Written test
2014/15	-0.4203	-0.6224	-0.7022
2015/16	-0.3903	-0.4653	-0.5028
2016/17	-0.2556	-0.4190	-0.5611

Table 7: Pair correlation coefficients for the influence of other factors on final exam outcomes in the case of PARD (source: own calculation)

According to the data in Tables 6 and 7, it is apparent that the situation for the PARD field of study is different. The impact of the factors taken into account on the final grade decreases each year and, on the contrary, the impact of "other factors", which have not been factored in, increases. Self-tests and credit tests play a more important role in the final assessment of PARD students in the subject. Their pair correlation coefficients are much higher than in the case of the BA field of study.

Discussion

Moodle allows students to continually monitor their level of knowledge and their level of understanding of the material presented and practiced by taking self-tests, whereby test scores can be constantly improved through repetition since students are allowed to take an unlimited number of tests. Knowledge consolidation should positively impact the outcome of both credit tests and the written tests in cases where the student is not satisfied with the minimum result required for obtaining a credit.

The learning outcomes observed for the two fields of study under examination, Business Administration and Public Administration and Regional Development, are somewhat worse which, according to Otavová and Sýkorová (2015), could be attributable to the students' conditions of study or the lecturer's personality, his teaching methods, methods of testing or personal motivation (Majovská, 2015). Kunzová (2015) claims that students do not usually try to get the best possible grade but are happy to obtain any grade as long as they finish the subject. Also, according to Popelková and Kovářová (2013), the impact of the quality of e-learning materials

can be a decisive factor in improving the oral exam result. Kunzová (2015) partly refutes this view with her assertion that study support using an e-learning course can give students the impression that it is not necessary to prepare for the exam using other information sources as well.
According to Frydrychová, Klímová and Poulová (2011), the Moodle study course should be divided into sub-thematic chapters with information about the goals, study materials, the possibility of self-assessment and providing feedback to the student on the results achieved. Authors Poulos and Mahony (2008) dealt with the ways in which students perceive feedback and found that, at a time when they are getting used to the university system, whether they receive negative or encouraging feedback on their progress is important, particularly for Year 1 students. This could affect VSRR students who have first-year accounting. Boháčková and Brožová (2012) analyzed the oral exam results of Faculty of Economics and Management (FEM) students and cited two reasons for their poor results, namely insufficient exam preparation and insufficient study aptitude.
Since no similar study has been published which analyzes exam results in accounting subjects at Czech or foreign universities, it is not possible to conduct a comparison. This creates a new scope for exploration, for example, a similar analysis could be conducted at the University of Economics Prague or at Mendel University Brno, where accounting subjects are taught, together with a comparison of the findings with those obtained at the CULS.
A study focusing on the quantified evaluation of student test data through Moodle was conducted in the subject of Fundamentals of Law at the University of Economics Prague where the authors examined the impact of e-Learning support on some lecture topics and confirmed the hypothesis that continuous Moodle testing helped to increase the average accuracy of answers by approximately 20% (Moravec and Valenta, 2015). Jarkovská et al. (2012) conducted an analysis of the exam results in the consultancy centres at CULS Prague in the courses on Mathematical Methods in Economics and Management and Systems Analysis of Product Verticals.
On the basis of our research findings, the minimum requirement for self-tests was increased from a minimum of 70% to 90% for the PARD field of study in the 2017/18 summer semester. Whether this measure will improve results in end-of-semester exams will be the subject of further research.

Conclusion

Based on the results of 836 BA students and 517 PARD students for three academic periods, it is possible to answer the research tasks identified.
Student results in the subject of Accounting Theory were not identical for the two fields of study examined. PARD students achieved better results, despite having somewhat worse results in continuous preparation/assessments. PARD students prepare more coming up to the oral exam.
In each of the years under review, self-tests play the least significant role in both of the study fields. This form of home preparation allows students to use all the learning tools available to them and therefore the student does not have to put in the maximum learning effort to achieve the desired result. This means that the newly acquired information is not of a lasting nature. Furthermore, self-tests are taken anonymously in the student's home, and therefore the lecturer is unable to check whether the student logged in Moodle is the person completing the test. However, overall, student self-tests are regarded in a positive light, as they encourage students to prepare for exams regularly. Nonetheless, their results show that it would be appropriate to increase the required number of points, a measure which was already introduced for the 2017/18 summer semester.
A certain increase in the required number of points should also be considered for credit tests. In the case of continuous credit tests, the student does not have the possibility to use any study tools, with test outcome based on knowledge alone. The knowledge tested includes smaller units for which students can prepare directly before the test.

In the case of both courses, the results of the credit tests have a moderate impact on the exam result. The written test has the greatest impact on the oral exam result. A high number of points does not necessarily mean that the student will pass the oral exam, despite the fact that the written test is a quantified reflection of the level of student preparation for the oral exam. The result of the oral exam is influenced by all factors at the same time, but to a lesser extent for Public Administration and Regional Development than for Business and Administration. Nonetheless, for both fields of study, a relatively large part of the variability of the results is influenced by other factors. In addition to ordinary student fears, nervousness, health, procrastination, etc., these factors include inadequate preparation or preparation that is not sufficiently in-depth, poor time management in the exam period, non-attendance of student tutorials, a greater inclination of the current generation of students to take risks, and the students' personal learning methods. Thanks to current technologies, students tend to replace knowledge with information that is not logical and that is short lived. During their studies, students at economics universities are not aware of the fact that accounting is very important in practice because accounting data is used to compile the reports used to conduct economic analyses that form the basis of responsible managerial decision-making.

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ACT AS A®: DEALING WITH NEGATIVE EMOTIONS

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Abstract

As part of testing the Act As A® simulation on a sample of secondary school students, it was found that negative emotions may emerge during the simulation. The aim of this paper is to propose new elements that can minimize negative experiences of the participants, either during or immediately after the simulation. The paper describes specific situations that occurred during the testing and the influence of the facilitator on the simulation process. In the context of the observed phenomena, suggestions are presented at the end of the article that can mitigate negative emotions in participants in the simulation. Ensuring a safer environment can positively affect the effectiveness of the didactic simulation.

Keywords

Aggressiveness, anxiety, didactic games, emotion, sensitivity, simulation

Introduction

The game is a phenomenon in the life of man that can be viewed from different angles. It accompanies human beings since birth and runs as a proverbial golden thread throughout their lives. From a psychological point of view, the game can be defined as one of the elementary human activities that, in children, is motivated primarily by their experiences; in adults, by rules and the meaning of the game (Hartl and Hartlová, 2015). In the general concept of Čáp and Mareš (2007), the game is perceived as a highly motivated activity, satisfying the need for activity, curiosity, social interaction and performance motivation. In educational reality, the game is an important activating element of teaching, allowing self-realization of pupils governed by rules and pursuing educational and training goals (Vališová, Kasíková and Bureš, 2011).

Didactic games have an irreplaceable role in the teaching process. They are intentionally created to develop cognitive processes, knowledge, and mental capabilities of the player. They serve to motivate, enable better understanding and application of the taught curriculum in simulated situations. They provide the participant with self-satisfaction which allows for more free and alternative activities that are more interesting, natural and emotionally richer for pupils than traditional didactic practices (Maňák and Švec, 2003). Činčera (2003) considers simulation games a demanding, yet highly efficient education and training tool that can be used in school lessons. In this context, Zormanová (2012) draws attention to the use of didactic games to fix the subject matter taught. However, Šisler and Brom (2008) argue that learning games will not replace teachers not even in the future, yet, they still have great potential for inclusion in new teaching systems.

As stated by Čačka (1999), the game includes both the rational cognitive area and the imaginatively emotional one. According to Hayes (2005), the notion that participants in the simulation will see their mutual weaknesses and mistakes can create a feeling of vulnerability and anxiety and may endanger people on a personal level. Some participants in the simulation are not able to speak in front of a group and share with others their own views if these views are considered inappropriate or meet with derision (Hayes, 2005).

Game technologies, such as simulation games, are used as a new generation of learning tools that improve learning and academic outcomes, involvement and motivation of students during learning. An important aspect in the assessment of these methods is their focus especially on cognitive outcomes of learning (Evangelia et al., 2016). Evangelia et al. (2016), however, draws attention to the fact that the importance of emotional aspects in game environments, which also make a significant contribution to learning, performance and motivation, is ignored. The results of their research have shown that students in these forms of education experience, in addition to positive emotions such as motivation and satisfaction, also negative emotions such as anxiety, nervousness, disappointment, insecurity, inability to solve the assigned problem, defeat, dissatisfaction, fatigue, fear and stress. Woolf et al. (2010) wrote about the same when addressing the use of educational resources such as educational games. According to him, participants in educational games may experience frustration, excitement, nervousness and anxiety.

For the purposes of this article, what is important is the notions of stress, anxiety, fear and aggression. Lazarus and Folkman (1984) understood as stress the relationship between a person and the environment which an individual perceives as extraordinarily demanding and thus exceeding his/her ability to manage it and, at the same time, endangering his/her well-being. Although stress does not have to be only negative, it can have its consequences on the psyche. These are manifested in the area of feelings and emotions and in the cognitive area where issues can arise, for example with attention, thinking, memory, imagination (Míček and Zeman, 1992). What is typical for stress is that it is manifested by increased emotional and physical tension, like another usual negative reaction - anxiety.

Rachman (2013) defines anxiety as a neurotic disconcerting anticipation of a threatening event without a specific form. Unlike fear, anxiety tends to be pervasive, and persistent, with uncertain points of onset and offset. Symptoms of anxiety and fear are divided into the psychological area (restlessness, feeling of being distressed or threatened), the mimic area (hypomimia, opened mouth, frightened expression), somatic (shivering, turning pale, rapid breathing), behaviour (stiffening, defensive behaviour, escape) and the area of performance (Vymětal, 2000). Vágnerová (2008) distinguishes two types of anxiety: (1) A feeling of anxiety as a sign of a potential threat that activates a person to be able to defend against something that is still unclear and undefined that, however, could harm him/her. (2) Anxiety as a more permanent personality trait that increases the readiness to feel insecure and respond by anxiety experiences.

In people with mental disorders, such as anxiety disorders, although sufficiently trained, despite their trying hard and having appropriate capabilities and skills, their anxiety limits them to such an extent that they are unable to fulfil their job responsibilities, are usually not assertive and have communication problems (Praško, Vyskočilová and Prašková, 2008).

During performance simulations and games, aggression can also be expected. Depending on the causes, aggression is divided into instrumental aggression and affective aggression. Instrumental aggression is a by-product in achieving other goals. As Fromm writes (1997), the objective of instrumental aggression is not destruction as such, it serves only as a means of achieving the goal. In contrast, affective aggression is more likely to be caused by unpleasant feelings induced by stressful events (Čermák, 1998). Čermák (1998) also divides aggression according to its form into direct/indirect, physical/verbal and active/passive aggression.

The aim of this paper is to propose new elements that can minimize negative experiences of the participants, either during or immediately after the simulation. The text is structured as follows: in the Materials and Methods, there is the description of the research context, results of the previous research, and methods used for the proposal of an extension. There is a descriptive output of our observation in the Results part, the Discussion is divided into the explanation of the link between

the theory and the suggestions, suggested changes, and their possible impact. At the end of the manuscript, the Conclusion part is mentioned.

Materials and Methods

Act As A® is a simulation in which participants play hidden roles. Ideally, twelve players play the roles of collaborators involved in the implementation of several projects. There are two basic types of collaborators (hidden roles) in the simulation. The aim of the simulation is to successfully complete (workhorses) or damage (loafers) three projects (Švec, 2013). The simulation is divided into: (a) a roles lottery (participants obtain hidden roles), (b) individual rounds (there may be three to five rounds) and (c) discovering principles (discussion with participants in the simulation that has taken place). There are phases in each round as shown in Figure 1 (Švec, 2013).

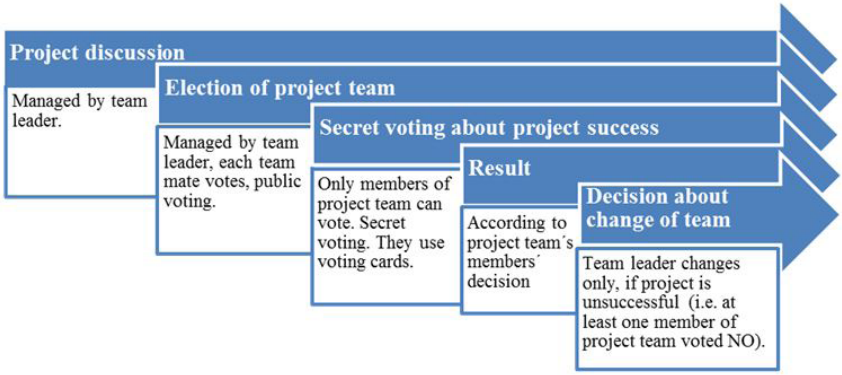

Figure 1: Phases repeated in each game round (Švec, 2013)

The Act As A® simulation was created at the Department of Management of the Faculty of Economics and Management of the Czech University of Life Sciences in Prague for the purposes of teaching basic team work competencies. The principles and ways of using simulation were presented by Švec (2013) and Křečková, Švec and Rydval (2017).

As part of the assessment of the possibilities to extend the simulation also to teach vocational subjects at secondary schools, simulation was also used, at the beginning of 2018, to test students of full age of third and fourth years at a Prague secondary vocational school. The simulation was conducted in eight cases where a total of 100 pupils were observed, of whom 28 boys and 72 girls. The conditions for the simulations were similar in all cases, a combined two-hour lesson in the morning was used. The simulation was assigned by two facilitators in the identical way. At the beginning of the simulation, instructions were always provided, the purpose and the objective were explained. At the end of the simulation, reflection was carried out, the participants verbally evaluated individual stages of the simulation, describing the selection of individual project participants, motivation to choose game strategies and emotions they experienced.

The Act As A® tool, developed at the Czech University of Life Sciences in Prague to train practical experience, can be classified as a simulation game, according to the classification of Meyer (2000), since it models reality in the form of project management and predicts discussion and conflict. According to Činčera (2003), this tool can be ranked among the so-called role-playing games in which clash of players among themselves is of key importance. Although the main goal of the simulation is a development of three basic team competencies: activity, assertiveness and awareness (Švec, 2013), the simulation does not meet the definition of a cooperative game

(Kasíková, 1997). Participants in the simulation thus cannot define the rules of the game and the ability to model a safe environment is limited due to game parameters.

Results

During the simulations carried out, in some participants, phenomena were observed that can be grouped into several situations:

1. The choice of the team leader took place in six simulations in a manner whereby one person was chosen on whom the others agreed, while this participant did not show interest in the position of the leader. Our observations were thus identical with the description presented by Švec (2013) as well as by Křečková, Švec and Rydval (2017), i.e., in most cases, a constructive debate concerning the choice of the leader was completely missing. This fact is explained by Křečková, Švec and Rydval (2017) as an effort to get rid of the responsibility and fear of an unknown situation. It has been observed that a leader chosen in this way shows somatic symptoms of anxiety, namely motoric restlessness, trembling and accelerated breathing.
2. In three simulations, there were individuals who took the initiative for the whole team and their communication behaviour was verbally aggressive. There were accusations of other less proactive participants, these accusations were repeated and intensified while, in one case, the participant's behaviour escalated by a blow to the table.
3. 26 simulation participants (18 girls and 8 boys) experienced anxiety and stress at all stages of the simulation. Manifestations of this anxiety and stress were observed in situations where the proactive individuals were fully involved in the simulation. The more anxious individuals tried to get involved in communication, but, after the initial failure, they did not keep trying. In response to the game situation, it was possible to observe a withdrawal from communication in these individuals and non-verbal expressions of tension, such as crossing the hands and legs, moving away from the game table or a withdrawal.
4. After the simulation concluded, nine of the participants (6 girls and 3 boys) continued to demonstrate symptoms of anxiety and stress observed before. Three of them (2 girls and 1 boy) showed reactive aggression towards the facilitator or the simulation as such. The experimental nature of the simulation was pointed out without reference to the real environment.
5. The way in which the facilitators conducted the simulation was the decisive influence on the situations described above. Although the instructions in all observed cases were identical, in the course of the simulations the personality characteristics of the individual facilitators manifested themselves and contributed to the intensity and dynamics of the experienced emotions. The degree of facilitator's directiveness influenced the management of psychological stress and the length of the individual phases of simulation. If the facilitator gave clear directions and instructions specific to the given situation in each phase of the simulation, the course of simulation was smoother, the simulation phases lasted for a shorter period of time and the participants showed negative emotions to a lesser extent.

Discussion

During the simulation, negative emotions were repeatedly observed, especially anxiety, fear, stress and aggression. In the first situation, the anxiety of the leader, after his/her election, manifested itself visibly above all by physical symptoms. Yet, as Praško, Vyskočilová and Prašková (2004) wrote, anxiety and fear affect the whole organism. We suddenly react mentally (thoughts and emotions), by physical symptoms (turning red, heart pounding) and behaviourally (stiffening, escape from the situation). It is possible to assume that the anxiety of the leader has manifested

itself in behaviour and thinking. These findings are supported by Švec (2013) who observed that some elected leaders were not able to come up with new ideas in the simulation. The speed and sophistication of the choice of the project team that is in the hands of the leader can therefore be greatly influenced by his/her emotions. A leader experiencing anxiety will probably try to escape the situation by not dedicating too much time and thought to the choice of the project team. Similarly, a team with more anxious participants, as described in the third situation, cannot be expected to play the role consisting in checking the leader and his decisions. Both physical and behavioural manifestations were observed in these participants. Resignation and withdrawal, primarily caused by anxiety, resulted in these participants having voted automatically for the project team without showing any interest in what was going on or the result of the simulation. Atkinson (2003) defines two ways of coping with stress; one can focus on a particular problem that has occurred and try to find a way to resolve it or avoid it (= coping focused on a problem) or one can focus on relieving the emotions associated with the given stress situation (= coping focused on emotions). Both the response of the leader in situation 1 and the response of the participants in situation 3 correspond to the focus on the problem and, specifically, on avoiding it. The simulation should include elements directly addressing the solution of a problem or on mitigating emotions that would allow participants to cope more effectively with stress.

The second situation concerned aggression. Enforcing one's opinion is an important element in the Act As A® simulation which is why the assertiveness of the participants is welcome. However, as Čermák (1998) points out, in practice, assertiveness can easily turn into aggression. The aggression that emerged from the initially assertive need to express suspicion that one of the participants was a loafer served as a means of achieving a certain goal and corresponds to Fromm's (1997) definition of instrumental aggression. According to Čermák's (1998) classification, we can characterize it as active, direct and verbal aggression. In the case of a blow to the table, the aggression was active, indirect and physical. Although conflicts are natural in each human group, they need to be maintained within the appropriate limits (Forsyth, 2000). It is advisable to focus on the victims of such aggression. Novák and Capponi (1996) point out that the person who has become the target and the victim of aggression is endangered by the consequences. These consequences can vary according to the degree of aggression and the sensitivity of the "victim". The victim of aggression may experience feelings of exhaustion, humiliation, loss of personal value, hopelessness and anxiety.

The fourth situation describes another form of aggression. After the simulation ended, the participants responded aggressively to the facilitator or the simulation itself. What appeared to be an uproar of anger could also have started as anxiety (O'Neill, 2007). Therefore, it is necessary to pay attention to both the emotions during the simulation and the emotions that persisted even after the end of the simulation. Hasson (2015) warns directly against the suppressed emotions which, he says, will always manifest themselves in a different way; a typical example being passive aggression. This type of aggression uses sarcasm, lamentation, resentment, insincere looks, etc., these are only methods of expressing the true, original emotion that such an individual is reluctant to admit. Participants in situation 4 showed their suppressed emotions by complaints about the futility and meaninglessness of the simulation and the poor work of the facilitator. This could be avoided by a method of working with emotions that would be incorporated in the simulation or that would follow up on it.

As Švec (2013) writes, the Act As A® simulation is focused on the development of activity, assertiveness and awareness. Nevertheless, negative emotions that emerge during the simulation significantly interfere precisely with these team competencies. The activity of participants experiencing anxiety and stress is decreasing, the assertive approach can grow into aggressive behaviour or may be absent altogether. Awareness, as the third principle of simulation, is based on

attention in which, according to Vuilleumier (2005), emotions play an important role. A facilitator also plays a significant role in the simulation as shown by the fifth situation. However, his/her role and activity are not clearly and precisely specified in the simulation. Not all emotions, however, have a negative impact on the participants. Stress and anxiety, if present to a reasonable extent, can be subjectively perceived as exciting. Anderson et al. (2016) point to the correlation between excitement, interest, and satisfaction. These emotions motivate participants to continue in the activity (Anderson et al, 2016). The motivation to continue in the simulation and the interest in repeating the simulation thus manifested themselves in some of the participants in whom symptoms of anxiety were observed during the simulation. It thus also depends on the intensity of the emotions during the simulation. Emotions, as reported by Petroviča and Anohina-Naumeca (2017), should be taken into account when acquiring and subsequently evaluating the knowledge obtained during game-based learning. The authors found that participants' emotions are rarely taken into account when evaluating results. In the best case, simulation developers only mention how to use the emotions identified in players (Petroviča and Anohina-Naumeca, 2017). Therefore, in the part called Suggested Changes, ways how to work with emotions, how to mitigate negative emotions and ensure safer environment that can positively influence the effectiveness of the Act As A® didactic simulation are mentioned.

Suggested Changes

In accordance with Ewert and Sibthorp (2009), it has been confirmed that the results of experimental education are affected by a number of variables, many of which escape attention of researchers. These variables (e.g., the diversity of the participants, their choice, personalities and feelings such as anxiety, euphoria, etc.) are uncontrollable and yet very influential which means they can negatively affect the course and the results of the simulation; they affect what and how the participants will learn, or even what they experience during the simulation. Suggested changes to the Act As A® simulation allow a better control over the aforementioned effects by both the facilitator and the participant.

In all the situations described above, one of the decisive factors is the role of the facilitator who sets its atmosphere by the way in which he/she conducts the simulation. The facilitator can also simulate non-standard situations when trying to achieve didactic goals, however, he/she should not create a dangerous environment. As Huizinga (2008) states, rules are an important part of games. They are unconditionally binding and do not permit doubts. The rules create a safe environment in which participants in the simulation can better express and cultivate their own emotions and work more effectively. The mental states of participants in the simulation also need to be worked with because in their "low psychological safety" they tend to cause disturbing events that interfere with communication, making it more turbulent and conflicting (Wyss-Flamm, 2002). According to Maslow, "psychological safety" is about the need for safety and protection from pain, fear, anxiety and disorders (Maslow, 1954).

It is recommended to prepare clear instructions for all possible interaction situations in the form of a facilitator's manual. Right in the first situation, when a constructive discussion on the part of the team members was completely absent, it is considered necessary to properly familiarize participants in the simulation with the objectives, the course, emotional risks, consequences in relation to the participants and the situations that they may encounter during the simulation. In agreement with Huizing (2008), it can be assumed that somatic anxiety when electing the leader would be reduced if there were more clearly defined rules; communication among the participants would be more open and the atmosphere safer. Provision of these instructions can be varied with respect to the age and educational structure of the participants or the didactic goal of the

simulation. Instructions for younger or less experienced players can be algorithmized so that each facilitator can offer to every participant in the simulation, directions for possible solution to the problem.

When creating a manual, inspiration by standardized psychological tests (such as the Wechsler Adult Intelligence Scale, Amthauer test, etc.) is suggested that contain clear guidelines for administration, scoring criteria, and the possibilities how to interpret the given results. The instructions for the facilitator should include the goal of the game, the duration of its implementation, the definition of the participants in the simulation, risks and the way of their elimination and, potentially, also other methodological issues. Part of the guidelines should be a clear procedure the facilitator should take in each predictable situation. This measure minimizes the interaction of personality and other influences on the course of the simulation on the part of both the facilitator and the participants.

Cards in three different colours are designed to alleviate negative emotions during the simulation. Two of them symbolize the basic components of assertiveness, namely the ability to express feelings and the ability to protect one's assertive rights. A yellow card can be used by the participant who personally is not in a discomfort situation but uses the card to protect the others. It expresses the following message: "It seems to me that your communication is not assertive." A red card can be used by the participant who feels threatened and it expresses the following message: "I do not like your way of communication" or "You are overdoing it". Another, green card, could express a tactical intent. The actual execution of the cards should reflect the situation. Inscriptions "STOP", "CAUTION" or just an exclamation mark may be considered.

With regard to the fourth observed situation, it is suggested to use some of the available emotional cards (e.g. "States", "Sea of Emotions", "Emotions", etc.) during the post-simulation analysis. Working with emotional cards is a modern approach that, after being trained, not only psychologists and coaches but also regular teachers and facilitators can use. The cards use Freud's projection principle. Freud applied it to the defence mechanism against anxiety (Svoboda, 1999). The projection principle can be understood as the attribution of one's own characteristics, motives or values to what one sees in the picture. Cards are, in addition, a safe tool for depersonalization – the participant in simulation does not speak primarily about himself/herself but talks about the picture in the card. Emotional cards are available in different forms on the market but they usually contain six basic emotions (joy, sorrow, resentment, surprise, anger and fear) that, according to the research carried out by Ekman (2015), are found in all cultures and other emotions that can be divided into adaptive, maladaptive and neutral. After the end of the simulation, the participant in the simulation can more easily express his/her current state in terms of qualities, skills or social interactions, the cards can capture the view of a person from the other shore or to model the future. It can be assumed that, by using the above suggestions, mitigation of the manifestations of negative emotions will take place during the simulation at all its stages.

Conclusion

Act As A® is a didactic simulation thanks to which optimally twelve players play hidden roles in managing several projects. It is a tool thanks to which players develop three basic team competencies: activity, assertiveness and awareness. Since 2014, the simulation has been used to teach at the Czech University of Life Sciences in Prague and its use is also planned in vocational subjects taught at secondary vocational schools. In 2018, at one of these schools, the simulation was experimentally tested, namely on a hundred of students of the third and fourth years of study in courses concluded by the school-leaving examination. In the course of the testing, negative emotions, especially those of anxiety and verbal aggression, were observed in the participants.

In order to minimize these negative emotions, based on the above, it is proposed to include two types of cards in the simulation. The first of these are cards that allow a participant to express his/

her feelings and ability to protect their assertive rights, the other type are emotional cards that are designed to be used for post-simulation analysis. At all stages of simulation, the facilitator is the key person. To make his/her role easier and to create a safe environment, it is advisable to process a manual that will include all of the predictable situations that may occur during the simulation.
The current observation results show that the Act As A® simulation is an interesting didactic tool that can be effectively used to teach vocational subjects at secondary vocational schools. However, the emotional impacts observed in the students are considerable and it is therefore desirable to continue to address this topic. In further research of the simulation, it is recommended to experimentally verify the proposed changes and their impacts on the psyche of the participants and the efficiency of the simulation. Furthermore, it is proposed to experimentally verify the dependence between the personality dispositions of the participants and the experiencing of negative emotions during the simulation in the form of standardized methods, namely on an appropriate number of participants.

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EFFECTS OF EDUCATION AND HIGH WAGES ON AVERAGE WAGES IN THE CZECH REPUBLIC

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Abstract

Average wages are among the most frequently published indices concerning wages. The level of average wages is influenced by numerous factors; the highest achieved education is one of such factors. On the other hand, the average is subject to many shortcomings, in particular, sensitivity to outliers. In our setup, high wages (above 100,000 CZK per month) play the role of such outliers. There need not be many of them, but they are able to significantly increase the average values. In the present paper, we study the influence of the high wages on the average values within individual categories by education, and compare the results with the data for the Czech Republic as a whole. We support our observations with calculations, compute the average wages after exclusion of the high wages, and indicate the effects the high wages have on the total number and financial volume of wages. We also be interested in the quantile measures for the wage data.

Keywords

Average wage, achieved education, high wages, wage quantiles, wage median

Introduction

One of the basic economic indices is the amount of the wage (or salary or income). The wages are among the most closely watched characteristics by employees, economists, politicians, etc. The level of wages is usually measured by their arithmetic average values. Many authors have been active in this area in the Czech Republic; in particular, (Bartosová, and Longford, 2014) and (Malá, 2015). Some authors focus on specific areas of the economy – for example, ICT (Maryska, Doucek, and Nedomová, 2015; Nedomová, Doucek, and Maryska, 2015; and Doucek, Nedomová and Maryska, 2015). A general treatment on the time evolution of wages can be found in (Hanclová, 2006; Marek, 2010; and Marek, 2013). The effects of education on the amount of wages are well described in (Marek, Doucek, 2015). Some authors deal with the question of income inequality (Pacakova, 2012) and (Terek, 2016). However, none of these authors have given attention to high salaries and their effects on the amount of average wages in a given industry, or the Czech Republic as a whole, with respect to the education achieved.

Methodology

All our calculations are based on the monthly wage data surveys carried out by the company Trexima (Trexima, 2016); this company conducts statistical surveys for the Ministry of Labor and Social Affairs and the Czech Statistical Office – see the ISPV sample file (ISPV, 2017) – Information system on average earnings.

For our calculations, the most important feature is the structure of the data set, clearly seen in Table 1:

Number	Wage interval			Midpoint	2_Q_2014	2_Q_2015	2_Q_2016	2_Q_2017
…	…	…	…	…	…	…	…	…
41	20,000	-	20,500	20,250	53,984	51,452	50,850	47,453
42	20,500	-	21,000	20,750	52,323	52,703	50,189	47,865
43	21,000	-	21,500	21,250	51,881	51,440	52,300	48,769
44	21,500	-	22,000	21,750	51,723	51,176	51,762	49,865
…	…	…	…	…	…	…	…	…

Table 1: Example of data (source: Trexima)

It is a relatively detailed interval distribution, with an interval width of 500 CZK. A problematic interval is represented by wages above 100,000 CZK, which are all aggregated under a heading of "above 100,000". Here we have to reconstruct the average level of wages in this interval; this is only possible due to the fact that we have at our disposal relative frequencies in all intervals and know the overall average value. We will speak about the wages above 100,000 CZK as "high wages" below.

The data were recorded in the years 2000-2017, always in the second calendar quarter in each given year (this is not a random choice: it is the quarter with the most stable working hours). This data makes up a time series that is sufficiently long for not only comparing between years, but also for studying of the time evolution (and estimating the trends). The following data are at our disposal for each year:

CountZam - number of employees;
CountICO - number of employers;
Prumer - average;
StanDev - standard deviation;
VarKoef - variation coefficient;
D1, D9 - 10% and 90% quantiles
Q1, Q3 - upper and lower quartiles;
Median - median;
FondPD - volume of working time (in hours).

The number of monitored employees has been growing from 321,000 in 2000 to 2,186,000 in 2017 (for the entire Czech Republic). This sample is large enough that we can rely on credibility of the results based on it.

High Wages

Let us first have a look at the changes in high salaries in 2017 as compared with 2000.

Category	2000	2017	Absolute change	Relative change
PhD	36	1,878	1842	5,217%
Master	849	16,432	15,583	1,935%
Bachelor	23	955	932	4,152%
Secondary	100	3,914	3,814	3,914%
Secondary Vocational	6	176	170	2,933%
Elementary	3	17	14	567%
CR Total	1,391	23,795	22,404	1,711%

Table 2: The wages above 100,000 CZK (sources: Trexima, author's own calculations)

This Table shows that, for nearly all categories of education, the differences are very large. For comparison, we also refer to the number of high wages in the Czech Republic as a whole (CR Total). We can observe the following facts in 2017:

- the largest change in the percentage value occurs for the PhD category;
- the absolute increment is largest for the Master category;
- as expected, the smallest increments (both absolute and relative) occur for the Elementary category; and
- the proportion of the Master category in CR Total amounts to 69%, while for the PhD category this proportion is 7.9%.

Even this simple Table indicates the large influence which the achieved education has on the high wages: the highest level of education (Master + PhD) represents a 77% proportion of the high wages in the Czech Republic.

The following Table records the time evolution of the high wages' proportions in the average wages by category of education achieved (the "Rel. freq." columns) and by the proportion of the high wages in the total financial volume of wages in the given category (the "Volume" columns). All these figures have been calculated for the entire monitored period of 2000-2017 and for four categories of education achieved.

	PhD		Master		Bachelor		Elementary	
Year	Rel. freq.	Volume	Rel. freq.	Volume	Rel. freq.	Volume	Rel. freq.	Volume
2000	0.470%	3.471%	0.773%	5.966%	0.430%	5.655%	0.002%	0.036%
2001	0.928%	5.099%	1.374%	7.408%	0.405%	2.760%	0.002%	0.001%
2002	1.105%	6.191%	1.989%	11.194%	0.689%	5.387%	0.003%	0.058%
2003	1.225%	7.094%	2.157%	11.623%	0.569%	4.365%	0.002%	0.023%
2004	1.094%	5.857%	1.572%	9.018%	0.237%	1.348%	0.001%	-0.617%
2005	1.381%	7.396%	1.709%	10.498%	0.372%	3.328%	0.020%	0.986%
2006	1.924%	8.904%	2.055%	12.037%	0.486%	3.331%	0.022%	0.299%
2007	2.222%	9.955%	2.605%	14.148%	0.584%	3.612%	0.039%	0.477%
2008	2.920%	12.589%	3.108%	15.826%	0.674%	5.096%	0.027%	0.330%
2009	2.988%	12.041%	3.320%	15.728%	0.716%	3.986%	0.039%	0.494%
2010	3.053%	12.176%	3.384%	15.703%	0.718%	3.842%	0.026%	0.274%
2011	3.509%	13.671%	3.507%	16.225%	0.706%	3.946%	0.045%	0.511%
2012	3.315%	13.629%	3.556%	16.556%	0.780%	4.997%	0.075%	1.386%
2013	3.453%	13.177%	3.756%	16.450%	0.822%	4.543%	0.011%	0.087%
2014	3.770%	13.550%	3.615%	15.297%	0.744%	4.070%	0.008%	0.072%
2015	4.076%	13.944%	3.624%	14.998%	0.802%	4.351%	0.012%	0.086%
2016	4.512%	15.295%	3.844%	15.214%	0.882%	4.479%	0.006%	0.055%
2017	4.810%	15.625%	4.027%	15.200%	0.994%	4.719%	0.013%	0.091%

Table 3: Wage proportions according to education (source: author's own calculations)

We will illustrate the meaning of these results on the example of the PhD category in 2017. Regarding the count, high wages made up a mere 4.81% out of the total number of wages in the PhD category. None the less, their proportion in the total financial volume of the PhD category amounted to 15.625%. We can see that the situation is rather similar in all the other categories as well. The volume proportions are, in all categories, many times larger than the frequency proportions.

Let us, using specific figures, illustrate the influence of the high wages on the average ones in the above-specified categories of education achieved; for the sake of brevity, we will restrict ourselves to 2017.

Category	Overall	Up to 100	Difference
PhD	46,948	41,614	5,334
Master	42,768	37,789	4,979
Bachelor	32,383	31,164	1,218
Elementary	19,234	19,219	15

Table 4: Average wages in CZK according to education (source: author's own calculations)

The "overall" column shows the average wages by the education category. The "Up to 100" column shows the average value after excluding the values above 100,000 CZK. The final column, the "Difference", calculates a difference between these two average values. If an employee with a PhD education was receiving 46,948 CZK on average, after the exclusion of high wages this average value went down by 5,334 CZK to a value of 41,614 CZK. It is therefore clear that the influence of the high wages on the average ones analyzed by category decreases together with the level of education achieved; it is negligible for the Elementary education.

Let us now have a closer look at the PhD category. The Chart below shows the average wages after the exclusion of those above 100,000 CZK, above 90,000 CZK,…, and above 60,000 CZK.

Figure 1: Time evolution of high wages (source: author's own calculations)

After the exclusion of the wages above a certain limit (and let us keep in mind that 60,000 CZK is more or less a doubled value of the average wage in the Czech Republic), the average wage value for the entire Czech Republic is significantly decreased. This is another illustration of the fact that a small number of the high wages substantially increases the average wage value.

A similar Chart for the "Master" or "Bachelor" category would provide similar illustrations.

Up to this moment, we have compared the situations inside of individual categories. Let us now have a look at a comparison of high wages with respect to the Czech Republic as a whole. We have calculated the results for all years in the period 2000-2017; for the sake of brevity, we only show them for 2017 below.

Category	Rel. freq.	Volume
PhD	0.09%	0.45%
Master	0.75%	4.16%
Bachelor	0.04%	0.23%
Elementary	0.00%	0.00%
PhD + Master + Bachelor	0.88%	4.84%
Czech Republic	1.09%	5.91%

Table 5: Comparison with the entire Czech Republic (source: author's own calculations)

Now we compare the values in individual categories of the education achieved with those valid for the Czech Republic as a whole; however, let us keep in mind that we compare the wages above 100,000 CZK with all the remaining ones:

- the count of the high wages was 1.09% out of the total count of all the wages in the Czech Republic; but this percentage was a 5.91% proportion of the financial volume;
- the PhD category accounted for 0.09% of the count and 0.45% of the volume, the Master category 0.75% of the count and 4.16% of the volume, etc.;
- the Elementary education level has no measurable effect – the proportion in both count and volume is virtually zero; and
- considering the university education levels aggregated into one whole (PhD + Master + Bachelor), they make up 0.88% of the count, but their proportion in the total financial volume amounts to 4.84%.

Conclusions

Several general conclusions can be made on the basis of the presented analysis:

- high wages above 100,000 CZK substantially influence the overall average wages;
- this influence of the high wages is growing in time;
- the proportion of the high wages in the financial volume of wages as a whole is substantially larger than their proportion in the number of wages; and
- the high wages' proportion grows with a higher level of education achieved – the "Master + PhD" category represents a 77% proportion in the total number of high wages in the Czech Republic.

Significant economic growth occurred in 2017; hence we can expect for all wages to be growing. The increased minimum wage will also contribute to the increase in the average wages. We can be certain that both the number and the volume of the high wages will be growing. On the basis of the evolution in the most recent 18 years, we can deduce that the differences will be increasing between the average values over all wages and over those after exclusion of wages above 100,000 CZK. In other words, high wages will influence the average wages in the Czech Republic to an ever-growing extent. Continuation of the present analysis will therefore be very desirable.

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SNT PROCESS PETRI NETS THEORY APPLIED TO RECORDING OF REMOTE PRESENTATIONS

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Abstract

The deployment of various eLearning technologies in all forms of the educational process has been a common part of it for many years, but it is clear that classical textbook support cannot fully replace the direct or mediated interaction of a teacher with a student. The realization of this interaction and its recording is also necessary if the educator cannot participate in the lecture process directly in the classroom but he interacts with students from a remote site. Apple mobile technologies have been successfully deployed in fulfilling these objectives at the Faculty of Economics VŠB-Technical University of Ostrava. They are available within the services of the training center of the Apple Authorised Training Centres for Education (AATCE) worldwide program. The SNT process Petri nets theory was applied at the design and implementation of information barrier-free approach that is determined for the realization of the remote teacher‘s presentations and their recordings.

Keywords

AirPlay, Apple, FaceTime, MERLINGO, remote communication, rich-media, SNT process Petri nets, TV

Introduction

The deployment of various eLearning technologies in all forms of the educational process has been a common part of it for many years, but it is clear that classical textbook support (possibly supplemented by multimedia components) used mainly in asynchronous form of teaching cannot fully replace the direct or mediated interaction of a teacher with a student. Comprehensive multimedia visualization of the educational process that is available on-line or on-demand becomes an absolute necessity for the full mediation of information from the teacher towards the students and it is essential for the state of development of Czech higher education to be a standard part of the teaching process of all the forms of study. The realization of the teacher-student interaction and its recording that is available on-line or on-demand is also necessary if the educator cannot directly participate in the lecture process directly in the classroom for various reasons but interacts with students from a remote site with using of the Internet services. Apple mobile hardware and software technologies, like Apple TV (AppleTV, 2018), FaceTime (FaceTime, 2018), AirPlay (AirPlay, 2018), etc., have been successfully deployed in fulfilling these objectives at the Faculty of Economics VŠB-Technical University of Ostrava. They are available within the services of the authorized training center of the Apple Authorised Training Centres for Education (AATCE, 2018) worldwide program with its current statutes of IT Focused AATCE and Media Focused AATCE. The AATCE training center has the whole university scope of operation and its main goal is the education and preparation of the certified students and teachers in the areas of the MacOS operating systems, multimedia technologies and the Swift programming language in the chosen bachelor and master study programmes. An integral part of the implementation of the educational process in the AATCE training center is then also recording of the lectures and exercises with using of the rich-media (EduArt, 2018), FaceTime and AirPlay technologies.

Achieving comprehensive collections of recordings of presentations in the learning process and accomplishment of their availability on-line and on-demand in creating the information barrier-free approach for all the students to the learning process is one of the main goals of the MRERLINGO (*MEdia-rich Repository of LearnING Objects*) project (MERLINGO, 2018). The design and implementation of the hardware and software support of the AATCE lecture room enabling automated central recordings of the remote presentations and their on-line and or-demand publication was one of the solved problems. It was necessary to design and implement the single-purpose programming support based on Apple technologies determined for the generally distributed computing environment with the stated properties. Mathematical theory of Petri nets was chosen (Balogh et al, 2012) for that reason. The class of high-level Petri nets (Diaz, 2009) named SNT proces Petri nets (Martiník, 2015) was chosen for these requirements and it has been significantly applied at the design, verification and implementation phases of the necessary hardware and software support preparation.

Materials and Methods

Mathematical preliminaries

Let $\boldsymbol{N}$ denotes the set of all natural numbers, $\boldsymbol{N}$:= {1, 2,…}, $\boldsymbol{N}_0$ the set of all non-negative integer numbers, $\boldsymbol{N}_0$:= {0, 1, 2,…}, $\boldsymbol{Z}$ the set of all integer numbers, $\boldsymbol{Z}$:= {…, -2, -1, 0, 1, 2,…}, ∅ the empty set, $|A|$ the cardinality of a given set A, ¬ the logical negation operator, ***IDENT*** the set of all the identifiers. **Multiset** M over a non-empty set S is a function $M: S \rightarrow \boldsymbol{N}_0$. The non-negative integer number $M(a) \in \boldsymbol{N}_0$, where $a \in S$, denotes the number of occurrences of the element a in the multiset M. The multiset M over a non-empty set S will be represented by the notation M:= $[a^{M(a)}, b^{M(b)}, c^{M(c)},\ldots]$, where S:= $\{a, b, c,\ldots\}$. Notation S_{MS} then denotes the class of all the multisets over the set S. If $K, L \in S_{MS}$, then $K \oplus L$:= $[s^{K(s) + L(s)} \mid s \in S]$; $K \neq L \Leftrightarrow \exists s \in S: K(s) \neq L(s)$; $K \leq L \Leftrightarrow \forall s \in S: K(s) \leq L(s)$; if $K \leq L$, then $L \setminus K$:= $[s^{L(s) - K(s)} \mid s \in S]$; $|K|$:= $\sum_{s \in S} K(s)$.

SNT Petri nets and their static properties

SNT (*single-number token*) **process Petri net** (SNTPPN) is an ordered 9-tuple $SNTPPN$:= (P, T, A, AF, TP, RP, IP, OP, M_e), where P is the finite non-empty set of **places**; T is the finite set of **transitions** disjoint from P (i.e., $P \cap T = \emptyset$); A is the finite set of **arcs** (flow relation), $A \subseteq (P \times T) \cup (T \times P)$; AF is the **arc function**, AF: $((P \times T) \cup (T \times P)) \rightarrow \boldsymbol{IDENT} \cup \boldsymbol{Z}$, such that $(AF(x, y) \in \boldsymbol{IDENT} \cup \boldsymbol{N}_0) \Leftrightarrow ((x, y) \in A)$, $(AF(x, y) := -1) \Leftrightarrow ((x, y) \notin A)$, where $x, y \in P \cup T$, and $\forall t \in T\ \forall q \in t\bullet$: $(AF(t, q) \in \boldsymbol{IDENT}) \Rightarrow (\exists p \in \bullet t: AF(p, t) = AF(t, q))$; TP is the **transition priority** function (with the default value of 1), TP: $T \rightarrow \boldsymbol{N}$; RP is the finite set of **resource places**, $RP \subset P$; the **input place** IP is the only one place $IP \in (P \setminus RP)$ such that $\bullet IP = \emptyset$; the **output place** OP is the only one place $OP \in (P \setminus RP)$ such that $OP\bullet = \emptyset$; M_e is the **entry marking**, M_e: $P \rightarrow (\boldsymbol{N}_0)_{MS}$ such that $(M_e(IP) \neq \emptyset) \wedge (\forall p \notin (\{IP\} \cup RP): M_e(p) = \emptyset)$; ($P$, T, A) is the **connected net**.

SNTPPNs represent a popular formalism connecting advantages of the graphic representation of a modeled system with the possibilities of its simulation and the formal analyzability. The system is then described with a bipartite graph containing a finite non-empty set of **places** P used for expressing of the conditions of a modeled system (we usually use circles for their representation); a finite set of **transitions** T describing changes in the system (we usually draw them in the form of rectangles); a finite set of **arcs** A being principally oriented while connecting the place with the transition or the transition with the place and we usually draw them as lines with arrows; the **arc function** AF assigning each arc with a identifier or non-negative integer number expressing the kind of removed or added token from or to the place associated with that arc when firing a particular transition; **priority function** TP value of each transition (such priority has the default

value of 1, if not explicitly indicated in the net diagram); the finite set *RP of* **resource places is used for expressing of the conditions of a modeled system containing some initial resources and we use circles with the double line for their representation; the input place** *IP* is the only one place from the set of non-resource places that has no input transition; the **output place** *OP* is the only one place from the set of non-resource places that has no output transition; the **entry marking** M_e then expresses the initial status of the modeled system with so called **tokens and it assigns the input place** *IP* and selected resource places with the multiset over the set $\boldsymbol{N}_0$ of the tokens (i.e., every token is then represented by a single non-negative integer number in the input place or selected resource places).

Some commonly used notations for SNTPPNs are $\bullet y := \{x \mid (x, y) \in A\}$ for the **preset** and $y\bullet := \{x \mid (y, x) \in A\}$ for the **postset** of a net element y (i.e., place or transition). **Marking** M of the SNTPPN *SNTPPN* is a mapping $M: P \rightarrow (\boldsymbol{N}_0)_{\text{MS}}$. Marking M then express the current status of the modeled system. If $P := \{IP, \text{P1}, \text{P2}, \ldots, \text{P}n, \text{R1}, \text{R2}, \ldots, \text{R}m, OP\}$, where $n \in \boldsymbol{N}$, $m \in \boldsymbol{N}$, $RP := \{\text{R1}, \text{R2}, \ldots, \text{R}m\}$, marking M can be then written as a vector $M := (M(IP), M(\text{P1}), M(\text{P2}), \ldots, M(\text{P}n), M(\text{R1}), M(\text{R2}), \ldots, M(\text{R}m), M(OP))$.

Dynamics of SNT process Petri nets

As it has been stated, with SNTPPNs not only the current status of the modeled system can be presented, but dynamics of transitions between its individual states, too. Transition $t \in T$ is **enabled** in the marking M of the SNTPPN $SNTPPN := (P, T, A, AF, TP, RP, IP, OP, M_e)$ iff for every place p in the preset of the transition t there exists **input binding function** i_p of the tokens in the actual marking M of the place p, i.e., $\forall p \in \bullet t\ \exists i_p: \{AF(p, t)\} \rightarrow M(p)$ such that:

- $AF(p, t) \in \boldsymbol{N}_0 \Rightarrow i_p(AF(p, t)) := AF(p, t)$, where $AF(p, t) \in M(p)$,
- $\forall p \in \bullet t\ \forall q \in \bullet t: AF(p, t) = AF(q, t) \Rightarrow i_p(AF(p, t)) = i_q(AF(q, t))$.

If the transition t is enabled in the marking M of the SNTPPN *SNTPPN*, we denote that fact symbolically in the form of t ***en*** M. If the transition t is enabled in the marking M of the SNTPPN *SNTPPN* then for every place p in the postset of the transition t there exists **output binding function** o_p, i.e., $\forall p \in t\bullet\ \exists op: \{AF(t, p)\} \rightarrow \boldsymbol{N}_0$ such that:

- $o_p(AF(t, p)) := i_q(AF(q, t))$, *if* $((AF(t, p) \in \boldsymbol{IDENT}) \wedge (AF(t, p) = AF(q, t)) \wedge (q \in \bullet t)$,
- $o_p(AF(t, p)) := AF(t, p)$, *if* $AF(t, p) \in \boldsymbol{N}_0$,
- $o_p(AF(t, p)) := \varnothing$, otherwise.

Firing of the transition $t \in T$ itself consists in the removal of one token from each preset place p of the transition t as required by the value of the input binding function i_p of the particular place p, and adding of one token into each of the postset place p of the transition t as required by the value of output binding function o_p of the particular place p, i.e., it results in changing the marking M into the marking M', where $\forall p \in P: M'(p) = M(p) \setminus [i_p(AF(p, t))^1] \oplus [o_p(AF(t, p))^1]$, that is denoted by $M\ [t\rangle\ M'$. The set of all markings reachable from the marking M will be denotet by the symbol $[M\rangle$. **Exit marking** $M_x: P \rightarrow (\boldsymbol{N}_0)\text{MS}$ is every marking of SNTPPN *SNTPPN* that fulfills the property $(M_x \in [M_e\rangle) \wedge (M_x(OP) \neq \varnothing) \wedge (\forall p \notin (\{OP\} \cup RP): M_x(p) = \varnothing) \wedge (|M_e(IP)| = |M_x(OP)|)$.

Figure 1, illustrates the SNTPPN $SNT := (P, T, A, AF, TP, RP, IP, OP, M_e)$, where $P := \{\text{IP}, \text{R1}, \text{OP}\}$, $T := \{\text{T1}, \text{T2}\}$, $A := \{(\text{IP}, \text{T1}), (\text{IP}, \text{T2}), (\text{R1}, \text{T1}), (\text{T1}, \text{R1}), (\text{T1}, \text{OP}), (\text{T2}, \text{OP})\}$, $AF := \{((\text{IP}, \text{T1}), x), ((\text{IP}, \text{T2}), x), ((\text{R1}, \text{T1}), x), ((\text{T1}, \text{R1}), x), ((\text{T1}, \text{OP}), x), ((\text{T2}, \text{OP}), 3)\}$, $TP := \{(\text{T1}, 2), (\text{T2}, 1)\}$, $RP := \{\text{R1}\}$, $IP := \text{IP}$, $OP := \text{OP}$, $M_e := (M_e(\text{IP}), M_e(\text{R1}), M_e(\text{OP})) = ([2^1], [2^1], \varnothing)$. The transition T1 is enabled in the entry marking M_e, because $\bullet\text{T1} = \{\text{IP}, \text{R1}\}$; $\exists i_{\text{IP}}: \{AF(\text{IP}, \text{T1})\} \rightarrow M_e(\text{IP})$, i.e., $\exists i_{\text{IP}}: \{\text{x}\} \rightarrow [2^1]$; $\exists i_{\text{R1}}: \{AF(\text{R1}, \text{T1})\} \rightarrow M_e(\text{R1})$, i.e., $\exists i_{\text{R1}}: \{\text{x}\} \rightarrow [2^1]$; $AF(\text{IP}, \text{T1}) = AF(\text{R1}, \text{T1}) \Rightarrow (2 = i_{\text{IP}}(AF(\text{IP}, \text{T1})) = i_{\text{R1}}(AF(\text{R1}, \text{T1})) = 2)$. The transition T2 is also enabled in the

entry marking M_e, because $\bullet T2 = \{IP\}$; $\exists i_{IP}$: $\{AF(IP, T2)\} \rightarrow M_e(IP)$, i.e., $\exists i_{IP}$: $\{x\} \rightarrow [2^1]$ such that $i_{IP}(AF(IP, T2)) = 2$.

Conflicts and their solving in SNT Petri nets

When enabling individual transitions of a given SNTPPN so called **conflicts** can originate in its certain markings (or **conflict transitions**). At the enabling of the transitions t_1 and t_2 of the given net in its marking M the conflict occurs, if both the transitions t_1 and t_2 have at least one input place, each of the transitions t_1 and t_2 is individually enabled in the marking M, but the transitions t_1 and t_2 are not in the marking M enabled in parallel and enabling of one of them will prevent enabling the other, i.e., $(\bullet t_1 \cap \bullet t_2 \neq \emptyset) \wedge (t_1 \; \textbf{\textit{en}} \; M) \wedge (t_2 \; \textbf{\textit{en}} \; M) \wedge \neg(\{t_1, t_2\} \; \textbf{\textit{en}} \; M)$. The term of conflict transitions can be obviously easily generalized for the case of the finite set $t_1, t_2, \ldots, t_n$, $n \in \boldsymbol{N}$, of the transitions of a given SNTPPN.

A typical example of the conflict transitions in the entry marking M_e of the SNTPPN *SNT* is shown in Figure 1, where the transitions T1 and T2 have the common input place IP, both are enabled, but not enabled in parallel. When solving such transitions conflicts we will therefore follow the rule which determines, informally said, that from the set of conflict transitions the one will be enabled, whose value of transition priority function *TP* is the highest. If such transition from the set of conflict transitions does not exist, the given conflict would have to be solved by other means. In our studied example will be then on the basis of that rule the transition T1 enabled (because $TP(T1) = 2$ and $TP(T2) = 1$). Firing of the transition T1 changes the entry marking M_e of the SNTPPN SNT into its exit marking M_x that can be shown in Figure 1, where:

$M_x(IP) = M_e(P1) \setminus [i_{IP}(AF(IP, T1))1] = [2^1] \setminus [2^1] = \emptyset$,

$M_x(R1) = M_e(R1) \setminus [i_{R1}(AF(R1, T1))^1] \oplus [o_{R1}(AF(T1, R1))^1] = [2^1] \setminus [2^1] \oplus [2^1] = [2^1]$ $(o_{R1}(AF(T1, R1)) = i_{R1}(AF(R1, T1)) = 2$, because $(AF(R1, T1) = x \in \boldsymbol{IDENT}) \wedge (AF(T1, R1) = AF(R1, T1) = x) \wedge (R1 \in \bullet T1))$,

$M_x(OP) = Me(OP) \oplus [o_{OP}(AF(T1, OP))^1] = \emptyset \oplus [2^1] = [2^1]$ $(o_{OP}(AF(T1, OP)) = i_{IP}(AF(P1, T1)) = 2$, because $(AF(IP, T1) = x \in \boldsymbol{IDENT}) \wedge (AF(T1, OP) = AF(IP, T1) = x) \wedge (P1 \in \bullet T1))$,

$(M_x \in [M_e\rangle) \wedge (M_x(OP) = [2^1] \neq \emptyset) \wedge (M_x(IP) = \emptyset) \wedge (1 = |[2^1]| = |M_e(IP)| = |M_x(OP)| = |[2^1]| = 1)$.

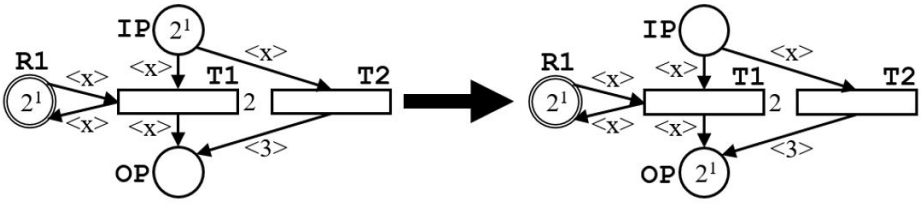

Figure 1: Firing of transition T1 in SNTPPN *SNT*

Let SNTPPN $SNTPPN := (P, T, A, AF, TP, RP, IP, OP, M_e)$. We will denote that SNTPPN SNTPPN is:

- **deadlock-free** iff $\forall M \in [M_e\rangle \; \exists t \in T$: $t \; \textbf{\textit{en}} \; M$,
- ***k*-bounded** iff $\exists k \in \boldsymbol{N}_0 \; \forall p \in P \; \forall M \in [M_e\rangle$: $M(p) \leq k$,
- **proper-formed** iff $\forall M \in [M_e\rangle$: $M_x \in [M\rangle$.

For instance it can be easily shown that SNTPPN *SNT* in Figure 1, is deadlock-free, 1-bounded and proper-formed.

Apple technologies installed in AATCE training center

FaceTime is the proprietary videotelephony product developed by Apple Inc. that is available on mobile devices with MacOS and iOS operating systems. FaceTime application is one-to-one

audio and video chat, it does not support group conferencing in the present time and it is based on numerous open industry standards (H.264, SIP, STUN, TURN, RTP, SRTP, etc.)
AirPlay is a technology that allows wireless streaming of the audiovisual content among AirPlay devices. There are two types of AirPlay devices, those that send audiovisual content, i.e., senders, and those capable of receiving the content and rendering it on displays or speakers, i.e., receivers. AirPlay senders include MacOS and iOS devices, Android phones and other third party devices, AirPlay receivers include AirPort Express, Apple TV and selected third party speakers. **AirPlay Mirroring is a technology that allows broadcasting of the audiovisual content from a variety of Apple devices to a second generation of Apple TV.**
AATCE training center is equipped with the **iMac** computers, large format multi-touch display **65" NEC MultiSync V651 TM**, **Apple TV** and **AirPort Express** devices (see Figure 2). AirPlay Mirroring technology is then intensively used during the teaching process to wirelessly mirror screen content of desktops or mobile devices of students and teacher (all these devices are used as AirPlay senders) on the NEC V651 HDTV with a large screen or on the teacher's iMac computer (Apple TV equipment connected to these devices is used as AirPlay receiver) and for content sharing to other students. It is also possible to make a real-time recording of a mirrored screen content by the rich-media technology recorder software ***EduArt*** (EduArt, 2018) and to publish it on-line or on-demand.

Results and Discussion

A software solution utilizing the equipment of AATCE authorized training center and enabling the remote presentation of the teacher, his live communication with the students, his recording and also on-line publication of this presentation was realized as one of the goals of the MERLINGO project. The main principles of this solution can be seen in the Figure 2. The teacher in the remote location communicates via the FaceTime product with the selected presentation computer located in the AATCE classroom. The presentation computer is also equipped with the FaceTime software, presentation software (e.g., MS PowerPoint) containing the teacher's presentation, rich-media recording software (e.g., EduArt) and it is also used as AirPlay Sender. The teacher in the remote location then uses the features of Apple Remote Desktop software to remotely control its own presentation on the presentation computer and he can also communicate during the presentation via FaceTime software with the students in the classroom. Students can watch the whole presentation on the NEC V651 HDTV shared large screen. With the use of the AirPlay technology, each student can present the content of their computer screen on a shared NEC V651 HDTV shared screen while recording and publishing of the entire presentation is performed throughout by the rich-media recorder software.
Design and verification of the generally parallel algorithm with the deadlock-free property that fulfills all the above goals required also the use of SNTPPN formal theory. It was necessary to design the ***k*-bounded, deadlock-free and proper-formed SNTPPN** for the above purposes. This research goal was achieved and the simplified SNTPPN model of the given algorithm is shown in the Figure 3 (a time-based model represented by process timed Petri net (Popova-Zeugmann, 2013) is much more complicated).

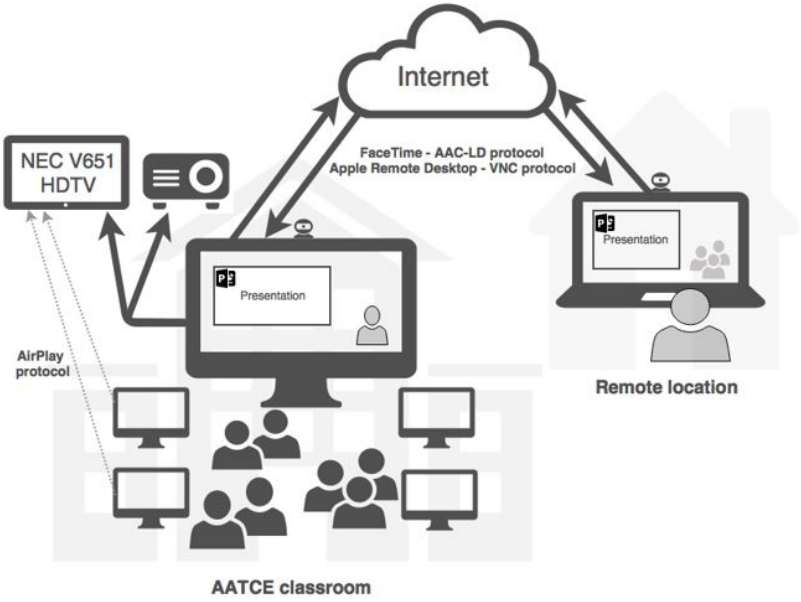

Figure 2: Principle of teacher-student remote interaction in AATCE classroom

The token 0 in the input place IP of the SNTPPN entry marking M_e (i.e., M_e(IP):= [0^1]) represents the initial state of the lecture. The teacher's computer in the remote location without any active FaceTime video and audio connection with the AATCE presentation computer is represented by the token 0 in the resource place R2 (i.e., M_e(R2):= [0^1]). Firing of the transition T1 and location of the token 0 in the place P4 then models the establishing of the FaceTime connectivity with the presentation computer. The start of the teacher's presentation and its recording and publishing is modeled by the firing of the transition T2. The tokens 1, 2,…, 9 in the resource place R1 then represent the student's computers (i.e., iMacs or iPads). Firing of the transition T4 allows any student modeled by the chosen token in the resource place R1 wirelessly project the screen of his device on the NEC V651 HDTV at any time (i.e., informally said, the teacher's token 0 will be moved into the place P3 and the chosen student's token will be moved into the place P2 that represents active shared and recorded computer screen). Firing of the transition T5 then models the reverse action and it again starts the teacher's presentation on the NEC V651 HDTV. Firing of the transition T6 models cancellation of the FaceTime connectivity of the teacher's remote computer with the presentation computer (i.e., teacher's token 0 is moved back into its initial resource place R1) and firing of the transition T7 then models re-estabilishing of the FaceTime connectivity and continuing of the teacher's presentation. 100 tokens '1' located in the resource place R3 then models the time counter and after the repeating of 100 firings of the transition T9 the transition T3 will be fired, the lecture will finish and the SNTPPN will move into its exit marking M_x where the token 0 will be located in the output place *OP*, the tokens 1, 2,…, 9 will be located in the resource place R1 and the token 0 will be again located in the resource place R2. It can be shown that the presented SNTPN in Figure 3, is *k*-bounded (where $k = 100$), deadlock-free and proper-formed.

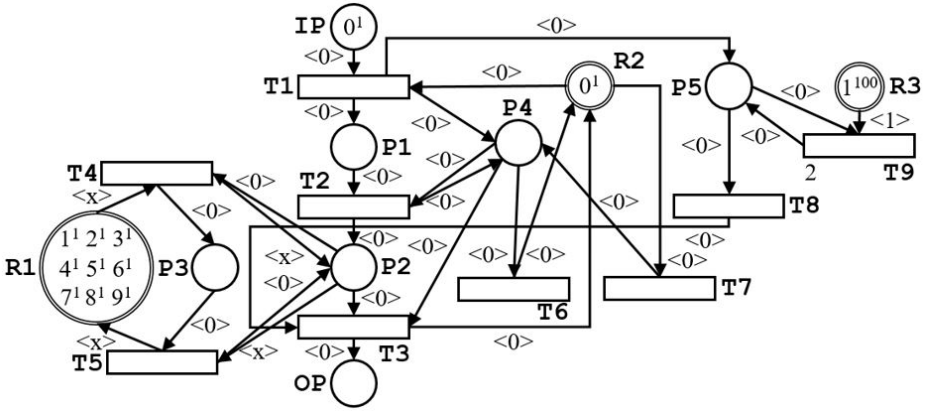

Figure 3: SNTPPN representing AATCE training center functionalities in its entry marking M_e

The successful realization of recordings of presentations which were launched in the Czech Republic at Masaryk University in Brno many years ago (Hladká and Hrdlicka, 2005), and their availability on-line or on- demand is now a standard part of eLearning services at a number of universities in the Czech Republic and in the world (Bos et al, 2016), (Dona et al, 2017), (Ollermann et al, 2016). However, the uniqueness of the approach presented in this article is based on the organic blending and deployment of Apple technologies in a comprehensive solution to this problem and its software support which is designed and implemented with using of the specially designed SNT process Petri nets theory.

Conclusion

At the Faculty of Economics, VŠB-Technical University of Ostrava, over 40 presentations and their recordings were realized from remote teacher's location with the support of AATCE training center equipment and the comprehensive collections of the following subjects are available: Introduction to Programming (2nd year of Bachelor studies of Informatics in Economics), Dynamic Web Pages Creation (2nd year of Bachelor studies of Informatics in Economics) and Artificial Intelligence and Expert Systems (2nd year of Master studies of Informatics in Economics). The rich-media recordings were published in the on-demand mode through the LMS system *Moodle*. All the recordings are available as the part of the study materials for more than 50 students of relevant subjects who can replay the topic they did not fully understand again.

Another important initiative of the AATCE authorized training center is currently preparing for participation in "Everyone Can Code", a comprehensive global program designed by Apple to help everyone learn to build mobile apps in the Swift programming language. More than 70 colleges and universities are adopting Apple's App Development with Swift curriculum and equipping the students with the knowledge and skills they need to pursue their careers in the booming economy. Making presentations records for all the students will be an integral part of the participation in the "Everyone Can Code" initiative.

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IDENTIFICATION OF CRUCIAL COMPETENCIES IN MATHEMATICAL INQUIRY

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Abstract

The inquiry-based learning (IBL) has been in the focus of recent studies. With use of inquiry in mathematics in school practice, further questions have arisen: What kind of problems can be useful for analysis of students' competencies in IBL and how to assess the performed level of competencies? In this paper the Mathematics B-day contest assignment is introduced as a mean to assess the students' performance in mathematical inquiry. The rubrics with didactical variables were designed as a tool for assessing the students' competencies. The statistical implicative analysis was used to investigate 29 solutions of Mathematics B-day 2017: Arrow clocks. We identified key subtasks solutions directly related to the level of IBL competencies performed in final mathematical investigation. The subtask which required high level of algebraic thinking influenced the level of final mathematical investigation the most.

Keywords

Assessment, competencies, inquiry-based Learning, mathematics education, open-ended problems

Introduction

Inquiry-based learning (IBL) is based on posing, exploring and evaluating. Yackel and Rasmussen (2002) define developing personally meaningful solutions, explaining students' approaches, ability to listen to each other and attempt to make sense of the thinking of other students as the characteristics of IBL. Mathematical open-ended problems, which are close to real situations, represent a tool for IBL implementation, and solutions require multiple problem solving strategies. The term open-ended refers to the outcome of the work and to whether more than one solution, design or answer is possible (Lock, 1990). Contrary to standard mathematical tasks, the solution of open-ended problems involves "understanding the task, formulating an appropriate sequence of actions or strategy, applying the strategy to produce a solution, and then reflecting on the solution to ensure that it produced an appropriate response" (Blaško, 2013: 126).

Hence the assessment of mathematical open-ended problem is not uniform (Dorier, 2012). The correctness of results indicates higher students' competencies, but also the steps of the solution process are in the focus of the assessing process. Recent studies have been looking for an objective tool for assessing mathematical open-ended problems. Rubrics can be helpful to minimize subjective view in assessing the solutions of mathematical open-ended problems. To judge the quality of a broad range of subjects, the use of rubrics is to guide the evaluation of written work of students (Moskal, 2000). Brookhart (2013: 5) defines rubrics as "a coherent set of criteria [which] includes descriptions of levels of performance quality on the criteria".

Department of Mathematics of Constantine the Philosopher University in Nitra is an organizer of the Mathematics B-day contest for Slovakia. The origin of the contest is from Netherlands where Mathematics B-day contest is based on the educational program of mathematics for university

level of technical studies and studies in science and mathematics. Students solve the assignment created with intent to motivate inquiry in mathematics. The assignment is composed of 15-20 pages of mathematical text divided into basic and final assignment. Teams of three or four students work on a written final report by conjecturing and proving in mathematics, demonstrate their mathematical knowledge and competences (Utrecht University, n. d.). "The preparing for the competition, and trying to solve the problems during the competition itself, all participants increase their knowledge significantly, also the teacher gain experience how to teach mathematical topics that are currently not in the curriculum" (Kenderov, 2006: 1589). Students are challenged to show process skills in developing strategies, making conjectures, trying to prove or reject these (Abril et al, 2013).

Recent studies focus on the implementation of IBL into educational process (Engeln et al, 2013; Bruder and Prescott, 2013). The Mathematics B-day contest provides students with a unique opportunity to participate in inquiring mathematical principles. The goal of this paper is to verify whether the complex assignment, like Mathematical B-day is, is a reasonable mean to estimate the level of students' performance in process of mathematical problem-solving. Two research questions were formulated.

What are the relations between the levels achieved in chosen attributes and manifested competencies?

Which subtasks of the basic assignment had the significant importance for performance in final assignment?

Materials and Methods

Participants

Mathematics B-day contest is aimed for upper secondary students interested in mathematics. For the contest assessment only the two best reports from each school are submitted, therefore the relatively high achievement in solving process and in creating the mathematical model is assumed. The ability to solve non-routine mathematical problems is one of the basic components of the general problem-soling ability (Pantziara et al, 2009). The non-routine problems demand high cognitive load (Schoenfeld, 1992), so the high-achievers' solutions need to be analysed. For this reason, the solvers, who participated in Mathematical B-day, represent appropriate sample for observing the level of different competencies related to mathematical inquiry.

Description of the assignment

The assignment of Mathematics B-day 2017 *Arrow clocks* was mainly aimed on modular arithmetic which was novel for all the participating teams of students. Wider knowledge from mathematics: functions, projection in geometry, mapping the points based on rule $x \to ax + b$, etc. was required.

Basic assignment consisted of eight main parts (with subtasks marked with letter, e.g. 1a). The initial problem introduced the rules and principles in arrow clocks (Fig. 1).

The following problems were guiding exploration of the properties of different types of clocks with different rules. Gradually, by the generalization of previous explorations about modular arithmetic, by proving the conjectures and solutions and using the dynamic mathematics software GeoGebra for experiments, students are encouraged to connect all findings to mathematical model. In the final assignment students performed their own original research. They were challenged for: *"Describe what geometrical phenomenon you are seeing: think of the mutual placement of the lines or arrows, rotational or axial symmetry… Find patterns…. Explain the patterns."* (*Arrow clocks*, 2017: 14).

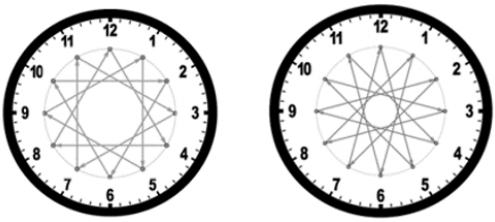


Figure 1: Examples for Arrow clocks $x \to x+9$ and $x \to x+5, x \in \{1,\ldots,12\}$ (Arrow clocks, 2017)

Rubrics

The rubrics which were used for assessing the students' solutions had six levels based on the Bloom Taxonomy of Educational Objectives. In mathematical open-ended problem solving students operate with mathematical competencies, which are manifested in the solution. Therefore, suitable assessing tool may be based on analysis of students' mathematical competencies with mathematical modelling as the highest level of mathematical thinking in IBL structure. By means of rubrics it is possible to observe development of aspects of IBL. The coherent set of criteria is described by processes of IBL associated to appropriate level from Bloom Taxonomy of Educational Objectives (Tab. 1).

Level	Mathematical Competencies	Processes of Inquiry Based Learning
1	Usage of tools and information processing.	Sorting information. Observing systematically and visualising.
2	Knowledge of concepts, facts, assertions and approaches. Application of symbolic, formal and technical operations.	Measuring and quantifying. Controlling variables.
3	Description of mathematical objects and situations.	Discovering connections and relationships. Simplifying and structuring.
4	Defining the problem by asking a question. Mathematical thinking and reasoning.	Classifying and creating definitions. Hypothesizing and predicting.
5	Mathematical arguments and proofs.	Experimenting. Inferring.
6	Mathematical modelling.	Mathematical modelling.

Table 1: Rubrics of mathematical competencies and processes of IBL (source: Bulková, Čeretková, 2017a)

As in the rubric of processes of IBL, there is a possibility to create the assessing tools for other observed attributes. The students' written report represents the complex summary of their manifested skills. The written report represents the complex summary and description of mathematical results and thinking processes in individual or in team work (Russek, 1998). The mathematical writing can be used as illustration of students reasoning of a problem or concept (Kosko and Wilkins, 2010). For the mathematical writing, the set of rubrics for three criteria was created:

- *Integrity of mathematical text*: The principle of integrity is based on the fluency of text and the continuity of sections.

- *Mathematical reasoning*: The proper formulation of sentences and the usage of mathematical argumentation are required in order to create mathematical text. Correct and logic use of the standard mathematical terminology as well as terminology established by students is expected.
- *Clarity and readability*: The criterion is closely related with the previous criteria, i.e. mathematical reasoning and integrity of mathematical text. The text has to be clear without any errors interfering with meaning (Bulková and Čeretková, 2017b).

The written report also displays the creativity as a product in sense of Leikin and Pitta-Pantazi (2013). Sternberg (1998) define creativity as an ability to produce original, appropriate and useful piece of work. The inventive thinking depends on novelty, usefulness, correctness and applicability.

- *Originality*: The creative process does not response in process from nothing to something. Original ideas and conclusions by the connecting, developing and conditioning of existing information are developed.
- *Correctness of conclusion*: understanding of assignment of mathematical open-ended problem is a "reflecting bridge" to choose the relevant information and to use it for expected conclusion. The meaningfulness and coherence of final conclusion depend on choosing relevant pieces of information as well as on correctness of defining of concepts, creating of the equations, reasoning of the assumptions etc.
- *The applicability of conclusion and solving process value for following studies*: New and correct ideas do not have to be necessarily applicable. The condition of the practical use of previous knowledge has to be fulfilled, not only for assigned problem. The criterion lies on three rules: any idea is not wrong by itself, it has to be tried and the immediate inferences do not have to be correct (Bulková and Čeretková, 2017c).

Statistical analysis

The statistical analysis of the obtained data was performed in the software environment R (R Core Team, 2018), package RVAideMemoire. The success-rates in the subtasks of the assignment were compared by Cochran Q test which is the generalisation of McNemar test for two independent samples. The subtasks were considered as independent samples. Subsequently, the post-hoc analysis comparing each pair of problems was performed by McNemar test. The level of studied variables in final assignment according to the correct solution of chosen subtasks was compared by Mann-Whitney's U test.

Statistical implicative analysis (Gras et al, 1996) performed in software CHIC: cohesive hierarchical implicative classification ver. 3.3 (Couturier, 2008) was applied to explore the mutual relations between defined attributes of assessing and to evaluate relations between the subtasks in basic assignment and the students' performance in final assignment (Tab. 2).

	Assessed attribute	Levels	name of variable
Basic assignment (Subtasks 1a – 8b)	Mathematical competencies	1 – 6	MathCom_I
Final assignment (FA)	IBL competencies	1 – 6	FA_IBL_I

Table 2: Names of didactical variables defined for parts of the assignment

Two kinds of didactical variables were defined for all the subtasks; the correctness (Cor) of answer for each particular subtask and the level of the observed property according to the above described rubrics (Tab. 3). Each of the "rubric" variables end with number according to level, e.g. MWrit_Intg_3 means that integrity of mathematical text reached level 3. We take into account that the correctness of the subtask is an observable fact and the variables based on rubrics are

theoretical constructs, but in agreement with Nesher et al (2003) we assume that analysis of both types of variables can facilitate deeper understanding of aspects needed for correct solution of the complex problem.

assessed attribute	criterion of assessed attribute	Levels	name of variable
Mathematical Writing	Integrity of mathematical text	1-6	MWrit_Intg
	Mathematical reasoning	1-6	MWrit_Reas
	Clarity and Readability	1-6	MWrit_Clar
Creativity	Originality	1-6	Cre_Orig
	Correctness of conclusions	1-6	Cre_CConcl
	Applicability of conclusions and solving process value for following studies	1-6	Cre_App

Table 3: Names of didactical variables defined for criteria of assessed attributes

Results

Out of total 29 submitted students' solutions 21 started to solve the final assignment. The results obtained from Cochran's Q test ($Q(24) = 232.396$; $p < 0.001$) imply that the three problems were not equally demanding (Tab. 4). The introductory tasks 1a and 1b seem to be the least demanding, students should apply the rule for given value of a and number of hours n. Subtasks 7a and 7b had the least success rate. The task 7b is the investigation of the rule $x \rightarrow ax$ for different values of a and n. Students were asked to produce original work, to find the number of loops as a function of a and n, in task 7b students should explain the rule constructed in subtask 7a.

Further, we focus on rules where a subtask and the final assignment were present simultaneously. Out of all the rules with cohesion higher than 0.9 only variables of subtasks 2a, 2b, 4d and 4e occurred together with any variable related to the final assignment. The subtask 2a was a reasoning task, in task 2b students were expected to compose the congruence equation for given rule, describe the way how they came to it and solved it. Task 4 focused on target points of arrows. Subtask 4d asked students to find a rule for finding starting point of target point for given rule and n. This rule should have been adjusted and written as an equation for other n in 4e subtask.

The most significant (cohesion 0.991) rule of this kind was the rule 4e_Cre_Concl2 → FA_MWrit_Clar2, it means that students who achieved level 2 in criterion for creativity "correctness of conclusions" in subtask 4e were assessed at least 2 in criterion "clarity and readability" of mathematical writing. It means that teams of students who were not able to formulate appropriate reasoning for subtask 4e did not write their solution of the final assignment very clearly.

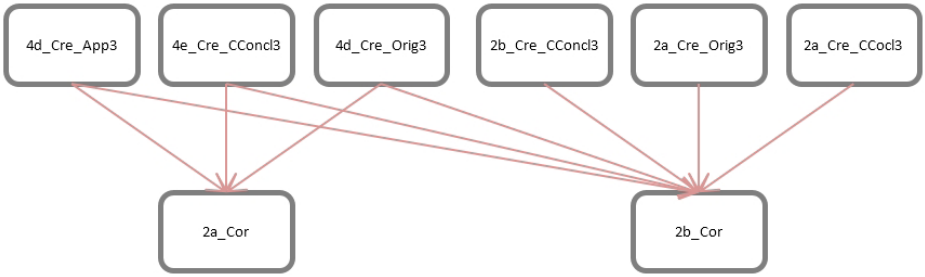
The rule 4e_Cre_Orig2 → FA_Cre_App2 (cohesion 0.988) indicates that relatively low level of originality in subtask 4e implies low level of applicability of conclusions and problem solving processes in the final assignment. It means that students who were not able to formulate the general rules algebraically had problems with possible generalisations of the rules in final assignment. This rule further implies rule 4e_Cre_Concl2 → FA_MWrit_Clar2 with cohesion 0.982. This relation may indicate that aspects of mathematical creativity can be related and influence different aspects of solution of the final assignment.

Task	Succes rate	
Task 1a	96,6%	a
Task 1b	93,1%	ab
Task 3b	89,7%	abc
Task 4b	86,2%	abcd
Task 3a	86,2%	abcd
Task 2b	86,2%	abcd
Task 2a	86,2%	abcd
Task 3c	82,8%	abcde
Task 1c	79,3%	abcdef
Task 4c	69,0%	abcdef
Task 4a	62,1%	abcdefg
Task 4d	55,2%	bcdefgh
Task 4f	51,7%	cdefgh
Task 1d	51,7%	cdefgh
Task 6a	48,3%	defghi
Task 8a	41,4%	efghi
Task 6b	41,4%	efghi
Task 4e	37,9%	fghi
Task 8b	31,0%	fghi
Task 6c	31,0%	fghi
Task 8c	24,1%	ghi
Task 6d	24,1%	ghi
Task 4g	20,7%	ghi
Task 7a	17,2%	hi
Task 7b	10,3%	i

Note: Values assigned by the same letter do not differ significantly based on McNemar test ($p \leq 0.05$)

Table 4: Success rate in subtasks

The relation between creativity and other attributes of the solution can be seen in R-rules for creativity in subtasks 2a, 2b, 4d and 4e. Correct solutions of these four tasks were significantly conditional only upon variables describing different creativity criteria. There were not any more rules implying variables 2a_Cor and 2b_Cor with cohesion higher than 80 (Fig. 2).



Note: Red full arrow - Cohesion of the R-rule is higher than 99

Figure 2: R-rules including correctness of subtasks 2a and 2b

The previous rule implies from FA_IBL3, i.e. FA_IBL3 → ((4e_Cre_Int2 → FA_Cre_App2) → (4e _Cre_CConcl2 → FA_MWrit_Clar2). Based on this it can be concluded that the rule described

is valid for teams of students who used at least level three IBL processes, e.g. discovering connections and relationships, simplifying and structuring. Students who used the level 3 IBL processes fulfil at least level 2 creativity criteria. Thus, discovering connections and simplifying is necessary for solving 4e subtask and the final assignment manifesting criteria for creativity at level 2 or higher. This implication partially confirms that the B-day assignment can be used for assessing these processes. It can be presumed that for solving subtask 4e at higher level, higher IBL processes were needed.

Blue dashed arrow: Cohesion of the R-rule is higher than 95; Grey dotted arrow: Cohesion of the R-rule is higher than 90

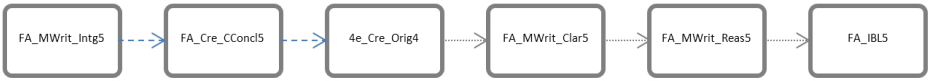


Figure 3: R-rules leading to high level of manifested IBL competencies in final assignment

The processes of inquiry based learning are also present in a series of R-rules (Fig. 3) leading to variable FA_IBL_5 which means that experimenting and inferring appear in the final assignment. It is conditioned by high levels of integrity and clarity of mathematical writing, ability to formulate correct conclusions and provide reasoning in the final assignment and relatively high level of originality in subtask 4e solution, i.e. with ability to connect own ideas with mathematical concepts provided in the assignment.

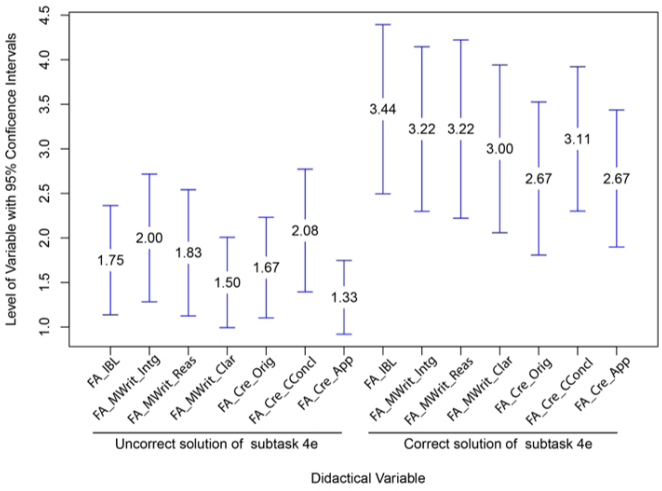


Figure 4: Plot means of variables describing final assignment grouped by correctness of solution of 4e subtask

The subtask 4e was demanding for all the students. After excluding variables connected with the final assignment, one of the most significant rules (cohesion 0.962) was 4e_Cor → (4e_MathCom4 → (4e_MWrit_Intg5 → (4e_MWrit_App5 ↔ 4e_MWrit_Clar4)))). Integrity, reasoning and clarity are difficult to be assessed separately, they are closely related. The subtask 4e was solved correctly only by teams who were able to reason at high level, their mathematical writing is clear and coherent text almost without any errors. Surprisingly, the correct solution of this task is not related with the fact whether the students attempted to solve the final assignment or not (Mann-Whitney's U test, $p = 0.521$). On the other hand, the levels of almost all studied variables

(except aspects of originality, $p = 0.052$) of the final assignment differ significantly according to Mann-Whitney's U test based on correct solution of task 4e (Figure 4). However, the other three subtasks present in rules with high cohesion (2a, 2b, 4d) were not in significant relation with any of the described variables.

Statistical implicative analysis allowed us to define 4 subtasks related to different aspects of students' solutions of final assignments. Success in solution of the subtasks 2a and 2b was mainly influenced by different attributes of mathematical creativity demonstrated in various subtasks (including 4d and 4e).

Correct solution of subtask 4e, where teams of students should compose the general equation, seemed to be crucial for high level of solution of the final assignment and hence for success in the competition. In contrast with subtask 2b the equation was not necessary for the final assignment Solution of 2b also in form of equation was necessary for general investigations in final assignment, and did not influence levels of different aspects of the final assignment.

Discussion

The main objective of this paper was the identification of crucial steps and skills in solving complex mathematical problem. To observe high-level competencies used within the mathematical inquiry we worked with problem stated for mathematical contest and its solution by high-achieving upper-secondary students.

We are aware that the study has several limitations. We focused only on high-achieving students able to investigate mathematically and create innovative conclusions. However, exactly this ability allowed us to observe the relationship between the basic and the final assignment.

It is necessary to point out that the final reports were composed by *teams* of students. In relation with this, Stacey as early as in1992 found that teams' solution was not necessarily better than individual one. Even though groups have sufficient amount of ideas they fail to select the correct ones.

Based on the results of the statistical implicative analysis we identified the partial problems (subtasks) related to the final assignment which require original mathematical investigation. Subtasks 2a, 2b, 4d and 4e were related to the final assignment. Two of these (2a and 2b) were conditional only upon variables describing different creativity criteria. It is in accordance with Dow and Mayer (2004) who found that "solutions to mathematical insight problems lie in a novel approach to numbers". These results confirm also findings of Kamp (2016: 30) who claims that "…creativity in mathematics by the attitude to solving process is represented. Solver focused on more possibilities to solve the problem is open to reach the new view of world, not only of mathematics".

The subtask 4e requires students to develop an equation. Pantziara et al. (2009: 55) state that "for novel tasks, like non-routine problems whose abstract structures are not known, the form of representation can determine the information that can be perceived, the processes that can be activated, and the structures that can be uncovered from the specific representation." Generalising a pattern algebraically rests on capability of grasping commonality of particulars, extending it to all subsequent terms and being able to provide a direct expression. According to (Radford, 2008) students often fail at formulation of direct and meaningful rule and only students with well-developed algebraic thinking are able to work with expressions and equations where signs and numbers "acquire a non-contextual, relational mode of signification".

Conclusions

This study was carried out with the aim to shed some light to the low-investigated area of solving novel complex problems. Within the basic assignment we tried to identify subtasks necessary

for successful solution of the final assignment by means of statistical implicative analysis. Four subtasks were confirmed as having the greatest impact. Two subtasks (2a and 4d) were aimed to facilitate students to get deeper insight to the problem situation and consecutive subtasks (2b and 4e) ask students to provide outcome in the form of an equation.

Correct solution of subtask 4e can be used as a predictor of high-level performance in final assignment despite the algebraic expression was not required. Nevertheless, the necessary algebraic expression obtained in subtask 2b did not show this effect. It seems that not the content but the processes involved in solution are the key to good performance in mathematical investigation, particularly in Mathematics B-day contest.

Social competencies of students (mutual interaction and communication) are needed to be observed for complex assessment of teamwork on mathematical open-ended problems.

Acknowledgement

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Appendix

Subtasks 4d and 4e from assignment *Arrow clocks (2017: 8)*.

4d Use the fact that $4 \to 1$ to quickly find the starting point of the arrows with target points 2, 3, 4,…, 14.

4e Use the same method to indicate with an equation what the starting point is for every target point 1, 2,3,…,44 for $x \to 4x$ and $n = 45$.

THE ROLE OF PARENTS IN EARLY CHILDHOOD MORAL DEVELOPMENT

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Abstract

This paper sets out to investigate the specifics of the moral development of children aged 3-7 years and establish the role that their parents play in this process. Using the results of a sociological survey carried out in 2016 in Russia among parents having preschool-aged children, we analyse the respondents' perceptions with regard to how children develop those moral norms that regulate their interactions with relatives, caregivers, peers and pre-school educators. It is widely recognized that these interactions lay the foundation for a child's self-development during their cognitive, playful, and everyday activities. It is shown that the overwhelming majority of parents lack systematized scientific knowledge on the content and mechanisms of the moral development of preschool-aged children and, therefore, are guided by contradictory and misleading non-scientific ideas.

Keywords

3–7-year-old children, early childhood moral development, family, moral development, moral qualities, parents

Introduction

Rapid and sweeping changes in the modern world lead not only to the emergence of automated production systems, widespread use of new technological devices, transformations in information distribution and processing, implementation of economic innovations, but also to extensive transmutations in the system of parent–child relationship. This becomes a crucial social factor, particularly because the modern child socialization system faces the challenge of preparing the new generation for life under the uncertain conditions of a constantly changing society. Various aspects of moral development, morality and their connection with the development of society have been thoroughly investigated (see e.g. Fourcade and Healy, 2007; Vaisey, 2007; Sayer, 2005; Stets and Carter, 2011; Lapsley, 2010). However, according to Brooks and Goldstein (Brooks and Goldstein, 2001), compared to 20 years ago, parents find it more difficult to raise in their children an orientation towards conforming to behavioural norms and rules accepted in a society.

In this connection, a search for ways of restructuring the modern education and upbringing system to facilitate the development of a child's ability to perceive new information and adjust to new conditions is as relevant as ever. A harmonious coexistence with other people is possible only if a person's behavioural patterns meet cultural norms accepted in a society (Du Toit and Kruger, 1994). A man without a moral compass is a traveller in a foreign city without a map, who is completely at a loss about what to do and where to go next (Kretzchmar, 1998).

Researchers believe (Piaget, 1967; Kohlberg, 1968) that early childhood education is responsible not only for a child's physical development, but also for their moral growth, which is known to be foundational for the formation of social skills. It is emphasized that children, whose moral development is ignored, frequently experience physical, mental or social developmental delays. According to other studies, children develop moral norms only under targeted external influence,

specifically on the side of their parents (Van den Aardweg and Van den Aardweg, 1990; Smetana, 1999). However, it should be noted that different moral qualities emerge at different ages. For instance, there is evidence that the evolution of moral emotions in children is highly individual (Malti and Buchmann, 2010). The age factor should be taken into consideration; otherwise, the educational influence of the family may be ineffective and even provoke constant conflicts between adults and children.

Following the concept devised by L. Kohlberg (Kohlberg, 1971), we believe that morality begins to develop at the age of 2-3 years, when a child experiences an urgent need to interact with surrounding people, feeling a sense of pride in showing independence in their playful, everyday and cognitive activities. It is common knowledge that pride can be understated, normative and exaggerated. Understated pride is frequently a result of constant intimidation and punishment of children for their self-assertion attempts. In this case, adults keep on criticizing a child's actions, causing a feeling of fear, self-doubt, irritability and anger. As was shown in (Papalia and Olds, 1992), these feelings stop children from experiencing shame for their misdeeds, which is certain to play an important role in children's moral development. Normative pride is considered to form when adults react positively to a child's actions, particularly when he/she demonstrates willingness to work together with the adults. Such form of pride is characterized by the feeling of joy, which children experience because they can do something useful for other people, e.g. take care of their parents and peers. At the age of 4-4.5 years, this feeling becomes a basis for the development of the shame emotion: adults condemn children for violating rules and fulfilling their selfish desires. The formation of self-control and self-assessment skills allows 5-6-year-old children to develop conscience as the unique human ability to distinguish between right and wrong, good and evil, proper and inadequate (Gouws and Kruger, 1994). Exaggerated pride (arrogance) arises from children's freedom to manifest selfishness, when parents and other adults indulge them, taking for granted all their actions (Boom, 2011). As a result, self-confidence may turn into a sense of superiority and contempt for those who are on a lower social position. In such a situation, the shame emotion is unlikely to form, which hinders the formation of moral qualities.

Changes in the system of younger generation socialization should begin within the family, where a child meets and subsequently adopts those cultural norms that determine their independent adult life in the future (Clipa and Iorga, 2012; Loudova and Lasek, 2015). However, innovations that are currently being introduced in the education and upbringing system concern solely the school level. Little is done to involve the family in the formation of the younger generation's orientations towards moral behaviour in small and large groups, ensuring their successful adaptation to a dynamically changing world.

In this research, we focus on the specifics of the moral development of preschool-aged children and attempt to establish the role that their parents play in fostering this process. The subsequent sections of the paper present the details of the research methodology used to investigate the problem, discuss the results obtained during quantitative and qualitative research stages and draw a conclusion.

Materials and Methods

In order to reveal the specifics of the moral development of preschool-aged children and their parents' attitude towards this process, in 2016 we carried out an online sociological survey among 370 parents having 3-7-year-old children. To this end, a questionnaire consisting of 15 questions was developed. The online form of the study allowed us to interview respondents regardless of their place of residence. Another advantage of online surveys is its high level of anonymity, when participants feel more comfortable providing honest opinion. The fact that our respondents were from different Russian regions did not affect the sample homogeneity, since no specialized

knowledge on how to raise children is provided in the Russian system of either general or higher education.

The average age of the respondents was 33 years. Out of 370 respondents, 76% were women, and 24% were men. The majority of the respondents had higher or incomplete higher education (67%). 86% of the respondents were raising their children in two-parent families. The average age of the children, whose parents were interviewed, was 6.5 years. The average number of children in the families surveyed was 1.8. In 86% of the families, children were included in the system of public education, i.e. attended pre-school educational institutions (kindergartens).

For a more detailed study of the content and methods of 3-7-year-old children's moral development, we conducted a series of standardized interviews with parents (N = 14) using a specifically devised questionnaire consisting of 10 questions. The standardized interviews were conducted with parents residing in the city of Ekaterinburg. The respondents for the interviews were selected using the systematic sampling method among the participants of the aforementioned online survey. All the as-selected respondents provided their agreement for the interview and determined a convenient place (playgrounds in the respondents' house yards, cafes, kindergartens). Among the respondents, 10 interviewees were women aged 28 to 35, with 7 of them having higher and 3 – vocational education. 4 male interviewees were 30–37 years old and all had higher education.

The analysis of the respondents' answers received at the qualitative stage was performed as follows. After the transcription of the interview recordings, the respondents' answers were analysed using the thematic network method (Attride-Stirling, 2001), which allows methodical systematization of textual data. In this approach, a text is treated as consisting of a set of textual fragments, each of which conveys either a thematically independent or thematically related ideas. It was of value for our research purposes due to its potential to unearth explicit and implicit ideas in interviewees' responses. To this end, themes of various order were identified applying a hybrid strategy involving both theory-driven (deductive) and data-driven (inductive) interpretative approaches. In addition, triangulation was utilized to increase the validity of the results. The revealed basic, organizing and global themes were drawn into a thematic network to visually depict relationships between them. The thematic network was further used to interpret the original texts.

The qualitative research results facilitated interpretation of the respondents' answers received during the online survey.

Results

Our study showed that 43% of the parents believe that moral development is a process of forming a system of moral values that guide people in their daily lives. According to a respondent, this position was expressed as follows: 'Moral development… is teaching children to perceive the world adequately, to live according to the norms that are accepted in our society' (woman, two children, 32 years old, married). Parents are found to believe that such an education is aimed 1) at developing children's normative behaviour in typical life situations; 2) parents are the main subjects of their children's moral development; 3) since adults have conflicting ideas with regard to what a moral norm is, differences in the direction, content and methods of children's moral education and upbringing in various families are inevitable.

In the process of research, it was found out that many respondents have no idea when they should engage in their child's moral development. In answering the question "what motivates you to form specific moral qualities in your child?", parents noted that the reason is their child's behaviour, which does not meet their expectations. Therefore, upbringing is frequently characterized by an unsystematic character; rather it is provided occasionally, when children, in fulfilling their selfish desires, cause difficulties for adults. Then, for the sake of realizing their ideas about how to act in a specific situation, parents try to form the image of a well-bred person in their children.

However, it should be taken into account that moral development proceeds not only through external instructions to follow certain rules. Parents can facilitate the development of moral understanding and behaviour in their children by setting their own example, displaying proper attitude towards relatives and colleagues, as well as towards events taking place in the country and in the world. Children are extremely sensitive to their caregivers' behaviour: every act is perceived as something that should be reproduced in their own behaviour. Young children accept their parents' values, personal qualities and beliefs as their own (Mwamwenda, 1998).
The survey results showed that 58% of the respondents are convinced that they should start contributing to their child's moral development at the age of 1.5–2 years. Table 1 summarizes the parents' opinions with respect to the formation what moral qualities they should encourage.

No.	Moral qualities of a 1.5-2-year child	%, of number of respondents
1	Concern and love for close people	89
2	Discipline	62
3	Politeness	51
4	Patience	43
5	Diligence	42
6	Honesty	41
6	Conscience	24
7	Will	21
8	Responsibility	17

Table 1: Moral qualities that should be formed in a 1.5–2-year child (the respondents' opinions, %)

The primary moral quality to be developed at this age is believed to be concern and love for close people, which quality mentioned 89% of the respondents. In describing this quality, the respondents used such words and phrases as: "affectionate", "hugs, kisses their parents", "listens to what adults say". Interestingly, there is a contradiction between how adults perceive manifestations of love and concern in their children and how they demonstrate these feelings themselves. The interaction of the child with the parents, on the one hand, is determined by the so-called 'natural mechanism', which requires constant confirmation that the child is protected from external hazards and can satisfy his/her basic needs. On the other hand, manifestation of love and concern for other people is determined by cultural norms and require the child to master the skills of care for his/her parents. These include sensitivity as the ability to be considerate when dealing with close people; empathy as the ability to understand and share the feelings of close people; tactfulness as an ability to deal with people without offending them. In other words, children should learn how to express their feelings not only using words, but also taking practical steps. However, it is next to impossible to develop this ability at the age of 1-2 years, since toddlers yet have no the physical ability to demonstrate their care.
Over 60% of our respondents asserted that it is the ability to be disciplined that should be developed from the very early childhood (1–2 years). Parents believe that children should first of all be obedient. In addition, politeness was mentioned as an important quality to form, as soon as a child has learned how to communicate his/her desires. 42% of respondents believe that, at a very early age, children should be taught to perform elementary work, supporting their desire to copy the behaviour of adults. Unfortunately, none of the respondents indicated that, at this age, it is crucial to shape a child's sense of pride for something he/she has managed to perform for the first time. On the one hand, parents usually praise their children for their willingness to dress independently, use the TV remote control, take care of house plants, etc. On the other hand, they lack knowledge of special technologies aimed at developing normative pride. Few parents understand that praising a child for something achieved not through hard work, but due

to his/her natural talents (singing, dancing, memorizing verses) can result in the development of exaggerated pride. Such a child might develop an understanding that he/she should receive some advantages in the peer group due to his/her exclusiveness, leading to a sense of superiority over other people.

Parents are shown to have little understanding that normative pride forms when children receive a positive evaluation for their actions aimed at helping parents and other people; or when success is achieved due to willpower and patience in overcoming arising difficulties. Indeed, 43% of the respondents noted the importance of the development of patience in early childhood, and 21% believed that willpower should be formed first. However, none of the respondents mentioned that these qualities should emerge simultaneously.

The respondents have shown to lack understanding with regard to when and under what conditions such qualities as honesty, conscience and self-control form. Thus, 41% of the parents said that 2-year-old children are able to develop honestly, because it is at this age that they start to deceive their parents. However, psychological and educational literature proves that the first attempts to hide their misconduct are undertaken by children usually not earlier than 3-4 years. We observed a similar situation analysing the parents' opinions about the development of conscience. 24% of the respondents consider the age of 4 years to be the optimal time; nonetheless, existing knowledge shows that conscience can form only on the basis of a well-developed self-esteem, which normally shapes in 5-6-year-old children. The desire expressed by 17% of the parents to engage in the formation of responsibility in their children also points to their lack of knowledge, since responsibility is known to develop on the basis of conscience and the sense of duty in 9-10-year-old children. Our findings indicate that many adults lack scientific knowledge on the sequence in which children develop certain moral qualities in the process of their socialization.

An important problem of raising preschool children is determining effective methods of influencing their feelings, thoughts and actions, i.e. methods that would ensure the development of a morally developed personality. 83% of the respondents consider that adults should set an example of proper behaviour for children. However, many parents admit that they rarely manage to provide such a positive example. 73% of the respondents believe that children should be given an explanation why they should fulfil demands put forward by adults. This method is used by 34% of the parents when fostering proper behaviour in their children. 43% asserted that an effective means of moral development is involving children in household chores, sports activity, art schools, dance studios, etc.

The majority of our respondents believe that praise rather than punishment should be used when attempting to influence children's moral development. In reality, children are much more often encouraged towards fulfilling demands by sweets, toys, etc. It is surprising that the sole verbal approval of children's actions is not considered an effective method for motivating a child. However, research shows (Fontana, 1990) that young children seek praise from adults in accordance with such notions as "a good girl" or "a good boy". Parents are not shown to recognize the importance of the permanent development of pride in children for their significant results in acquiring new knowledge and skills. Not all parents understand that, in order to encourage self-development, appraisal of achievements should be accompanied by a detailed explanation of what role willpower, patience and self-control have played in this process.

Our respondents' opinions about the methods of punishment turned out to converge. About 80% of the parents think that punishment should take the form of limiting those activities that children like. If the child has misbehaved, the parents reduce his/her screen time, forbid to play computer games or ground. All the respondents condemn physical punishment.

In asking to provide self-assessment, 36% of the parents said they are completely satisfied with the results of their educational activity. Those parents that were not entirely satisfied mentioned

the following reason: the child does not behave, showing selfishness and laziness. 42% of the parents noted that they lack the necessary knowledge with regard to how form moral qualities in their children.

Discussion

Our results have revealed a number of issues associated with the moral development of the 3–7-year-old children in context of the family. The primary problem concerns a reluctance on the part of parents to cardinally change the system of interaction with their offspring. Parents are mostly guided by persisting stereotypes related to a person's upbringing. Eysenck (Eysenck, 2002) singled out three main educative styles used by parents in their children's moral upbringing, including: explanatory discussions, punishment and encouragement. In our study, punishment and encouragement were named as the most effective upbringing strategies.

Parents seem to adhere to the following principle: the child is a "blank slate" beginning his/her life as a morally neutral individual. Thus, it is the responsibility of parents to shape the desired image of a personality. As a result, adults, from a child's very early childhood begin deliberate attempts at forcing the child to adopt a moral norm, without first analysing whether he/she is mature enough for that. Interestingly, parents believe themselves to be the role model for their children. If the mother and the father hold opposing views and have different characters or habits, either of them try to make the child copy their own behaviour. This idea is contradictory to our position that every person is unique and implements their own enculturation programme of familiarizing with culture, determined both by natural inclinations and by those methods of upbringing that parents, educators, caregivers or other socialization subjects apply.

It seems highly unlikely that adults having children can be successfully involved in the process of theoretical parental education for acquiring specialized knowledge. Most parents are reluctant to spend time studying theoretical ideas in the field of child rearing; however, they find it practically useful to discuss real cases of forming a certain moral quality. Therefore, a possible solution can be involvement of parents and professional educators in a joint search for effective educational strategies, taking into account a child's individual characteristics and his/her maturity to adopt the moral norms accepted in a society.

Santrock (Santrock, 1995) distinguishes three approaches to teaching young children morality: parents should encourage children to choose a certain type of behaviour; parents should make the most of the time they spend with their children; parents should develop the ability to self-control in their children, which serves as a basis for their moral development.

On the basis of the results of our study, we believe that parental education should provide parents having preschool-aged children with at least the following knowledge 1) what moral qualities children are able to develop between ages 3 to 7; 2) in what sequence these moral qualities emerge; 3) what effective practical approaches can be used to facilitate the development of such qualities as normative pride, shame, conscience, duty, willpower, patience, self-control, self-confidence, mercy and the ability to take care of parents or other people overcoming difficult life circumstances.

Conclusion

We have shown that modern parents lack scientifically-based knowledge on how children develop moral qualities and what methods can be applied to facilitate this process. The domineering approach used by parents in overcoming upbringing difficulties is a situational one. In Russia, the previously existing system of the transmission of cultural norms and values from generation to generation has been destroyed, thus interrupting the continuity of cultural experience. Moreover, the dynamics of the modern world requires that children, from a very early age, acquire the skills

of self-development and resilience, as well as the capability of adapting their behaviour to meet the moral norms accepted in a society. This challenging task can be accomplished under condition that parents, accepting and investigating the child's individuality, would search for most effective educational and upbringing methods. Therefore, an improved system of parental education should be created, so that parents (including future parents) could acquire reliable knowledge of the principles and methods of the moral development. We believe that the moral development of preschool children is a problem that could only be solved provided preschool educational institutions and parents work in close collaboration. Preschool education specialists should accept responsibility not only for the moral development of children, but also for educating parents with regard to the specifics of early childhood moral development. Otherwise, growing contradictions between parents' and teachers' views on early childhood moral development can significantly reduce the overall effectiveness of preschool education.

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MATHEMATICS LESSONS IN CULTURALLY AND LINGUISTICALLY HETEROGENEOUS CLASSROOMS

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Abstract

Cultural and linguistic heterogeneity at schools and multicultural education have become an integral part of education. Although teachers of mathematics might think multicultural topics should be covered in other subjects, they have to face "multicultural reality" and plan and conduct lessons respecting the needs of learners from diverse cultural and linguistic backgrounds. Moreover, mathematics of other cultures can bring new perspectives and enrich mathematics education as such. The paper presents an experiment showing that traditional mathematics content can be adapted to include multicultural topics and can be well used in culturally and linguistically heterogeneous classrooms. Activities presented in the experiment pay due attention to linguistic and cognitive aspects. Thus they respect the needs of pupils from different cultural and linguistic backgrounds. The results of this study are relevant for mathematics educators as well as in-service and pre-service teachers.

Keywords

Cultural heterogeneity, linguistic heterogeneity, substantial learning environment, sociocultural background, teaching in culturally and linguistically heterogeneous classrooms

Introduction

Without any doubt fast social changes and development of the 21st century, European integration, migration from other countries make Europe an increasingly multicultural world. School is one of the institutions affected by these changes. Teachers cannot expect any longer to be conducting their lessons in socially, linguistically and culturally homogeneous classrooms. They have to face linguistic as well as content obstacles that pupils' linguistic and cultural heterogeneity bears. Multicultural education has become one of the cross curricular subjects in Czech Framework Education Programme for Elementary Education (http://nuv.cz/file/133), which means that multicultural topics must be included even when teaching classrooms with no minority pupils. This of course brings the need for teachers of mathematics to be ready to handle multicultural topics and cope with cultural and linguistic heterogeneity in their lessons (although many will still try to claim that mathematics is universal, culture free).

As Straková (2012) states, current labour market needs workers with a wide range of cognitive and affective skills, often referred to as the 21st century skills. These include intercultural communication skills, use of information technologies, ability to solve complex problems, critical thinking, collaboration with others, ability to quickly adapt to the fast changings environment and conditions of work, effective management of work, will to gain new knowledge and information. The meaning of the world is not culture-free (e.g. Geertz, 1973; Strauss and Quinn, 1997; Bourdieu, 1998). We construct its meaning in a particular culture with values in the background. This naturally means that pupils from a different sociocultural background with a different mother tongue face more difficulties and obstacles at school; not only because of the language obstacles but also because their cultural values, patterns of behaviour and acting and meaning

they ascribe to the world and particular situations are different. Contents and topics presented in schools are culture-dependent and pupils from other cultural backgrounds see them as alien, less comprehensible. Their life experience is rarely taken into account. Meaney and Lange (2013) stress that learners may have additional difficulties if their experience of home context is very different from contexts they come across at school. The problem is not only materials and subject matter, pupils from other cultures may find it difficult to interpret the signals of the teacher and vice versa. Their interaction might be loaded with misunderstanding. The didactical contract in the classroom might be broken (Brousseau, 1997). Without any doubt due attention must be paid to intercultural psychology, multicultural issues, appropriate teaching methods, approaches, tools and contents. Then school will be ready to put up with current social changes and will be ready to promote equity in education.

Textbooks used in contemporary Czech schools do not offer multicultural topics, the cultural settings of word problems and mathematical procedures are mostly or entirely Czech, they come out of everyday experience of Czech pupils and disregard experience and everyday life of other pupils. In-service teachers themselves in a questionnaire study within the project M³EaL: Multiculturalism, Migration, Mathematics Education and Language (526333-LLP-1-2012-1-IT-COMENIUS-CMP) state that they lack suitable teaching materials and didactic units that they could use in culturally heterogeneous mathematics classrooms (Favilli, 2015; Moraová, Novotná, Favilli, 2015). Lack of multicultural materials for mathematics lessons puts more demands on the teacher who must be able to create their own multicultural teaching materials and didactic units.

Arslan and Altun (2007) point out that the usually recommended learning environments may be alien to certain groups of pupils, and teachers must take steps that will decrease this alienation. The here presented study is based on the concept of substantial learning environments – SLE developed by Wittmann (1995), namely on the concept that "A good teaching material for teachers and pupils should be the one which has a simple starting point, and a lot of possible investigations or extensions." A well-chosen and constructed SLE helps to break the wall between home and school culture between mathematics naturally used at home and mathematics used at school (Meany and Lange, 2013).

In (Favilli, 2015), different learning environments and teaching units suitable for the work in culturally and linguistically heterogeneous classrooms were created: Ornaments, Who did what in mathematics in my country?, Putting bins in our school's yard, Mastering Mathematics, mainstream and minority languages, A factory of triangles, Finger multiplication and Introduction to an ancient magic square. Their brief descriptions follow:

Ornaments

The authors of this teaching unit came out of the fact that ornaments are used in all cultures across which they differ considerable. In various cultures different patterns, regularities and motives are used. Using ornaments as the learning environment gives minority pupils an opportunity to bring their own culture into the classroom. Moreover, ornaments allow interdisciplinary relations to art, crafts, history, geography etc. What is typical for most ornaments regardless of their cultural origin is repetition of a specific decorative element following given rules. Thus ornaments are more than suitable for a number of mathematics topics from symmetries, regularities in geometry to ration, proportion, percentage or functional relationships in arithmetic and algebra.

Who did what in mathematics in my country?

This unit is based on the use of history of mathematics to show how various cultures contributed to development of mathematics as science and mathematical thinking. Pupils work in small

groups and discover how mathematics developed in their country or culture. They look for which famous mathematicians or mathematical concepts come from their country. The activity shows that mathematics itself is multicultural and would not exist in its current form without contribution of many cultures and nations. Moreover, minority as well as majority pupils grow aware of the fact that being from another culture is not a reason to be ashamed, it is something to be proud of.

Putting bins in our school's yard

The idea is to design a material based on the activities of locating and designing because of their universal dimension. Students are asked to depict their school's floor plan as well as its court for a particular purpose as to place garbage bins for recycling. All students are expected to have the interest to be involved in this designing. Mathematics notions involved through this activity are e.g. measurement, measure unites and transformation from the one to the other, parallel lines, perpendicular lines, scale, linear equations. Dynamic geometry software can be used for the implementation of the activity.

Mastering mathematics, mainstream and minority languages

The goal of this teaching unit is to provide to teachers a tool that helps pupils overcome cultural and language difficulties, barriers and obstacles. The language of a problem formulation is simple while mathematics remains complex enough. In this activity, pupils first work with their textbook and underline all difficult and unknown words. Then they discuss in the class what the meaning of these words is, translate them to their mother tongues and create a "minidictionary" or a glossary of mathematics concepts and terms. They look for possible differences between the meaning of the word in language of mathematics and everyday language.

A factory of triangles

This teaching unit is an introduction to the topic triangle in mathematics. The goal of the activity is to allow pupils to gain sensomotor experience with triangles and to master the needed terminology – both in written form and orally. The selected topic also offers a multicultural perspective on human knowledge and technology. An environment supporting activity and individual experience in social context providing tools for reduction of teacher talking time is created.

Finger multiplication

Finger and line multiplication are examples of a situation when we use procedures in mathematics education that have origin in different cultures. Finger multiplication from 6 to 10 can be used successfully not only on primary school level when pupils have already mastered multiplication tables from 1 to 5 but have not started multiplication tables from 6 to 10 (i.e. in the beginning of the 3rd grade) but also on secondary school level. Primary school pupils see that multiplication can be fun, not just memorizing. At the same time, they practice addition and multiplication by 1 to 5. Secondary school pupils may look for the background principles of the system and look for why finger multiplication works. The same applies for line multiplication.

Introduction to an ancient magic square

The ancient magic square is the environment which is connected to various cultures and historical periods. At the same time, it is a good background for a number of mathematical activities. This environment was used in the experiment described in this article.
The goal of the M3EaL project was to create suitable frames for pre- and in-service teacher courses focusing on work in linguistically and culturally heterogeneous classrooms. In this paper

we look for the answer to the following research question: Can inclusive mathematics education be successfully conducted by creative teachers if they are given a learning environment with an outline of its possible uses in mathematics education that they then adapt and develop according to the needs of the curriculum and their specific group of learners?

Materials and Methods

The experiment used the environment *Introduction to an ancient magic square*. The researchers studied how three teachers in three countries (France, Italy and the Czech Republic) coped with adapting and using the same original teaching unit.

The process of creation, piloting and analysis of the teaching unit was analogous to the process developed in M3EaL project (Favilli, 2015; Moraová, Novotná, Favilli, 2018). The original teaching unit was developed by one of the M3EaLproject partners and adapted for piloting in one school in their home country. The teaching unit was then piloted in the same form in another partner country with a different system of education and culture (unless some changes were inevitable e.g. because of unavailability of selected tools and programmes). In the next step the unit was given to a teacher in another partner country but the teacher was expected to make any needed changes to it so that it would correspond to the system of education in their country. The adapted unit was then piloted in that country. All three pilotings were then analysed qualitatively and further modifications and adaptations of the material were proposed if these were considered essential.

Qualitative analysis of implementation of the teaching unit was based on analyses of prepared teaching materials, video recordings from lessons, interviews with teachers and pupils' work. Attention was also paid to how difficult modifications and adaptations to the particular class were and how much space for involvement of minority pupils the material provided.

Original teaching unit

The original teaching unit was designed, developed and piloted in a seminar for teachers run by the French project team. The aim of this unit is to have the students work at the same time on decimal numeration and on the use of the French language, in writing and speaking in mathematics both in terms of vocabulary and explaining one's reasoning. It is also to allow verbal exchanges about written and oral numeration used yesterday and today in various countries and to highlight the input of other civilizations to the construction of mathematics in Europe.

This unit is based on this ancient magic square discovered in 1956 (Fig. 1).

Figure 1: Magic square (http://home.nordnet.fr/~ajuhel/Grenier/car_mag.html)

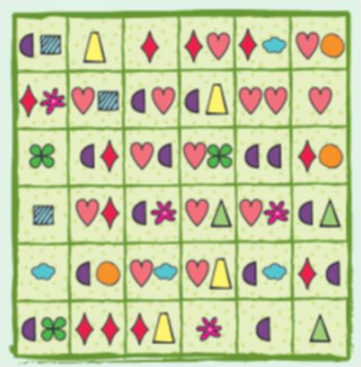

Figure 2: Adapted square (source: Hélice, 6th, Didier)

For pre- and in-service teacher education the unit was divided into several stages. In the first stage the document representing the ancient magic square in the ancient Arabic numerals (Fig. 1) was given as such to them. They had to discover the numbers in their current writing hidden behind the symbols. Once the square was decrypted, the trainers gave information about the used symbols, which were the ancestors of the current Arabic numerals. This phase had a double goal for the trainers: on the one hand to put the teachers in a search situation which they would have to reproduce with their own students in class, exchanging with teachers on their practices, and on the other hand to make the teachers aware of the search difficulties on the given document to enable them to adapt the situation. Then the trainers asked the teachers to find a use for this document in class.

Adaptation of the original teaching unit for use in a classroom

Based on a detailed analysis of use of the unit developed in France, the decision was made to replace the magic square with ancient Arabic numerals from Fig. 1 by drawings of mathematical figures or daily life objects (Fig. 2). Thus mathematical and daily life terms is required to name them, so the student have to practice mathematical or common vocabulary.
Anticipation of pupils' difficulties when solving the problem, the square was reduced to a square with dimensions 3 x 3 or 4 x 4. In a classroom situation, it would be necessary to guarantee that pupils have a thorough comprehension of some terms that would be needed, such as figures, numbers, lines, columns, diagonals, addition and total. The work done in the discovery of the magic square will allow to introduce or reactivate these words.

Results

Adaptations to the original teaching unit by a French teacher

The training sequence in class was adapted with the teacher who implemented it and anticipated a three-session organization. The first session was devoted to magic square discovery. The teacher gives a mission to students on a collaborative software (Framapad[1]): they have to discover a legend, the one of the Lo river tortoise. Each student has a laptop connected to the Internet and launches research on the legend. They have to discover what is hidden behind number 15, a crucial element in the legend, which is nothing but the constant of a 3x3 magic square. They

1 http://framapad.org/

then have to check that a given square is magical and to fill in three squares in order to make them magical. To conclude, they must write a summary of what they have learnt on the collaborative tool.
In the next stage the adapted square is handed out to the students, with questions enabling them to decrypt it. The students work in groups of three or four in order to promote exchanges and reasoning formulation.
The third session is dedicated to the review of the work done, to the study of the initial square, to exchanges and to cultural and historical inputs.

Adaptations to the original teaching unit by an Italian teacher

The teaching unit in the original form was to be piloted in Italy. However, Italian pupils could not use Framapad as it was not available at school. This required modification of the teaching unit. The use of Framapad was replaced by other activities including internet search. Also extra time was given and the activity supplemented by historical and cultural details. The modified unit was piloted successfully.

Adaptations to the original teaching unit by a Czech teacher

In this piloting the teacher made substantial changes to the original teaching unit to make it suit the needs of Czech education system. The lesson started by a historical narrative: The basic magic square with numbers 1 to 9 is connected to the legend of the turtle Lo-Shu which had the magic square on its shell. Only when the inhabitants of the valley of the river Lo were able to understand the meaning of the magic square could they appease gods by giving the right number of gifts to the god of the river and prevent flooding of their homes. The legend serves as a good introduction to a lesson in which pupils develop their mathematical creativity and look for the magic number – 15. They have to discover that the magic number is the sum of numbers on the diagonal, in a row and in a column. The unit was piloted in 5th grade (pupils aged 11 to 12) and 7th grade (pupils aged 13 to 14). The adaptations made by the teacher were different for each of the grades to correspond to the pupils' level. The environment may help 5th graders to discover properties of arithmetic operations (What happens if we add the same number to each of the numbers in the magic square? Will the new square be magic? Why?; What happens if we multiply each number in the magic square by the same number. Will the new square also be magic? Why?; What happens if we swap columns or lines that are equally distant from the centre? Why?). Another option is to show pupils the algorithm of creation of an odd order magic square and ask them to create more and more squares using the algorithm. Pupils then learn to work according to instructions.
More about this topic can be found in (Moraová, 2015).
The pupils' attention was drawn to another interesting fact: The engraving Melencolia by Albrecht Dürer (1471-1528) became really well known because there is a magic square the top right corner (Fig. 3).
The experiments carried out tend to confirm the interest of the "magic square" activity and its adaptability to different class levels and pupils´ linguistic and cultural differences. Differences show up in the implementations (e.g. the length of the activity). The multicultural and historical aspect was managed differently. The decoding of the ancient magic square puts the emphasis on the difficulty of symbolism, but also on real reasoning difficulties concerning numeration and the position of a figure in a context that is different from "classical" exercises. The historical aspect and the study of different numerations is consequently an interesting extension from a mathematical point of view.

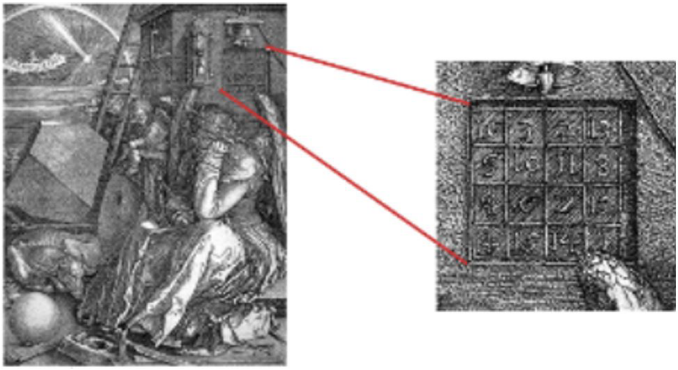

Figure 3: Melencolia by Albrecht Dürer (http://bennetti.blog.cz/1102/dureruv-magicky-ctverec)

Discussion

While Moraová, Novotná and Favilli (2018) focus on development of pupils' creativity thanks to a well proposed multicultural teaching unit *Ornaments,* the focus of this experiment is on the teacher. Another difference is in the material used as the base for the unit: While in *Ornaments* teachers plan a unit in which pupils works with everyday life objects, the unit *Introduction to an ancient magic square* is based on a historical artefact. The experiment shows that despite this significant difference creative teachers are able to adapt the basic teaching unit in a way that it is at the same time motivating and interesting but also helps to bridge cultural and linguistic differences among the pupils.

The decoding of the magic square confirms that the linguistic and the cognitive aspects are intimately linked. The activity seems to provide a context allowing the development of both language and mathematical competences, while remaining motivating for the students and adaptable to different class levels and to different objectives.

Conclusion

In this paper we used magic squares as an example which shows that a well-designed basic teaching unit or activity can be adapted to suit the needs of a particular group of learners. Textbook analysis as well as analysis of all activities developed within the project M^{3}EaL show that since contexts from other cultures are rarely present in textbooks, materials set in other cultures or based on concepts from other cultures can be created by the teacher. It is recommended to include examples of such work in pre- and in-service teacher education courses. (Favilli, 2015)

When researchers look at teaching mathematics in culturally heterogeneous classrooms, they usually focus on linguistic issues (e.g., McDermott and Varenne 1995). What we really have to ask is how mathematics is specific and what the dangers of teaching it in culturally and linguistically heterogeneous classrooms are. This paper and the presented results contribute to bridging the gap as they show a feasible way to improvement.

The presented analyses clearly show that creative teachers are able to adapt and develop teaching materials if given a stimulating learning environment and an outline of the possible mathematical uses. If teachers are offered environments rooted in other cultures they get the space for their adaptation into teaching units presenting and practicing a mathematical content. In other words, they get the chance to become creative. The pilotings even imply that this is preferred to having a database of thousands of ready-made materials.

Nearly every topic from school mathematics can be enriched by elements of diverse cultural origins.

There are a whole range of activities that can be used in mathematics lessons for development of knowledge of mathematics as well as of multicultural sensitivity and competence. Moreover, using such activities supports learning of pupils from various sociocultural backgrounds and brings cross curricular topics. The here presented research shows that even busy teachers have the potential to adapt multicultural teaching materials for the needs of their own classrooms, given they have access to the original idea. Having no experience with similar tasks from their own school years, pre-service teachers should get the experience with this kind of learning environments already during their undergraduate studies.

If activities similar to those presented in this paper become more widely used at schools, more understanding and respect among groups of people with different linguistic and cultural backgrounds could be achieved.

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USE AND ADAPTATION OF CAREER ADAPT-ABILITIES SCALE IN CZECH UNIVERSITY STUDENTS

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Abstract

This paper focuses on translation and adaptation of the Career Adapt-Abilities Scale (CAAS) questionnaire into the Czech language and exploration of basic psychometrics properties. The adaptation of CAAS tool consists of two parts. The first phase focuses on the translation into the Czech language including back-translation into English, consultation in the researching team and pilot testing in a small sample and consequent modifications. In the second phase of the research, the final version of the questionnaire was administered to a Czech sample containing 224 Czech university students to determine psychometric qualities and factor structure of the Czech version. In this paper, the psychometric properties are examined and presented. Results of the confirmatory factor analysis are subject of a subsequent paper. The findings could lead to more effective lectures' preparation of Career Development programme and a better understanding of the needs of students participating in career guidance and counselling (CGC).

Keywords

Career adaptability, career development, occupational transitions, vocational behaviour

Introduction

Studies have confirmed that not only professional experience but also soft skills (Savickas and Porfeli, 2012) are important for future job success. Additionally, nothing is predictable, everything is in motion and subject to constant and rapid changes (Ditrichová and Šubrt, 2010), the expectations of labour market raises pressure on greater flexibility and adaptability of the workforce with the need to adapt to the rapid changes (Hlaďo, 2016). Therefore, universities, in addition to preparing their students for their professional career path, also focus on developing their skills and knowledge that are crucial to their successful application to the labour market in the 21st century. These include, for example, critical thinking, planning and organizing work, adaptability, communication and cooperation, representing and self-presenting (Jackson and Chapman, 2011). Because these skills are often rated by employers as insufficient (Balcarová et al., 2016), career counselling at universities play an important role here (Savickas, 2012). Students who are aware of this and want to improve these competencies are actively taking advantage of career guidance offerings, thus increasing the chances of good employment in the labour market. The main goal of this paper is the translation and adaptation of the Career Adapt-Abilities Scale (CAAS) questionnaire into the Czech language and exploration of basic psychometrics properties. The implementation of the CAAS questionnaire at the Czech universities could lead to finding out if the soft skills are sufficient and what career guidance and counselling (CGC) needs to focus on most (Savickas and Porfeli, 2012). The CAAS questionnaire enables career guidance to be as

close to the needs of students as possible and the current labour market and therefore we have decided to put it into practice.
The preparation for career development and the importance of career counselling has been given a great deal of attention in the literature (Holland, 2000; Savickas, 2005; Amundson, 2009; Bandura, 2013).

Materials and Methods

The procedure consisted of two phases. The first phase involved the questionnaire translation. Firstly, the questionnaire was translated from English into Czech. Consequently, a researcher not acquainted with the original version translated the questionnaire back into English. After that, disputable terms were consulted in the researching team and some of the items were changed to be more accurate. The new version of the Czech questionnaire was piloted in a small sample and last problematic details were modified again to be as clear as possible.
In the second phase of the research, the final version of the questionnaire (paper-pen form) was administered to a Czech sample containing 224 Czech university students to determine psychometric qualities and the factor structure of the Czech version. In this paper, the psychometric properties are examined and presented. The descriptive of the data were computed (mean, standard deviation, skewness and kurtosis) and the reliability (Cronbach´s alpha) was examined for each of the factors of the questionnaire (see below). Results of the confirmatory factor analysis are subject of a subsequent paper.
The research sample consists of 224 students who participated in the research. Each participant gave their written consent to the data analysis. Students were enrolled in two groups during the first week of the summer semester 2017/2018:

- Students of the elective semester bachelor course Career Development. The 13-week curriculum aims at gaining skills and information necessary for timely labour market entry preparation and for labour market orientation. It is focused on job search based on students´ vocational background and personal characteristics. It leads students towards a systematic and responsible approach to forming their own professional career. It lays stress upon practically applicable outputs.
- Students from the "waiting list" who expressed their interest in gaining support through interventions in CGC, namely to take part in the optional semester bachelor course Career Development.

33% of participants were enrolled in the course Career Development and 67% participants were from the "waiting list". The sample was relatively equally distributed according to gender. Women accounted 53% of the sample, men 47%. Almost all students study at the Faculty of Business Administration, only 6 % were representatives of other faculties at the university. The majority of all participants were born between 1995 and 1998, only 3% were younger and 5,5% of students were older. 67% of participating students are currently in their first year of studies, the rest was equally divided between the 2nd year and 3rd-year students.
The CAAS questionnaire is a psychometric scale measuring career adaptability and the scale was constructed based on the collaboration of researchers from 13 different countries. The final CAAS consists of four scales, each with six items. The four scales measure concern, control, curiosity, and confidence as psychosocial resources for managing occupational transitions, developmental tasks, and work traumas (Savickas and Porfeli, 2012).

Results

24 items of the CAAS questionnaire were administered to 224 Czech university students bringing about the following results.

Items	Mean	Std. Deviation	Skewness	Kurtosis
VAR01 Thinking about what my future will be like	3.4598	1.00143	-.537	-.161
VAR02 Realizing that today's choices shape my future	3.8795	.92243	-.588	-.093
VAR03 Preparing for the future	3.2545	.80496	-.130	-.043
VAR04 Becoming aware of the educational and career choices that I must make	3.4018	1.01079	-.215	-.567
VAR05 Planning how to achieve my goals	3.2098	1.00924	-.009	-.544
VAR06 Concerned about my career	3.3929	1.03184	-.154	-.661
VAR07 Keeping upbeat	3.4554	1.18955	-.361	-.804
VAR08 Making decisions by myself	3.8884	1.00271	-.689	-.099
VAR09 Taking responsibility for my actions	4.1027	.89000	-.935	.833
VAR10 Sticking up for my beliefs	3.9375	.85002	-.587	.085
VAR11 Counting on myself	3.9955	.90091	-.400	-.860
VAR12 Doing what's right for me	3.5759	.96743	-.202	-.537
VAR13 Exploring my surroundings	3.2277	.92156	.121	-.650
VAR14 Looking for opportunities to grow as a person	3.1607	.98921	.261	-.625
VAR15 Investigating options before making a choice	3.6295	.96170	-.236	-.616
VAR16 Observing different ways of doing things	3.5446	.87710	-.178	-.467
VAR17 Probing deeply into questions I have	3.2946	.91953	-.095	-.287
VAR18 Becoming curious about new opportunities	3.6027	.93184	-.269	-.478
VAR19 Performing tasks efficiently	3.5089	.93747	-.191	-.577
VAR20 Taking care to do things well	3.8259	.97090	-.386	-.593
VAR21 Learning new skills	3.7991	.83628	-.350	-.380
VAR22 Working up to my ability	3.8616	.86463	-.484	-.127
VAR23 Overcoming obstacles	3.6741	.86592	-.444	.194
VAR24 Solving problems	3.7768	.84927	-.397	-.142

Table 1: Descriptive statistics in the Czech university student sample, 2018 (source: own calculation)

On a 5 - point scale, some items showed relatively the high mean and skewness. Item 9 (Taking

responsibility for my actions) shows higher skewness and kurtosis, items 11 – Counting on myself and 7 – Keeping upbeat higher kurtosis – all the values are above 0,8.
Yet none of the variables showed skewness or kurtosis outside of the values considered acceptable in a normal distribution (between -2 and +2, see George and Mallery, 2010).
Subsequently, reliability (using Cronbach´s alpha) was computed for all constructs of the scale. All but one factor (control) showed an acceptable level of Cronbach´s alpha (0,7 - Cronbach, 1951).

Concern	0,726
Control	0,664
Curiosity	0,702
Confidence	0,767

Table 2: Reliability (Cronbach´s alpha) for the four factors of the CAAS questionnaire, 2018 (source: own calculation)

As the reliability of the construct Control was low, the inter-item correlation was computed for the Control construct. Some items have a very low inter-item correlation.

Items	VAR07	VAR08	VAR09	VAR10	VAR11	VAR12
VAR07 Keeping upbeat	1.000	.272	.104	.192	.136	.309
VAR08 Making decisions by myself	.272	1.000	.450	.244	.426	.154
VAR09 Taking responsibility for my actions	.104	.450	1.000	.394	.263	.098
VAR10 Sticking up for my beliefs	.192	.244	.394	1.000	.193	.317
VAR11 Counting on myself	.136	.426	.263	.193	1.000	.281
VAR12 Doing what's right for me	.309	.154	.098	.317	.281	1.000

Table 3: Inter-Item Correlation Matrix, 2018 (source: own calculation)

The lowest inter-item correlation was detected between items 9 – Taking responsibility for my actions and 12 – Doing what's right for me (0,098), 7 – Keeping upbeat and 9 – Taking responsibility for my actions (0,104), 7 – Keeping upbeat and 11 – Counting on myself (0,136) and 8 – Making decisions by myself and 12 – Doing what's right for me (0,154). On the contrary, the highest correlation was found between items 8 – Making decisions by myself and 9 – Taking responsibility for my actions (0,45), 8 – Making decisions by myself and 11 – Counting on myself (0,426) and 9 – Taking responsibility for my actions and 10 – Sticking up for my beliefs (0,394). Inter-item correlation, which is too high, would not be acceptable due to multicollinearity assumption.

Discussion

The low Cronbach´s alpha in Control construct could occur due to several reasons. One of them is the sample size. Some authors recommend a sample size of at least 300 respondents (Kline, 1986), other 400 (Charter, 1999). Cronbach´s alpha obtained from a larger sample seems to be a more accurate estimate (Yurdugul, 2008). Therefore, a study using a larger pool of respondents could show different Cronbach´s alpha.
Another explanation might stem from the items loading on the Control factor as some of them have a low inter-item correlation. This could also appear due to the specific sample. For example, the item VAR09 "Taking responsibility for my actions" shows the high mean and higher skewness

(skewness is close to 1). The sample consists of students with a business background, which might differ from different populations. To resolve this, another study with a different and bigger sample should be conducted.

Several different international studies focus on the relationship between career adaptability, demographics and psychometrics variables (Duarte, 2012; Pouyaud, 2012; Soresi, Nota, Ferrari, 2012; Vianen, 2012) and confirm correlations between level of career adaptability and quality of life.

An international study in France included 609 high school students with a mean age of 16,60 years. The CAAS-France item means frequencies show that the typical response was moderate or strong. Skewness and kurtosis values ranged from −80. to.12 and −.96 to.24 (Pouyaud, 2012). Italian participants included 762 adolescents with a mean age of 17,38 years. The CAAS-Italy skewness and kurtosis values for the items ranged from −.83 to.11 compared to −.67 to.39 respectively for the 24 items of the International Form, suggesting that the items conform to the assumptions of confirmatory factor analyses for this sample (Soresi, Nota, Ferrari, 2012). The CAAS-Netherlands questionnaire was administered to 465 university students in the Netherlands with a mean age of 20,77 years; means and standard deviations suggest that the typical response was in the range of strong to very strong. Skewness and kurtosis values items ranged from −.74 to −.25 and −.57 to 1.14 (Vianen, 2012). In Portugal, the sample included 916 participants: 255 students with a mean age of 15,04 years; 395 employed adults age 46,62 years and 266 unemployed adults age of 22,43 years. The CAAS-Portugal item means, and standard deviations suggest that the typical response was in the range of very strong to strongest. Skewness and kurtosis values for the CAAS-Portugal items ranged from –.72 to 0.04 and −.74 to 0.15 (Duarte, 2012). Compared to these results, our analyses show skewness not exceeding 0.7 and on the contrary, relatively high kurtosis for some of the items – several items had kurtosis over 0.8, in accordance to some other national studies (France, Italy).

The CAAS questionnaire could be used in the Czech Republic focusing on research and practice fields. The implementation of CAAS and its findings will lead to more effective lectures' preparation of Career Development programmes at the Czech universities, and a better understanding of the needs of students participating in CGC interventions. With regard to the availability and variety of the forms of intervention in CGC is important to pay attention to compare the efficacy of different forms of interventions. Career adaptability could be measured across different types of student's group and could evaluate the efficiency of different types of CGC interventions.

Conclusion

This paper focused on the translation and adaptation of the CAAS questionnaire into the Czech language and explored basic psychometrics properties. The first phase focused theoretical background followed by questionnaire's translation, discussion within research team and pilot testing. The second phase determined psychometric qualities and factor structure of the Czech version. The questionnaire was administered to 224 Czech university students including the examination and presentation of psychometric properties.

All factors (except one) showed the acceptable level of Cronbach's alpha, the possible explanation for lower Cronbach's alfa results was discussed. Subsequently, future research direction was proposed and other implications for practice as such as usability during CGC interventions were maintained and stated. This paper will be followed up by different papers focused on discussion of factor's structure and on the comparison of CGC interventions efficacy provided at the university. The CAAS tool enables career guidance to be as close as possible to the needs of students and the current labour market; the findings lead to more effective lectures' preparation of Career Development programme.

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VALUE OF KNOWLEDGE IN THE PROCESS OF LIFELONG EDUCATION

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Abstract

The paper aims to identify the factors for measuring the value of knowledge in any organization. It proposes how contents and concepts from evaluated documents can help to find those factors. The study aims to broaden the domain of measuring the amount of knowledge a broader range of human resources, intellectual capital but also the matter of innovations in organizations and others. This research uses the method of content and contextual analysis through the Tovek Tools program which is perfect for use in the context of unstructured data sources, such as scientific articles, reviews studies, books, or a simple, informal piece of text. Authors used 106 documents (articles, scientific papers, and surveillance studies). These materials included papers and texts from the period between 1990 and 2016. This paper provides a basis for the derivation of the missing general concept based on measuring the value of knowledge.

Keywords

Content analysis, contextual analysis, knowledge, knowledge contribution, knowledge seeking, lifelong education

Introduction

This article examines, in general, the relationship between research documents and measuring the value of knowledge. Especially in finding the factors on measuring the value of knowledge in any organization. Measuring the amount of knowledge is a critical component of financial costs of organizations (Wiewiora et al., 2013). There are a highly growing interest and potential in how to measure the value of knowledge in any organization and evaluation of measured results. This paper addresses the particular need for real critical analysis of measuring the amount of knowledge which also comprises an analysis of relevant research documents which include many types of metrics how to gauge the value of knowledge. The paper´s findings have practical implications for managers to mentioned parameters and to achieve strategic alignment of the business (Tsai et al., 2016). This article explores how organizations measure their organizational knowledge by focusing on strategy execution and employee effectiveness. The outcome is, in this case, a table for a specific factor and its detailed description (Thorleuchter and Van den Poel, 2012; Jarošová et al., 2017).

The goal of this paper is to examine more deeply the relationship among employees, the value of knowledge and value of the organization. The output of the paper is the proposal of new factors to develop methods to measure the value creation (i.e., work activity). This study is based on data gathered from the previously published studies analyzed with content and contextual analysis. The first section examines the materials and methods used in this research. There is content and contextual analysis described and also software utilized for this research. The second section addresses the manner in which the data were collected and analyzed, and the findings. The third part of this study provides a discussion of the results and the implications for measuring the

value of knowledge and those interested in using mentioned methods in practice. Finally, practical consequences of the research focus on what kind of variables to measure in an organizational environment are discussed (Edwards and Taborda, 2016; Wievora et al. 2013). The findings at the investigation paper organization showed that organizations could use many metrics and it depends on their business focus. Managers can address the problem of finding the best variables to measure the value of knowledge and the value of the organization by using a factor from that group of variables in this research (Edwards and Taborda, 2016).

Materials and Methods

A sample of Text Documents from the Previous Text Mining Study

In the previous study were documents analyzed by software Statistica by text mining module. The amount of all documents which were analyzed was 106 (Mudrychová and Houška, 2016). Originally there were 568 papers which were selected to be connected with the knowledge transfer, knowledge sharing, knowledge engineering, and companies´environment and other related topics. After second round selection and availability of those papers, authors selected only 106. All articles were presented in English and searched from online search engines and indexed worldwide scientific databases such as WoS, ScienceDirect, Scopus, and others. An average of those papers had between 10-20 pages and going even beyond that concept of knowledge and value of knowledge (Tsai, Lu, and Yen., 2012).

Contextual vs. Content analysis

The contextual analysis was used in Tovek Tools by Query Editor. The principle was simple to find selected words and stems. The program searched word chosen or stem from selected and uploaded documents. When the program finished it evaluated documents that match a running query. After running, the first 20 documents were displayed implicitly, and all documents were ranked according to the score that the program calculates based on the algorithm. It can be searched in multiple sources at once, of course, and not just in the „physically" recorded documents. Also, this tool in program Tovek can evaluate data in so-called Inforating feature. Inforating can be used to illustrate the links between the content of the searched documents and the defined topics. Therefore, it was still the contextual analysis of the searchable records. Usually, it was presented in the form of matrix or graph. The last exciting thing about Inforating was that authors were able to find connections and relations between each topic or for the building of structured summaries with cross-references (Bai, White, and Sundaram, 2012). On the other hand was content analysis used. Harvester is the tool which provided the content analysis of selected materials. Content analysis means that tool evaluates the most important keywords and connections between them (Jong-Min and Sunghae, 2015). It's possible to see the environment around chosen keywords and documents, in which can be found those words. It also can be used even for contextual analysis and see connections between topics and contents (Barelson, 1952).
Content analysis is intended to describe and explain the content structure of the text. It serves an objective, systematic and quantitative analysis of the content of serious content units (Jong-Min and Sunghae, 2015). The main objective is to identify the key terms in the group of documents, their frequency, and development over time using statistical methods. The outputs are then annotations, abstracts, sets of descriptive keywords and subject passwords (Barelson, 1952). The contextual analysis attempts to identify elements that describe specific contexts, to illustrate the context of the content of the searched items related to the analyzed problem and the defined topics. The aim is to find in the set of documents which describe these specific contexts (Bai, White, and Sundaram, 2012).

Software used in the study

In this study is used Tovek Tools software, version 7.4. Any file system, such as e-mail ODBC database, can be indexed using Tovek Tools. In our case, text documents were indexed. Consequently, it is possible to apply searching in these documents from one place. This tool was used for content analysis and allows to see what keywords and links were found in the retrieved documents. For contextual analysis allows sorting these documents quickly by selected topics. The visualization content can be consulted in these documents or structured sources and displayed graphically. Search results and analysis can be exported in various formats, including automatically generated summaries and overviews. The Tovek Tools software includes an editor for creating structured queries and plug-ins for connecting Tovek Tools with Analyst's Notebook. Tovek Tools program contains two main tools - Query Editor and Harvester. Query Editor is a tool for creating more complex queries that can be used in purely statistical programs within mining text. These queries are in the tree / hierarchical structure. Queries are formed by compiling individual nodes into the previously mentioned hierarchical structure. Query Editor lets you create themes, accurately formulate the problem, and determine the importance of setting the weight of each part of the query. Harvester allows content analysis of selected documents. It is suitable for orientation in large texts that contain unknown data and allows for their subsequent analysis. It also combines statistical methods with linguistic analysis. It searches for pairs and, in particular, for the three words that are likely to occur in the documents examined close to each other, i.e., it creates a map of the topics that are written in the documents. It also shows important keywords and relationships between them, surroundings of selected words, and the documents in which they occur. (Tovek Tools website, 2016).

Results

The first results of the analysis in the Tovek program served authors only for illustrative purposes and for orientation in selected documents. Furthermore, the first step was used to verify the suitability of the selected documents. The results are presented in two parts. In the first part, the results were analyzed based on similar frequency matrix for all documents as in other statistical programs. The second part of the study was focused on the importance given to stems, selected words or selected topics/concepts, etc. The documents used were prepared in an optimum way, as the process only took a few minutes. After completing the analysis by specifying queries, evaluating all documents after applying these queries and creating an image from several selected queries (and therefore from the selected documents), some images with the results were set up in the Harvester module. Authors prepared the set of queries for "asking" the program about what was wanted to know. The goal was clear—to find a connection among topics, words, queries, contexts, and contents, etc.

Contextual analysis outputs

So, first, the Query Editor was used for the purpose to contribute to new queries for the research of authors. In the Query Editor, authors used several simple queries with operators (conceptual operators, positional operators, and relational operators). There is another editor named Contextual Query Editor in which one can ask more questions (queries). Every query in the Contextual Query Editor has a unique name and stems for what we are looking. The most important thing is that queries in the Query Editor selected the total number of documents for a particular unique query (it was possible to define the summary and get summaries, e.g., about entities from evaluated documents there). After that, the Contextual Query Editor specified the number of combinations between terms: InfoRating and contextual matrix (Bai, White, and Sundaram, 2012).

Content analysis outputs

These are outputs of queries and the summary of selected documents (from specific queries). Based on their evaluation, authors have described several variables which seem to be the right ones for measuring the values of knowledge storing and transfer in organizations and presented one example (knowledge contribution).

Factor defined based on the analysis

From the analysis through the program, Tovek Tools researchers gained factors, and one of them is described below what important for measuring the value of knowledge within the organization. Then researchers came back to those selected documents used for the analysis and found out in those articles how other researchers described and evaluated those factors.

Knowledge contribution to the organization

Describes how employees create a contribution to the organization. The formula of knowledge contribution contains image, enjoyment, and reciprocity of those employees.
Image means the employee can increase own positive reputation in a company due to contributing knowledge. For employees is building reputation a strong motivator to be even more active and participated in activities of a company. It´s transparent that employees contribute knowledge, even more, when they perceive their professional reputations will be enhanced (He and Wei, 2009).
Enjoyment means that employees help each other in a company. Employees are pleasured to obtain from helping other colleagues in a company through knowledge contribution. It was described that people who contribute their knowledge gain satisfaction stemming from their intrinsic enjoyment in helping others. That enjoyment in helping others can significantly impact the knowledge contributor´s in information systems usage (nowadays those IS are used considerably as a „library“ for knowledge) (He and Wei, 2009).
Reciprocity is described as the expectation of benefits. Those benefits should be an output of a future request for knowledge being met as a result of the current contribution. It means that employees who share knowledge and can share knowledge in a company believe in reciprocity. That reciprocity is thought to exert influence on information sharing using a „return-in-kind“ attitude (He and Wei, 2009).
It is measured based on a structured questionnaire within the organization with specific scales (5-point Likert scale, with 1 denoting strong disagreement and 5 denoting strong agreement. The scales are anchored by (1) strongly disagree, with (3) neutral (either agree or disagree) as the midpoint, and (5) strongly agree (Kankanhalli et al., 2005; He and Wei, 2009).

Factor	Knowledge contribution (within the organization)
Group	Knowledge contribution and seeking
Formula	Knowledge contribution = Image + Enjoyment + Reciprocity (Kankanhalli et al., 2005; He and Wei, 2009).
How to measure	The results of the survey are measured using a 5-point Likert scale, with 1 denoting strong disagreement and 5 denoting strong agreement. The scales are anchored by (1) strongly disagree, with (3) neutral (either agree or disagree) as the midpoint, and (5) strongly agree. The survey is unlimited by how many questions companies want to ask their employees (Kankanhalli et al., 2005; He and Wei, 2009).
Survey´s questions	Enjoyment: I can share my knowledge with my colleagues through knowledge management system. I enjoy helping others by sharing my knowledge through knowledge management system. I feel good to help someone else by sharing my knowledge through knowledge management system. Sharing my knowledge with others through knowledge management system gives me pleasure (Kankanhalli et al., 2005; He and Wei, 2009). Image: Sharing my knowledge through knowledge management system improves my image within the organization. People in the organization who share their knowledge through the knowledge management system have more prestige than those who do not. Sharing my knowledge through knowledge management system improves others´recognition of me. When I share my knowledge through knowledge management system, my supervisors praise me (Kankanhalli et al., 2005; He and Wei, 2009). Reciprocity: When I share my knowledge through knowledge management system, I believe that I will get an answer for answering. When I share my knowledge through knowledge management system, I expect somebody to respond when I´m in need. When I contribute knowledge to knowledge management system, I expect to get back knowledge when I need it. When I share my knowledge through knowledge management system, I believe that my queries for knowledge will be answered in future (Kankanhalli et al., 2005; He and Wei, 2009).
Evaluation of measurement	The actual evaluation of the data that was obtained by Likert scaling must prevent the analysis of their character or type. It is necessary to find out with which variables work about the scale used. Jacobs and Sorensen (2010), because it is from this relationship that the subsequent analysis is developed. It´s distinguished four different scales; nominal, ordinal, interval, and scale ratios. Nominal scale ratio describes this factor. A scale determines the difference between classes that can t be arranged. Descriptive analysis options based on the nominal scale used: rate central tendency (such as modus) and degree of variability (such as frequency) (Kankanhalli et al., 2005; He and Wei, 2009). The most effective test of the reliability of this factor is to test the results via the statistical program and of the construct through Cronbach alpha. The results should be above 0.7 to be acceptable (Kankanhalli et al., 2005; He and Wei, 2009).
Characteristics	It s the level of employees knowledge contribution in companies including their beliefs, prestige, and helpfulness.
Source of data	Data from questionnaire; the environment in the company and its employees.
Problems	The survey must be anonymous. The common method variance may be a concern. The researcher has to assure respondents of the anonymity and confidentiality of the study. Also, hiding the meaning of items and adding reversed items in questionnaires may be helpful (Podsakoff et al., 2003).

Outcome/ Output	Where is the drive" of companies´employees to share and transfer knowledge? Also, how should companies motivate them to do it and update their learning methods, tools and evaluate them? If Cronbach also is under 0,7, those results are not reliable or not enough. If the results are above companies can trust" those results, and it means that they can evaluate them. Higher are results more knowledge contribution is placed in that company.

Table 1: Factor „Knowledge contribution" (source: own processing)

Discussion

We argue that the meaningful importance of the value of knowledge is not only about the process of transfer of knowledge, such as in the study of Tsai, Lu, and Yen (2012). But Tsai, Lu, and Yen (2012) founded methods how to establish a transfer of company values from traditional physical assets to intangible knowledge, at this point we are compliant. For our paper was the most important at first to understand how it is possible for the organizations to measure and evaluate the value of knowledge. On the other hand, there are authors like Jong-Min and Suanghe (2015) who tried to use text mining for an unstructured data set with a preselected couple of words for a specific organization (Apple company). So, the importance of an understanding of key documents and keywords from those documents in the organizations is clear from their study, and it‘s clear to us too. Bud our research comes with groups of variables and those groups are more flexible and applicable for a big huge of documents.

We are also partly compliant with another study from Lee, Shiue and Chen (2015) called "Examining the impacts of organizational and top management support of knowledge sharing on the success of software process improvement." This paper is focused more on top management support of knowledge sharing in most of the organizations and their processes, not only in SPI (software process improvement). From research´s point of view, researchers believe in support of top management influences the path to the processes of organizations success. In the improvement of information technologies and their application can affect knowledge sharing and transfer as well can all agree.

Bai, White, and Sundaram (2012) founded the new direction of watching on the value of knowledge in the case of visualizations. They think that those visualizations assist in creating, transferring and sharing of knowledge within the organizations. This research is different in the way of using visualizations. This study contains only one factor from a whole group of variables which researchers founded by that analysis and visualizations were used to see where can be the value of knowledge founded, etc.

Conclusion

This paper was a part of the analysis which came with a group of variables (factors) and its subcategories. In this paper, researchers presented one factor, such as knowledge contribution. Researcher began with examining current research possibilities and directions in measuring the value of knowledge. Researchers focused on the analysis of literature using a tool which supports contextual and content analysis and how those results can be used to help organizations (public or private) to manage resources to improve the value of knowledge. However, the contextual and content analysis was used in this paper for a better understanding of connections among topics, contexts, and contents. The proxy for managing the value of knowledge in the organizations, also its measuring in using our conceptualization of this value to increase organizations´ value, in general, is strategic alignment. It‘s clear that the conceptualization of the matter of the value of knowledge and analysis of texts will have the most benefit for an organization such as universities, IT-based companies, and others.

This paper aimed to contribute to the knowledge value research by looking at how and where is knowledge measurement used or can be used. Authors have focused on how other authors and researchers can use knowledge measurement and for what in public and private sector perspective. By defining the group of variables from selected documents (those documents were selected due to pre-defined keywords etc., as mentioned above in this paper) in the matter of knowledge measurement, it´s explained how this definition of the group of variables could be extended to help companies understand how to align their strategy. First, researchers described the group of variables for the better overview in this matter of knowledge possible ways of measurement. In paper was used one factor from those variables. This identification of the group of variables can also help managers of public or private companies to understand what kind of knowledge to measure they are looking. Second, they contributed to the need for specification of this group of variables and approach to usability. The problem should be addressed by showing how managers can use these metrics to measure knowledge. And how to use those results and to take action to track the change regarding expanding and growing companies and improve organizational learning and training.

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FULL-TIME OR COMBINED STUDIES: DIFFERENT PERSONALITIES IN DIFFERENT STUDY MODES?

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Abstract

This study examines the particularities of differences in some personality traits of students with regard to their study programme. A descriptive survey research was conducted from November 2017 to February 2018. The questionnaires (EPI and SVF78) were administered to 109 undergraduate students studying in full-time (N=60) or in part-time (N=49) mode of study. The findings indicate that there exist differences between the groups of part-time and full-time students, in the use of stress coping strategies, especially regarding the use of the positive triad: situation control, reaction control and positive self-instruction. We found significant differences also in the use of the coping strategy need for social support and in the level of neuroticism in compared groups. The interpretation of these results and further research questions are discussed.

Keywords

Full-time study, part-time study, personality traits, psychology of university students, study modes

Introduction

Asking questions about personality traits of students educated in university education, university employees would probably answer them in a different way than students themselves. A substantial body of evidence shows that those stable personality traits exist (Heckmann and Kautz, 2012: 453). There is also general agreement that specific personality traits predict important life outcomes, such as mortality, divorce and success in work (Roberts et al., 2007: 336; Damian et al., 2015: 474). At the same time, people who study at a university, whether engaged in a full- or part-time study, can be expected to exhibit some specific traits in terms of their personality. In this respect, it can be understood that students engaged in different forms of study will probably differ in some personality traits, and these traits shall then be reflected also in their choice of the form of study as in agreement with Hagel and Shaw (2006: 289), 'each study mode offers a different benefit mix to students'. These authors further explored the students' perceptions of study modes, taking into account the following factors with respect to the choice and evaluation of the given study mode: age, gender, cultural background, attitudes towards and experience with ICT and learning approaches or learning styles (Hagel and Shaw, 2006: 289).

Considering that some personality traits lead to specific life outcomes, one needs to realize, among others, that personality traits of students will also impact on how the given student copes with the requirements and demands of university study. Many studies have assessed the role of personality in academic performance (Poropat, 2009: 41). Sternberg, Grigorenko and Zhang (2009: 486) define ability-based and personality-based styles in thinking and learning, and claim that 'not taking them into account prevents students from capitalizing on strengths

and/or compensating for or correcting weaknesses and thus is suboptimal'. According to the authors of this study, a set of personality traits termed coping strategies is an important factor of coping with stressors associated (not only) with fulfilment of the requirements and demands of university study (Natovová and Chýlová, 2012: 227). Shankland et al. (2010: 353) describe coping strategies as cognitive and behavioural responses to a stressful situation and conclude, that 'problem-focused strategies are more effective in coping controllable situations, like coping with the demands of students' life, while emotion-focused coping strategies are more effective in unmanageable events'. Generally, it can thus be noted that certain coping strategies usually either decrease or increase stress. For example, resignation apparently always increases or maintains stress, while tendencies to action aimed at removing or eliminating a stressor always reduce stress (Janke and Erdmann, 2003: 7).

Besides coping strategies, fundamental personality dimensions such as neuroticism and extraversion also seem essential with respect to coping with requirements, and according Siegling et al. (2012: 776) also the trait emotional intelligence, which is 'located at the lower levels of personality hierarchies but has shown incremental validity over the Big Five personality traits and other related constructs in predicting affect-laden criteria'. Neuroticism is a moderately heritable personality trait and this term refers to 'a tendency to respond with a negative emotional response to threat, frustration, or loss' (Cuijpers et al. 2010: 1086). These authors found 'higher levels of neuroticism in women, in people who live alone, in those without a paid job, in those with less education, and in older people' (Cuijpers et al. 2010: 1090). In general, extraversion as a personality trait is usually associated with talkativeness, action, impulsiveness, creating of social contacts and networks.

Our research interest stems from our consulting and teaching activities at Faculty of Economics and Management of the Czech University of Life Sciences Prague (FEM CULS), therefore the main aim of our research and our major research question is, if we can identify some differences in extraversion, neuroticism and coping strategies in groups of students studying in different study modes. In the section Materials and methods we describe the group of our participants, the design of our research and all methods we used for data collection and analyses. The section Results summarizes most important findings of our study, and their interpretation. Further research possibilities and questions are discussed in the sections Discussion and Conclusion.

Materials and Methods

Group of respondents

A descriptive survey research was conducted from November 2017 to February 2018. The questionnaires (for the detailed description see the section below) were administered to 109 undergraduate students at the Faculty of Economics and Management (FEM) at the Czech University of Life Sciences (CULS) within the study programmes Public Administration and Regional Development, and Systems Engineering. The sample consisted of 35 males and 74 females in the age range from 19 to 54 years, mean value 28.28 years, with standard deviation 7.76. Of the total number of 109 students, 49 were part-time students and 60 were full-time students. The groups of full- and part-time students show a distinct difference in the age variable, as illustrated in Figure 1.

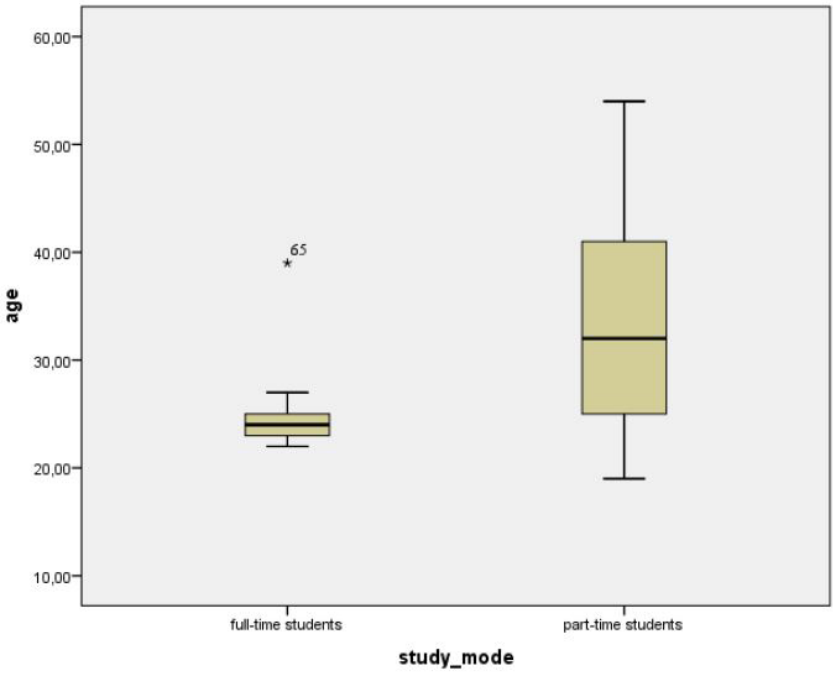

Figure 1: Descriptive characteristics of the variable age in the group of full-time students and the group of part-time students, 2018 (source: own data)

Participation was voluntary and the subjects were not paid.

The method

We used the Czech version of the Stress Coping Style Questionnaire SVF 78 (Janke and Erdmann, 2003: 8) and the Czech version of the Eysenck Personal Inventory EPI for the adult population (a description of the Czech version is to find in Svoboda, 1999: 268). In the Czech version of the SVF 78 questionnaire, subjects decide for each item how likely the reaction presented corresponds to his or her way of reacting, when he/she is '…disturbed, irritated or upset by something or someone…' (Janke and Erdmann, 2003: 10, Chýlová and Natovová, 2012: 138). SVF 78 contains 13 subscales and 78 items. Scales 1 – 7 are assumed as positive coping strategies, scales 10 – 13 as negative coping strategies, scales 8 and 9 are neutral (have positive and also negative impacts on coping). Further description of the scales is to find in Chýlová and Natovová (2012: 139) or Janke and Erdmann (2003: 13). The Czech version of EPI includes 57 items and 3 subscales – subscale extraversion, subscale neuroticism and a lie scale (Svoboda, 1999: 268).

Statistical Analysis

As was mentioned above, this study attempts to identify differences in some personality traits (coping strategies, extraversion, neuroticism) by students in different study modes, specifically in the full-time and part-time study mode. We have formulated a hypothesis on the statistically significant differences in extraversion, neuroticism and in the use of coping strategies between the group of the full-time and part-time students, identified through the SVF 78 and EPI questionnaires. To test the null hypothesis of non-existence of a significant difference between the two groups,

we used a t-test for two independent samples (Norušis, 2011), and before each testing, the null hypothesis of no difference in the variance of the evaluated variable values in both groups was adopted based on Levene's Test for Equality of Variances.

Results

Next to the descriptive analyses, an examination of the relationship between independent variable (in this case the independent variable is the study mode represented in two categories – full-time and part-time studies) and dependent variables (coping strategies, extraversion and neuroticism measured by SVF 78 and EPI questionnaires) followed. Table 1 shows mean values and other descriptive statistics of our research sample, with regard on the categories of the independent variable.

	Study mode	N	Mean	Std. Deviation	Std. Error Mean
Extraversion	Full-time	59	12.29	3.76	0.49
	Part-time	43	12.40	3.60	0.55
Neuroticism	Full-time	59	12.25	5.55	0.72
	Part-time	43	9.91	5.12	0.78
Minimization	Full-time	60	10.27	5.93	0.77
	Part-time	49	11.94	5.19	0.74
Denial of Guilt	Full-time	60	11.28	3.85	0.50
	Part-time	49	11.29	3.80	0.54
Distraction	Full-time	60	12.15	4.15	0.54
	Part-time	49	14.08	3.87	0.55
Substitute Gratification	Full-time	60	11.50	5.66	0.73
	Part-time	49	12.51	4.73	0.68
Situation Control	Full-time	60	15.90	4.03	0.52
	Part-time	49	17.86	3.51	0.50
Reaction Control	Full-time	60	14.80	3.84	0.50
	Part-time	49	16.73	3.49	0.50
Positive Self-Instructions	Full-time	60	15.12	4.33	0.56
	Part-time	49	17.65	4.05	0.58
Need for Social Support	Full-time	60	16.50	4.82	0.62
	Part-time	49	14.41	5.14	0.73
Avoidance	Full-time	60	14.08	4.23	0.55
	Part-time	49	14.69	5.84	0.83
Escape	Full-time	60	10.25	4.63	0.60
	Part-time	49	12.08	14.94	2.13
Rumination	Full-time	60	15.45	5.81	0.75
	Part-time	49	15.18	5.84	0.83
Resignation	Full-time	60	8.80	4.52	0.58
	Part-time	49	8.49	4.19	0.60
Self-blame	Full-time	60	10.75	5.05	0.65
	Part-time	49	9.92	4.39	0.63
POZ_summ	Full-time	60	13.13	2.53	0.33
	Part-time	49	14.79	2.69	0.38
NEG_summ	Full-time	60	11.26	3.95	0.51
	Part-time	49	10.95	3.94	0.56

Table 1: Results - descriptive statistics of the research sample, 2018 (source: own calculation)

It is evident from Table 1 at first sight that considerable differences exist in some dependent variables in both groups. Specifically, this applies to neuroticism and to some variables of the group of positive coping strategies. The results of Levene's Test for Equality of Variances are presented in Table 2, as well as the results of t-tests for two independent samples.

	Levene's Test for Equality of Variances		t-test for Equality of Means					
	F	Sig.	t	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Extraversion	0.03	0.87	-0.15	0.89	-0.11	0.74	-1.58	1.36
Neuroticism	0.94	0.33	2.18	**0.03***	2.35	1.08	0.21	4.48
Minimization	1.74	0.19	-1.55	0.13	-1.67	1.08	-3.81	0.47
Denial of Guilt	0.49	0.49	-0.00	0.99	-0.00	0.74	-1.46	1.46
Distraction	0.11	0.74	-2.49	**0.01****	-1.93	0.78	-3.47	-0.39
Substitute Gratification	1.74	0.19	-0.99	0.32	-1.01	1.01	-3.02	0.99
Situation Control	1.37	0.25	-2.67	**0.01****	-1.96	0.73	-3.41	-0.50
Reaction Control	0.60	0.44	-2.73	**0.01****	-1.93	0.71	-3.34	-0.53
Positive Self-Instructions	0.06	0.81	-3.13	**0.00****	-2.54	0.81	-4.14	-0.93
Need for Social Support	0.30	0.59	2.19	**0.03***	2.09	0.96	0.20	3.99
Avoidance	3.29	0.07	-0.63	0.53	-0.61	0.97	-2.52	1.30
Escape	1.98	0.16	-0.90	0.37	-1.83	2.04	-5.87	2.21
Rumination	0.05	0.82	0.24	0.81	0.27	1.12	-1.96	2.49
Resignation	0.15	0.70	0.37	0.71	0.31	0.84	-1.36	1.98
Self-blame	1.23	0.27	0.91	0.37	0.83	0.92	-0.99	2.65
POZ_summ	0.05	0.83	-3.31	**0.00****	-1.66	0.50	-2.66	-0.67
NEG_summ	0.00	0.97	0.41	0.68	0.31	0.76	-1.19	1.82

*$\alpha \leq 0.05$, ** $\alpha \leq 0.01$, N full-time students = 60, N part-time students = 49; descriptive statistics is shown in Table 1.

Table 2: Results - two independent samples t-tests for each dependent variable, with Levene's Tests for Equality of Variances, 2018 (source: own calculation)

Taking a closer look at Table 2, several surprising findings can be detected. The first one is that there is a significant difference in the neuroticism variable between part-time and full-time students. Looking at Table 1, it shows that part-time students achieve lower scores in the neuroticism variable compared to full-time students.

At the same time, significant differences can be seen in some positive coping strategies, specifically in distraction, and also in POZ3 category, which includes the following strategies: reaction control, situation control and positive self-instructions. This influence is assumed to be reflected also in the difference in the POZ summary category, calculated as the mean of all positive strategies. According to the authors of the SVF 78 questionnaire, the POZ3 group is considered as most suitable for coping with stress, and as can be seen, part-time students do use these strategies to a significantly higher extent compared to full-time students. The opposite is true for the coping strategy need for social support – where full-time students achieve significantly higher scores compared to part-time ones.

Discussion

Understanding personality-based styles and knowing of personality traits helps teachers differentiate so as to maximize the learning outcomes of all learners (Sternberg, Grigorenko and Zhang, 2009: 498). The results of verifying the differences in the use of coping strategies in full- and part-time students agree with our published results (Natovová, Chýlová, 2012: 232). Coping skills are largely acquired by learning. It can thus be assumed that an individual masters a certain repertoire of ways of coping with stress in the course of life and that this individual repertoire is characterized by certain time- and situation-related stability, although some modifications can also be expected due to the effect of experience (Janke and Erdmann, 2003: 8). In this respect, the research of Shakland et al. (2010: 363) should definitely be mentioned; in their research study these authors conclude that 'alternative school participants appear to have a significant advantage in adjusting to the demands student life: they report less anxiety and depression symptoms, and show greater life satisfaction and academic achievement'.

In his meta-analyses, Poropat (2009: 41) focuses on the relationship between the scales of Eysenck questionnaires and academic performance and confirms existing findings in this field, i.e. that 'neuroticism and extraversion had relationships with academic performance'. Together with Cuijpers et al. (2010: 1091) we must note that neuroticism is manifested in the field of mental and physical health as well as in other fields of life (including the field of education achievement and achievement of academic success), and it is important to perceive its economic but also personal aspects related not only to the life of an individual but also to the society. As with the regard to coping with the demands of part-time study, and taking into account different life situations of these students (higher age, study at consulting centres, employment as their main activity, etc.), it is probable that this situation will be managed rather by individuals with lower neuroticism levels as clearly indicated by the results of our research.

Our results show significant differences in the use of some positive coping strategies between the groups of full- and part-time students. These outcomes should be taken into account not only in contact lessons in psychological subjects, but also in university education in general. We can conclude, that cooperation and working in teams may be a more appropriate form of learning in full-time study, but not so beneficial for part-time students. Our research shows also further possibilities – to examine the influence of gender, age and other personal traits on academic achievement and coping with academic stress.

Conclusion

Sternberg, Grigorenko and Zhang (2009: 486) in their paper describing ability-based and personality-based styles of learning conclude, that 'in teaching, we need to take into account students styles of thinking if we hope to reach them'. The authors of this paper believe that other personality traits of students are also important to be considered (coping styles, neuroticism, etc.) when building space for an adequate performance in the university study, whether in terms of the teaching process or in terms of procedures used to verify the students' knowledge.

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CHANGES IN PROFESSIONAL VISION IN PRESERVICE TEACHERS AFTER WATCHING OWN LESSON

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Abstract

The aim of the paper is to show differences in aiming of the professional vision of biology preservice teachers (n=30) after watching video of own lesson. Student teachers during pedagogical practice wrote two reflections. The first (pre reflection) was made 24 hours after teaching a lesson, the second (post reflection) was made in the next 14 days with the support of the video from the lesson. Both written reflections were analysed by the qualitative approach. They were divided into units and were coded (according to Sherin, van Es, 2009). The results should show the benefits of individual work with own video for students in some areas of noticing and knowledge-based reasoning. On the contrary, they paid less attention to biology and didactics of biology in reflections supported by video. Here we see the important role of a mentor, which could help students focus again on the subject and subject didactics.

Keywords

Biology lessons, future secondary teachers, pedagogical practices, professional vision, self-reflection, video reflection

Introduction

If we want to deal with the quality of education, it is necessary to pay particular attention to the professionalization of teachers (Píšová, 2010). Experts, as well as politicians, emphasize that teacher education needs to be more effective in helping future teachers develop their knowledge and skills in the way that is required in the classroom (Blomberg, Renkl, Sherin, Borko and Seidel, 2013). The teacher is, therefore, a professional who has some knowledge that is typical only for teachers (Janík, 2009). This is pedagogical content knowledge. It is linking content and pedagogy to understanding how specific topics or issues are organized, represented, and adapted to the diverse interests and abilities of students (Shulman, 1987).

Some interventions are broadly considered to be able to help to developing of pedagogical content knowledge in future teachers. For example analysis of curriculum documents, preparation for teaching, action research, training courses and workshops and also the reflections of lessons with the use of video (Janík, 2009). It is precisely thanks to the video that a student, beginner and more experienced teacher is able to evaluate their own or someone else´s behavior with distance, compare their practice with current ideas, and reflect on it at a cognitive level (Janík, Janíková, 2006). Video footage of lessons allow researchers to capture real situations at schools in their entirety. In addition, the plurality of video recordings can be investigated even after a longer pause, as the durability of the video is long-lasting (Janík, 2009). Furthermore video helps students focus on specific aspects of teaching, and allows them to evaluate their own learning (Sonmez, Hakverdi-Can, 2012). Teachers have the opportunity to see remarkable events they did not notice before, and if they repeatedly record their lessons, they can consider things from many different perspectives (van Es, Sherin, 2010). Although there is a vast body of literature on the different

types of video viewing and their effects on teachers' professional vision, to watch one's own video has been suggested as more motivating (Seidel, Stürmer, Blomberg, Kobarg and Schwindt, 2011). Furthermore, watching of one´s own video provokes the development of descriptive and critical reflection (Gaudin, Chaliès, 2015). However teachers see and evaluate video in a different way than student teachers and beginner teachers (Janík, Minaříková, 2011). For example beginner teachers put a little or no emphasis on the students, their behavior or interactions between them and teachers. Also details that are related to the quality of teaching are more invisible for beginner teachers (Sonmez, Hakverdi-Can, 2012).

Because professional vision represents one dimension of teachers' professionalism (Sherin, van Es, 2009), we used this parameter to judge benefits of using students' own videos during their pedagogical practice. The aim of the paper is to show changes in focus of professional vision (noticing and knowledge-based reasoning) in biology preservice teachers after watching video of their own lesson and finding out areas of benefits of individual video observation for student teachers. We asked two research questions:

1. What are the changes in focus of professional vision in biology preservice teachers after watching video of their own lesson compared to before watching?
2. Does watching own lessons influence the number of suggested alterations?

Materials and Methods

The sample consisted of 30 respondents; 14 future teachers of biology who were teaching during their practice at lower secondary schools ISCED 2, (n=14, group 1 in the text), 16 future teachers of biology who were teaching at upper secondary schools ISCED 3, (n=16, group 2 in the text). Both groups were studying for their Master´s degree (Teaching Training for Secondary School – Biology) which takes 2 years (4 semesters). The first mentioned group which was practiced at ISCED 2 was studying the 1st year of the Master´s degree (2nd semester). The 2nd group which was practiced at ISCED 3 was studying the 2nd year of the Master´s degree (3rd semester) at Charles University in Prague, Faculty of Education.

The respondents were autonomously teaching any topic of a biology lesson which was 45 minutes of length. They were free to implement any method and organizational style. They were asked to video-record their lesson. After the lesson they had to write a pre reflection within 24 hours after teaching. There was no restriction of the length of their written reflection. They had to write everything they considered to be important and interesting. They were then asked to watch the footage of their lesson. They could observe the video-record as many times as they wanted and then again were asked to write a reflection (post reflection), which should be submitted within 14 days after teaching that lesson.

Those reflections were split into units and were coded according to the categorical system published by Sherin and van Es (2009). Every unit of meaning was assigned to one category in four dimensions of analysis: Actor (categories Teacher, Student, Self, Curriculum and Other), Topic (categories Subject, Pedagogy, Climate, Management and Other), Stance (categories Describe, Evaluate, Interpret) and Specificity (categories Specific, General), see in the tab. 2. We did not judge in this phase of research whether the reflections were positive or negative. At the same time suggested Alterations ("What to do differently in teaching") in statements were identified. Coding was conducted by two researchers, the authors of the article. Before coding they trained coding using several other reflections. Coding itself was followed by three controls of its correctness provided alternatively by both of the researchers and the final codes were agreed by both of them. They used a descriptive statistic in MS Excel to evaluate the data.

Results and Discussion

The number of units in pre and post reflections of group 1 and group 2 (see in tab. 1) reflects the differences in its length for each student. The median number of units is quite close in intervals, between 16 and 21 units per one reflection and it does not matter with the group of students or the type of reflection.

	Number of units			Mean	Median	SD
	Min.	Max.	Total			
Group 1 (n=14)						
Pre reflection	7	52	304	22	19	12
Post reflection	5	29	233	17	16	7
Group 2 (n=16)						
Pre reflection	7	38	316	20	17	8
Post reflection	5	44	335	21	21	13

Table 1: Number of units in pre and post reflections of group 1 and group 2, 2016/2017

Tab. 2 shows comparison of absolute and relative frequencies of codes in pre and post reflections in both groups of students. We can see some important differences in all areas of categories which indicates the changing focus of components of professional vision in two examined groups.

	Pre-service teachers at ISCED 2 school (group 1)		Pre-service teachers at ISCED 3 school (group 2)	
Dimension of analysis/ Category	Pre reflection Abs. | rel. freq.	Post reflection Abs. | rel. freq.	Pre reflection Abs. | rel. freq.	Post reflection Abs. | rel. freq.
Actor				
Teacher	4 |1.32 %	0 | 0.00 %	9 | 2.85 %	6 | 1.79 %
Student	92 | 30.26 %	62 | 26.61 %	95 | 30.06 %	101 | 30.15 %
Self	119 | 39.14 %	120 | 51.50 %	119 | 37.66 %	150 | 44.78 %
Curriculum	46 | 15.13 %	22 | 9.44 %	39 | 12.34 %	31 | 9.25 %
Other	43 | 14.14 %	29 | 12.45 %	54 | 17.09 %	47 | 14.03 %
Topic				
Subject	102 | 33.55 %	43 | 18.45 %	63 | 19.94 %	49 | 14.63 %
Pedagogy	85 | 27.96 %	91 | 39.06 %	118 | 37.34 %	123 | 36.72 %
Climate	42 | 13.82 %	26 | 11.16 %	49 | 15.51 %	48 | 14.33 %
Management	51 | 16.78 %	50 | 21.46 %	48 | 15.19 %	72 | 21.49 %
Other	24 | 7.89 %	23 | 9.87 %	38 | 12.03 %	43 | 12.84 %
Stance				
Describe	134 | 44.08 %	52 | 22.32 %	119 | 37.66 %	124 | 37.01 %
Evaluate	107 | 35.20 %	101 | 43.35 %	100 | 31.65 %	95 | 28.36 %
Interpret	63 | 20.72 %	80 | 34.33 %	97 | 30.70 %	116 | 34.62 %
Specificity				
Specific	113 | 37.17 %	44 | 18.88 %	80 | 25.32 %	80 | 23.88 %
General	191 | 62.83 %	189 | 81.12 %	236 | 74.68 %	255 | 76.12 %

Table 2: Comparison of pre and post reflections, 2016/2017

Dimension of analysis: Actor. Participants reflected on their own lessons first without video and then with video, thus the category Teacher (another teacher then themselves) is not represented. Both groups pay attention to the category of Student (pupils) at a similar level, which did not change during the second reflection with the video. Values are in an agreement with Pavlasová (2017), who tracked students of the same study discipline at the beginning of their study. The

difference is that they were watching another teacher´s video. The Self category (the case when the students write about themselves in the role of the teacher) is represented much more than in this study focused on students´ reflections on other teacher's videos (Pavlasová, 2017). Furthermore more experienced teachers focus more on students' and their learning rather than on Self (Melnick, Meister, 2008). What is important is that the category of Self increases in both groups after viewing the videos. It shows the benefits of a video for students´ teachers in their pedagogical practice. According to McConnell et al (2008), observations are also dependent on how often the participants have watched the video of the lesson. Participants of that research begin to focus less on themselves after the first or second viewing of their tapes. Actually in our research the frequency of watching the video was arbitrary, so we do not know how often the participants were watching the video. According to Cocca and Cocca (2016) participants (already in-service teachers) were more often focusing on teachers´ activities rather than activities performed by pupils in their reflections. The Curriculum category (describing, curriculum developers, task itself, topic of the lesson) is similar in the pre reflections to Pavlasová (2017).

Dimension of analysis: Topic. What is really interesting is how students in group 1 focused at the Subject category (biology and didactics of biology) in pre reflections. In one case, we have recorded a higher proportion of comments than in the Pedagogy category, which is usually enrolled in professional vision research (e.g. Sherin, 2009). According to data analysis of Sherin (2009) even teachers of mathematics gave minor emphasis to the mathematical thinking (it means "subject" thinking) in comparison to Pedagogy, although they were prompted by facilitators. The focus on the Subject is higher in the pre reflections in both groups, in the case of group 1 the difference compared to the post reflection is a notable difference (33.55 % versus 18.45 %). In post reflections, the relative frequency of statements in the Subject category is similar to that of students writing reflections on another teacher's video (Pavlasová, 2017). For both groups, we consistently see an increase in Management's statements (category related to discipline, class organization and arrangement of class). These findings are comparable to the study of Sonmez and Hakverdi-Can (2012). According to this study, participants were also more capable to identify strengths and weakness of the lesson when using videos for their reflections.

Dimension of analysis: Stance. The category Describe in pre reflections was used the most often in both groups of students. In comparison to Cocca and Cocca (2016), the participants of their research described the phenomena in the lesson very often, because the predominant percentage of all comments was coded like a description. On the other hand, the category Interpretation, which means explanation of the events, explanations which are based on one´s own experiences as a pupil or as a teacher or making an inference from the observation, linking the observation to some underlying theory, was used more in both groups in post reflections. According to Sherin and van Es (2009) after a year, teachers began to take more account of the explanation and justification of learning situations. The two groups differ with regard to the changes of focus of professional vision (see tab. 2). In group 1, post reflections are declining in the Describe category and increasing in Evaluation and especially Interpretation of phenomena present in teaching compared with pre reflections. This could be considered to be a desirable shift in professional vision. On the other hand there is practically no change in group 2. One of the possible explanation is that students of group 2 are more experienced and are doing their second practice, and their ideas about their own lessons are no longer different from what they see on the video, which means that the mentor might need to be consulted further. However, according to these results, it is beneficial for students on their first practice to follow the video of their own lessons even separately. Our findings are in line with those of Cocca and Cocca (2016) who found that teachers were able to not only provide more complex analysis, but also evaluate both positive and negative events, as well as propose alternatives.

Dimension of analysis: Specificity. The observation of specific phenomena in their own tuition is higher than that of students studying the video of another teacher (Pavlasová, 2017), which is definitely desirable. In group 1 in post reflection, it drops at the expense of general phenomena, but it still exceeds results gained in another researcher´s video (e.g. Pavlasová et al, 2018).
Alteration. We consider the ability to suggest alternative approaches to teaching as very important for pre-service teachers. That is why we highlighted this phenomenon in written reflection, too (tab. 3). In both groups we noted an increase of number of alterations in post reflections. Also according to some studies (e.g. Shepherd, Hannafin, 2008, 2009) the participants changed their practice after participating in video reflections. It means they were compelled to alter their own behaviour by watching the video. Video thus can provoke students to think out in different ways of their teaching in the case that their own process does not work.

Category	Pre-service teachers at ISCED 2 school (group 1)				Pre-service teachers at ISCED 3 school (group 2)			
	Pre reflection		Post reflection		Pre reflection		Post reflection	
	Abs. freq.	Rel. freq	Abs. freq.	Rel. freq	Abs. freq.	Rel. freq	Abs. freq.	Rel. freq
Alteration	10	3.29 %	32	13.73 %	12	3.80 %	27	8.06 %

Table 3: Number of suggested alteration in pre and post reflections, 2016/2017

Conclusion

According to Janík and Minaříková (2011), a mere observation of a video from the lesson does not necessarily lead to desirable results and to improving accountability. However, according to our results, the video observation itself helped our respondents to notice specific events that were important to the lesson, even if they had not been instructed to focus on particular events. It is clear that not only secondary student teachers but also high student teachers need constant feedback on their professional growth that is offered to them, for example through the video.
Students of both groups, after viewing their own videos, are more focused on themselves as teachers, which is definitely beneficial for them. Students in the group 1, who are in their first pedagogical practice, focus on biology and didactics of biology in pre reflections rather than pedagogical and didactic phenomena. For the group 2, which is already more experienced and already have had one practice, this focus on biology and didactics of biology is no longer noticed. In post reflections which were written with video support, we see a decrease in the comments of the Subject category and, on the other hand, an increase in comments related to the class management for both groups. It is possible that in their own lessons all of the phenomena falling within the Management category did not find and see them on the video. Here we see the important role of a mentor, which could help students´ focus again on the subject and subject didactics.
An increase in the number of interpretative statements in the group in their first practice suggests that watching the video itself, in the beginning of a student teachers study, can help to improve their knowledge-based reasoning. For experienced students, it may be necessary for the mentor to intervene further. It is also important to consider the tendency of student teachers to notice specific phenomena in teaching when they watch their own video to a higher degree in comparison to watching another teacher's video. And finally, in both groups, we noted the increase of number of alterations in post reflections, which can testify that students are trying to think about what they would do differently in teaching. In developing students´ skills mentioned above we see the purpose of using the video, its reflection, and the role of the mentor.
This finding is an important message for guarantors and mentors of pedagogical practices at universities as well as biology teachers who should not forget self - reflection and self - education.

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IMPACT OF ORDER OF DATA IN WORD PROBLEMS ON DIVISION OF A WHOLE INTO UNEQUAL PARTS

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Abstract

The paper investigates how the order of numerical data in word problems on division of a whole into unequal parts affects achievement and reasoning of 14-16-year old pupils. The variable was altered in two word problems, in one of which also the context was changed (psychological variable) and in the latter "if-clause" is or is not used (linguistic variable). 182 pupils were involved in the experiment. The solutions were analysed quantitatively using Item Response Theory as well as qualitatively. The data suggest that pupils' success is affected by the order of numerical data in the statement in an unfamiliar context. The presence of "if-clause" in the statement was studied in a two-level problem. The order of numerical data played its role in case of formulations without "if". The results of the experiment are of interest for mathematics education as well as for construction of tests.

Keywords

Context, "if-clause" formulation, mathematics, order of numerical data, word problems

Introduction

The area of word problems has been identified as an area of concern in many countries because of pupils' difficulties while solving them. Teachers and researchers report that word problems are one of the areas in which pupils show the poorest performance, see e.g. (Hembree, 1992; Zohar and Gershikov, 2008).

Novotná and Vondrová (2017) investigated the impact of context on Grade 8 pupils' choice of strategies when solving two missing value word problems with the same mathematical model but different contexts. Vondrová, Novotná and Havlíčková (2019) studied the impact of the order of numerical data, context, position of the unknown transformation and the length of the text in an additive word problem on the performance and reasoning of primary pupils from grades 4 and 5.

The study described here analyses only one type of word problems (problems on division of a whole into unequal parts) in terms of the impact of the variable "the order of numerical data in the word problem statement". The study is a part of a wider research within the project of the Grant Agency of the Czech Republic aimed at investigating variables influencing the difficulty of word problems. The project is unique at least in the Czech context because the research is conducted in cooperation of researchers in linguistic, mathematical education and psychology. This enables the project team to investigate the problem from different standpoints.

In this paper, the result of coding of word problem statement is called the *legend* (Novotná, 1999). The order of numerical data in the problem statement is called *proper* if the data appear in the sequence needed to solve the problem, otherwise it is called *mixed* (Vondrová, Novotná and Havlíčková, 2019). For the purposes of this paper, the *order of information recorded in a legend* is called *direct* if the data appear in the order used in the problem statement, otherwise it is called *indirect*. It is obvious that a proper order of numerical data does not imply that the solver records it in the proper legend and vice versa.

Searle, Lorton and Suppes (1974) reported that the order of data was a major predictive variable

for pupils from Grades 4, 5 and 6 in problem solving. Similarly, Hembree's (1992) pointed better performance in case of proper order of data. Neither reference specifies how exactly the order of data was changed, though. On the other hand, Nesher, Hershkovitz and Novotná (2003) found that the effect of the order of presenting comparison relations was negligible in simple comparison problems.

Vicente, Orrantia and Verschaffel (2008) altered both mathematical and situational variables in word problems. The mathematically difficult problems included a combination of two inconsistent change situations; in the situationally difficult problems, the information about the initial moment of the action string was given at the end of the text. They found statistically significant differences in the performance of pupils in Grades 3 to 5 for both variables with a larger effect size coming from the mathematical difficulty level.

The paper answers two research questions: How does the order of numerical data in the problem statement in problems on division of a whole into three unequal parts influence the achievement and reasoning of Grade 9 (age 14-16) pupils? Do the solving strategies used by these pupils vary according to the numerical order of data in the statement? Attention in the analyses is also be paid to the impact of change in context or wording from the linguistic perspective on the choice of solving strategies.

Materials and Methods

Participants

As Novotná and Vondrová (2017: 280) report, pupils participating in the research are from four primary schools which were purposefully sampled within the GAČR project (focusing on investigation of parameters influencing the difficulty of word problems). The schools were selected on the basis of Reports by the Czech School Inspection and of websites of the schools in with the aim of selecting schools with no specialisation, of medium size, attended by children from their immediate surroundings with a varied socio-economic background, with the percentage of children/foreigners not exceeding the average for the whole Czech Republic, not founded for children with special needs and placed in the area of outer Prague. An important criterion for inclusion of the school in the GAČR project was that the whole school would get involved. The *sample* used in the part of research presented here consists of 182 Grade 9 pupils. No selection of pupils was made; all the classes from the four schools of the same grade participated.

Materials

The pupils were given initial tests in mathematics and Czech language that enabled division of classes into equally abled groups. These groups were later given different versions of the same word problem differing in the order of numerical data in the problem statement or in the context or the presence of "if-clause". For the purpose of this text and based on our research questions, two word problems (labelled 9A and 9C in the following text) were selected. Both work with division of a whole into unequal parts where the whole and the relationships between the parts are given. In both problems, the variants are based on the same mathematical model. In Table 1 and 2, the statements are presented. In both, variants 1 and 3 have the same order of numerical data and variants 2 and 4 are their modifications in another context (9A1 versus 9A3 and 9A2 versus 9A4) or with another wording (9C1 versus 9C3 and 9C2 versus 9C4).

Familiar context	Unfamiliar context
9A1 Gymnastics, basketball and swimming clubs take place at the same time on Wednesday evening. Basketball club is attended by three times more children than gymnastics, swimming is attended by 114 more children than basketball. In total the three clubs are attended by 380 children. How many children are enrolled in each of the clubs?	**9A3** There are three political clubs in the parliament: Liberal, Conservative and Green. Each member of parliament can be member of only one of the clubs. The Liberal Club has three times more members than the Conservative Club, the Green Club has 114 more members than the Liberal Club. In total there are 380 members in all the three clubs. How many members are there in each of the clubs?
9A2 380 children are enrolled in three clubs: gymnastics, basketball and swimming. All these clubs take place at the same time on Wednesday evening. Basketball club is attended by three times more children than gymnastics, swimming is attended by 114 more children than basketball. How many children are enrolled in each of the clubs?	**9A4** 380 members of a parliament in a foreign country is divided into three political clubs: Liberal, Conservative and Green. Each member of parliament can be member of only one of the clubs. The Liberal Club has three times more members than the Conservative Club, the Green Club has 114 more members than the Liberal Club. How many members are there in each of the political clubs?

Table 1: Word problem 9A for Grade 9 in four variants (change of the order of numerical data in the statement and change of the context)

Formulated with „if" (linguistic variable)	Formulated without „if"
9C1 Students Kamil, Eva and David spent part of their holiday making money as tour guides at the Děčín palace. They earned 8 800 CZK, which they divided with respect to the number of tours. For one tour they earned 40 CZK. How did they divided the money if Kamil had 12 fewer tours than Eva and David had twice as many tours as Kamil?	**9C3** Students Kamil, Eva and David spent part of their holiday making money as tour guides at a palace. They earned 8 800 CZK. They divided this money with respect to the number of tours. For one tour they earned 40 CZK. Kamil had 12 fewer tours than Eva and David had twice se many tours as Kamil. How did they divide the money?
9C2 Students Kamil, Eva and David spent part of their holiday making money as tour guides at a palace. For one tour they earned 40 CZK. They divided the earned money with respect to the number of tours. How did they divide the money if Kamil had 12 fewer tours than Eva and David had twice as many tours as Kamil and in total they earned 8 800 CZK?	**9C4** Students Kamil, Eva and David spent part of their holiday making money as tour guides at a palace. For one tour they earned 40 CZK. They divided the earned money with respect to the number of tours. Kamil had 12 fewer tours than Eva and David had twice as many tours as Kamil. In total they earned 8 800 CZK. How did they divide the money?

Table 2: Word problem 9C for Grade 9 in four variants (change of the order of numerical data in the statement and change of formulation of the assigned conditions)

Note: The order of numerical data in the assignment, or context, or "if" formulation represents one of the mathematical, or psychological, or linguistic variables investigated in the GAČR project.

A brief analysis *a priori* in terms of solving strategies for both problems is presented below. Novotná (2016) and Novotná et al. (2013) give a list of heuristic solving strategies used for this analysis. Both "school" algebraic and arithmetic solving strategies are appropriate. The following heuristic strategies are the most suitable: Guess – check – revise, Systematic experimentation, Solution drawing.

There are commonalities as well as differences in Problem 9A and 9C statement structures. In both problems, the whole is known, there are three parts and one relationship between parts is multiplicative, the other additive. Part 2 is expressed in terms of Part 1 and Part 3 in terms of Part 2. There are two main differences between Problem 9A and 9C statements:

- In Problem 9A, both relationships are expressed by "more than". In Problem 9C, the additive relationship is expressed by "fewer than". Several studies suggest that the word "more" is comprehended easier than the word "less" (Riley and Greeno, 1988).

- Problem 9C can be solved either on the level of (1) the number of tours or (2) the earned CZK. In both cases, additional calculations must be done. (1) – the total number of tours must be calculated from the total amount of money and the price of one tour. (2) – in calculations, the money awarded for one tour must be used.

Methods

To answer the research questions, quartets of Problem 9A and 9C were posed. The study is of a mixed methodology design, consisting of quantitative and qualitative parts.

Quantitative analysis

Item Response Theory (IRT) (Lord, 1980; Van der Linden and Hambleton, 1997) was used both for the division of the pupils into equally able groups, each of which was solving a different variant of the word problem, and for the quantitative interpretation of data. The pupils' written solutions were analysed. The scoring rubric was as follows: 0 points (no or wrong solution), 1 point (partially correct solution), 2 points (correct problem model with a numerical mistake), 3 points (correct solution).[1]

To analyse the parameters of problems, a two-parameter logistic model was used (Lord, 1980):

$P_{ij} = \frac{1}{1+e^{-a_i(\theta_j - b_i)}}$, where Pij is the probability that a pupil j with the ability of Θ_j will solve the problem i correctly, a_i characterises problem discrimination and b_i its difficulty. To find the latent ability of pupils, a scale was put on a z-score with Bayes estimation EAP, in an iterative way using results in the Initial Test (for which a model graded for the total result in the test was used) and Test 1 (9A) and Test 2 (9C). This allowed compensation for any inconsistencies in terms of ability grouping which may have arisen at the beginning.

The situation is visually depicted in Figure 1. Θ_j is on the x-axis and the value of 0 means an average result in the initial test. On the y-axis we can read the probability with which the pupil of a certain ability will solve the task. For example, an average pupil will solve 9A2 with the probability approximately 0.6 (Figure 1 left), 9C2 with the probability approximately 0.14 (Figure 1 right).

Qualitative analysis

Finally, a qualitative analysis of the data was carried out. The pupils' written solutions were analysed carefully for mistakes and solving strategies with the main focus on the relationships between the variants of the problem and order of information recorded in pupils' legends. In this case, we created a spreadsheet in which the order of information in the legends was recorded for each variant of the two problems. The occurrence of frequent mistakes was linked with the use of the order of information in legends.

Results and Discussion

Quantitative analysis using IRT

Table 3 presents the relative frequencies of point distributions and the average success rate for the four variants of Problem 9A.

1 The aim was to assess pupils' understanding of the problem, not their ability to carry out numerical operations and thus we considered as correct all solutions in which an appropriate problem model was created.

	Points					Average success rate		Points					Average success rate
	N	0	1	2	3			N	0	1	2	3	
Familiar context							Unfamiliar context						
9A1	46	37%	9%	2%	52%	57%	**9A3**	45	29%	18%	7%	47%	57%
9A2	46	28%	15%	9%	48%	59%	**9A4**	45	36%	20%	7%	38%	49%
Formulated with „if-clause"							Formulated without „if-clause"						
9C1	45	42%	33%	7%	18%	33%	**9C3**	46	46%	26%	11%	17%	33%
9C2	46	30%	43%	7%	20%	38%	**9C4**	45	51%	38%	4%	7%	22%

Table 3: Results for 9A, 9C according to success rate

It seems that most difficult are the variants 9A4 and 9C4, while in the variants 9A1, 9A2, 9A3, and 9C1, 9C2, 9C3 average success rates are similar. The order of numerical data played its role in case of a less familiar context, resp. formulation without "if". This corresponds to our expectations. The results confirm that Problem 9C was more difficult than 9A in three variants while in variants 9A4, 9C4 the average success is comparable and low, which was surprising. This can be explained by the fact that in both cases the pupils came across some "intricacy" that made the use of school procedures more difficult. These results are further specified by IRT evaluation and verified by the statistical methods below.

Table 3 and Figure 1 present the parameters of the problems according to IRT. They add more detail to the information that we can read from the average success rate. Figure 1 left suggests 9A2 has the best discrimination among 9A variants. 9A1 and 9A2 discriminations are comparable. Below-average pupils solved the variant with an unfamiliar context better, while the average and above-average pupils were not much affected by the context. 9A3 discriminates the worst pupils. Figure 1 right suggests that 9C is much more difficult than 9A – an important number of above-average pupils failed to solve its variants. 9C4 has the best discrimination. 9C2 and 9C3 discriminations are comparable.

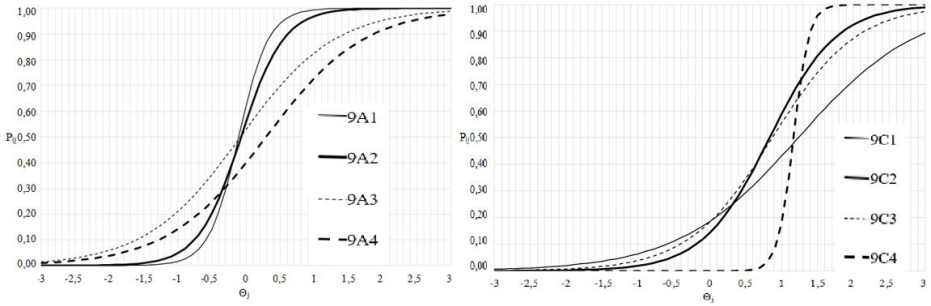

Figure 1: Two-parameter IRT model for the variants of 9A (left) and 9C (right)

Qualitative analysis

- Solving strategies

The experiment was conducted with 182 pupils. Only 12 of them selected successfully as their solving strategy the use of an equation (7 used Guess – check – revise: 9A1 – 1 pupil, 9C1 – 1 pupil, 9C2 – 1 pupil, 9C3 – 3 pupils, 9C4 – 1 pupil). 6 pupils solved the problem arithmetically as a problem on division of the whole into three equal parts, which can be accounted for by their failure to understand the conditions in the text statement correctly (9A3 – 1 pupil, 9A4 – 1 pupil, 9C1 – 1 pupil, 9C2 – 2 pupils, 9C3 – 1 pupil).

- Legends

In Problems 9A and 9C, the proper order of numerical data is (P1, P2, P3, W), where W describes the whole in all variants. In 9A1, 9A2 P1 refers to gymnastics, P2 basketball and P3 swimming whereas in 9A3, 9A4 P1 refers to the Liberal Club, P2 to the Conservative Club and P3 to the Green Club; in 9C P1 stands for Eva's, P2 for Karel's and P3 for David's number of tours. Table 4 and 5 present the distribution of direct and indirect legends in comparison to the proper order of numerical data in the statement. Recorded are only those cases where the pupil attempted to solve the problem and created a legend (independently of whether they solved the problem successfully). In some cases, the pupil used the whole but they did not record it in the legend. The order of parts in legends that did not appear in the pupils' solution are not included in tables 4 and 5.

	Legend			Legend	
9A1 Order of numerical data in the statement **P2, P1, P3, W**	Position of W	Order of parts	9A3 Order of numerical data in the statement **P2, P1, P3, W**	Position of W	Order of parts
	W as last: 30 W as first: 4	P2, P1, P3: 11		**W as last: 25** W as first: 2 Not recorded: 7	P2, P1, P3: 29
		P1, P2, P3: 20			P1, P2, P3: 1
		P2, P3, P1: 3			P2, P3, P1: 4
		P3, P2, P1: 0			P3, P2, P1: 0
	Legend			Legend	
9A2 Order of numerical data in the statement **W, P2, P1, P3**	Position of W	Order of parts	9A4 Order of numerical data in the statement **W, P2, P1, P3**	Position of W	Order of parts
	W as last: 18 **W as first: 15** Not recorded: 3	P2, P1, P3: 11		W as last: 17 **W as first: 9** Not recorded: 4	P2, P1, P3: 26
		P1, P2, P3: 22			P1, P2, P3: 0
		P2, P3, P1: 2			P2, P3, P1: 3
		P3, P2, P1: 1			P3, P2, P1: 1

Table 4: Distribution of direct and indirect legends for 9A

Table 4 shows that in case of proper order of numerical data in the statement most pupils use direct legend independently of familiarity of context. In case of mixed order of numerical data in the statement the situation is different for familiar and unfamiliar contexts: In case of an unfamiliar context, the proportion of pupils who changed the order of information in legend, albeit by moving W to the end or by swapping the order of recorded parts is much higher than in case of familiar context.

	Legend			Legend	
9C1 Order of numerical data in the statement **W, P2, P1, P3**	Position of W	Order of parts	9C3 Order of numerical data in the statement **W, P2, P1, P3**	Position of W	Order of parts
	W as first: 7 W as last: 21 Not recorded: 4	P2, P1, P3: 29		**W as first: 10** W as last: 13 Not recorded: 5	P2, P1, P3: 22
		P1, P2, P3: 3			P1, P2, P3: 2
		P2, P3, P1: 0			P2, P3, P1: 4
Number of pupils who interchanged level incorrectly: 11			Number of pupils who interchanged level incorrectly: 8		
	Legend			Legend	
9C2 Order of numerical data in the statement **P2, P1, P3, W**	Position of W	Order of parts	9C4 Order of numerical data in the statement **P2, P1, P3, W**	Position of W	Order of parts
	W as first: 2 **W as last: 22** Not recorded: 8	P2, P1, P3: 28		W as first: 4 **W as last: 25** Not recorded: 4	P2, P1, P3: 29
		P1, P2, P3: 2			P1, P2, P3: 2
		P2, P3, P1: 2			P2, P3, P1: 2
Number of pupils who interchanged level incorrectly: 21			Number of pupils who interchanged level incorrectly: 25		

Table 5: Distribution of direct and indirect legends for 9C

As stated earlier in the paper, Problem 9C is more difficult than Problem 9A as it does not contain only the relationship of the whole to parts but also the relationship between the money earned and number of tours. Thus there are two possible approaches to the solution. One is to find out how many tours were taken, find the number of tours of each of the students using the information

from the problem statement and finally calculate the money earned by each student. The other is to work directly with earned money, then it is essential to supplement the relationship between parts on the award for one tour; and the results are in crowns. If pupils do not realize what approach they use, they may come to a wrong result.

Table 5 is analogical to Table 4 for Problem 9C. In addition the table shows how many pupils made mistakes when switching between the levels of the number of tours and money earned. Table 5 shows that most pupils used direct legend in variants 9C2 and 9C4; this can be explained by the order in which data are used in calculations. In the variants 9C1 and 9C3 the order of parts mostly corresponded to the problem statement but the information on the whole was often in a different place that in the statement. This could be caused by the two-level problem statement which requires from pupils to pay a lot of attention to all data from the beginning in order to understand and by their attempt to find out the total number of tours. The table also shows that in the variants with W at the end of the statement independently of the presence of "if-clause" pupils make more mistakes in switching between the number of tours and money earned. This could be explained by the fact that they can process the relationships between parts without paying attention to the money issue.

Conclusions

The variables analysed here for 14-16-year old pupils are studied for pupils 8 to 16 in the GAČR project. The research in the GAČR project has important characteristics. The variations of the problems are carefully formulated so that only one variable was changed, the other being controlled (as requested by Daroczy et al. (2015)). Great care is paid to dividing pupils into equally able groups using IRT. The quantitative analysis is accompanied by a qualitative analysis to better understand the influence of investigated variables.

Analogical analyses of pupils' solutions in which various mathematical, psychological and language variables are changed allow us to get deeper insight into pupils' difficulties when solving word problems. The presented study has its limitations: a relatively small number of participants, one type of word problems, analyses based on written solutions only. However, it brought very interesting results important for mathematics education as well as test creation.

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THE EFFECT OF DATE AND MID-TERM TEST ON PERFORMANCE AT THE FINAL TEST

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Abstract

The paper elaborates on the effect of student's mid-term test score, student's faculty, semester, and date of final test on the final test score. The dataset used in the analysis comes from the course of Mathematics for Economists at the University of Economics, Prague for which 1473 students were enrolled in the academic year 2016/2017.

The correlation between the mid-term test score and the final test score and the correlation between the date of the exam and the final test score were calculated. The results show that the two tests are positively correlated, while the final test is negatively correlated with the date of the exam. Linear regression model in which final test score was used as the outcome and mid-term test score, faculty, semester, and date of the exam were used as predictors showed that all these predictors were significant and influenced student's score.

Keywords

Correlation analysis, linear regression, performance of students, results in mathematics

Introduction

The performance of students at the final test of the course of Mathematics for Economists at the University of Economics, Prague is highly variable and can depend on many factors. By statistical analysis of the scores, which were obtained by students during the tests, the lecturers can better understand why certain students score better during the final test than others. The aim of this paper is to analyse the relationship between the scores from the mid-term test and those from the final test and to analyse how the date of the exam, i.e., whether the student comes for the exam at the beginning of the exam period or towards the end of the exam period, affects student's performance during the final test.

Scores from mathematics courses have been analysed in different ways and many conclusions have been drawn. For example, Dickerson, McIntosh, and Valente (2015) have shown that there is still a difference between the scores of males and females and males tend to score better; Martin et al. (2007) showed that locus of control, self-control abilities, and family income can serve as predictors of student's score in mathematics and science; Stareček et al. (2017) analysed the psychological factors influencing student's performance; the impact of student's demographic and behavioural characteristics on his/her performance was also analysed by Kaspříková (2012); Kiwanuka et al. (2017) studied the relationships between student and classroom characteristics on math self-confidence, perceived usefulness, and enjoyment of mathematics; the relationship between results of entrance examinations and performance during the studies was analysed by Linda and Kubanová (2013) and Kučera, Svatošová, and Pelikán (2015). Moreover, Thompson, Bowling, and Markle (2018) have shown that mathematics score can also serve as predictor of scores in Biology studies.

Otavová and Sýkorová (2015; 2016; 2017) showed that student's performance depends on the student's faculty and the semester in which he/she enrolled for the course of Mathematics for Economists. Dependence of student´s score on the way he/she was admitted to the school was also analysed (Klůfa 2015a; 2015b; Otavová and Sýkorová 2017). Otavová and Sýkorová (2014) proved that there is an association between the mid-term test score and the final test score. Test variants and the effect of teacher were analysed by Měsíček, Petrus, and Kovářová (2017). Brožová and Rydval (2014) analysed mathematics results of IT students and found out that students use the first attempt to get familiar with the nature of the test. Doucek and Maryška (2015) studied the relationship between results in Mathematics and English during the entrance examination.

The purpose of this paper was to analyse the score from the final test. More specifically, we analysed whether there was any correlation with the mid-term test score and whether the date of the first attempt to the final test, is correlated with the score. Hence, the research is an extension of the previous research conducted by Otavová and Sýkorová (2014; 2015; 2016). In the first part, correlation analysis was conducted and in the second part, linear regression model for the score from the final test was built. All the statistical analyses were conducted in statistical packages R and IBM SPSS.

The paper is divided into four parts. In the material and methods part, the dataset is described and the applied statistical methods are briefly introduced. In the results part, the results of the analyses are presented and in the discussion part, these results are briefly discussed. In the conclusion, the results are summarized and future research plans are briefly outlined.

Materials and Methods

Data description

At the University of Economics, Prague each student has to take a course in mathematics and write an exam in the exam period. Mathematics for Economists is an obligatory course for most of the students during their Bachelor studies. The course is taught by the Department of Mathematics of the Faculty of Informatics and Statistics and is provided in both, winter and summer semesters. Hence, students can choose in which semester they register for the course. During the course, basic principles of linear algebra and mathematical analysis are taught, based on the book by Klůfa (2016).

The evaluation of the course consists of three parts: a mid-term test that is worth 20 points, a final test worth 40 points, and take an oral exam worth 40 points. The scores from the individual parts are then summed at the end and the final grades are then determined according to the rules of the University of Economics, Prague, which can be found in Table 7 in the Appendix.

The dataset contains 1473 students who took the course of Mathematics for Economists in the academic year 2016/2017. It provides information about each student's score in the mid-term test (0-20 points), score in the final test (0-40 points), the date of the exam (the date of the final test), student's faculty (Faculty of Finance and Accounting – F1, Faculty of International Relations – F2, Faculty of Business Administration – F3, Faculty of Informatics and Statistics – F4, and Faculty of Economics – F5), and the semester in which he/she took the course (winter, summer). The students from the Faculty of Economics were excluded from the analysis since the course is not obligatory for them and there were only 4 students from this faculty. Therefore, only 1469 students were in the analysis set. The actual date of the exam was not used in the analysis, but it was transformed into the ordinal number indicating whether the date of the final test was the first possible date of the exam in a particular semester, second, etc. 11 exam dates were offered in the winter semester, while 13 were offered in the second semester.

Table 1 shows the number of students per faculty and semester. We can see that most of the students take the course in the first semester and most of them are from the Faculty of International

Relations. Not many students from the faculty of Informatics and Statistics take the course in the summer semester as most of them have more advanced courses and are required to take this basic mathematics course in the first semester as prerequisite.

	Faculty				
Semester	F1	F2	F3	F4	Total
Winter	207	249	188	205	849
Summer	189	252	141	38	620
Total	396	501	329	243	1469

Table 1: Contingency table of number of students in each treatment

Table 2 shows the descriptive statistics for the mid-term test score and the final test score. Table 3 and Table 4 show average scores for both tests for each combination of faculty and semester and the distribution of scores by faculty and semester can be observed in the boxplots in Figure 1 and Figure 2.

	Mid-term test	Final test
N	1469	1469
Mean	12.00	25.40
Median	12.00	27.00
Std. Deviation	5.298	9.867
Skewness	-0.35	-0.55
Minimum	0	0
Maximum	20	40

Table 2: Descriptive statistics for score

	Faculty				
Semester	F1	F2	F3	F4	Total
Winter	12.66	11.64	11.53	11.82	11.91
Summer	13.09	11.81	11.65	11.05	11.90
Total	12.87	11.72	11.59	11.43	12.00

Table 3: Average mid-term test score by semester and faculty

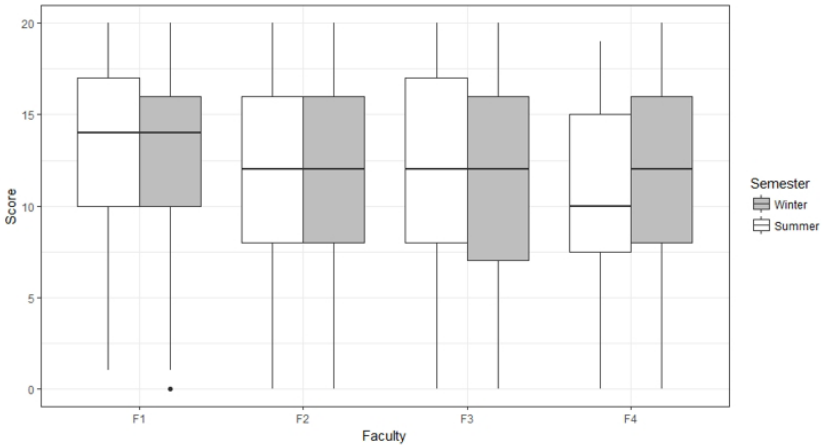

Figure 1: Boxplots for mid-term test score by semester and faculty

	Faculty				
Semester	F1	F2	F3	F4	Total
Winter	24.67	24.91	25.53	24.15	24.81
Summer	26.93	25.80	27.43	21.05	25.30
Total	25.80	25.35	26.48	22.60	25.40

Table 4: Average final test score by semester and faculty

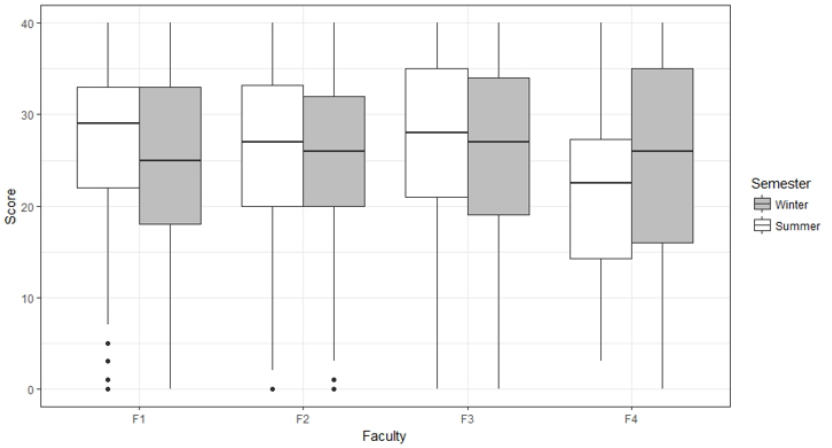

Figure 2: Boxplots for final test score by semester and faculty

Statistical methods

During the analysis, we calculated two Pearson correlation coefficients (Pecáková, 2011): between final test score and mid-term test score and between final test score and date of the exam. The correlation coefficients were then tested by using *t*-distribution in order to see whether the correlation between the variables is significantly different from zero.

In the second part of the analysis, we built a linear regression model to analyse whether the final test score is influenced by the mid-term test score, date of the exam, faculty and/or semester. At first, a model with all possible interactions was considered and then a final model was obtained by backward elimination of predictors. The significance of these predictors was then verified by ANOVA type III tests (Kutner et al, 2005).

Results

Correlation Analysis

Pearson correlation coefficients were calculated to quantify correlation between mid-term test and final test scores and between the date of the exam and the final test score. The results and corresponding tests are presented in Table 5. It can be observed that the mid-term test score is positively correlated with the final-test score, while the date of the exam is negatively correlated with the final test score. Both of these correlations turned out to be highly significant.

Linear regression model

Table 6 shows the ANOVA table from the linear regression model, in which the final test score was used as the outcome and mid-term test score, faculty, semester, and date of the exam were used as predictors. The final model did not include any interactions between predictors. From the

table it can be observed that all these factors significantly influence student's performance on the final test.

	Correlation	t-value	p-value
Mid-term test	0.456	19.603	<0.0001
Date of exam	-0.245	-9.665	<0.0001

Table 5: Pearson correlation coefficients

Source of variation	Df	Sum of squares	F-value	P-value
Mid-term test score	1	21798	292.70	<0.0001
Faculty	3	1109	4.96	0.0020
Semester	1	1049	14.08	0.0002
Date of exam	1	2844	38.18	<0.0001
Errors	1462	108878		

Table 6: ANOVA table (Type III sum of squares)

Discussion

The results have shown that the correlation between the mid-term test score and the final test score is positive, which coincide with the previous findings by using contingency tables (Otavová and Sýkorová, 2014) and students who score more at the mid-term test, tend to score more at the final test. The effect of faculty and semester on student's performance turned out to be significant, which also supports evidence found by Otavová and Sýkorová (2015; 2016; 2017).

The effect of date of the first attempt to the exam on the test results has not been analysed much in the past. From the correlation analysis, we can conclude that the later in the semester the students come, the worse their result tends to be due to the negative correlation coefficient. This is not in line with the findings of Brožová and Rydval (2014), who showed that students who come earlier for the exam tend to perform worse. However, students at the University of Economics, Prague have only one attempt for the exam (unless they score between 50-59 points, see Appendix), while their students were allowed to retake the exam and therefore they used the first attempt to the exam to get familiar with it. Měsíček, Petrus, and Kovářová (2017) have also shown that students tend to improve in time, but similarly to Brožová and Rydval (2014) their students have more attempts to the exams and there is some repetition of the variants, while the variants of the final tests of the Mathematics for Economists course are different at each exam date.

Conclusion

In conclusion, we have shown that the final test score can be predicted by student's performance at the mid-term test, student's faculty, semester in which he/she takes the course and the date when he/she comes to write the final test. This paper showed that the later the student comes to the exam, the higher the chance to score lower. These results can be presented to the students at the beginning of the semester in order to motivate them to study continuously during the semester, get higher score on the mid-term test and come earlier to the exam.

In the future research we would like conduct more detailed analysis of the scores, include all factors that have already been proven to influence scores into one statistical model. Moreover, we would like to show the effect of these predictors not just on the final test score, but also on the final grades and total score. Apart from that, our long-term goal is to collect enough data to conduct some long-term evolution of scores in mathematics. However, we still have to collect more data to be able to conduct such an analysis.

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Appendix

Grade		Points
Excellent	1	90-100
Very good	2	75-89
Good	3	60-74
Failed, eligible for retake	4+	50-59
Failed	4	0-49

Table 7: Grading rules at the University of Economics, Prague

ASSESSMENT OF THE PROFESSIONAL AND MANAGEMENT COMPETENCES AS PART OF PROJECT MEMORY

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Abstract

Project memory refers to the knowledge and wisdom achieved by the people involved in particular project development/implementation phases, which emphasises aspects of the evolution of human relations. Cognitive psychology and knowledge management are used to exploit the project memory. The paper presents a methodology (survey based on a test battery) describing the evolution of human behaviour aspects in the context of two successive life-long learning projects developed with the same international partners (six years of collaboration). Based on the analysis of the project memory, the applied methodology has delivered information about the professional and management competencies gained by the team members involved in the international partnership (reflecting the group learning efficiency). The main aspects that are investigated and discussed include the communication style, the level of the abilities, the emotional intelligence level and the decision-making style. After the description of the proposed methodology, the cumulative results of the investigations are presented.

Keywords

Assessment, human competence, knowledge management, project memory

Introduction

Knowledge management involves explicit and persistent representation of knowledge related to individuals and dispersed groups of people in the organization that interact in order to improve processes and activities in the organization, and to satisfy their professional knowledge needs associated with their own continuous development. Individual and collective knowledge (related to both, different types of teams and the whole organization) are interconnected, as different researches have shown over time time (Nonaka and Takeuchi, 1995; Nonaka, 2000; Davenport and Prusak, 2000; Dalkir and Beaulieu, 2017, Wei Choo, 2000). Loufrani-Fedida and Saglietto (2016) state that the *knowledge management discipline diffuses in every scientific domain* by expanding the application of its methods and tools in order to better support the knowledge creation cycle. Additionally, every individual, group or organizational initiative (activity) are developed and implemented in the context of a project.

As Carvallho et al. (2015: 1510) state, projects have evolved to be collaborative, concurrent and multi-disciplinary, as well as multi-cultural (e.g. in the case of international partnership projects) with almost all the activities being developed using information exchange and communication technologies and the virtual space; projects are cross-country and cross-industry. Due to these facts and tendencies, knowledge management for projects faces new challenges. Efforts have been made to save and preserve knowledge and wisdom achieved from past projects in order to nurture knowledge repositories and to develop project memory that could provide an effective and efficient support to future projects. Bekhti et al. (2011: 120) and Dai et al. (2014: 1754) have considered in their researches that knowledge repositories are important tools for the reuse and adaptation of knowledge (by extracting knowledge from the repository using knowledge engineering

techniques) when a new project requires similar solutions to those found in past projects. Similar to the organization memory (preserving in a systematic way the organization's wisdom), project memory should consider all the knowledge resulting from the project such as project organization, employed strategies, environment, constraints and design rationale. In this case, the challenge is to achieve knowledge capitalization without perturbing the workspaces, processes and activities of the actors and users.

As stated by Hornstein (2015: 292), the human side of projects is complex and the dynamics of the involved individuals or teams, together with the evolution of the human inter-relations, could be considered parts of the human resource management. In addition, the competencies developed by the team members, together with their communication and evolution of work abilities are the main sources for the enrichment of organization knowledge management as demonstrated by the research results of Carvalho et al. (2015: 1520) and Loufrani-Fedida and Saglietto (2016: 87). Thus, project memory is an interdisciplinary approach of high interest and can be considered a *hot topic* for education, research and industry as mentioned in the study of Atifi and Matta (2002: 1-5). Furthermore, project development usually implies the involvement of multiple members, from different organizations, with different cultures and backgrounds and which are geographically distributed. For example, in projects which are part of international partnerships, such as the life-long learning project is, several teams from several private and public entities collaborate to carry out an education type project (e.g. for the establishment of a specific training scheme that could support a defined target group in their professional life as in the research context of the current article). As stated by Matta et al., (2001: 43), the several teams are regarded as co-partners who share the decision-making during the project development. This type of partnership is in general, dissolved at the end of the project. Thus in this heterogonous partnership, the knowledge produced during the development and implementation of the project has a collective dimension, which is in general volatile. The documents produced during the project are not sufficient to keep track of the knowledge that even the project manager cannot fully comprehend. This dynamic character of knowledge is caused by the cooperative problem solving employed where various ideas are confronted and the cooperative nature of the produced solutions.

For the purpose of this article, we aim to underline the behavioural value add gained by the teaching and research staff of universities and companies involved in life-long learning projects, together with their professional and management competencies development in a collaborative environment.

In this context, this paper presents an investigation methodology and its application in the assessment of professional and management behaviours as part of the classical knowledge management approach. The research objective is to set a more accurate methodology by taking into consideration the motivational and personal aspects that *push* people to work together and to externalize, exchange knowledge and learn. In addition, the research results achieved by the proposed methodology in a real environment have described the human behaviour aspects and experiences gained in the context of two life-long learning projects developed with the same international partners (six years of collaboration between the same public and private organizations in Europe). The research results consist of valuable findings about the professional and management competencies gained by the team members involved in the international partnership. The main aspects that will be investigated and discussed are the communication style, the general level of the abilities, the emotional intelligence level and the decision-making style.

The paper structure consists of the following chapters: (1) Materials and methods; (2) Research results and their discussion; (3) conclusions that stress the utility of the proposed methodology and the experimental research done.

Materials and Methods

Social, psychological and managerial knowledge support the research approach as these can help the explanations of the interaction dialogue between the project's actors, communication issues during the project evolution and the inter-individual relations. In the research context, project memory has been defined by elements of the experience coming from both project contexts and the associated problem solving processes. The approach gives special attention to the assessment of personal and social competences. These were issues considered during the creation of the test battery. The research methodology was developed on the multiple application of a survey based on a battery of tests that consist of four questionnaires: the communication style assessment test, the General Abilities Test (GAT), the test for the Emotional Intelligence level evaluation (as a tool for the inter-relationship diagnosis) and the test for the decision-making style assessment. Preliminary, the Marsieu (2006: 187) research development has used which validated the tests battery in the context of the development of industrial projects. Her research aims to develop human resource competencies for the application of integrated engineering principles in the case of industrial projects. In addition, as stated by Gangolf (2000: 34), specific psycho-sociological techniques were used for selecting the most appropriate variables (the independent ones are most relevant) that have to be assessed by the tests and that influence the group work style and productivity.

The research objectives are focused on the characterization of the human behaviour and the experiences gained during two life-long learning projects developed with the support of the European Certification and Qualification Association (ECQA, www.ecqa.eu):

- CertiBPM – ECQA Certified Business Process Manager, LLP-LdV/ToI/10/RO/010, project duration 2010 – 2012;
- LeadSUS - Leadership in Sustainability – Sustainability Manager, LLP - LdV / TOI / 2013 / RO / 022, project duration 2013 – 2015.

The members of the partner teams that were involved in each project were considered for the experimental research.

Figure 1 shows the proposed methodology for the human interaction analysis in project memory. The next steps were followed for the experimental research:

1. *Research hypotheses* are linked with the projects and the international partnership development. The research hypotheses are:

(H1) The communication style evolves from a process oriented one to a human oriented one;

(H2) The level of cognitive abilities is expected to achieve the "very high" level during the projects lifecycle;

(H3) The personal and social competencies of the members of the teams (that represent their emotional intelligent) have an increasing tendency;

(H4) The decision-making style converts from a sequential one to an intuitive one. Because of this expected evolution of the personal, professional and managerial competencies, a debate on the organizational structure was proposed. Teams' managers expect that the pyramidal (impersonal) project organization structure to be replaced by a matrix structure, which is more interpersonal and which could assure more flexibility in the operations during the projects' implementation phases.

2. *The sample* of subjects has to be relevant for the international partnership regarded to as an organization. In the experimental research, all teaching and research staff of the partners' organizations were considered, and they were all involved in a project. In this case, the response rate was 100% as all partner organizations have a common interest for the research results.

3. *The research methodology* is depicted in Figure 2. Other important aspects that have been considered include the group dynamics (the evolution from an initial stage to a final one,

associated with the end of each project), the sample representativeness and the tests battery definition (together with the knowledge accumulated from the pre-test, standardization and validation processes).

4. *Experimental design* consists of the establishment of the preliminary research stage, the initial phase, the intermediary phase and final phase of the investigation. Furthermore, aspects related to intermediary conclusions and future possibilities for the research results were considered. This step was dedicated to the experience acquired in the context of projects memory.

5. *Quantitative and qualitative results and their interpretations* are related to the experience representation.

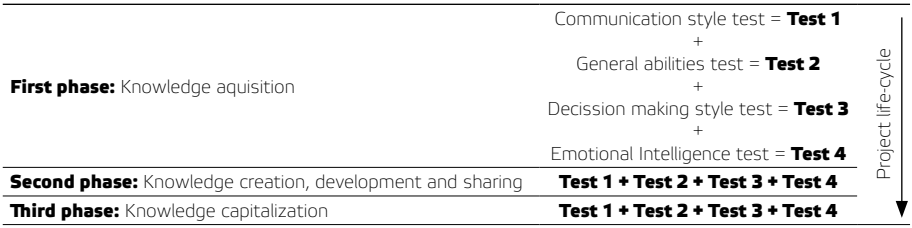

Figure 1: The methodology for professional and management competences assessment (human interaction analysis) as part of project memory

Research Results and Discussions

The adopted methodology was applied in the case of an international partnership defined by the life-cycle context of two life-long learning projects that have been developed and implemented between 2010 and 2015. The same partners were involved: one university from Romania and four private companies from Romania, Ireland, Slovenia and Austria. The proposed research methodology has been applied during the lifecycle of each of the projects, and the cumulative data processing and interpretation have been done at the end of 2016. The research sample is depicted in Table 1. As shown, a total of 32 subjects, with the members of the teams being involved in both projects, have been considered for the research sample; the subjects' age ranged from 22 to 62 years and the research sample has a female dominance.

The partners	No. of teaching and research staff involved in the projects		Gender structure Male (M) + Female (M) number	
	No.	%	No.	%
P1 - university	14	43.750	6M + 8F	42.86%M + 44.44%F
P2 - company	5	15.625	1M + 4F	7.14% + 22.22%F
P3 - company	6	18.750	3M + 3F	21.43% + 16.67%F
P4 - company	3	9.375	2M + 1F	14.29% + 5.55%F
P5 - company	4	12.500	2M + 2F	14.29% + 11.11%F
Total	32	100.00	14M + 18F	43.75%M + 56.25%F

Table 1: The research sample structure (source: own calculation)

Table 2 depicts the research scenario. The projects' traceability consists of three stages: *the initial phase* (focused on team members' identification and acquisition of knowledge needs), *the intermediary phase* (or the second one, focused on the members' knowledge creation, development and sharing) and the *final phase* (focused on the members' knowledge capitalization). Table 2 shows the research development over time, by showing the points in time for the data collection through the different tests included in the battery. As the research methodology was applied twice (in the case of each project), the cumulative results have been presented as two waves of the test

application on the same investigated group. Finally, each subject was investigated six times with each test (from the test battery), but at different moments in time related to the development and implementation of the two projects that have been considered.

First project (CertiBPM)			Second project (LeadSUS)			
2010	2011	2012	2013	2014	2015	2016
1st (initial) phase	2nd (intermediary) phase	3rd (final) phase	1st (initial) phase	2nd (intermediary) phase	3rd (final) phase	Cumulative results
↑	↑	↑	↑	↑	↑	
Communication style test + General abilities test + Decission making style test + Emotional Intelligence test			Communication style test + General abilities test + Decission making style test + Emotional Intelligence test			Data processing debate and analysis of conclusions of projects impact on members career develop.

Table 2: The research scenario (source: own development)

The considered *direct variable* of the study was the projects' traceability, in association with the specific phases of the project lifecycle (beginning, maturity and end) and the team members' evolution during these phases. The *indirect variables* were the communication style, the decision-making style, the general skill level and the emotional intelligence level. The study's scope was to characterize the experimental group development (personal and professional aspects as well as experience gained) through each project's development phases and to identify the most important aspects that support knowledge capitalization and sharing.

The indicators used for characterizing the human behaviour and experience were:

- The communication style that can be: process, action or human oriented (Figure 2(a));
- The cognitive ability level that can be: very low, low, high or very high (Figure 2(b));
- The emotional intelligence level that can be interpreted as: (a) low personal competences – low social competences, (b) low personal competences – high social competences; (c) high personal competences – low social competences; (d) high personal competences – high social competences (Figure 3(a));
- The decision-making style that can be sequential, logic, global or intuitive (Figure 3(b)).

According to the results presented in Figure 2(a), the process-oriented communication style is dominant during the first project lifecycle (2010 – 2012), while the subjects (during the 2013 – 2015 period) prefer the action-oriented communication style. During both projects' evolution, there is a gradual increase of both human and action-oriented communication styles (increasingly preferred by the teams' members), but a decreasing preference of the process- and ideas-oriented communication styles. In conclusion, the H1 hypothesis is confirmed and the research results have underlined that the communication style evolved from a process oriented one to a human and action oriented one. The reasons for this result are related to the requirements (specified in the management and financial guidelines) and the monitoring program of the program authority in this type of projects.

As presented in Figure 2(b), the general cognitive abilities of the investigated group vary between the "high" and "very high" level during the projects lifecycle. In addition, the deep analysis of the general abilities test shows that subjects are focused on human relations, communication, co-operation, open to others, increasing self-respect and identification with the work group. These attitudes reflect the tendency for increasing group cohesion and for increasing professional efficiency. Thus, H2 hypothesis is confirmed.

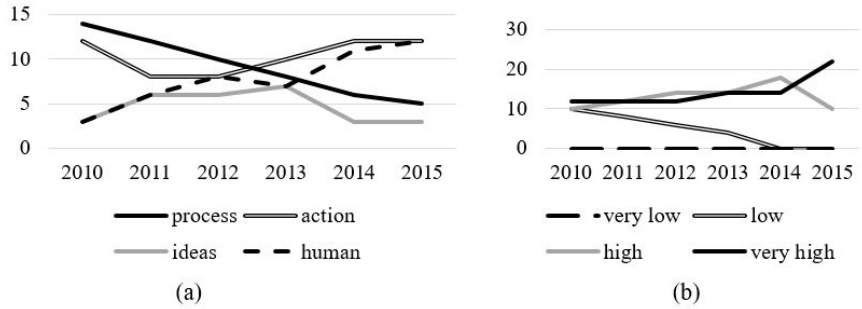

Figure 2: (a) the communication style evolution (H1 is confirmed) and (b) the cognitive abilities level confirmed by the results of the General Abilities Test application (H2 is confirmed)

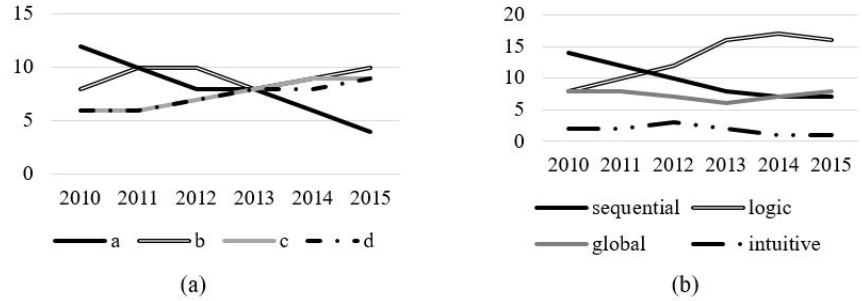

Figure 3: (a) the Emotional Intelligence level evolution (H3 is confirmed) and (b) the decision-making style dynamics (related to H4)

According to the research results represented in Figure 3(a), there have been observed a general tendency of increasing personal and social competences, between phases, for the group members. The diagnosis of the Emotion Intelligence level evolves from the "a" type (in 2010) to "b", "c" and "d" type (during 2013 – 2015). Group members evolve from "low level of personal competencies – low level of social competencies" ("a" type) to "high level of personal competencies – high level of social competencies" ("b" type in 2015). This confirmed the H3 hypothesis. The group was oriented towards the learning processes, mostly dedicated to new knowledge, which is also correlated with the communication style. Furthermore, the results underlined that cooperation and collaboration during the implementation of the both projects benefited from the team members' increase in empathy, and from the positive evolution of the socio-affective communication competences (associated with "b" type emotional intelligence).

As shown in Figure 3(b), the *sequential decision-making style* was preferred less during both projects' implementation. In addition, the subjects preferred less the *global and intuitive decision-making styles*, and included more towards the *logic style of decision*. The managers of the teams have considered these results during the debates and explanations on the evolution of the organizational and partnership structure during 2010 - 2015. The hierarchical relations between team members turned into matrix type relations mostly used during the projects' implementation (2013 – 2015) when managers were easily and efficiently replaced with other team members depending on their competencies and involvement in different streams. In general, the decision-making process was supported by the involvement (opinions and experiences) of all the group

members. The relations between team members were sometimes constrained due to the quick evolution of the projects, mainly in the case of activities with short duration.

Conclusions

Table 3 summarizes the research conclusions and the dynamics of the investigated dimension of professional and managerial competencies. Three relevant moments in time have been considered: 2010 related to the first project design and the beginning of the international collaboration; 2013 corresponding to the end of the first project and the beginning of the second one; 2015 when the second project ended.

Year	Aspect of project memory	Communication style preferred	General abilities	Emotional intelligence style	Dominant decision style
2010	Members part experiences in lifelong learning projects; Team managers experiences and wisdom; Knowledge related to projects content and plan;	Process oriented	Very high	low level of personal competencies – low level of social competencies (a" type)	sequential
2013	The international partnership is mature; First project results, knowledge and wisdom acquisition from problem solving; Knowledge acquisition related to ECQA schema and lifelong learning program (guidelines); Knowledge accumulated for a successful new project proposal;	Action oriented	High and Very high	A mix of a", b", c", d" types (explained by the members flexibility of assuming different roles in the teams, during the project development)	logic
2015	Knowledge and wisdom accumulated have minimized the project risks; Team members are confident in their capacities of working and interacting in an international context/ partnership; High cohesion of the international partnership and the teams.	Action oriented Human oriented Ideas oriented	Very high (higher level than in 2010)	high level of personal competencies – high level of social competencies (b" type)	logic

Table 3: The conclusions synthesis (source: own development)

Research conclusions have proved the usefulness of the test battery for the diagnosis of professional and management competencies (for diagnosis and characterization of behaviour dimensions) of the team members involved in the two lifelong learning projects. In addition, the proposed methodology has been proved to be a coherent one and useful both for teams' managers and members (teaching and research staff). The project results support the knowledge acquisition processes between the team members and also their personal, social and professional efficiency and effectiveness. The research results were linked with the development of the international partnership and its matrix-oriented structure, which has been observed during the second project development (2013 – 2015).

The exploitation of the proposed methodology into two projects has underlined the team members' capabilities for adapting themselves to the projects context with the help of the experience gained

in the past and with the help of the evolution of their professional and social competences. During the experimental research, an important role in the knowledge / experience capitalization process have been given to the teams' managers which have monitored and registered all the events (mistakes, omissions, conflicts, misunderstandings) for a better representation of the project memory. These aspects were part of the risk analysis associated with project management.

As the debate of the research results has taken place after the finalization of the first project (2013), the conclusions related to valuable knowledge acquisition and related to the team members' social and professional development have been considered for the second project design. Furthermore, the second project proposal has been approved to be financed and thus the already created partnership context (familiar, stable) has assured the on-going evolution of the teams' members. The second project scheme (training and certification scheme according to the European Certification and Qualification Association, ECQA requirements and guidelines) was identical with the first one but adapted to a new training area dedicated to a new target group. This fact proves that team partners have not only accumulated the knowledge and experience to implement the scheme correctly and complete, but they also have the capacity to innovate in order to develop the training materials and to adjust the teaching strategies to each target group.

The partial and cumulative results of the research have underlined positive aspects of young researchers teaching and learning (similar with those stated by the researches of Bartoška et al. (2011) and Flégl et al. (2013)). Is has been observed that young researchers and PhD students benefit the most from the project memory both by developing their professional competencies, and by learning to operate efficiently within the project context. The *leraning by doing* process associated with *mentoring processes* in the case of both projects' implementation has been proved as efficient and effective methods for the vocational training of young researchers.

Since 2015, the partners have proposed various other projects in the new framework of the Erasmus+ program (for actions dedicated to lifelong learning), but they were not accepted or financed. In the near future, they propose to extend the partnership in order to improve their innovation processes and better accomplish the new requirements for the lifelong learning projects.

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FLAWLESS MANAGERS: MYTH OR REALITY?

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Abstract

This paper summarizes our pilot study, in which we verify the conscious rational decision making of the managers through the use of experiment. As the experiment environment, we use the business simulation FactOrEasy®. We chose the specific decision situation and defined the possibility of the error. We analysed 44 games from 10 managers. We started with the analysis of games with the focus on the occurrence of the error. Then, we focused on the fact, whether managers can be conscious of their mistakes, learn from them and not repeat them. Eye-tracking analysis has been used for this purpose. The main objective of this paper is to make summarization and description of found error behaviour. For this purpose, we define the distribution of managers into four quadrants based on two dimensions - the occurrence and the consciousness of this error. Managers are distributed into following quadrants: 'Faultless-Unconscious', 'Faulting-Unconscious', 'Faultless-Conscious' and 'Faulting-Conscious'.

Keywords

Decision-making, error, FactOrEasy®, manager, mistake, simulation

Introduction

Nowadays, managers are under the huge pressure. Their ability to make quick, effective and efficient decisions significantly affects the success of the companies (Trevis Certo, Connely and Lihanyi, 2008). Although the decision-making process and its problems are described by a number of theories, such as the theory of rational decision-making (March, 1994), bounded rationality (Simon, 1976) or natural decision-making (Klein, 2015) and by heuristic approaches (Tversky and Kahneman, 1981), there are only few studies focused on the analysis of errors in decision-making. Anyway, analysis of those errors could help to understand problems of decision-making and improve efficiency and effectivity (Trevis Certo, Connely and Lihanyi, 2008). How Bortun (2014) mentioned, mistakes are an integral part of the learning process and the way, they are managed, make the difference between good and poor manager.

Decision-making can be defined as a process of 4 phases (Simon, 1976; March, 1994), which are: (1) identifying a set of options, (2) identifying the consequences, (3) criteria setting and (4) choice. Any other decision results in a mistake (error) that is defined as 'an error in action, calculation, opinion, or judgment caused by poor reasoning, carelessness, insufficient knowledge, etc.' (Nicolaides, 2013: 18). This action or decision subsequently cause an undesirable result (Bortun, 2014; Livnat and Pippenger, 2008). The first causes of an error can be found in bounded rationality - not all alternatives are known, all preferences are not considered and also all consequences cannot be ascertained. The decision is based only on the available knowledge and choice represents a good solution, but not the best, because the best one may not be known (Simon, 1976; March, 1994). We can state, that wrong decisions, which are caused by bounded rationality, are affected by shortcomings in the first three phases (1-3) of the decision-making process. In the context of this, the wrong decision may not mean the decision maker's error,

who chooses the right and rational option - the best variant among the available ones. In reality, decision makers face poorly defined goals, unstructured tasks, uncertainty, ambiguity, missing data, dynamic conditions, time pressures, etc. Decision-making under these circumstances is defined as the natural (Klein, 2015). This is also confirmed by Wilke and Mata (2012) who claim, that people have limited resources such as time, information, and cognitive capacity to find the best solutions to all problems. Therefore, a number of decision-making take place with using heuristic methods that can be connected with cognitive biases, which lead to errors (Kahneman, 2011). Wilke and Mata (2012) points on, that cognitive biases are in itself a systematic error in judgment and decision-making that can be caused by cognitive capacity limits, motivational factors or adaptation to the environment. In other words, we can state that a decision maker can make an unconscious error, because believes, that choice is the best and right one at the moment. In our research, we focus on the decision-making of managers. We have used the FactOrEasy® simulation game that is designed to teach decision-making in management. The user makes decisions in bounded rationality; makes only a few (up to 5 in 1 round) decisions, has a limited number of variants, consequences and criteria. User proves the ability to make decisions rationally and based on data analysis (Švec et al, 2016). In the simulation, we define a specific error situation for our experiment, in which we are focused on the managers' decisions. Then, we focus on the task, where the user makes the conscious decision or where not. Conscious decision-making has been tested in the past for example by experiments, where participants had to say their thoughts aloud (Harte, Westenberg, and van Someren, 1994). But this method, also called introspection, can significantly influence the participants (Leisti and Häkkinen, 2016). Explanation of own actions makes thought processes more conscious and analytical (Baumeister, Masicampo and Vohs, 2011). The method of loud thinking can also not be suitable for testing a group of participants, because they can influence each other. In our research, for evaluating conscious decision-making, we design a methodology that combines analysis of FactOrEasy® simulation exports and the eye-tracking analysis of the game records. In this place, we accept the conclusion of Bettman, and Johnson (1988), that the right decision is the result of the conscious mental activity. We consider that activity as the slow logical thinking (Kahneman, 2011). We assume, that if one decides rationally, does some effort, hence follows the necessary data, think about them and makes (right) decision.

The paper summarizes our pilot research where we tested managers' decision-making in a particular situation and find out, whether they decide consciously, whether they can be able to found the error, and whether the recognition of the error leads to a change in decision-making. The main objective of this paper is to make summarization and description of found error behaviour and consciousness of errors. The paper is divided into the following parts: material and methods, where the methods used and the course of the experiment are described; results of the experiment; the discussion of the achieved results with the conclusions of other authors, and the own conclusions at the end of the paper.

Materials and Methods

The research was conducted with using the FactOrEasy® software, which secured the experimental environment. It is online dynamic deterministic simulation game of decision-making in financial, operational or strategic management. It uses artificial intelligence, where competitors in the form of multi-layer neural networks compete with a human (Švec et al, 2016).

Formulation of the Observed Error

From the FactOrEasy® description is clear, that player makes a series of decisions that are related (Švec et al, 2016). For the purpose of research, we chose the specific situation, where it can be

clearly defined, that wrong decision means error. The identified error can be made by players during the sale phase. Player tries to sell products on the market (in each round of simulation). Key to success is to beat the competitors. The sale is based on a reverse auction (Bannock and Manser, 2003). The player knows the maximum market price and also knows the number of products, which can be sold by competitors. The player does not know only the price at which competitors are willing to sell. The player's goal is to evaluate the figures and set the price and number of pieces for sale. Only right evaluation of situation can lead to the sale. There exists the situation of excess demand in the simulation. It means, that the market demand is higher than the player and all competitors together have in stock. It happens quite often, the mean is 4.25 cases in our research per game (game has 12 rounds). The player should identify the excess demand, because all figures are available. If the player realizes and identifies the situation, gains opportunity (hereinafter referred to as the 'opportunity') to sell all products at the maximum price. In addition, this decision is done under certainty (of maximum profit), because the outcome of the decision is safe and known (Mařík, Štěpánková and Lažanský, 1993). Jablonský (2007) states that the goal of the decision-making process under certainty is to set the order of all variants according to their advantage. In this case, there is only one relevant criterion for order - the profit. The best variant is to set the maximum possible selling price. If the player offers less, makes the error, which is observed in this research. Opportunity to maximize profit in the round is not been used.

Research Sample

The research sample is the group of 10 managers from middle and large companies, which operates in the Czech Republic. There is the uniform representation of males (5) and females (5). All managers are university graduates and have more than 5 years of practical experience.

The Course of Research

Testing of managers took place in 2 groups in July and August of 2017 in the laboratory for the study of human behaviour (HUBRU), FEM, CULS Prague. In the beginning, managers were instructed about the simulation. After that, they started to simulate. Their task was to achieve maximum 'cash' at the end of the game. The number of simulations´ attempts was limited to 5 for each manager. Managers saved all exports from the games and marked the best one. In total 44 exports were submitted. After that, we analysed all exports and focused to find out the defined error. Exports, which were not finished (bankrupt before the 12th round) and also do not contained the opportunity, were excluded. In those cases, managers were going to bankrupt before the first opportunity. For this reason, 14 games were excluded. We also excluded 2 games, which did not contain any opportunity. These results were not relevant for further analysis. We got 28 relevant exports. In those games, we were focused on the number of occurrences of excess demand, the number of misuse of this situation (number of errors), and whether the player repeated the error in the rounds. The results were processed using a pivot table. Subsequently, the causes of the error were identified. Video records of games and eye-tracking were used to identify the errors. Eye tracking has been applied only at half of the tested managers (5) due to the limited capacity of the laboratory and time limitations of managers. Eye-tracking records usually include fixation points, lengths, maps of tracking path, heat-maps, etc. (Xiao et al, 2017). The parts of records, which contains the error has been analysed through Tobii studio software 3.4.6. Possible causes of errors have been identified using heat-maps.

Results

The results of analysis of managers' simulations' exports with focus on the occurrence of observed opportunity and error are summarized in Table 1. There were 28 errors of the total of

119 opportunities (24%). The error has been found in 11 exports (38%). There were 6 out of 10 managers (No. 2, 3, 6, 7, 8 and 9), who made the error at least once. Only 2 tagged the game with error as the best one (No. 7 and 8). Subsequently, the course of individual games was studied with the target of focus on the occurrence of opportunities and errors. Managers, who were analysed by eye-tracking, are marked in the Table 1.

Number of manager	Number of games	Number of relevant games	Number of relevant game with at least 1 error	Number of all occurrences of opportunities in relevant games	Number of errors in all games	Error in the best game	Eye tracking available
1	5	2	0	12	0	No	No
2	5	4	1	16	1	No	No
3	5	3	1	10	3	No	Yes
4	5	2	0	9	0	No	No
5	3	3	0	7	0	No	Yes
6	5	4	3	16	3	No	Yes
7	4	3	3	12	12	Yes	Yes
8	3	2	2	7	7	Yes	No
9	5	2	1	8	2	No	No
10	4	3	0	22	0	No	Yes
Total	44	28	11	119	28	2	5

Table 1: The occurrence of errors in decision-making, 2017-2018 (source: own calculation)

Analysis of Games of Managers, Who Did Not Make Any Mistake

Managers 1 and 4 – the error did not occur in any game. They found the opportunity in all occurrences. Eye tracking has not been recorded.
Managers 5 and 10 – the error did not occur in any game. They found the opportunity in all occurrences. Eye tracking was recorded and confirms, that they paid attention to all necessary figures. They used figures for identification of the opportunity and made the right decision.

Analysis of Games of Managers, Who Made Mistakes

Manager 2 – made the mistake only in the 1st game on the second occasion. He probably realized existence the possibility of opportunity before made this mistake. In all the following cases, the opportunity was found and exploited. Eye tracking has not been recorded.
Manager 3 – the error was made only in 1 out of 3 games. But the mistake was made in all 3 occurrences in the 1st game. How eye-tracking prove, the errors were caused by zero attention on the stock of competitors. Excess demand did not be identified. But whole next two games were without error, and according to eye-tracking, attention was paid on all necessary figures.
Manager 6 – was aware of the opportunity, but despite of it, made mistake in 3 out of 4 games. The 1st error in the 1st game was made during the 3rd occurrence. The existence of the opportunity was found and realized before the 1st mistake. The cause of the 1st mistake was the zero-watching of market conditions. Also, the 1st occurrence in the 2nd game was missed. Eye-tracking proves, that opportunity was found, but the decision was written into the wrong box - for the number of offered pieces. Also, the 3rd game contained an error. There was no pay attention to stock capacity, the situation could not be evaluated in right way. Manager marked the 4th game as the best one. There was no mistake in this last game.
Manager 7 - played 2 games, where the opportunities occurred (6x, 1x, 4x). Occurrences have not been identified in any case and the error has been repeated in every occasion, also in the example

of the marked best game. Eye-tracking proves, that all important figures were watched before all of the decisions. But also too much attention was paid on irrelevant figures.

Manager 8 - played 2 games, where the opportunities occurred (4x, 3x). Occurrences were not been identified in any case and the error was repeated in every occasion, also in the example of the marked best game. Eye tracking has not been recorded.

Manager 9 – played 2 games, where the opportunities occurred. Made the mistake in the 1st two occurrences out of 7 in the 1st game. After the opportunity has been found and realized, no more mistakes occurred until the end of the 1st game. Moreover no occurrence of mistakes in the 2nd game. The game without mistakes has been marked as the best one. Eye tracking has not been recorded.

Discussion

According to the results, managers can be divided into four quadrants based on two dimensions. The distribution is shown in Figure 1. As the 1st dimension, we determine the occurrence of the error in decision-making; the situation where wrong decision leads to a variance from the condition of the desired maximization of profit. The 2nd dimension is the consciousness of the error. In other words, that means, whether the player was conscious of the occurrence of the opportunity to get the maximum profit; he/she used the opportunity consciously or not. We defined the state of consciousness by: 1) analysing the exports of the games - when player does not make the error in the observed situation, he/she make the right decision consciously; and by 2) eye-tracking - the player, who watch the data that are necessary for the right decision and makes right decision, does this decision consciously. Thus, we can confirm our presumption of conscious observation, thinking and decision-making (Payne, Bettman, and Johnson, 1988; Kahneman, 2011). Individual quadrants are submitted based on the percentage share of decisions on all 119 decisions. 67 decisions were subjected to eye-tracking analysis. In 49 decisions (73%), where eye-tracking was used, monitoring of the necessary figures proceed to the right decision. As one conscious and right decision, even if there was the bad result, we can mark the mistake of manager No. 6. There, the situation was correctly evaluated, but the right decision was written into the wrong column. All other errors were made unconsciously. In 5 (7%) cases, the manager did not watch the necessary data, he/she could not make the reasonable and rational decision. In the other 12 (18%) cases, manager watched necessary figures, but did not realize the opportunity, because he/she made error repeatedly. The situation, when the manager did not watch the necessary data and decided correctly, did not happen at all.

In the Figure 1, we also describe the internal dynamics among quadrants. It is represented by arrows. Thereby we take into consideration the influence of time factor on the possible moving of managers between quadrants.

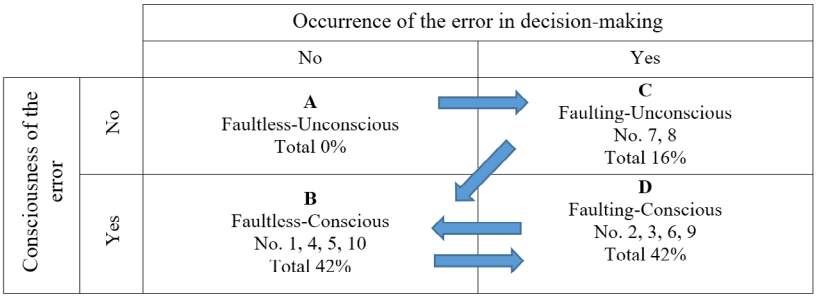

Figure 1: Distribution of managers into quadrants, 2018 (source: own compilation)

Quadrant (A) Faultless-Unconscious includes managers who did not make any error in all games without realizing the opportunity (did not watch the necessary data before decision). In our research, we cannot include any manager into this quadrant, because this situation did not occur. Nevertheless, this quadrant can be hypothetically defined based on our findings. Such a right and moreover repetitive decision would be the result of intuition, or rather, of lucky chance. This option is very improbable in the FactOrEasy®. In our sample, the opportunity was detected 4.25 times in average per game. Each manager played 2-4 games. The probability of repeating the right and unconscious decision in all occurrences is very low.

Faultless-Conscious (B) are managers (No. 1, 4, 5 and 10), who did not make any error in all occurrences of the opportunity. The eye-tracking records of manager's No. 5 and 10 confirm that they always watched the all necessary figures, what means, that the decisions were conscious. We can state that their decisions were fully rational, because they have fulfilled all phases according to March (1994): they identified the variants, the consequences, and the criteria and then they made the right decision.

Faulting-Unconscious (C) are two managers (No. 7 and 8) who made the error in every occurrence of the opportunity; they never realized opportunities, which they faced, even though they were watching the necessary data. In these cases, this may be the systematic error, which is caused by the wrong processing of available information, but not by a lack of information (Livnat and Pippenger, 2008). This fact is confirmed by the eye-tracking records of games of manager No. 7, who was watching all necessary information, but wrong decision was still repeated. The causes of a systematic error can be found in the cognitive biases (Wilke and Mata 2012). These biases lead to variances in the decision-making from what we normally consider to be rational and therefore right (Tversky and Kahneman, 1981; Kahneman, 2011).

Faulting-Conscious (D) include managers who have been aware of the opportunities in the game from the first moment, but despite it, they made some mistakes. That behaviour was found in games of manager No. 2 and 6. As soon as they faced their 1st opportunity, they identified it and did not make the mistake. However, during the several of next rounds and games, wrong decision has been made. There are not the systematic errors in this cases (Livnat and Pippenger, 2008). Those are only random occurrences of mistakes. Their causes can be found in the eye-tracking records of manager No. 6. This manager did not pay attention to some figures in some cases, what prevent to define available variants for a rational decision (March 1994). Or the right solution was found but the decision was written into the wrong column. This unique fail can be caused by bias in fast thinking (Kahneman, 2011), what has completely betrayed the manager in the simple task. Manager No. 3 and 9 can be also included in this category. The run of their games did not contain the error in the 1st few occurrences (3x and 2x). Manager No. 3, as eye-tracking prove, did not pay attention to the necessary figures in those 1st occurrences and could not make a rational decision. But as soon as he/she began to watch the necessary figures, consciousness took a place and right decision was used in all next occurrences. We can divide this run into two shorter time periods. He/she was faulting-unconscious during the 1st game (C), but in the 2nd he/she has already become the faultless-conscious (B).

This means that the distribution of managers into quadrants is not static in terms of the time factor. Managers can move between quadrants in time. We have mentioned the low probability of inclusion in the category of faultless-unconscious (A), but we cannot completely exclude this option. In a very short time period, it can be assumed that random right decisions can be made without consciousness. However, the probability of right decision in the state of unconsciousness is decreasing with every other occurrence of opportunity. In that case, it can be assumed that the number of occurrences increases the probability of moving decision-maker into the quadrant of faulting-unconscious (C).

The state of faultless-conscious (B) may also not be definitively permanent. In the long term, there may be a shift to faulting-conscious (D). This illustrates the behaviour of manager No. 6, who according to eye-tracking, found the 1st occurrence, but subsequently did make mistake in some following decisions. If we divide his/her decisions into shorter time periods, we can state that once occasion has been identified, it was realized and the manager became conscious. The causes of his/her other mistakes can be found elsewhere than in consciousness. According to Mintzberg (2013), management is a craft based on learning from experience. For simulation of FactOrEasy®, this is confirmed also by Pavlíček et al (2015); simulation is designed to verify knowledge and gain experience. Therefore, in our research, we can regard this experience as conscious and the state of consciousness can be considered to be relatively persistent. In other words, it is not possible to shift those, who have already realized at least one opportunity, from the two quadrants of the conscious (B and D) back to the two quadrants of the unconscious (A and C). However, in the long term, conscious ones can change the state of faultless (B) to the state of faulting (D). The manager can forget to apply experience.

On the other hand, it is possible to change the states of the unconsciousness (A and C) to the consciousness (B and D). In cases of managers No.7 and No.8 can be supposed, that the state of unconsciousness and systematic error will not last forever. State of consciousness can come with the increasing number of confrontations with opportunities during a time. The FactOrEasy® simulation is, according to Švec et al (2016), a learning tool where users can learn from their mistakes. Players are repeatedly exposed to opportunities, make decisions and gain experience (Pavlíček et al, 2015). Users, sooner or later, should start with slow logical thinking (Kahneman, 2011) in the process of the game, and therefore the rational decision-making process (March, 1994) should be involved. It results in consciousness and gaining experience. At least in short period after such consciousness, the state of faultless-conscious should occur (B). As Bortun (2014) writes, mistakes are owns for people, but we should learn from mistakes and not repeat them.

All time factor effects are symbolized by the arrows in the Figure 1 and can be summarized as follows: 1) Managers in the quadrant of the faultless-unconscious (A) are exist only in a short time period till they moving to the faulting-unconscious (B). 2) Faulting-unconscious (C) can shift over time to the flawless-conscious (B). 3) And finally, managers can shift in different time periods from flawless-conscious (B) to faulting-conscious (D) and vice versa.

Conclusions

In our pilot research, we tried to find out if managers make errors in a particular decision-making situation. We were focused on facts, whether they are able to realize mistakes and whether they are able to learn from these mistakes and do not repeat the error. For this purpose, we used the methodology combining the analysis of FactOrEasy® simulation export and the eye-tracking. Here we have confirmed our assumption that to watch and evaluate all necessary figures is essential to make the rational and right decision. The result of the research is the distribution of managers into four quadrants based on two dimensions - the occurrence of the error and the consciousness of this error. Based on these quadrants, we distribute the managers into 'Faultless-Unconscious', 'Faulting-Unconscious', 'Faultless-Conscious' and 'Faulting-Conscious'. Based on the analysis of managers' decisions, we also determine the internal dynamics that takes into account the time factor. It is mainly based on the analysis of managers' decision-making in the 'Faultless-Conscious' quadrant and their behaviour in shorter time intervals. Two managers (No. 3 and 7) did not use the opportunity in the first few occurrences. After consciousness, they stopped making mistakes. Based on the experience gained, they changed their follow decisions - they have learned to not do mistakes. On the other hand, two managers (No. 2 and 6) identified the

opportunity at the first occurrence, but despite their experience, they did not avoid mistakes. That means, that managers can move between quadrants over time. This time dynamics can be the subject of further research. For states of unconsciousness, it is possible to examine how long a manager can make the right decision without consciousness, or whether it is necessary first to make mistake, and how long the error will repeat before realizes it and begins to make the right decisions. The state of consciousness is considered to be permanent, but it does not mean permanent faultlessness. We estimate that despite the consciousness, the decision maker may make a mistake in the same decision situations. In future research, therefore, we will also focus the causes and circumstances of the errors, which are made despite the proven gained knowledge and experience.

The results are limited by a small research sample of the pilot study and the methodology used. In the future, therefore, verification of a larger research sample will be necessary. Or a validation of results will be added by adding another method, for example by expanding research on structured interviews with participants.

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WHY STUDENTS FAIL TO FINISH UNIVERSITY (CURRENT DILEMMA: TO STUDY OR TO WORK?)

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Abstract

The objective of this article is to verify the importance of the reasons for dropping out of university before finishing a degree. The second objective is to identify whether the reasons for dropping out differ between full-time and part-time students. The survey group consisted of 643 students of a public university in the Czech Republic, the selected method was written interviews.

The Friedman ANOVA analysis showed statistically significant differences among the submitted 11 reasons which can probably lead to dropping out of university. Reasons marked most frequently by respondents were: insufficient willingness to overcome obstacles (laziness); preference of working to studying and lack of skills ("they cannot manage").

Apart from this, the Mann-Whitney test was used to verify whether there are statistically significant differences between full-time and part-time students. It was established that there are statistically significant differences in 10 items (of the total of 11).

Keywords

Educational Dropout, Dropping out of university, University Dropout, reasons for preliminary termination, part-time students, full-time students

Introduction

Dropping out of university represents a considerable financial loss irrespective of the mode of study. Some authors point out not only the financial impact, but also social issues, such as reduced social cohesion, lower financial income or increase in social benefits (Gyönös, 2011; Vuolo, Mortimer and Staff, 2016). Adverse consequences of early dropout can be identified both at the level of the student (who can appreciate such a situation not only as a personal failure, but as a loss of money as well), at the level of the university (there is a loss of the investments in the student, both financial and academic), and last but not least, at the national level, where the failure during the course reduces the recoverability of the funds invested in education, and reduces the number of qualified graduates (Larsen, Sommersel and Larsen, 2013).

This article focuses on university students dropping out of university. This issue is currently one of the considerable problems of higher education recognised in the Czech Republic as well as worldwide. For example, in the Republic of South Africa, 35 % of students admitted to baccalaureate courses drop out of university after the first year of study, and 30 to 67% of students drop out of university in subsequent master of arts courses (Dlungwane at al., 2017). In the USA, 50% of students doing bachelor degrees fail to finish their courses (Hendricks and Leukhina, 2017). Nearly 15% of students leave university in the first year in Germany (Scholten and Tieben, 2017). Although the number of unsuccessful students is significantly lower than in the RSA or USA, attention is still paid to the issue. An extensive investigation was conducted in Germany to establish the risky groups which most frequently tend to drop out of distance education prematurely. It was concluded that females, migrants and students working full-time drop out more frequently. The factor identified by them as the one which significantly influences whether they finish the course or not is the students' goal orientations (Stoessel at al., 2015). On the other

hand, a study conducted in Italy shows that boys are more vulnerable to leaving university early. Girls are identified as being more resistant to academic failure (Borgna and Struffolino, 2017). Similarly, extensive surveys were conducted among university students in Australia to identify those who are thinking of dropping out of university. Consequently, they look for possible ways of support to retain them (Coates, 2014). Mansouri and Moumine (2017) also report on the considerable number of students who drop out of Morocco universities. Although the National Charter of Education and Training (NCET) was introduced as early as in 1999, with the aim to focus on different grants, accommodation and catering services, health coverage and pedagogical architecture, the number of students leaving early is still growing. A very important presumption for reducing the high number of students prematurely leaving universities is correct selection of the field of study (Khan, Ahamad and Kousar, 2013; Troelsen and Laursen, 2014).

The OECD countries report one-third of students drop out. The figures in the Czech Republic show an even worse situation than the average in OECD countries. About 55% of students drop out of university (Mouralová and Tomášková, 2007).

The objective of this article is to establish what students see as the most frequent reasons for leaving university early and whether these reasons differ between full-time and part-time students.

Materials and methods

A study by Mouralová and Tomášková (2007) was chosen for the methodological basis for working with the reasons. It provides a qualitative investigation into students dropping out of university. A total of 17 interviews were carried out, following which the most frequent reasons for study failure were identified: dissatisfaction with the teaching and the concept of the education programme, changes in priorities, incorrect selection of the programme, lack of motivation, family, health or financial situation (Mouralová a Tomášková, 2007).

The conclusions of the qualitative investigation will now be verified quantitatively. The selection group consists of both bachelor and linking up masters' students of the Faculty of Social and Economic Studies, Jan Evangelista Purkyně University in Ústí nad Labem. The method selected for collecting the information was written interviews. Students were asked to use a scale with a rating from 1 to 7 to assess the most frequent reasons for some students dropping out of university. Rating 1 means "I strongly disagree" and rating 7 "I strongly agree". If students were unable to answer the question, they were allowed to choose number 8. Table 1 summarizes the reasons assessed by students

	Reasons for leaving university early	Marking
1.	Work is a priority for them	A
2.	Travelling or hobbies are a priority for them	B
3.	Studying at a different university is a priority for them	C
4.	They lack sufficient skills (they cannot manage")	D
5.	They lack sufficient will to overcome obstacles (laziness)	E
6.	Change in personal status (marriage, pregnancy)	F
7.	Health	G
8.	Financial difficulties (the family cannot provide financial support)	H
9.	Dissatisfaction with the functioning of the university	I
10.	Dissatisfaction with the form of teaching	J
11.	Dissatisfaction with the selection of the field of study	K

Table 1 Reasons for leaving university early (source: own)

Data collection took place in November 2017, based on the processed time schedule in such a way that students of all grades, all branches and both forms of study were questioned. The time

schedule covered courses with obligatory attendance. In that academic year, 1,494 students were admitted, and 778 respondents filled in the questionnaires, i.e., the rate of return was 52 %. A total of 778 respondents were contacted. Those who used answer No. 8 at least once, i.e., they could not assess the reason, were disqualified. The size of the selection group after the disqualification fell to 643 respondents. Of those, there were 158 males and 485 females.
Indeed, it would be better to include students who finished university prematurely in the research. Howevere, as Vlk et al. (2017) point out, such a category of students is hard to reach (legislative restrictions related to personal data protection do not allow study departments to provide addresses of students who finished university prematurely).
The data were collected in December 2017, and developed using MS Excel and Software Statistica. The tests used: Friedman´s ANOVA and Mann-Whitney U Test.

Results

The first objective of this article was to establish the most frequent reasons for leaving university early.

	A	B	C	D	E	F	G	H	I	J	K
Arithmetic mean	5.537	3.81	**3.75**	5.08	**5.74**	4.185	4.01	4.1	3.91	4.09	4.92
Median	6	4	4	5	6	4	4	4	4	4	5
Mode	7	4	4	6	7	5	3	5	4	4	6
Stand. deviation	1.472	1.713	1.8	1.61	1.4	1.774	1.81	1.738	1.83	1.8	1.68
Variance	2.168	2.933	3.24	2.58	**1.95**	3.148	3.27	3.021	**3.36**	3.23	2.81
Sum	3.560	2.450	2.410	3.268	3.688	2.691	2.577	2.636	2.513	2.627	3.164

Table 2 Descriptive statistics – assessment of individual reasons for dropping out of university – the whole set, n = 643 (source: own)

Table 2 apparently shows that the lowest arithmetic mean appears in the reason marked C (Studying at a different university is a priority for them). This reason is generally assessed as the least frequent. On the other hand, the highest frequency was established in the reason marked E - They lack sufficient will to overcome obstacles (laziness).
The variability of answers is highest in reason I (Dissatisfaction with the functioning of the university) and the lowest in reason E - They lack sufficient will to overcome obstacles (laziness). For all reasons A to K, respondents marked both the lowest as well as the highest ratings of the scale. This is apparent from the following boxplot in Figure 1.

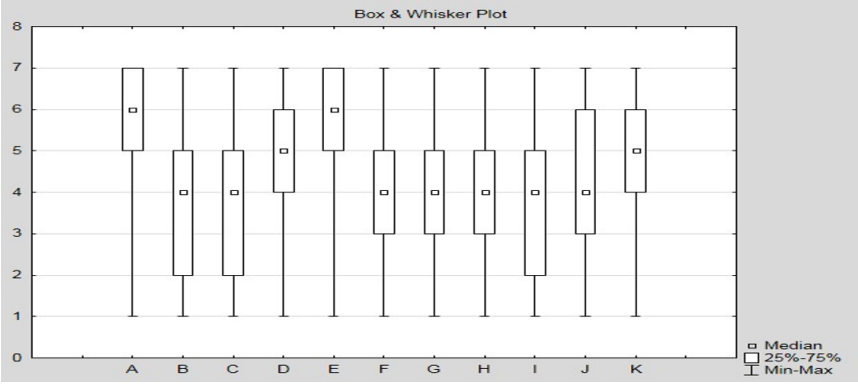

Figure 1: Boxplot – reasons for leaving university early (source: own)

Friedman´s ANOVA proved that the responses show statistically significant differences between individual reasons for dropping out of university (ANOVA Chi Sqr. (n = 643, df = 10) = 1118,819 p =0.00000). The concordance coefficient (= 0.17400 Aver. rank r = 0.17271) is low, however. The most frequent reasons for dropping out marked by respondents were "They do not have sufficient will to overcome obstacles (laziness)" (arithmetic mean of 5.74) and "Work is a priority for them" (arithmetic mean of 5.53), while "They do not have sufficient skills ("they cannot manage")" (arithmetic mean of 5.08) ranked as the third most frequent reason.
The Wilcoxon signed-rank test was done always between two questions to find out between which questions the statistically significant difference was. The final p-values are shown in the following Table No. 3.

	A	B	C	D	E	F	G	H	I	J
B	**0.00000**									
C	**0.00000**	0.56637								
D	**0.00000**	**0.00000**	**0.00000**							
E	**0.02257**	**0.00000**	**0.00000**	**0.0000**						
F	**0.00000**	**0.00024**	**0.00001**	**0.00000**	**0.00000**					
G	**0.00000**	0.07547	**0.00872**	**0.00000**	**0.00000**	**0.00251**				
H	**0.00000**	**0.00179**	**0.00018**	**0.00000**	**0.00000**	0.32048	0.08568			
I	**0.00000**	0.36314	0.10001	**0.00000**	**0.00000**	**0.00461**	0.28109	**0.03713**		
J	**0.00000**	**0.00575**	**0.00029**	**0.00000**	**0.00000**	0.27091	0.51668	0.74620	**0.0001**	
K	**0.00000**	**0.00000**	**0.00000**	0.07779	**0.00000**	**0.00000**	**0.00000**	**0.00000**	**0.00000**	**0.00000**

Table 3 P-values of the Wilcoxon signed-rank test in the respective two questions (source: own)

Table 3 apparently shows that answers to question A "My job is a priority for me" and question E "They lack sufficient willpower to overcome obstacles (laziness)" differs statistically significantly from the answers to all other questions. Answers to question D "They lack sufficient skills ("they cannot manage") show a statistically significant difference from the answers to all other questions, excluding question K "Dissatisfaction with the selection of the field of study"
The second objective was to establish whether there are significant differences between full-time and part-time students.

part-time	A	B	C	D	E	F	G	H	I	J	K
Ar. mean	5.471	3.374	3.097	4.922	5.617	4.85	4.553	4.262	3.607	3.684	4.417
Median	6	3	3	5	6	5	5	4	4	4	5
Mode	7	2	2	6	7	7	7	5	2	2	5
Stand. deviation	1.551	1.725	1.717	1.585	1.395	1.787	1.883	1.736	1.852	1.8	1.835
Variance	2.406	2.977	2.947	2.511	1.945	3.192	3.546	3.014	3.43	3.241	3.366
Sum	1.127	695	638	1.014	1.157	999	938	878	743	759	910

Table 4 Descriptive statistics – evaluation of individual reasons for dropping out – part-time students, n = 206 (source: own)

Table 4 shows ratings of individual reasons for dropping out in part-time students (n = 206) and Table 5 shows ratings of full-time students (n = 296). Both tables feature only bachelor students (n = 502).
The comparison of the ratings listed in Tables 4 and 5 show significant differences between the groups in the assessment of reasons for dropping out of university. To assess whether the established differences are statistically significant, the Mann-Whitney Test was used.

full-time	A	B	C	D	E	F	G	H	I	J	K
Ar. mean	5.439	3.953	4.122	5.314	5.855	3.662	3.625	3.916	3.926	4.152	5.378
Median	6	4	4	6	6	4	3	4	4	4	6
Mode	7	4	4	7	7	4	3	3	4	5	6
Stand. deviation	1.49	1.662	1.76	1.64	1.403	1.68	1.6868	1.718	1.776	1.743	1.435
Variance	2.22	2.764	3.097	2.691	1.969	2.821	2.8453	2.952	3.154	3.038	2.06
Sum	1.610	1.170	1.220	1.573	1.733	1.084	1.073	1.159	1.162	1.229	1.592

Table 5 Descriptive statistics – evaluation of individual reasons for dropping out – full-time students, n = 296 (source: own)

The ratings listed in Table 6 show that apart from reason A (Work is a priority for them), all other reasons show a statistically significant difference between full-time (FTS) and part-time students (PTS). The corresponding p values are printed in bold in the table. The reasons "Studying at a different university is a priority for them" and "Dissatisfaction with the selection of the field of study" are more frequently given by full-time students (4.122, resp. 5.378) compared to the opinion of part-time students (3.097, resp. 4.417). On the other hand, the reasons "Change in personal status (marriage, pregnancy)" and "Health" appear more frequently in part-time students (4.85, resp. 4.553) when compared to the opinion of full-time students (3.662, resp. 3.625). The Mann-Whitney Test was used to evaluate whether the established differences are statistically significant. The null hypothesis of the test states that there is a median concordance of both random samples. The alternative hypothesis negates the statement.

Mann-Whitney Test					Marked tests are significant at p <.05000		
variable	U	Z	p-value	Z adjusted	p-value	Valid n PTS	Valid n FTS
A	29764.50	0.45224	0.651099	0.46564	0.641475	206	296
B	24461.00	-3.76957	0.000164	-3.82323	**0.000132**	206	296
C	20383.00	-6.32036	0.000000	-6.40238	**0.000000**	206	296
D	25591.00	-3.06276	0.002193	-3.12878	**0.001755**	206	296
E	26801.50	-2.30559	0.021134	-2.41193	**0.015869**	206	296
F	19143.00	7.09598	0.000000	7.18180	**0.000000**	206	296
G	21827.00	5.41714	0.000000	5.48561	**0.000000**	206	296
H	26986.00	2.19019	0.028511	2.21962	**0.026445**	206	296
I	27348.50	-1.96344	0.049595	-1.98750	**0.046868**	206	296
J	25795.50	-2.93484	0.003337	-2.97072	**0.002971**	206	296
K	21141.50	-5.84592	0.000000	-5.95900	**0.000000**	206	296

Table 6 Testing statistical significance in the assessment of individual reasons for dropping out of university between full-time and part-time students (source: own)

As to the total ranking of the reasons according to their frequency of occurrence, both groups feature relative compliance. The reason "They do not have sufficient will" ranked first and "Work is a priority for them" ranked second. There was a difference established in the third place. Full-time students mark as the third most frequent reason "Dissatisfaction with the selection of the field of study" (arithmetic mean 5.378) and part-time students mark as the third most frequent reason "They do not have sufficient skills ("they cannot manage")" – with an arithmetic mean of 4.922.

Discussion

The objective of this article was to establish the most frequent reasons for dropping out of university. This phenomenon has recently been recognised in all countries and great attention is

paid to it due to the large financial losses. There are certainly a number of reasons why students drop out. A very interesting study conducted in Denmark comes to the conclusion that poor mental health might be one of the reasons (Hjorth, 2016). There is one more study pointing out worsening mental and physical health of university undergraduates which can be one of the causes of failure at school. It was conducted with first-year students in Australian regional universities (Hussain, 2013). "Health reasons were ranked by part-time students as relatively serious in this survey and ranked as 4th with an arithmetic mean of 4.553. However, full-time students did not find this reason serious and ranked it 10th (arithmetic mean of 3.625)".

A couple of interesting studies have been published in the Czech Republic recently, the objective of which was to identify the most frequent reasons for early droupout from university, e.g., different/unfulfilled ideas and expectations, dissatisfaction with the selected field of study, insufficiently strong motivation to study, resistance to some subjects, insufficient ability to cope with the content of the tuition, coping with too high requirements from teachers, insufficient readiness to study at university, adverse family situation, health condition of family members, own health condition, maternity/parental obligations, inability to balance university and work, priorities (job), personal reasons (preferring different activities, such as earning money, job / career), poor financial situation, crucial inconsistencies with a specific teacher (s), dissatisfaction with the methods of teaching, low teaching quality, insufficient bureaucratic literacy (knowledge of study conditions, error in the application, failure to register for a new term…), and poorly planned study schedules (Fučík and Slepičková, 2014). This segmentation is very detailed. The issues of specification of reasons for failure during a course were also dealt with by Koláčková and Švec (2014). They stated that similar categories of causes which resulted in possible dropout from university were established in individual research studies. However, the research studies differ subject to the criteria used for categorisation and the depth of the established causes.

Such a detailed segmentation was not necessary within the framework of this study to identify the reasons for unsuccessful studying. The faculty paid great attention to the monitoring and assessment of teaching quality so that the great majority of problems are tackled before they can grow and result in termination of study.

Considering the high costs associated with students leaving prematurely, many universities seek to create instruments which would help predict and then eliminate these negative issues. Sung-Po refers to the EDM method (educational data mining) used in Taiwan. It can analyse future chances of individual students and help them face the difficulties in suspending or dropping out of courses, which will increase the quality of university education (Sung-Po, 2015). The effort to create standardised instruments to measure teaching quality is quite common today in other countries as well (Šimsová and Reissová, 2017).

Some teams focus within university dropping out issues on research of specific groups, such as Fichten at al., who look into predictors for dropping out among impaired students (Fichten at al., 2014). A study in the USA tried to identify factors which lead to Hispanic students dropping out of Texas universities (Kent at al., 2017). The team at the Michigan State University investigated whether there is higher probability of dropout in students from foster families (Day at al., 2011). The survey conducted in North Carolina and Virginia established that students using marihuana also face problems with early dropout (Suerken at al., 2016). Another study deals with specific strategies to overcome difficulties in dyslectic students (MacCullagh, Bosanquet and Badcock, 2017). Generally, leaving university prematurely is considered a serious problem appreciated by individual governments, which are the main sponsors of university education (Vlk, Stibůrek and Švec, 2016). Attention is also paid to measures focused on strengthening study achievements. Among the interesting recommendations available in this connection, is, for example, the reintroduction of obligatory participation in seminars and some courses, particularly for first-year

students, to stimulate students´ motivation by way of scholarships paid to students according to their achievements, to pay greater attention to students´ assessments, and a number of others (Švec, Vlk, and Stibůrek, 2015).

Conclusion

The study established the most frequent reasons marked by students as being the causes for dropping out of university. Friedman´s ANOVA showed that there was a statistically significant difference between the assessments of individual reasons. The first three most frequently ranked reasons were: "They do not have sufficient will to overcome obstacles (laziness)" (arithmetic mean of 5.74), "Work is a priority for them" (arithmetic mean of 5.53) and "They do not have sufficient skills ("they cannot manage")" (arithmetic mean of 5.08).

The second objective was to establish whether there are differences between the opinions of full-time and part-time students. The study proved no differences between the two groups of students in the ranking of individual reasons in the first two places, but there were statistically significant differences in the importance of other reasons ranked behind them. The reasons "Studying at a different university is a priority for them" and "Dissatisfaction with the selection of the field of study" are more frequently stated by full-time students (4.122, resp. 5.378) compared to the opinion of part-time students (3.097, resp. 4.417). On the other hand, the reasons "Change in personal status (marriage, pregnancy)" and "Health reasons" appear more frequently in part-time students (4.85, resp. 4.553) compared to full-time students (3.662, resp. 3.625).

Specific measures can be proposed upon the established results to eliminate some reasons leading to students dropping out of university. It is possible that particularly first-year-students would find it very useful if tutors were appointed to encourage them in the new academic environment as well as to help them overcome obstacles. However, some reasons are difficult to eliminate, for example, if full-time students´ priority is work instead of studying (listed as the second most frequent reason in this survey). These trends are very strong in students entering the labour market before completing their education. Such reasons are expected to cease with the follow-up recession with a substantial reduction in demand for labour.

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BENEFITS OF VIDEOCLUBS FOR FUTURE TEACHERS TRAINING

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Abstract

Video has become a regular part of teachers' training. The impact of videoclubs on the development of teachers' professional competences is described by many studies. Our research focuses on how future teachers of mathematics and art education assess the benefits of videoclubs for their professional development. The probe is part of a wider research project which takes place at Charles University. Within its framework, in the autumn of 2016, five videoclubs were organized for future teachers of various subjects. Here we analyse the statements of pre-service teachers of mathematics and art education, which they provided in the questionnaires at the conclusion of these videoclubs. We use the qualitative method of Grounded Theory. We select five questionnaire items aimed at students' self-development. We note the differences in the perception of the benefits of videoclubs between students of mathematics and art education.

Keywords

Art education, mathematics education, professional vision, reflection, videoclub

Introduction

An important part of the professional training of future teachers is the development of their professional vision and the observation of important moments in teaching. Professional vision in education consists of selective attention (noticing) and knowledge-based reasoning (interpreting significant features of classroom interactions). "Thus teachers' professional vision involves the skill to notice and interpret significant features of classroom interactions" (Sherin and van Es, 2009: 22). The important teaching and learning moments are those which have been shown to play the key role in pupils' learning (Vondrová and Žalská, 2015).

The results of many studies show that the reflection of classwork observation is an essential tool for the development of professional vision, and that videoclubs, where participants learn to reflect teaching situations, develop professional vision of teachers (Stockero, 2008). It has been shown that even a short video-course has an impact on noticing skills such as more specific comments, more attention to subject specific thinking and less on pedagogy, more attention to pupils and less to the teacher (Stockero, 2008). The literature also describes the shift of videoclub participants from the evaluation of situations to their interpretation (Sherin and van Es, 2009; Stockero, 2008), while interpretations occur less often and most interpretations are naive statements (Uličná, Stará and Novotná, 2017). Video shows the situations of teaching and learning in a real time; assuming that the video recording is of good quality, it allows them to see the teaching situation comprehensively. Repeated analyses of video recordings enable the participants to perceive overlooked phenomena, think of them and substantiate them with support in theory. Connections between theory and practice should be developed during the teacher's education (Korthagen et al., 2011). A lot of research documents how, through analysing classroom videos, teachers can shift attention toward student learning and cognition (Barth-Cohen, Little and Abrahamson,

2018; Sherin and van Es, 2009; Stockero, 2008). Interventions using video analysis and noticing scaffolds proved to be successful in developing students' noticing important moments (Vondrová, Robová and Pavlasová, 2017).
In the context of our research, we are interested in studies that compare the professional vision of teachers of various subjects. Blomberg et al. (2011) show that the skill of professional vision is subject-specific. They highlight the possible link between choosing a field of study and what and how future teachers of the given field perceive during the lesson.
The objective of the article is to consider how future teachers of mathematics and art education appreciate the videoclubs in relation to their professional development.

Materials and Methods

Our study is a part of wider research project which takes place at Charles University. From October 2016 to January 2017, Charles University implemented a research study dealing with the development of professional vision of 44 future teachers of five various subjects (mathematics, biology, art education, English language, social science) through videoclubs in which students – under the guidance of a subject specialist – reflected and discussed video recorded lessons from their field of study. Students of each subject were randomly divided into two groups-videoclubs marked as *experimental group* (EG) and *control group* (CG). In total, five videoclubs were thus created (for experimental groups and control groups). Each videoclub included 4-5 students. Within their videoclubs, the students in EGs also jointly prepared and taught two classes whose video recordings they subsequently analysed; students in CGs reflected only video demonstrations of foreign classes. Teaching in videoclubs took place based on a common methodology agreed by the researchers.
This paper is devoted to the final part of the research, in which the participants in videoclubs obtained the same output questionnaire; data collection was performed through Moodle system. The questionnaire contained 16 open items in the form of incomplete sentences to be completed by the students. The questionnaire items aimed at the reflection of videoclubs in terms of their organization, methodology, content and benefits for further professional development of the participants. We then analysed the questionnaires submitted by future teachers of mathematics and art education (n = 18, see Table 1). Our interest focused on whether and what differences occur between the responses of students of the exact field such as mathematics and students of human-oriented art education. This part of the research includes two research questions:

- How do future mathematics and art education teachers reflect on the benefits of video clubs for their professional development?
- What differences are there between future mathematics and art education teachers in terms of the perception of videoclubs benefits?

Table 1 lists participants in this part of the study. At the time of data collection, all of them were fourth-year students at Charles University in Prague. Future teachers of art education did not have much experience with their own teaching at school, except for the leadership of art education afterschool clubs. Future teachers of mathematics were in a similar position, but they provided private supplementary tutoring on a long-term basis.

Videoclub	Experimental group (EG)	Control group (CG)	Number	Total
Art Education (AE) - future primary teachers	5	5	10	18
Mathematics (MA) - future lower and upper secondary teachers	4	4	8	

Table 1: Participants, October 2016- January 2017 (source: own calculation)

The number of participants in our study seems to be small. However, also other studies aimed at examining the professional vision of future teachers have worked with similarly large groups of students (Barth-Cohen, Little and Abrahamson, 2018; Sherin and van Es, 2009; Stockero, 2008). The main tool for questionnaire processing was therefore qualitative data analysis.

During the qualitative data analysis, we first processed all the items in the questionnaires independently of the study field of videoclub participants (art education, mathematics, English language, biology, social sciences) and the specific group (EG, CG). The questionnaires were analysed by *open coding* according to the methodology of *Grounded Theory* (Strauss and Corbin, 1998). The *Grounded Theory* includes a set of inductive and deductive procedures for conducting qualitative research aimed at building theory from an empirical basis. The basis of the analysis is conceptualization and categorization of the collected data, which take place in three phases: *open*, *axial* and *selective coding*.

In the first phase of the analysis, the *open coding*, the authors of this paper repeatedly browsed the obtained data. They searched for keywords that characterized the phenomena noticed in students' responses to individual questions of the questionnaire, e.g., *reflect classes,* or *monitor pupils' reactions to suggestions*. The students' responses mostly consisted of several sentences or complex sentences; therefore, one to several keywords was assigned to each response.

In the second phase, the *axial coding*, the designation of phenomena was organized through mutual relationships. For example, designations of phenomena such as *goal analysis, work with goals, goal setting, goal achievement* was summed up in the common code *class goals.* The created codes were further refined or merged into more general *categories*. During the refinement of the codes and coding of students' statements, the number of categories and their anchoring were reduced. The phases of *open* and *axial* coding blended together; during the analysis, the investigators continuously returned to the input data, i.e. to students' statements, thereby verifying the categories.

The final third phase of data integration, *selective coding*, produced the definitive list of categories. All occurrences of a particular category were always included into the total number of its occurrences in the questionnaires independently on the questionnaire item.

At the end of the coding process, the obtained list of categories was verified by searching for questionnaire statements with regard to each established category as well as questionnaire questions.

Within the next data processing, as for the *first research question*, we focused on the five selected questionnaire items which explored the subjective view of the students regarding the videoclub benefits for their professional development. These included the following questionnaire items:

- In this videoclub, I realized…
- In this videoclub, I have learned…
- I see the greatest sense in…
- For my future teacher's profession, I think that I will use…
- I would recommend the videoclub to classmates because…

In these items, we focused on the most significant categories present in the responses of students of both fields[1], i.e. MA and AE; due to the small research sample, we considered those categories that occurred in the given item in about a quarter and more students.

Regarding responses to the *second research question*, we further compared the categories between MA and AE fields; we also relied on students' statements in questionnaires.

1 Differences between experimental and control groups are surveyed within another part of wider research at Charles University.

Results

In the introduction to this chapter we present the results of research related to the first question of how future teachers of mathematics and art education assess the benefits of videoclubs for their professional development. The result of the response coding process in the five selected items is a list of six categories that summarize the personal view of MA and AE students regarding the videoclub benefits (Figure 1).

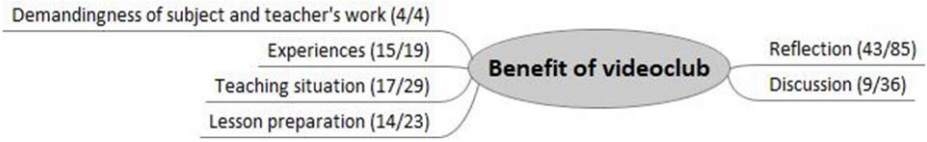

Figure 1: List of categories with their occurrence in selected / all items, 2016-2017 (source: own graph)

Students realize the *demandingness of subject and teacher's work*, the importance of lesson planning within *lesson preparation* as well as the importance of *experiences* gained in videoclubs. Students have also understood that the *reflection* is a key element of the teaching profession, that the *discussion* allows for sharing experiences and mediates other views and approaches to *teaching situations*.

Figure 1 shows that the students' statements in the five items surveyed mostly contain the category *Reflection* (43 occurrences, 85 occurrences in all questionnaire items); this category is followed by the category *Teaching situation* (17 occurrences / 29 occurrences). The other two categories, *Experiences* and *Lesson preparation*, are represented almost equally (15 and 14 occurrences /19 and 23 occurrences). The category *Demandingness of subject and teacher's work* occurred only in 4 statements in items surveyed and did not appear in any other questionnaire item.

In the first item (what the students realized in the videoclub), we identified three categories: *Demandingness of subject and teacher's work, Teaching situation* and *Reflection.* The students' view of the benefits of videoclubs for their own professional development is also illustrated by specific statements provided in the questionnaires. Table 2 lists examples of coding the students' statements.

Category	Statement
Demandingness of subject and teacher's work	*…, that the teacher has a much greater influence on the pupils than I thought. He/she not only shares information but is primarily responsible for the approach which pupils take to the subject.* (MA)
Teaching situation	*…, how it is important to perceive the pupils' reaction to the subject matter and to notice also inconspicuous reactions that may mean lack of understanding.* (MA)
Reflection	*…, how it is important to retrospectively reflect own work. Teacher can thus learn from his/her mistakes.* (AE)

Table 2: Examples of statements from the first item, 2016-2017 (source: own research)

In the second item surveyed (what the students learned in the videoclub), the students' statements were mostly coded using categories *Teaching situation*, *Reflection* and *Lesson preparation.* In the third item (what meaning of videoclubs they see), we identified categories *Teaching situation*, *Reflection* and *Discussion*. In the penultimate fourth item surveyed (what they will use in their profession), the most frequent categories were *Reflection* and *Experiences.* In the last fifth item (why they would recommend the videoclub), the statements were coded by categories *Reflection*, *Lesson preparation* and *Experiences.*

The following results relate to the *second research question*. We compare the perception of the benefits of the videoclub between MA and AE teachers. Figure 2 illustrates the occurrence of

categories in the five items surveyed in future MA teachers. For example, in the first item of the questionnaire (what the students realize), the figure shows that the responses were coded by category *Demandingness of subject and teacher's work* in less than half of the cases (44 %), by category *Teaching situation* in one third of cases (33 %) and by category *Reflection* in 23 % of cases. However, not all of the categories identified in this part of the study have occurred in the future teachers of mathematics – see the categories *Discussion* and *Experiences*. Interestingly, all included statements of future MA teachers in the fourth item (what they will use in their profession) were related to the category *Reflectin* (100 %).

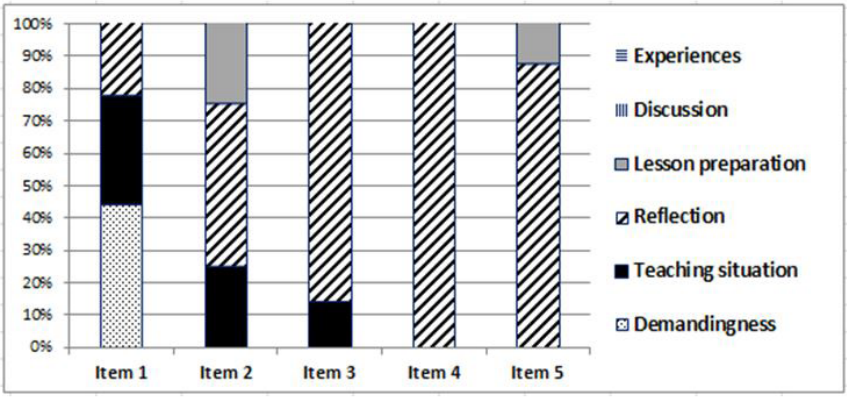

Figure 2: Occurrence of categories – mathematics teachers, 2016-2017 (source: own graph)

Figure 3 shows the distribution of the six categories obtained in responses of AE students. If we look at the first item, it is clear that the included statements were coded by only two categories – *Teaching situation* (a third of cases) and *Reflection* (two thirds of cases).

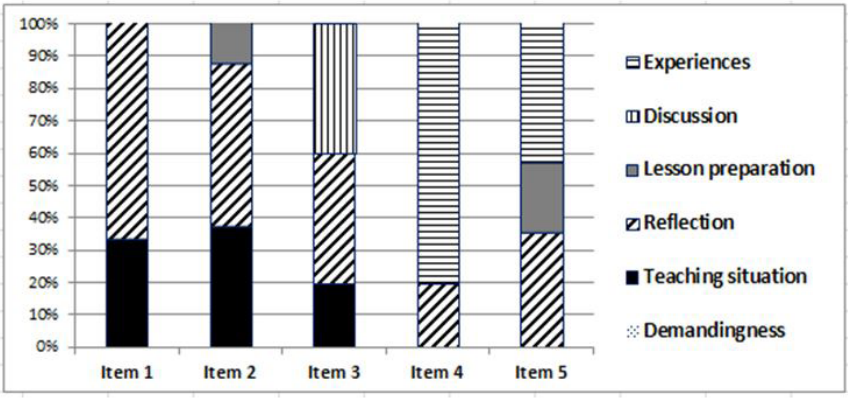

Figure 3: Occurrence of categories – teachers of art education, 2016-2017 (source: own graph)

Comparison of Figure 2 and Figure 3 shows the main differences between students in both fields. These include the occurrence of category *Demandingness of subject and teacher's work* only in MA teachers (first item), and the occurrence of categories *Discussion* and *Experiences* only in teachers of art education (third, fourth and fifth item).

For both groups, we congruously identified the category *Reflection* in all five surveyed items of the questionnaire. Categories *Teaching situation* and *Lesson preparation* occur in both fields in the same items of the questionnaire, i.e. the first to third item, although in different percentage representation.

Discussion

This study examines how future teachers perceive the benefits of videoclubs for their professional development and how this perception varies between MA and AE teachers.

First, we focus on *common features* in students' statements which were analysed. In all items surveyed, students of both fields are equally aware of the importance of reflection, i.e. the skill to reflect teaching, for their future practice. This is the strongest category. It is clear that students consider this as the main benefit of videoclubs for their professional development. Therein, the perception of students is consistent with the literature that emphasizes the importance of reflection for professional development (Korthagen et al., 2011; Stockero, 2008; Schön, 1983). MA and AE students also agree on the fact that the videoclub teaches them to focus on specific educational situations, which they consider meaningful. Students from the two groups also perceive that the videoclub taught them to plan the lessons and that they will use this skill in their future practice (students from our study did not have a longer teaching experience so far).

Different features in the perception of the benefits of the videoclub between MA and AE students can especially be seen in categories *Demandingness of subject and teacher's work, Discussion* and *Experiences.*

In our survey, the *Demandingness of subject and teacher's work* is perceived only by MA students whereas AE students' statements do not fall under this category; this may be related to the type of their studies. AE teachers from our study are prepared for primary schools while MA teachers are prepared for lower and upper secondary schools. The training for primary schools includes all school subjects [2]. This type of training for teaching profession does not allow a deeper field study compared to the training for higher grades of education. It is therefore possible that future primary school teachers do not realize the scope and complexity of individual subjects including AE (Pavlasová et al., 2018). Another reason can be the specialization of students, which affects professional vision (Blomberg et al., 2011; Steffensky et al., 2015). It may also be due to the fact that mathematics is a key school-leaving subject in our country, while art education is among the marginal subjects that often have to defend their position in the education system (Eisner, 2015; Swift and Steers, 1999).

The benefit of joint discussions is mentioned only by AE students as the category *Discussion* appeared only in their group and only in the third item. We think that the opportunity to jointly discuss teaching situations is important for AE students because their responses indicate the importance of mutual communication and cooperation. The importance of cooperation is also highlighted by Barth-Cohen, Little and Abrahamson (2018) in their conception of videoclubs, for example. In our opinion, the importance of discussion also consists in the development of the ability to argue and defend own views. Future teachers of mathematics learn the skill to argue continuously in the professional part of their training, which may be the reason why they do not explicitly mention the benefit of discussions.

In contrast to MA teachers, the future teachers of AE also state that they will make use of videoclub *experience* in practice; in most cases, they mean inspiration or ideas for teaching AE. In our opinion, this is again due to the influence of the students' field of study (Blomberg et al.,

2 Within their professional training, the future teachers of the first grade can *partly* focus on some of the subjects: art education, music education, physical education and foreign language.

2011), namely the influence of different availability of quality teaching materials for teaching mathematics and teaching art education.

Conclusion

Students from our study are consistent with experts regarding the importance of reflection for professional development of teachers. However, the obtained results indirectly show that the reflection of teaching is not yet a common part of their professional training because otherwise they would not perceive this benefit so strongly. Compared to teaching practice, we think that other positives of the videoclub include the opportunity to repeatedly observe and analyse teaching situations, and immediately link the theoretical knowledge to practice. However, the analysis of the questionnaire items indicate that MA and AE students only rarely ranked the mentioned positives among the benefits of the videoclub.

The outcomes of this study may serve as an important guideline for further development of videoclub methodology. Understanding the students' opinions on the benefits of videoclubs can contribute to improving the quality of student teachers' professional development.

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HOUSEHOLDS OF SECONDARY SCHOOL AND UNIVERSITY STUDENTS: THE CASE OF THE CZECH REPUBLIC

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Abstract

The social and educational background of the students influences the choice whether they continue the studies at the university or not. This assumption can be confirmed by using the individual data from household survey Statistics on Income and Living Conditions that contains not just the educational level of the head of the family, but the information about the education of children living at the household as well. The results based on the logistic regression prove that the social background, gross income and level of the material deprivations of the household influence the decision to continue the study at the university level in the Czech Republic. The higher social status the family have the highest probability of the University student as the member of the family is.

Keywords

Educational background, EU-SILC, social background, logistic regression, social selectivity

Introduction

The impact of the social status on a student has been a topic of studies and discussions for many years. The significant impact of parental education on the college graduation of the children has been already analysed before almost 50 years by Sewell and Shah (1968). Changes in inter-generational transmission in the Czech Republic after the WWII have been deeply analysed by Simonová (2009). Considerations of tuition fees and financial support for students helped bringing the topic forward in recent years since Matějů et al. (2009) stated that the system of universities in the Czech Republic was significantly more social selective in comparison with universities abroad. The decision to attend universities represents topic of several studies across the world. Becker and Hecken (2009) analysed high schools graduates in Germany that have to make the decision to enrol to university or not. Authors focus on what social class divided based on the profession of the parents these graduates are connected with. Furthermore, Bowden and Doughney (2012) investigated the decision to attend university in upcoming years and its relationship to economic and cultural background of graduates in Australia. On the other hand, Chevalier et al. (2013) were interested in graduates in the United Kingdom that choice not to attend university. They examined parental income and the results of students at the secondary school levels in the United Kingdom and they found that male students with uneducated parents are the most likely to drop out of school.

Some Czech researchers already investigated the problem of social selectivity using data from the Survey on Adult and Education 2011 (Fischer and Lipovská, 2013), survey targeted to the highly talented students Talent 2016 (Lipovská and Fischer, 2016) or survey focused on the living and social condition of university students EUROSTUDENT V (Šimková and Švarcová, 2014). Fischer and Lipovská (2013) proved the influence of the parental educational level on the participation in activities of formal and non-formal education in adulthood and the income of the

household of the participant family as well. Moreover, they learnt that Czech adults are mainly influenced by parents who reached the higher educational level. Further, Lipovská and Fischer (2016, p. 324) discovered that most of the talented students at the secondary schools originated from the complete '*highly educated families with tradition in their field of interest and long positive attitudes toward accumulating the knowledge*'. Moreover, they confirmed important role of the teachers in the support and guidance of students. On the contrary, Šimková and Švarcová (2014) detected significant impact of family social status on university students' life. Based on the EUROSTUDENT V survey data students from low-income family more frequently work during their studies. Moreover, they usually under evaluate themselves and their chances on both national and international labour markets or finish the study before the next level.

This article aims to compare households of secondary students and university students and by the statistical methods find significant factors for both groups. The article investigates what different variables indicates families of secondary and university students in the Czech Republic using data from Statistics on Income and Living Conditions survey. In contrary to previous studies, this article uses unique data which could help to answer question if the education in the Czech Republic is really social selective.

Materials and Methods

One of the possible way how to evaluate the influence of social background of students is using data from the household survey Statistics on Income and Living Conditions (European Commission, 2014, hereafter: EU-SILC). This survey aims at collecting timely and comparable cross-sectional and longitudinal multidimensional microdata on income, poverty, social exclusion and living conditions of households with information about its structure. The data for the EU-SILC comes from years 2009 to 2015. For the purpose of the analysis the data was restricted to households containing at least one student studying at the secondary school or university level. Throughout this analysis, the group of households with a student only studying at the secondary school level is considered to be a reflection of the total population (households with both are in the university group). Some of these students will go on to attend university while others will continue to enter the labour market.

Households with only one person were omitted from much of the analysis due to the fact that the head of the household is the student themselves and their education and income responses are not an accurate reflection on their family background. Therefore, the sample contains of 3,329 observations, where 46.8% secondary school, 53,2% University. Respondents who did not report their household income were removed from any analysis that contained income per capita as a variable. Analysis was conducted on examining the subpopulation of households with at least one member attending university.

For the evaluation of the relationships between the variables, we use two sample *t*-tests and the logistic regression. Using logistic regression, we predict the probability of outcome variable Y occurring given known values of predictor variable X (Field, 2009).

Logistic regression is based on one dependent variable level of study and three independent variables that could thoroughly describe the social selectivity within the Czech education system. Namely education level of the head of the family, gross income divided by number of people in the household, degree of material deprivation. Education level of the head of family was split according to International Standard Classification of Education ISCED (UNESCO, 2012). Material deprivation variable includes 9 items which could be missed by household. For each household the score of this variable is between 0 and 9.

Binary logistic regression was finally conducted on data where the dependent variable for binary logistic regression was a simple variable that indicated if a household contained a student at

university or not. Firstly, the significance of the variable in the model was examined and then a large model was constructed using significant variables to determine which variable has the largest influence on the decision. Binary logistic was extended by variable 'Type of working activity based on EU specification' which was re-categorized into three groups, employed, unemployed and pensioners. Then only the differences between the work activities 'Employed' and 'Unemployed' was investigated since these are the two groups we are interested in for the analysis without the pensioners.

For Binary logistic regression, education level was re-grouped as from 0-9 levels of education to two groups. The new groups are 'No higher education (ISCED 0-4)'and 'Higher education (ISCED 5-8). Moreover, variable 'Degree of material deprivation' was re-grouped from the 10 levels of material deprivation into 3 groups. The new groups are 'none', 'one item' and 'two or more items'. The category 'two or more items are use as the ref. category'.

Results and Discussion

Distribution of households of Secondary school and University students by the highest education of the head of household displays Figure 1. The majority of households are leaded by heads with secondary education (with or without A levels). The distribution differs for households of Secondary school students and University students. For Secondary school students the highest share of households – around 45% – is leaded by heads with the highest education level 3 - Practical Schools (without A levels), slightly lower is for households where head has High school (with A levels) – 36% and the third highest ratio is for households where head has Master's degree education – 12.2%.

For households of university students, the distribution is shifted to higher education groups. Share of households where head has High school (with A levels) is very similar as for households of Secondary school students – around 36%, but for Practical Schools (without A levels) the share is much lower than for Secondary school students – only 34%. In contrary share of households where head has Master's degree education is much higher – 23.5%, which means that the share is almost doubled.

As next variable Gross income per person in the household was analysed. Figure 2 shows the distributions for both types of households. The distribution of income of households with University student is shifted up and also dispersal is wider. For the households with only a student in secondary school the 25th percentile was at 96,340 CZK per person per year. The 75th percentile amounted to 185,000 CZK per person per year. The population of households with at least one university student was examined next. The 25th percentile was at 117,699 CZK per person per year and the 75th reached to 221,419 CZK per person per year. That is a difference at the 75th percentile of 36,419 CZK per person and year.

The mean for households containing high school students amounted to 158,335 CZK. On the contrary, the mean for households containing university students was 190,942 CZK. Conducting the independent sample *t*-test, it shows that the difference of the means when it comes to income is significant with 0.000. Households that contain university students have a larger income compared to households with Secondary school students.

The next variable that was examined was financial issues variable. 'Degree of material deprivation - 9 items' shows that for the group containing a high school student we get the result of 1.15 (households were missing 1.15 item in average). The group containing a university student has a mean of 0.76. A higher value indicates a higher degree of material deprivation (scale 0-9). According to the independent *t*-test the means differ significantly (0.000). The results show us that households containing a high school student are worse off financially when it comes to material deprivation compared to households containing a university student.

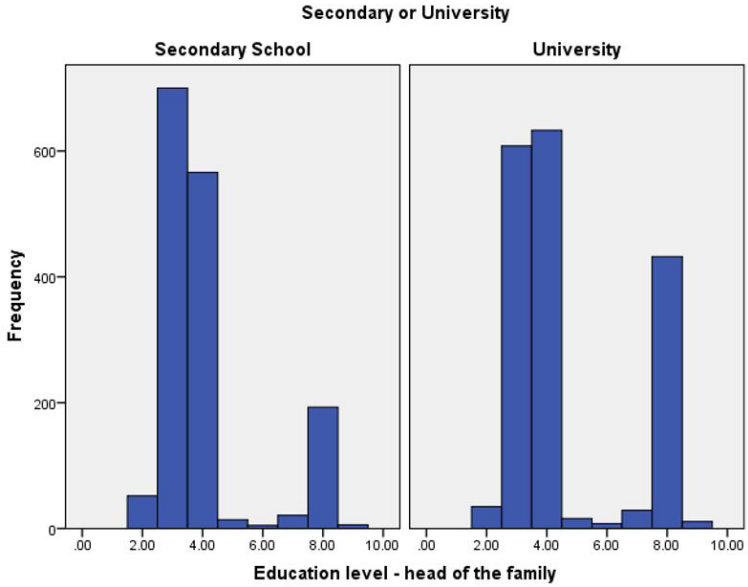

Figure 1: Structure of Secondary school and University families by the highest attained education level of the head of the family, Czech Republic, 2009-2015 (source: EU-SILC, own calculation)

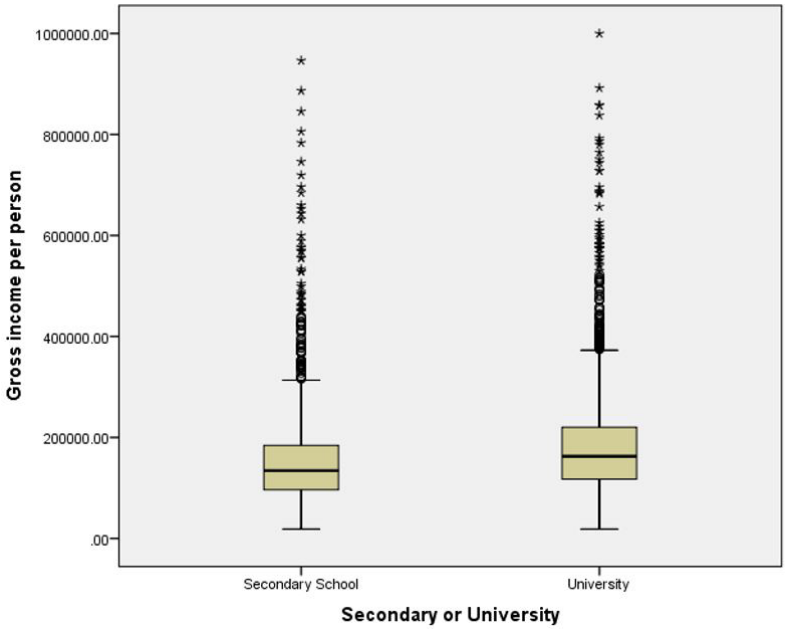

Figure 2: Gross income per person distribution of households with Secondary school and University students, Czech Republic, 2009-2015 (source: EU-SILC, own calculation)

The last part of the analysis is focused on binary logistic regression. We did single variable models as well as one bigger including several variables. Regarding the single variable models, we started with the variable 'Type of work activity' (head of family employed or not employed). The results show that the households where the head of the family is unemployed are less likely (0.519) to have a student at the university level compared to the households where the head of the family is employed (sig. 0.001). For the variable 'Education level - head of the family – grouped' results are the following; households where the head of the family has a high education are more likely (2.207) to have a student at the university level compared to the households where the head of the family has a low education (sig. 0.000). The binary logistic regression for the variable 'Degree of material deprivation - three groups' tells us that the households that have 'none' material deprivation are more likely (2.047) to have a student at the university level compared to the households that have a material deprivation of 'two or more items' items (sig. 0.000). Results also show that households that have 'one item' in material deprivation are more likely (1.387) to have a student at the university level compared to the households that have a material deprivation of 'two or more items' items (sig. 0.001). When it comes to the income variable 'Gross income per person in the household' a model using the unit change of 100,000 CZK (this was based of the quartiles). The model shows that a change of 100,000 CZK in income for a household gives us the value of exp (β) = 1.501.

One larger binary regression model was constructed to examine the relative importance of the significant variables in a student's decision to continue studying at the university level. The variables selected for this larger model were the education of the head of the household (non-university or university), household income per person divided by 100,000 CZK and material deprivation in number of items as used in the previous model. These variables can be shown to be correlated. The results from the larger model (table 1) show that an increase in the education level of the head of the household from non-university to university causes the largest increase in the likelihood of a student to attend university themselves. Followed by the income variable and a decrease in likelihood by an increase in material deprivation.

Variable	B	Exp (B)
Income	0.271	1.311***
Education	0.566	1.762***
Material deprivation	- 0.190	0.827***

*Note: Odds ratios, ***0.001*

Table 1: Logistic regression results (source: own calculation)

Despite the fact that results of this article are based on very simple analysis, we can state that these results are unique in many ways. Literature review shows that there are no detailed analyses of economic situation of households with students in the Czech Republic (does not matter if secondary school or university degree). Also, the fact that data from EU-SILC survey were used represents unique method. Even though this data includes information about household members, the analysis of social selectivity of students based on this data source does not exist.

Looking at the international comparison the analyses of the social selectivity of the students based on EU-SILC data do not exist. Researchers focus on the data from different data sources such as census or different household surveys as Labour Force Survey thus indicators with different definitions. Nevertheless, we can find several papers that try to find the relation between family background and the attendance of the University. For example Björlung and Dalvanes (2010) studied how family background effected educational attainment in Sweden and the Great Britain. The results from studying the sibling correlations showed significant results from an inequality point of view when it came to explain a student's education attainment based on family

background. Parental education and income could only account for a third of what siblings had in common on family background factors. Moreover, Falck and Salih (2017) investigated why students from high social classes tend to pursue a higher education in a larger extent than students from lower classes in Sweden. The data came from the survey conducted by Stockholm University in partnership with the government agency. The results showed that the social class of the student was significant in the decision to move on to a higher education.

Conclusion

Results presented in this paper are based on the binary logistic regression. They prove the higher social status the family have the highest probability of the University student as the member of the family is. All the analyses were based on the independent variables educational level of the head of the family, gross income and degree of material deprivation. Using these variables in one model, we can state that the increase in the education level of the head of the household from non-university to university causes the largest increase in the likelihood of a student to attend university themselves followed by the income and decrease in likelihood by an increase in material deprivation. These results can serve as a policy tool to the Ministry of Education, Youth and Sports representatives who can try to reduce the social exclusion by targeting students from the lowest socioeconomic status families and force them to attend the higher education. Mainly by the state support for the higher education students (as it was assumed to be done after the Tertiary education reform) and higher value of scholarships which are targeted to the students from low-income families.

EU-SILC data covers each of the family for more than one year. Thus, there is still the space to use different statistical method and tool to prepare the longitudinal analysis for individual countries.

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WRITTEN TESTS VS CONCEPT CARTOONS: THE CASE OF FUTURE TEACHERS AND FRACTIONS

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Abstract

The contribution investigates opportunities that an educational tool called Concept Cartoons can offer in future teachers' education, namely in comparison with word problems in standard written tests. Participants of the referred empirical study were future primary school teachers who solved four word problems with increasing difficulty within the written test, and the fifth problem with a similar difficulty as the third one in the Concept Cartoon form. Comparison of results and solution procedures revealed participants who excellently mastered the four word problems but displayed a fundamental misconception when working with the Concept Cartoon. All of the problems in the study were based on the part-whole interpretation of fractions, the misconception consisted of incorrect determination of the whole.

Keywords

Concept cartoons, fractions, future primary school teachers, problem solving, word problems

Introduction

During university preparation, mathematics content knowledge of future teachers is often assessed through standard written tests where future teachers solve various calculation tasks and word problems. In my recent work, I have studied an educational tool called Concept Cartoons and its opportunities in assessing various aspects of future teachers' knowledge, e.g. the openness of their approach to mathematics (Samková and Tichá, 2016b), their reasoning (Samková and Tichá, 2017b), informal foundations of pedagogical content knowledge (Samková, 2018). And so naturally a question arose whether Concept Cartoons could provide us with information on mathematics content knowledge that might not be obtained by standard written tests. This question led to a qualitative empirical study that will be reported here.

As in previous studies, I will focus on future primary school teachers, i.e. future teachers for pupils from 6 to 11 years of age. The mathematical topic in the centre of the study will be the topic of fractions, namely the part-whole interpretation of fractions. I will approach it in the framework of word problems and Concept Cartoons. The topic of fractions is very important for future primary school teachers, there are many empirical studies reporting that the topic belongs to the most difficult ones for pupils (Lamon, 2006; Ryan and Williams, 2011; Steffe and Olive, 2010) as well as for future teachers and teachers (Cramer and Lesh, 1988; Ma, 1999; Depaepe et al., 2015).

From the perspective of ERIE conferences, the topic of the contribution is in relation to educational issues such as students' solving strategies (Novotná and Vondrová, 2017), error analysis of students' solutions (Medová et al., 2017), and knowledge-based reasoning (Vondrová, Robová and Pavlasová, 2017; Uličná, 2017). It directly follows the issues presented by me and my colleague at the two previous ERIE conferences (Samková and Tichá, 2016a, 2017a).

The contribution is organized as follows: at the beginning it presents word problems on fractions in the framework of the primary school curriculum, and introduces participants of the study and

employed tools (written tests, Concept Cartoons). Then it describes the course of data collection and data analysis, presents findings and discusses them.

Fractions at primary school level

At primary school level in the Czech Republic, the topic of fractions consists of the concept of a fraction per se, which is fundamentally interpreted through part-whole or part-part interpretation. The part-whole interpretation is based on partitioning either a continuous quantity or a set of discrete objects into equal-sized subparts or subsets (Behr et al., 1983; Lamon, 2006). In word problems, pupils usually deal with requirements to ascertain a fractional part for a given whole, a whole for a given fractional part, or a complement of a given fractional part to a whole. In more difficult tasks they also deal with requirements to ascertain a fractional part when another fractional part with the same whole is given. As the time goes, the pupils meet more complex tasks combining several different fractional parts (either with the same whole, or with different wholes), and also tasks that are based on one or more fractional changes (each of them is applied either on a whole, or on a part). To solve such tasks successfully, the pupils as well as the teacher have to be well oriented in the situation described in the word problem, and have to decide properly about the parts and the whole in the situation. For task samples see Table 1.

T1	There are 16 girls in our class, which is 4/7 of all pupils. How many boys are there?	one whole, two different fractional parts, one fractional part being a complement of the other, requirement to ascertain a fractional part when another fractional part with the same whole is given, the number in the assignment is not the whole
T2	A greengrocer came to a market for two days. On Monday he sold 3/8 of his potatoes, on Tuesday 4/5 of the rest. How much of the potatoes was not sold? How many kilograms of potatoes did the greengrocer bring to the market provided he sold 200 kilograms on Tuesday?	two different wholes, one of the wholes is a complement of a fractional part to the other whole, requirement to ascertain a fractional part for a given whole, requirement to ascertain a whole for a given fractional part, the number in the assignment is none of the wholes
T3	A bookseller discounted the price of a book by a quarter to 60 crowns. How many crowns did the book cost before the discount?	one whole, one fractional change (decrease) of the whole, requirement to ascertain the state before the change for a given state after the change and a given fractional change, the number in the assignment is not the whole
T3*	Today's audience at the athletic stadium equals 8000. It's a quarter more than yesterday. What was yesterday's audience?	one whole, one fractional change (increase) of the whole, requirement to ascertain the state before the change for a given state after the change and a given fractional change, the number in the assignment is not the whole
T4	A breeder keeps rabbits. Currently, 1/3 of his rabbits are white, and the others are grey. The breeder plans to give 3 grey rabbits to his neighbour today, and get 3 white ones for exchange. After this exchange, the proportion of white rabbits will rise to 4/9. How many rabbits does the breeder have?	one whole, one change of a fractional part with no effect on the whole, requirement to ascertain the whole from a given state of the fractional part before the change, a given state of the fractional part after the change and a given change, the number in the assignment is not the whole

Table 1: Samples of various word problems on fractions, increasing code numbers in the first column refer to increasing difficulty of the problems; attributes of the problems are listed in the last column

Materials and Methods

My study addresses the research question "Can Concept Cartoons provide us with information on mathematics content knowledge that might not be obtained through word problems in standard written tests?"

Participants

Participants of the study were 23 future primary school teachers, completely all students of the second year of five-year master degree program at the Faculty of Education, University of South Bohemia in České Budějovice. They are not math specialists; after graduation they are expected to teach all primary school subjects. In the time span of the referred study, the participants were attending a university course on mathematics.

Diagnostic instruments

As diagnostic instruments in my study I use a standard written test and a Concept Cartoon. In the written test, the participants solved four word problems with increasing difficulty: T1, T2, T3 and T4 from Table 1. The participants had to solve the tasks within the framework of primary school mathematics, i.e. they were not allowed to use unknowns and equations.

With the Concept Cartoon, the participants obtained a bubble-dialog picture related to the task T3*; the picture is presented in Figure 1. They were asked to decide which children in the picture were right and which were wrong, and to justify their decision. The form of the work with the Concept Cartoon was the same as with the written test: individual and written. The method of how to use Concept Cartoons for diagnosing knowledge of future teachers and the particular Concept Cartoon from Figure 1 had been already tested previously (Samková and Tichá, 2017b; Samková, 2018).

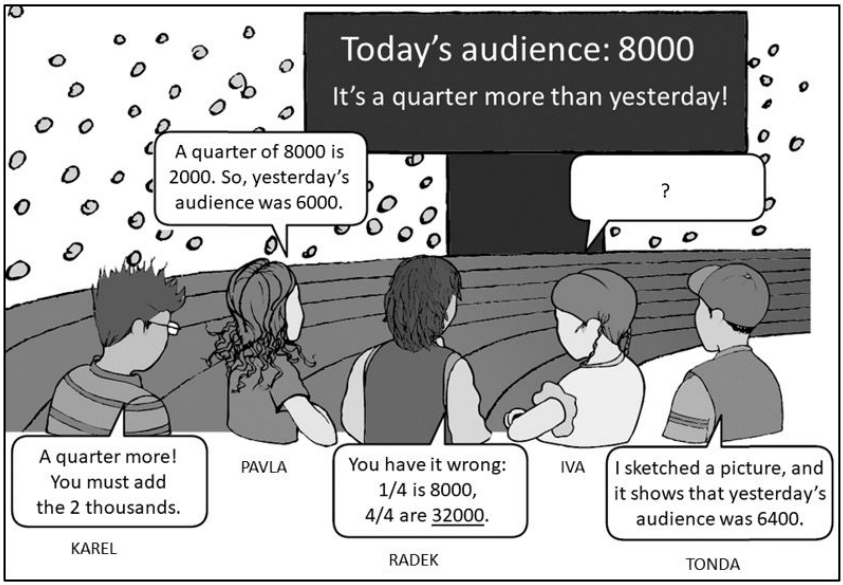


Figure 1: A Concept Cartoon related to the task T3*; (source of the template of children with empty bubbles: Dabell, Keogh and Naylor, 2008: 2.16)

Data collection and data analysis

All the data were collected at one time: first, the participants took part in the written test, and submitted it, immediately after they worked on the Concept Cartoon. The test served as a part of

the course assessment, i.e. it took place after the topic of fractions was discussed at lectures and properly practised at course seminars.
When analysing data from the written test, I initially registered combinations of word problems that were successfully solved by individual participants, and strategies that the participants used during solution process. When analysing data from the Concept Cartoon, I initially registered combinations of bubbles that were chosen by individual participants as right, combinations of bubbles that were chosen as wrong, and strategies that the participants used in their justifications. Afterwards, I analysed mutual relations of the two types of combinations and strategies.

Results

Written tests

Initial analysis of data related to written tests showed that for all of the participants the success directly depended on the difficulty of the tasks: T4 was successfully solved only by participants who succeeded in T1, T2 and T3; T3 was successfully solved only by participants who succeeded in T1 and T2; T2 was successfully solved only by participants who succeeded in T1.
Such an arrangement allowed me to distribute participants into five groups according to their success, and I labelled the groups by numbers corresponding to the most difficult tasks that the participants successfully solved: WT0 (no task solved), WT1 (only T1 solved)..., WT4 (all tasks solved). There were 6 participants in WT4, 7 in WT3, 2 in WT2, 6 in WT1, and 2 in WT0.
In further analysis, I focused in detail on the task T3. The participants in their solutions to T3 offered four different numbers as results, and achieved these results by six different procedures. The results and samples of corresponding procedures are presented in Table 2.

80 [13]	75 [6]	240 [3]	300 [1]
60... 3/4 60: 3 = 20... 1/4 20 · 4 = **80**... 4/4	60: 4 = 15... 1/4 60 + 15 = **75**	1/4 = 60 4/4 = 60 · 4 = **240**	60 · 4 = 240 240 + 60 = **300**
	now... 4/4... 60 before... 5/4 60: 4 = 15, 15 · 5 = **75**	1/4 from 60 = = 60 · 4: 1 = **240**	

Table 2: Various results and various solution procedures to the task T3, the column with the correct result is shaded; numbers of participants with a given result are indicated in square brackets

We can see that both the procedures leading to the result 75 proceeded from the incorrect identification of the whole; they were based on a similar misconception as in the Pavla's bubble. The first procedure leading to the result 240 might proceed from careless reading and understanding the text as "to a quarter" instead of "by a quarter"; a similar misconception as in the Radek's bubble. The second procedure leading to the result 240 combined two diverse misconceptions: an incorrect decision to calculate a quarter of 60 to get the result, and a calculation error consisting of reversing the order of division and multiplication when calculating the quarter of 60. The source of the decision to calculate a quarter of 60 is not clear, it might be a consequence of a strategy "take all numbers from the assignment, and do something with them" which sometimes appears among students (Samková and Tichá, 2015). The source of the calculation error probably lies in an unsuccessful effort to learn the calculation procedure by rote. The procedure leading to the result 300 might have a similar source as the first procedure of 240 – a response to a signal "before discount" causing the need for addition as the next step in the procedure. But the participant with

the 300 result did not specify any fractions in the solution procedure, so that the source might also come from the "take all numbers" strategy mentioned above.

Concept Cartoons

Since the Concept Cartoon was not compulsory and had no influence on the assessment of the course, seven of the participants decided not to take part in this activity. There was no relation between their success in the written test and the decision not to take part in the Concept Cartoon part: each of the WT groups was represented among those who refused, by one or two participants. Due to the lack of data from these participants, I had to remove them from the study. So that only 16 participants remained for analysis involving the Concept Cartoon.
According to the responses to the Concept Cartoon, the participants might be divided into two groups: those who expressed the opinion that Tonda was right and the others wrong, and those who expressed the opinion that Pavla was right and the others wrong. These opinions were justified by presenting a solution procedure that the participants considered as correct, the procedures were sometimes also accompanied by illustrative pictures. Samples of procedures and pictures are shown in Table 3.

Mutual relations

According to combinations of results to the task T3 and opinions to the Concept Cartoon, the participants might be divided into 7 groups, as is shown in the diagram in Figure 2. Due to the similarities between the task T3 and the task behind the Concept Cartoon, some of the combinations might be labelled as corresponding, the other as non-corresponding. The corresponding combinations consisted either of both responses correct (80 & Tonda), or of both responses incorrect, based on a similar misconception (75 & Pavla). Such combinations accounted for half of the participants. The other half of the participants displayed non-corresponding combinations of responses: either both incorrect but based on different misconceptions (240 & Pavla, 300 & Pavla), or one correct and one incorrect (80 & Pavla, 75 & Tonda, 240 & Tonda).

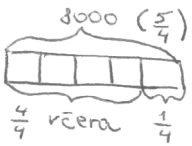
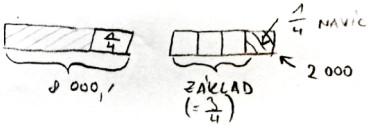
Tonda [9]	**Pavla** [7]
Only Tonda recognized that 8000 is a quarter more than the whole. The whole is 4/4, a quarter more is 5/4. 8000... 5/4 8000: 5 = 1600... 1/4 8000 – 1600 = **6400**	Pavla is true. altogether... 8000 yesterday... a quarter less than 8000: 4 = 2000 8000 – 2000 = **6000**
8000: 5 = 1600 1600 · 4 = **6400** 	Tonda: Where is the picture? Incorrect answer! The picture should be this way:  8000: 4 = 2000 came extra 2000 · 3 = **6000** yesterday

Table 3: Various responses to the Concept Cartoon, the column with correct responses is shaded; numbers of participants who agreed with a given child are indicated in square brackets; translation of texts in embedded pictures: včera = yesterday, základ = the whole, navíc = extra

Three of the non-corresponding combinations are noteworthy: 80 & Pavla, 75 & Tonda, and 240 & Tonda. Participants with a combination 80 & Pavla presented themselves successfully in the written test: they managed to solve the tasks T1, T2 and T3 (i.e. they belong to the group

WT3), some of them even solved the task T4 (group WT4). But responses to the Concept Cartoon showed a misconception about fractions: all of them incorrectly identified the whole in a task, presented incorrect solution procedures, and offered justifications for these incorrect procedures. Even the justifications did not warn them that something might not be right in their procedures.
Participants with combinations 75 & Tonda and 240 & Tonda were all weak in the written test: one of them did not succeed in any of the test tasks (group WT0), the others successfully solved only the task T1 (group WT1). But with the Concept Cartoon they all offered a correct solution procedure justifying the Tonda's bubble. Such an arrangement is surprising; the reason for the discrepancy might lie in the different format of the Concept Cartoon (e.g. in the fact that the numerical result of the correct solution appears inside one of the bubbles) or in the non-compulsory nature of the work with the Concept Cartoon or somewhere else, an exact determination would require more data.
The other combinations were more or less expected: good test solvers that responded correctly to the Concept Cartoon (80 & Tonda), and weak test solvers that responded incorrectly to the Concept Cartoon (75 & Pavla, 240 & Pavla, 300 & Pavla).

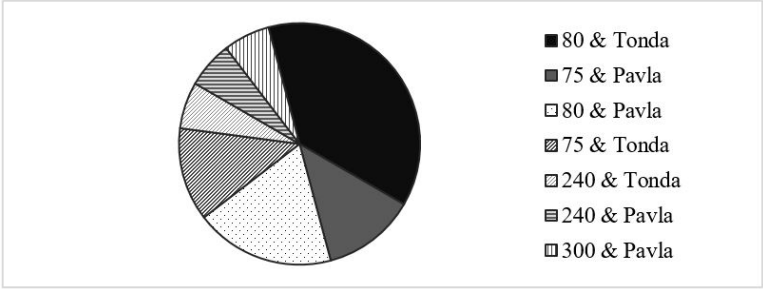


Figure 2: Combinations of responses to the word problem T3 and to the Concept Cartoon, corresponding combinations are colored, non-corresponding combinations are dotted ot hatched, n=16, 2017 (source: own calculation)

Discussion

The results of this study enriched the puzzle on "How can we meaningfully employ Concept Cartoons in future teacher education" by another piece of knowledge. In contrast with standard written tests, Concept Cartoons may reveal participants who look like good test solvers capable to solve word problems of any difficulty, but their capability is just an illusion. For instance, the participants of my study who belong to the WT4 & 80 & Pavla group: they might be considered as excellently mastering the topic of fractions on the basis of the written test, but with Concept Cartoons they displayed a fundamental misconception – incorrect determination of the whole.
There are two different mechanisms that allow Concept Cartoons to uncover the written test illusion: (i) Concept Cartoons offer several alternative viewpoints on the pictured situation, so that they may break the stereotype of "favourite" or "comfortable" solution procedures that the solvers learned for the purpose of the written test, and may temp the solvers to incline to some of the other procedures; (ii) when working with Concept Cartoons, the solvers are asked to provide justifications of their agree/disagree decisions, and so they expose their reasoning on the explored topic outside the common framework of problem solving.
These findings are important in light of the fact that the participants of the referred study were future teachers. Considering the way how Concept Cartoons make the respondents to reason not only in the framework of their "favourite" or "comfortable" interpretation of the topic but also in

the framework of other interpretations, we may understand this tool as a an artificially designed representation of school practice (Samková, 2018), as a result of the process that Grossman et al. (2009) call a decomposition of practice into constituent parts. With such representations we can engage future teachers in discussions about various aspects of teaching (mathematics content, classroom communication, etc.), and the representations may serve as mediating tools between teaching practice and future teacher education (Herbst and Chazan, 2011). In that sense, the representations may also indirectly promote the development of noticing and knowledge-based reasoning (Vondrová et al., 2017; Uličná, 2017).

From the perspective of the topic of fractions, the findings confirmed the difficulty of the topic for future primary school teachers that was reported e.g. by Cramer and Lesh (1988), Ma (1999), Depaepe et el. (2015): almost half of the participants of the referred study did not solve correctly a word problem based on one fractional change of the whole (T3), as they did not grasp the task properly and/or did not identified properly the whole in the task. This happened also with a similar word problem (T3*) which was assigned in the Concept Cartoon form. Even the correct result that numerically appeared inside one of the bubbles did not help. From the perspective of strategies that the participants used when they solved the tasks, the findings meet the results of previous research where similar tasks were used (Lamon, 2006; Tichá and Macháčková, 2006; Samková, 2018): typical correct solution procedures as well as common misconceptions appeared in solutions, some of them accompanied by visualizations.

A comparison of strategies and results related to the two similar tasks (T3, T3*) illustrates how diverse information can be provided by word problems and Concept Cartoons: only half of the participants displayed corresponding responses to the two forms, i.e. both responses correct and based on a similar strategy (80 & Tonda), or both responses incorrect and based on a similar misconception (75 & Pavla). The other half of the respondents responded correctly to one of the forms and incorrectly to the other (e.g. 75 & Tonda), or responded incorrectly in both cases but the responses were based on different misconceptions (e.g. 240 & Pavla). This finding is in line with conclusions of Novotná and Vondrová (2017) about the impact that the context of a task might have on solving strategies.

The weak point of the referred study consists in a small size of the sample and in its homogenous nature, and also in the impossibility to generalize the results. On the other side, I included as participants all future primary school teachers of the particular second study year at our faculty – in that sense the study is representative.

Conclusion

In this contribution I investigated opportunities that an educational tool called Concept Cartoons could offer in future teachers' education, namely in comparison with word problems in standard written tests. My small study confirmed the efficiency of using Concept Cartoons in future primary school teachers' education, since they may provide us with information that might not be obtained through standard written tests. From the perspective of mathematics content, I focused on the topic of fractions which again confirmed its difficulty for future primary school teachers.

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MODEL OF STUDENTS' ONLINE PRIVACY BEHAVIOUR

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Abstract

The article verifies the model of online privacy based on the theory of planned behaviour. It uses Nissenbaum's contextual privacy, Petronio's privacy management and Solove's taxonomy of privacy to specify the model. As a method a survey was used and students from the University of Economics were respondents of the questionnaire. The validity of the model has not been proven. The obtained results show that students are not very careful with regard to online privacy even though they are quite critical regarding the situation in the online environment. The underestimated approach towards privacy opens space for the role of educational institutions, which should draw students' attention to the issue.

Keywords

Online privacy, privacy model, information ethics

Introduction

The aim of our study is to verify the model of privacy behaviour based on the theory of planned behaviour (TPB). This theory has been proposed by I. Ajzen (1985) to model the relations between beliefs, attitudes, intentions and behaviours in various fields. The key concepts in the theory are normative beliefs and subjective norms which reflect normative pressures to perform or not perform a behaviour, control beliefs and perceived behavioural control which represent individual's perception of factors facilitating or hindering his behaviour and individual's attitude which refer to the positive or negative evaluation of the behaviour and its outcomes. The beliefs and attitudes determine intentions and further actions.

In recent years, online privacy has been a big issue (Castells, 2009), (Pavlíček, 2016). TPB has been utilized usually in a modified way to study various aspects of behaviour including the behaviour protecting security and privacy. Foltz, Cronan and Jones (2002) used it to prevent information system misuse, TPB has been combined with Theory of general deterrence to analyse students' software and data misuse (Cronan, Foltz and Jones, 2006), a study has attempted to use this theory in order to explain software piracy in China (Chan, Ma and Wong, 2013), digital piracy (Yoon, 2012) and files sharing (Blake and Kyper, 2013). The theory has been also used to study user self-protection (Lee and Kozar, 2005) and online privacy protection strategies (Yao and Linz, 2008).

We have carried out a survey to test the privacy behaviour model based on the theory of planned behaviour. To specify the model for the area of privacy we have used three theories that are very popular in this context: Nissenbaum's contextual approach, Petronio's privacy management and Solove's taxonomy of privacy harms.

Helen Nissenbaum (2011) came with the idea that the notice–and-consent approach which stresses the necessity of clear and fair privacy policies and information practices and presupposes individual's ability to understand all relevant facts and then choose the best option is based on false presuppositions. The problem with this argument is that privacy is not the right to have full control over one's private information and the free market agreement doesn't provide sufficient buyers' protection as many examples of privacy breaches prove. Another problem consists in the

fact that providing private information is often a necessary condition for using a service. The price of not using the service is often connected with social, financial or practical harms. The choice is not as free as it may seem. The supply of alternative products is not sufficient. Informing about privacy is not sufficient as well. Privacy policies are usually very long, complicated, full of technical terms, users don't read the privacy policies and even if they do they usually don't understand them.

The right to privacy is for Nissenbaum the right to the appropriate flow of information which is context-relative. Contexts are structured social settings with specific activities, roles, relationships, power structures, norms and rules. They determine how the private information will be treated and the user should have the right the rely on it.

Sandra Petronio (2002) has developed communication privacy management theory describing the way people make decisions in cases of revealing and concealing private information. People establish and remove privacy boundaries with partners in communication according to the perceived benefits and costs. The boundary divides between private and public information.

Self-disclosure is a mean for developing close relationships. Revealing information to others allows sharing bad life circumstances and gives other the opportunity to help. On the other hand we have a desire for privacy and we wouldn't like other people to share information we have disclosed to them.

Another approach mapping the harms related to privacy breaches represents D. Solove. He suggests in his article (2006) a taxonomy of privacy. He distinguishes four basic groups of harmful activities: 1) information collection, 2) information processing, 3) information dissemination and 4) invasion. Each of them has various subgroups. The first group focuses on problems related to data subject. Surveillance and interrogation belong into the first group.

The second group concerns data collectors, processors and holders. Into the second group belong aggregation of data, identification of individuals, insecurity, secondary use meaning use of information for a different purpose than originally stated and exclusion which consists in the fact that the person doesn't know about the data others have about him.

The third group of hams to privacy includes dissemination where processed data are transferred to others or disseminated. This group includes breach of confidentiality, disclosure (revelation of truthful information to others), exposure which is connected to someone's body privacy, increased accessibility of information on someone, blackmail, appropriation of someone's identity to help achieve aims and interests of another person and distortion which involves dissemination of false information about someone.

In our research, we were trying to verify the validity of the proposed model of online privacy behaviour, which included the theories of online privacy described above.

Materials and Methods

We collected the data using the Google online questionnaire from December 2017 to January 2018. We asked students in the bachelor program of the University of Economics in Prague. For the data analysis we used statistical methods analysing data dependencies (Řezanková, 2007), factor analysis and structural equation modelling (Birne, 2010). In case the questions didn't have exact numerical answers (age, year of study etc.), we captured the answers on 5-point Likert scale. We used the SPSS and Amos software for the calculation of the statistics.

We have collected 72 answers, 52 (72%) from male respondents, 20 from female respondents (28%) in the age between 18 and 28. Most respondents were between 19 and 22 years (72%). 67% of students don't have experience with the intrusion into their privacy, 14% have only one experience with the loss of their private data, 19% had more than one bad experience, but less than 10 experiences with privacy loss. Most of the students (91%) protect their privacy because it

is their protected space where they can do what they want without intrusion of external influences. It is interesting that students even in the first years of their studies work quite intensively. Only 25% of them don't work, 22% work in temporary jobs, 19% have less than half-contract, 31% work on bigger than half contract and 3% work in full contract jobs. It means that more than half of the students have regular contract jobs. The intensity of their work is independent of their age ($r=-0.09$, $\alpha=0.45$), but dependent on the year of their studies ($r=0.575$, $\alpha=0.01$). The longer the student studies the more intensively he works. Students consider the level of information ethics in society very low (5.6%) or rather low (44%). 45% of them can't evaluate information ethics' level. Students protect their privacy for various reasons – fear of distortion of information (61%), blackmailing (53%) and bothering (52%) prevail. The results show students don't protect their online privacy very intensively. Only 11% of them do all available measures to protect it and 34% rather use all available protective measure. See figure 1 for details.

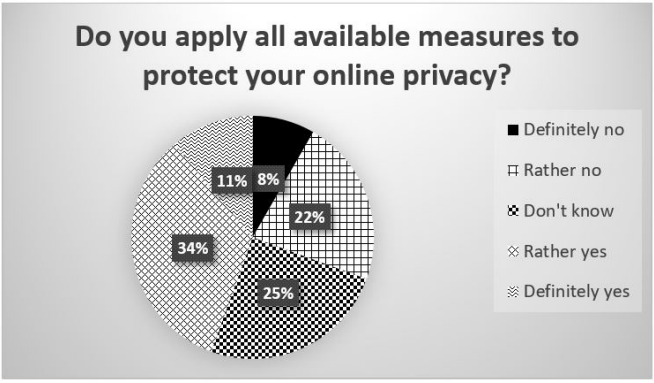

Figure 1: Application of available measures to protect online privacy (source: author)

Results

Further questions were constructed with the intention to verify the application of the theory of planned behaviour on privacy. See table 1 for details. Four questions were asked in the area of attitude. One of them was about the attitude towards privacy loss (Q2), one was about attitude towards using private data by private companies and the state (Q3) and one asked if respondents expect help from someone with whom they share private information (Q1). The last one asked if the respondents think that companies and the state too much of their private information (Q4). Regarding the norm regulating privacy we asked if respondents consider it a condition for the relationship (Q5), if respondents think that the society expects privacy protection (Q6) and if the respondents themselves consider it right to protect privacy (Q7). Within the behaviour control, three questions were asked. One about the fear of private information release (Q8), one about the effectivity of privacy protection measures (Q10) and one question asked if students agree with the person having their private information how he should deal with it (Q9). The intention to protect private information was tested indirectly only by the question asking if respondents read and understand terms and conditions of internet services providers. As it is not a sufficient measure of the behaviour's intention, we didn't use it in our model. Moreover the correlation with privacy protecting behaviour is not significant ($r=0.187$; $\alpha=0.116$) and if the model included this variable the results of the model fit were even worse. Regarding privacy protecting behaviour, only one question was asked, namely if respondents protect their privacy information. We didn't have enough facilities to test the respondents' real behaviour. See figure 2 for details.

Q1	Do you expect help from someone with whom you share your private information?
Q2	What is your attitude towards privacy loss?
Q3	What is your attitude towards using private data by private companies and the state?
Q4	Do you think that companies and the state have too much of your private information?
Q5	Do you consider privacy a condition for the close relationship?
Q6	Do you protect privacy because society expects that from you?
Q7	Do you yourself consider it right to protect privacy?
Q8	Do you fear that a close friend would release your private information?
Q9	Do you agree with the person having your private information how it should deal with it?
Q10	Do you consider privacy protecting measures you use effective?

Table 1: Questions included in the model (source: author)

If we summarise the correlations between our questions we will not get very positive results regarding the confirmation of our model, but the adequacy of the model is not excluded. The correlations are not very strong and very often they are not significant at the 5% significance level. The question about the level of privacy protection of respondents is at the 5% significance level correlated with the question about the fear that a close friend would reveal the respondents private information (Q8) ($r=-0.349$, $\alpha=0.003$), the question if the respondent informs the person with whom he shares his personal information to whom it may reveal it (Q9) ($r=-0.257$, $\alpha=0.029$), the question if the respondent minds the loss of private information (Q2) ($r=-0.519$, $\alpha=0.001$), with the question if the respondents themselves consider it right to protect their privacy (Q7) ($r=0.391$, $\alpha=0.001$), with the question if they consider the tools for privacy protection sufficient (Q10) ($r=0.352$, $\alpha=0.002$) and with the question if they mind that companies and authorities use their private information without informing them (Q3) ($r=0.286$, $\alpha=0.015$). The correlations are in any case quite weak. We may also add that the level of privacy protection is positively correlated with the perceived level of information ethics in the society ($r=0.39$, $\alpha=0.001$). The lower the perceived level of information ethics, the more the respondent protects his privacy. It is surprising that the results are not correlated with experiences with privacy loss ($r=0.05$, $\alpha=0.085$). The results are also independent on gender ($r=0{,}059$, $\alpha=0.625$) and age ($r=-0{,}198$, $\alpha=0.095$).

We have carried out the factor analysis to test the suitability of the data for structural equation modelling. The results are, however, not very promising. The KMO measure of sampling adequacy was 0.385 even though the Bartlett's test of sphericity was not significant. We used 10 components, there were 5 factors with eigenvalue bigger than 1, but these factors explained only 75% of total variance. Considering the component matrix we see that the first factor has five variables with loadings over 0.5. Specifically the variables with loadings over 0.5 were for the first factor were Q1, Q8, Q9, Q2 and Q3. For the second factor the variables with loadings over 0.5 were Q5, Q7, Q10, Q4; for the third factor Q6 and Q10, for the forth one Q1 and Q6; for the fifth one Q5. This proves the results of the KMO measure that the variables are not very suitable for factor analysis. The results may be interpreted that way that factors represent categories of harms to the individual, social benefits and norms regulating privacy protection, but this interpretation is quite speculative.

The last step consisted in carrying out the structural equation modelling. See figure 2 for the model. Unfortunately, the parameters of model fit didn't show the correspondence of the model with the data. The χ^2 test was significant ($P=0{,}001$) showing we should reject the H0 that the implied correlations and the observed correlations are from the same population and that any differences are due to sampling error. The RMSEA is over 0.1 (acceptable is up to 0.06), GFI=0.8; AGFI=0.7 (both should be over 0.9). No changes to the model have improved its parameters significantly. Only the regression weights of Q8 and Q10 were significant at the 5% significance

level. As a result we didn't prove the validity of the theory of planned behaviour based model for the privacy protection.

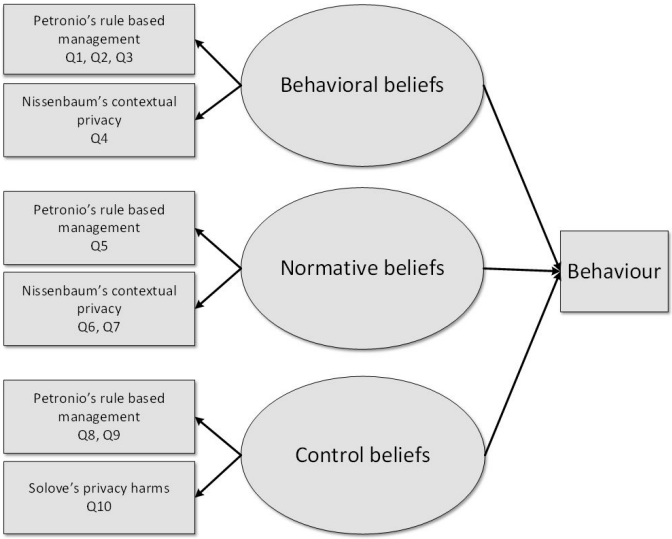

Figure 2: Model of online privacy (source: author)

Discussion

As a result, we didn't confirm the model based on the theory of planned behaviour as a suitable model explaining privacy behaviour. Such results are, however, not exceptional. An interesting result of some studies is the confirmation of a so called privacy paradox which describes the fact that people disclose a lot of personal information online even though they report strong privacy concerns. The paradox has been formulated by Susan Barnes (2006) and confirmed by many studies (Dienlin and Trepte, 2015), (Kokolakis, 2017). There are principally four explanations for this paradox. (Hoffman, Lutz and Ranzini, 2016). The first one uses the privacy calculus. Users weigh benefits against costs and risks of private data disclosure. If the benefits exceeds potential risks the users disregards the disadvantages. The second explanation focuses on user trust towards the transaction partner. Users form expectations towards the data collectors and adapt their behaviour accordingly. This approach adds an affective dimension to the calculus perspective. A third reason for careless behaviour may be the lack of risk awareness and missing knowledge regarding privacy misuse. The fourth reason may consist in privacy cynicism. Users are not able to weight the benefits against the risks and are not able (because of lack of internet skills) to protect themselves properly and resort to cynicism. Cynicism means that a person ascribes the responsibility to possible harms to external forces which the person cannot control. The cynicism may be a way out of the cognitive dissonance between the risky situation and inability to defend oneself. People don't trust the claims of online companies, but don't know what the risks are and how to defend themselves and so play the game of asserting privacy concerns but not behaving in accordance with them. The reason is not deliberate distrust in the ideal, but lack of power for its fulfilment.

When applied to our research, we may conclude that students don't follow the suggested pattern of behaviour. It may be the case that they follow a different pattern of behaviour, but it

seems their privacy protecting behaviour is quite random as it doesn't correlate with any of the questions strongly. There may be many reasons for that (including the four reasons mentioned in the previous paragraph) which will be researched in the future. It seems students don't think about privacy protection very thoroughly and cognitive dissonance is not so important for them. Cognitive dissonance is relevant rather for high involvement decision (Sweneay, Hausknecht and Soutar) and it seems it was not the case for the respondents of the presented study. There are surveys which show that cognitive dissonance needn't be resolved (Elinder, 2012), (Cummings, 1976). The student's interest in terms and conditions of internet services providers supports this hypothesis. Only 2.8% of students definitely reads them, 11.1% rather reads them, 30.6% rather don't read them and 36.1% definitely don't read them. The rest (19.9%) is somewhere between the rather yes and rather no scale results.

The second lesson to be learned from our study is that there seems to be no latent factor behind the various variables. This conclusion supports the cognitive dissonance hypothesis. Online privacy doesn't seem to be a big issue for students and that is why its concept is not very thought-out for them. This result calls for adequate accommodation of study programs that should incorporate information ethics and information literacy. In our previous researches, the students expressed interest in it and we should help students to take care of their privacy as it is a necessary condition for autonomy and freedom.

Conclusion

Our research didn't confirm the validity of the proposed model based on the theory of planned behaviour and three theories specifying privacy (Nissenbaum's contextual privacy theory, Petronio's privacy management and Solove's privacy harms). The results have shown students don't think very much about their online privacy which supports the efforts to include subjects and topics on privacy and online privacy into their curricula.

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GENDER DIFFERENCES IN MATHEMATICS ACHIEVEMENTS AND ATTITUDES

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Abstract

The mathematics is important area of schooling and it works as a crucial factor for career choice. It was found in previous studies that there exists gender gap in math achievements. In our study, we consider the math achievements in short-term (didactic test) and long-term way (final school grade) and we compare it with the preference of the math and with the feeling of competency in the math. The participants are 1.383 students of grammar schools from 4th to 9th grade. The analyses show that boys and girls significantly differ in the test results, the preference of the math and the feeling of the math competence, in all cases in the behalf of boys. The correlation between test results and school grades is strong, likewise between test results and feeling of competence in the math. Even the gender patterns are similar, the correlations are slightly stronger among boys.

Keywords

Competence, gender, grade, grammar school, mathematics, preference

Introduction

Mathematics is a key area of schooling, both in terms of academic development and orientation in a life reality. For many decades, it is studied as an area with high gender differences in school math performance and in identification with the mathematical domain (Friedman, 1989; Fryer and Levitt, 2010). It has deep consequences for career choices of girls and boys and finally for gender equality in the society. It is because the mathematics works as a distinguishing factor for career choice for most students. It means that such students who are not identified with the math and who do not consider themselves as competent in the math do not want even to take the math into account when they are making the decisions about their next studying and working steps (Correll, 2001; Shapka, Domene and Keating, 2006). In the same time, it must be emphasized that occupations with an important role of mathematics in professional competences belong to highly prestigious and better financed (Watt and Eccles, 2008). Both together, gender differences in students´ attitudes toward mathematics at a grammar school level can lead to gender differences in living standards and power in adult life. Because of that, the special attention to school mathematics should be paid both in research and in pedagogical reality.

With respect to gender gap in math, the Czech Republic traditional belonged to countries with high differences between math achievements of girls and boys, in behalf of boys (Else-Quest, Hyde and Linn, 2010). Both series of international assessments of mathematical knowledge produced by TIMMS (Trends in International Mathematics and Science Study) and PISA (Programme for International Student Assessment) have showed such similar results for many years, however during last six years the picture has changed. For elementary and low secondary educational level, the gender gap has slightly erased. However, the reason is not the improving performance by girls, but worsening of boys´ performance. We hypothesized the following explanation of such change: As many studies showed, primary gender socialization builds the interiorized structure in the girls more than in the boys (Fagot, Rodgers and Leinbach, 2012). The liberalization of

the Czech educational system during last 90´s brought the change in dominant pedagogical approaches that are less structured and disciplined now than used to be before. The result is that girls who come to schools with deeper interiorized structure, which supports their emotional and cognitive autoregulation, can work better even in less structured educational settings, while boys with weaker interiorized structure can be lost in less structured educational settings. Students´ school achievements are influenced with general feeling of "school as an understandable place" and thus school performance of boys – especially boys with low socio-cultural background – can decrease. This explanation must be tested through a complex research design. Unfortunately, our study is not so complex, however it still brings some evidence on gender gap in math attitudes.

In our study, we are focused on the question how competent in the mathematics Czech girls and boys feel, in which level they prefer the mathematics and what knowledge in the mathematics they perform. We search for relationship between following three variables: feeling of mathematical competence, preference of the mathematics and achievements in the mathematics.

The previous international studies dominantly show that girls in the average fail in all three variables, however the size of gender gap varies across countries. In countries with high gender inequality, gender gap in mathematics tends to be higher than in countries with high gender equality. According to the Global Gender Gap Report (World Economic Forum, 2015), the Czech Gender Gap Index in 2015 was 0.687 and economic participation and opportunity subindex was 0.636, where 0.000 indicates complete inequality and 1.000 full equality. It means that the Czech Republic is still a country with a quiet high gender inequality, including gender horizontal and vertical segregation at labour market. The decreasing of gender gap in mathematics showed by PISA and TIMMS (mentioned above) seems to be inconsistent finding. Does it mean that a reduction of gender gap in the mathematics is false and misleading? We assert that math performance should not be reduced on school grade or test result, but it should cover also preference of the mathematics and feeling of competence in the mathematics. With respect to such a wide approach, our study examines gender gap in all three areas and their mutual links.

Materials and Methods

Purpose of the Study

In the study presented in this paper, we addressed the following research questions: 1) What level of preference of mathematics, feeling of mathematical competence, school grade in mathematics and results in mathematical test achieved girls and boys in age from 10 to 15 years?; 2) What are relationships between preference of mathematics, feeling of mathematical competence, school grade in mathematics and results in mathematical test among girls and boys across different age groups?

Based on previous research, three hypotheses were formulated. First hypothesis (H1) is descriptive: *Boys are better than girls in math preference, feeling of mathematical competence, school grade in mathematics and results in mathematical test.* Second hypothesis (H2) is explanatory *Boys´ test results and school grades correlate stronger with math preference and feeling of mathematical competence than girls´ test results and school grades.* This hypothesis represents our assumption that among boys, their performance in mathematics varies more than among girls because they reflect boys´ abilities more than girls´ ones. Most girls are influenced by gender stereotypes which tend to discourage them from mathematical domain more than boys.

Measures

The study used correlation design which can show the strength of relationships among studied variables however it is not able to show the direction of the relationship. The study involved two measures - a written didactic test and a written questionnaire.

The didactic test in mathematics was prepared separately for six grades. Each test followed a similar structure, comprising of four different types of word problems and additional three to five numerical exercises to verify the knowledge of the mathematical operations. The tests were designed to cover the subject matter that had already been covered during the teaching classes and that corresponded to the national curricula documents and the textbooks that had been used in schools involved. The tests were taken by the students under supervision of trained examiners. The time limit for completing the test was set at 35 minutes; the most students succeeded to complete the test within the specified time limit. The test score was get as a sum of correct answers. Each item was evaluated with 1 point (correct answer) or 0 point (wrong answer). For statistical analyses, the individual success rates in test were compute as percentage of correct answers to all answers. In tables presented below, means of success rate in test and means of other variables and its standard deviations are shown.

The student questionnaire comprised 20 items. The first part of the questionnaire collected identification data, such as gender, school grade and age. The school grades vary from 1 (excellent) to 5 (insufficient). The second part focused on the objective and subjective success in mathematics and on the popularity of mathematics in a comparison to other subjects. The preference of mathematics was evaluated on three-points scale: *It is my favorite subject, I do not mind this subject, It is my unpopular subject.* Besides mathematics, two more subjects were evaluated on the same scale, including Czech language and foreign language. The competence in mathematics was evaluated on three-points scale too*: I am good at it, I am average, I cannot make it.* The competence in two more subjects was evaluated, including Czech language and foreign language. The three other parts consisted of items relating to the teaching practices, word problems solving strategies and proficiency in real-life domains that helped to other research questions out of this paper. The questionnaire was validated by a pilot study. With regard to its scope, the questionnaire required approximately 25–30 minutes for completion. The questionnaires were completed by students 2–3 weeks after taking the didactic test. All questionnaire items were closed or semi-closed, so the students' responses could be easily captured in an electronic form.

Participants

The participants of the study were students of six grades at four Czech grammar schools. The schools and the students take part in a three-year study of which the present study is a part of. We obtained informed approvals from students and/or their parents. The sample included in the present study consisted of 1,383 students who were asked to complete the questionnaire and take part in the didactic test. The sample covered six grades with the following distribution: 301 students (154 females and 147 males) from the 4th grade at the average age of 9.47 years (SD=.518); 300 students (150 females and 150 males) from the 5th grade at the average age of 10.55 years (SD=.538); 243 students (125 females and 118 males) from the 6th grade at the average age of 11.44 years (SD=.506); 180 students (88 females and 92 males) from the 7th grade at the average age of 12.54 years (SD=.553); 209 students (103 females and 106 males) from the 8th grade at the average age of 13.47 years (SD=.538); 150 students (88 females and 62 males) from the 9th grade at the average age of 14.50 years (SD=.528). The ratio between the male and female students was approximately 1:1 (variation from 48% to 51%), which corresponds to the national statistics, except for the 9th grade where the proportion of girls was 58%, which is above the statistical average.

Results

To investigate the research questions, the analysis consisted of two steps. In the first step, each variable was studied independently. The average and the frequency distribution of answers was

compared for boys and girls to find out whether gender gap exists in each variable. In the second step, the mutual relationships among all variables were examined. The correlation analysis and later the regress analysis were carried out. The results of both steps are presented gradually.

The analysis showed no gender gap in school grades. The average school grades varied across six age groups and got continuously worse. While the average school grade in the youngest group was 1.3, in the oldest group 2.33. Girls and boys did not differ in any age group. With regard to previous studies, this finding was surprising.

The mathematical test showed gender gap in the average success rates in the whole sample ($p<.001$), but also in the half of age groups – in the fourth, seventh and eighth grade. In all three grades (and in two more without statistical significance), boys achieved better test results than girls. See table 1 for details.

	Mean		Standard Deviation		P
	Girls	Boys	Girls	Boys	
Grade 4th	67.4%	72.4%	.186	.151	.011
Grade 5th	78.9%	78.0%	.168	.187	.665
Grade 6th	62.3%	66.9%	.244	.235	.145
Grade 7th	54.4%	62.9%	.249	.254	.025
Grade 8th	57.4%	66.6%	.273	.249	.011
Grade 9th	54.3%	58.6%	.225	.246	.272

Table 1: The average success rate in didactic test (source: own calculation)

The gender gap was found in the preference of mathematics as well. In total, the difference between girls and boys was highly significant ($p<.001$), however in more detailed view the gender difference existed only in three age groups. In all cases, boys reported higher preference of school mathematics than girls. See table 2 for more details.

	Mean		Standard Deviation		P
	Girls	Boys	Girls	Boys	
Grade 4th	1.47	1.42	.651	.623	.523
Grade 5th	1.69	1.40	.708	.627	.000
Grade 6th	1.64	1.49	.702	.625	.091
Grade 7th	1.89	1.74	.689	.647	.139
Grade 8th	2.16	1.94	.697	.691	.028
Grade 9th	2.06	1.94	.737	.744	.324

Table 2: The average preference of the school mathematics (source: own calculation)

The feeling of competency in mathematics showed also gender gap in total and in four age groups. In all groups, boys reported stronger that they feel competence in math. See table 3 for more details.

	Mean		Standard Deviation		P
	Girls	Boys	Girls	Boys	
Grade 4th	1.58	1.42	.626	.573	.023
Grade 5th	1.62	1.41	.622	.595	.003
Grade 6th	1.63	1.53	.632	.596	.204
Grade 7th	1.85	1.53	.724	.603	.001
Grade 8th	1.92	1.64	.640	.667	.003
Grade 9th	2.00	1.82	.673	.736	.131

Table 3: The average feeling of competency in the school mathematics (source: own calculation)

In the second analytical step, we counted the correlations between all three variables. The correlation analysis showed that there is a strong negative relationship between results in didactic tests and the feeling of mathematical competence (-.41) and the school grades (-.61). The correlation between didactic test and preference of mathematics was significant too, but weaker than two previous variables (-.23).

Because our main objective was to examine the gender patterns in math attitudes, we compared the correlations for boys and for girls separately. The results in both groups were similar in terms of direction and even strength of correlations. However, there were partial differences between girls and boys. Firstly, the stronger negative correlation between test results and preference of mathematics was found among boys (-.25) than among girls (-.19). Secondly, the stronger positive correlation was found between school grades and preference of mathematics among boys (.32) than among girls (.26).

With respect to other aspects, the results implied the slightly weaker relationships between math attitudes and math achievements (in long-term and short-term ways, thus in school grades and didactic test results) among girls than among boys. It can be interpreted as a less effect of experience and social feed-back for girls than for boys. If we put in the picture the gender differences that were found in particular variables, we can conclude that girls more than boys tend to be feel less competent and tend not to prefer the math, but it does not influence their math achievements so strongly. Because we speak about correlation, the perspective could be opposite as well. In such case, girls´ feeling of competency and girls´ preference of math is not influenced by girls´ math achievements (even they are good).

Such conclusion is supported by comparison of didactic test results in high competent groups. Girls with strong feeling of competence in mathematics (n=271) achieved the average success rate 76% in the didactic test while boys with strong feeling of competence in mathematics (n=364) achieved 77%. It means that gender does not matter in highly competence groups. However, we should underlie that the number of girls who feel to be competent in the mathematics is smaller than boys.

In the last step, we run a regress analysis to find the predictive strength of each variable toward the achievements in the didactic test. A significant regression equation was found for both models based on gender. Statistics for model among boys were $F(1, 650)=116.78$, $p<.001$, with an R2 of.394, for model among girls $F(4, 670)=104.97$, $p<.001$, with an R2 of.408. The preference of the math and the age group were showed to be insignificant both in total model and in gender separated models. In the opposite, school grade and feeling of competence in mathematics were significant predictors of didactic test results, $p<.001$, both for boys and girls.

Discussion

In presented study, two hypotheses were verified. The first hypothesis (H1): *Boys are better than girls in math preference, feeling of mathematical competence, school grade in math and results in mathematical test* was not proved in a total. There were four variables included but only for three of them the gender difference was showed. The school grades were the same for boys and girls. It is a surprising finding in a context of PISA and TIMMS and of Czech studies (Else-Quest, Hyde and Linn, 2010, Fryer and Levitt, 2010, Federičová and Münich, 2015). Those studies show that girls in average usually receive better school grades in most subjects, including the mathematics. Despite of that, external evaluation on mathematics shows better achievements of boys.

Our study shows that the gender gap in school grades is disappearing, however in the same time the international testing show that also gender gap in knowledge disappears, it can mean that the Czech Republic goes through steps toward gender equality relating to the mathematical domain.

However, our study does not prove that the mathematical knowledge is the same among boys and girls. Boys tend to score higher in the didactic test.
In such perspective, the inconsistency of gender gap in school evaluation and external evaluation usually even emphasizes the role of gender stereotypes. With regard to gender socialization, our study brings partial elaboration of previous findings by Fagot, Rodgers and Leinbach (2012). Socialization based on gender stereotypes leads to better school adaptation of girls but better mathematical knowledge of boys. Because of better adaptation of girls, they are able to follow teacher´s instructions and requirements so their performance is high enough to get a good grade in spite of lower real knowledge. The alternative explanation working with gender biased external tests, including our didactic test, should be taken into an account as well.
The second hypothesis was formulated (H2) – *Boys´ test results and school grades correlate stronger with math preference and feeling of math competence than girls´ test results and school grades.* The hypothesis was not proved in a total as well. However, if we excluded the preference of the mathematics from the hypotheses, it was verified. Previous studies assumed that performance in the mathematics is strongly linked to attitudes toward mathematics (Friedman, 1989, Fryer and Levitt, 2010). We did assume the same, however our findings are opposite. The performance in mathematics is linked to the feeling of competency in the mathematics more than to the preference of mathematics. It means that in the area of motivation for mathematics are still more studies needed.
Although the gender differences varied across age groups irregularly, we can conclude that they existed in a total. The relationships among variables showed by the correlation analyses and by the linear regression proved that the correlations have the similar values among girls and among boys, however the slight differences among them still existed. They can be interpreted as stronger influence of experience and social feed-back at boys than at girls and vice versa. This finding corresponds to previous studies on didactic practices toward female and male students (Fagot, Rodgers and Leinbach, 2012). We suggest that more studies also in this area are needed, especially for Czech education.

Conclusion

The mathematics is a crucial area of schooling and the key factor of career choice which influences the social status and living standards during the adulthood. That is why it is necessary to pay a huge attention to pedagogical approaches which should promote gender equality in math achievements. To use psychological knowledge, we must underlie that not only the achievements and mainly the attitudes, beliefs, expectation and self-evaluation are needed to be addressed. As was proved by our study and many studies before, the achievements in didactic tests (it means the actual mathematical knowledge presented in a testing situation) are strongly related to and even influenced by the feeling of the competence. The preference of the mathematics was showed as unimportant as predictor of test achievements. Thus, our conclusion is, that teacher can support the positive attitudes toward the mathematics and the preference of the mathematics, however the more important is to help students to feel competent in the mathematics. In the case of girls, it often means to help them to feel competent regardless of gender stereotypes which stop them to consider the math as a domain suitable for women.

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TEACHER BURNOUT SYNDROME, COPING STRATEGIES AND SELF-EFFICACY

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Abstract

It has been showed by many studies that the burnout syndrome is highly prevalent among teachers and thus protective factors are needed to search. Based on previous research, we expected that teacher self-efficacy and positive coping strategies could be two of them. Since the mutual relationship between all three variables – burnout syndrome, self-efficacy and coping strategies - have not been deeply examined yet, the purpose of our study was to find out whether the coping and the self-efficacy are interconnected and whether they predict the level of the burnout syndrome. The study used a correlation design with three instruments – Shirom-Melamed Burnout Scale, SVF78 and Czech Teachers Self-Efficacy Scale. The analysis supported the close relationship between burnout, self-efficacy and coping among Czech grammar school teachers. The strong connection was found between negative coping and burnout symptoms.

Keywords

Burnout syndrome, coping, grammar school, self-efficacy, teacher

Introduction

Teaching is a highly stressful occupation (Johnson et al., 2005; Caprara et al., 2006). Long-term stress decreases job satisfaction and can result in chronic exhaustion that can turn into a burnout syndrome. The burnout is defined as a deep and permanent exhaustion with many emotional, physical, cognitive and social symptoms, resulting from long-term occupational stress, particularly in occupations with incessant human interactions and high responsibility for others (Brouwers and Tomic, 2000). Burnout is considered as a multidimensional construct. Maslach's theory identifies emotional exhaustion, depersonalization, and reduced personal accomplishment as burnout dimensions (Maslach, Jackson, and Leiter, 1996). Shirom and Melamed (2006) stress another three dimensions: physical fatigue, emotional exhaustion and cognitive weariness. The burnout syndrome causes health problems and decreases quality of working activities, including teaching process and relationships with students. It is important to search for ways how to support teachers in avoiding stress.

This paper is focused on investigating mutual relationships among burnout syndrome, self-efficacy and coping strategies. Based on previous studies, we assumed that coping strategies and self-efficacy can prevent burnout syndrome among grammar school teachers. In the paper, each variable is briefly introduced before our study and its results are described.

Coping strategies

Each person uses some coping strategies to deal with stressful situations. To investigate how to eliminate working stress should cover coping strategies. Brouwers and Tomic (2000) define coping as the degree to which an individual is able to manage stress experienced in certain situations. Frydenberg (2008) describes coping strategies as methods of coping, which characterize an individual's response to stress, either over time or in different situations. In our research, we use

mainly the typology developed by Lazarus and Folkman (1984). Based on this, we can conclude that there exist two basic ways of how individuals can cope with stress. First, coping strategies aimed at changing the situation can be used. Such problem-centered coping strategies are active, positive and successful in reducing the level of stress (Lazarus and Folkman, 1984). Second, coping strategies that are unsuccessful in the long run can be used. Such strategies do not address the source of stress and bring only short-lived emotional relief. Such coping strategies are usually passive and emotion-centered. Research studies by Kepalaite (2013) and Austin, Shah and Muncer (2005) conducted in teacher populations show that the most common strategies include planful problem solving, but also self-controlling, positive reappraisal and distantiation. In contrast, the least-used strategies are avoidance and confrontive coping. By correlation analysis, Kepalaite (2013) also found that teachers who used positive reappraisal used other positive strategies more often as well. On the other hand, teachers who used negative strategies (confrontive coping) used also other negative strategies more often (distancing, escape-avoidance).

Self-efficacy

The coping strategies used at work situations are somehow related to professional competencies or rather self-efficacy (Skaalvik and Skaalvik, 2007). The self-efficacy is defined as teacher's beliefs in his/her own ability to plan, organize, and carry out different educational activities that are essential for achieving teaching goals. It affects how teachers perceive opportunities and obstacles presented by their environment and how much effort and what activities are they willing to invest in overcoming these obstacles (Pajares, 1997; Bandura, 2006). Teachers with high levels of self-efficacy are able to successfully manage these challenges (including problems relating to students' behaviour and learning, communication with parents and colleagues, school administration, life-long learning etc.) so they do not experience them as stressful, unlike teachers with low levels of self-efficacy.

Chwalisz, Altmaier and Russell (1992) found that teachers who scored low in self-efficacy reported a higher degree of burnout unlike the teachers with high self-efficacy scores. Brouwers and Tomic (2000) showed that self-efficacy has a longitudinal effect on depersonalization and a synchronous effect on personal accomplishment, while the direction was reverse for the relationship between self-efficacy and emotional exhaustion. Skaalvik and Skaalvik (2007) found a strong relationship between teachers' self-efficacy and burnout, and specifically for emotional exhaustion (Skaalvik and Skaalvik, 2014). However, more studies on this issue, especially with respect to different educational systems, are needed to understand the precise mechanism underlying the relationship between teachers' self-efficacy and teachers' burnout. Without such extensive understanding, it is not possible to conclude that self-efficacy works as a factor protecting from burnout nor is it possible to find the most efficient ways to support teachers' self-efficacy in order to avoid burnout. It is not known yet how the connection between the self-efficacy, the coping strategies and the burnout avoidance works. Previous studies confirmed the positive effect of high self-efficacy on prevention of burnout syndrome (Skaalvik and Skaalvik, 2007, 2014) and the positive effect of problem-centered coping on prevention of burnout syndrome (Austin, Shah, and Muncer, 2005). However, there is a lack of empirical evidence about the mutual relationships between all three variables.

Materials and Methods

The present study sought to answer the following two questions utilizing a correlation design. First, is a positive (problem-centered) and a negative coping (emotion-centered) coping linked to professional self-efficacy among teachers? Because the positive (problem-centered) coping strategies need an ability to consider structure in stressful situation which is easier with professional

teacher background, there is a positive connection between teacher self-efficacy and problem-centered coping. Thus, we expected that those teachers who prefer positive coping strategies would score as high in self-efficacy (Hypothesis 1) and who prefer negative coping strategies would score low in self-efficacy (Hypothesis 2). Secondly, does problem-centered coping and high self-efficacy predict the low burnout syndrome? Based on the combination of Skaavlik and Skaalvik (2007, 2014) and Austin, Shah, and Muncer (2005) findings, we expected that positive coping (which represents mostly problem-centered coping strategies) and the high self-efficacy would be important predictors of low burnout syndrome among teachers (Hypothesis 3).

Measurements

The measurements consist of three diagnostical tools and a questionnaire on personal and school information. The data were completed via on-line application for which the link was presented in medias and emails. The data were collected during eight weeks in the beginning of year 2017. Burnout was measured using the Shirom-Melamed Burnout Scale (Shirom and Melamed, 2006). The scale consists of 14 items evaluated on a 7-point Likert scale ranging from "never or almost never" to "always or almost always". High summary scores are indicative of burnout. Coping strategies were measured using the Stress Coping Style Questionnaire (SVF 78) which is standardized for the Czech population (Janke and Erdemann, 2002). The questionnaire uses 78 items evaluated on a 5-point scale ranging from "not at all" to "very likely". Self-Efficacy was measured using the Czech Teacher Self-Efficacy Scale (CTSES). The scale includes 45 items evaluated on a 5-point scale ranging from "never" to "always" (Smetackova and Vozkova, 2017). Within the correlation design, we searched the relationships among total scores of diagnostical tools via correlation analyses and regression analyses. We paid an attention to gender of teachers as well.

Participants

The study included 2,394 teachers working in Czech grammar schools. The set of respondents consists of 358 male teachers (15%) and 2036 female teachers (85%). Their average length of teaching experience in number of years was 21.42 (SD=10.67). Teachers were asked to participate in the study via emails which were sent to a principal of all grammar schools in the Czech Republic and via educational journals. The sample consists of teachers who were willing to participate in the research which can cause a bias. However, a comparison of all teachers working in grammar schools in the Czech Republic in 2016 (according to the statistics of the Ministry of Education for 2016) showed that the sample used in the present study was representative in terms of gender and educational levels.

Results

The mean differences in teachers´ burnout between the gender, the levels of education and the years of teaching experience were performed. The burnout is reported in means (sum divided by number of items) and interpreted by norms given by Shirom and Melamed (2006). All items were scored on a 7-point frequency scale, ranging from 1 (almost never) to 7 (almost always). On average, teachers reported mild burnout, M=3.14, SD=1.05. No burnout was reported by 16% teachers, very mild burnout 31.9%, mild burnout 32.7%, burnout 15.1%, serious burnout 3.6% and very serious burnout.7%.

Dimension	Mean	SD
Physical	3.55	1.31
Cognitive	3.03	1.23
Emotional	2.66	1.11

Table 1: The dimensions of burnout syndrome – the mean and standard deviation (source: own calculation)

The strongest burnout was reported on physical scale, milder burnout on cognitive scale and the lowest on emotional scale. Men and women do not differ in the total burnout score. However, a significant gender gap was found on the emotional subscale, $t(2390)=4.688$, $p<.001$, and on the physical scale, $t(2390)=-2.068$, $p<.05$. While male teachers reported stronger emotional burnout, female teachers reported stronger physical burnout.

Study variables	Mean	SD	Min	Max
Positive coping	.68	1.12	-4.86	4.29
Negative coping	.125	.97	-3.04	3.4

Table 2: The coping strategies – the mean, standard deviation, maximum and minimum (source: own calculation)

The coping strategies were measured by the SVF78 and reported in standard scores (z-score). The results presented in Table 2 show that teachers use more often the positive coping strategies than the negative coping strategies. Female teachers scored higher in positive coping than male teachers. The mean of positive coping (measured in z-score) for female teachers was.728 (SD=1.117) and for male teachers.401 (SD=1.069). In the contrary, male teachers scored higher in negative coping than female teachers. The mean of negative coping (measured in z-score) for male teachers was.29 (SD=1.124) and for female teachers.096 (SD=.937). The gender differences in both variables were highly significant, $p<.001$.

The self-efficacy was reported in standard scores (z-scores). On average, participants´ self-efficacy was rather low contrary to expectations. Most teachers perceived professional competency sometimes or rarely ($M=-.158$, $SD=.990$, minimum=-6.54, maximum=2.67). Male teachers had higher self-efficacy scores than female teachers, $t(2390)=-4.942$, $p<.001$. The means of standard scores show that the Czech teachers have moderately weak self-efficacy which is the lowest in their educational goals and practices. The pedagogical approach is considered to be the crucial aspect of teaching beliefs and thus, these findings have important consequences for the risky aspects of teachers´ identity.

Table 3 shows correlations between the study variables. All correlations in the table were significant ($p < .001$). The correlations between total scores in three scales were strong enough, both in terms of statistics and in reality. The correlation between teacher burnout syndrome and teacher self-efficacy was -.293 which means that teachers with high self-efficacy scored low in burnout symptoms and vice versa. All three dimensions of burnout syndrome show a significant negative correlation with teacher self-efficacy. However, the strongest value was found for emotional dimension (-.375). Teachers with high self-efficacy scored low in emotional burnout which has the most negative impact on relationships between teachers and students and thus on students' well-being in schools.

Study variables	CTSE	POSCOP	NEGCOP	BURSUM
CTSE	-	.354	-.214	-.293
POSCOP		-	-.291	-.259
NEGCOP				.553
BURSUM				

Note: CTSE=Teacher Self-Efficacy Scale, POSCOP=Positive Coping, NEGCOP=Negative Coping, BURSUM=Shirom-Melamed Burnout Scale

Table 3: The correlation among variables (source: own calculation)

The burnout syndrome was significantly linked to both types of coping styles. The correlation between positive coping and burnout symptoms was -.291 and the correlation between negative coping and burnout symptoms was as high as -.553. Teachers using negative coping strategies scored higher for burnout symptoms and teachers using positive coping strategies scored lower for burnout symptoms. It must be stressed that positive and negative coping do not exclude each other – it means that person can use positive and negative coping in the same period of his/her life. However, a negative correlation was found between those two types of coping strategies (-.291). This implies that most teachers prefer one coping style.

The connection between burnout and negative coping was strong. Therefore, we can assume that negative coping strategies work as one of the sources for burnout syndrome. On the contrary, the assumption about the protective function of positive coping strategies is not as dependable because the correlation is not so strong (even though it is significant). A significant correlation between both coping styles and teacher self-efficacy was found as well. Positive coping correlates positively (.354), the negative coping correlates negatively (-.214). It means that teachers with high self-efficacy score high in positive coping but rather low in negative coping. All subscales of teacher self-efficacy show similar patterns.

In order to be able to determine whether self-efficacy or coping styles show a degree of predictability of burnout, a multiple linear regression has been conducted. In model, with the burnout level as a dependent variable, the total scores of self-efficacy beliefs, positive coping and negative coping were tested in a regression equation as the independent variables. Results of hierarchical regression analyses showed that all three variables in model were significantly related to the burnout symptoms. The teachers´ burnout level decreased 2.30 points for each standard score of total self-efficacy score and.284 point for each standard score of positive coping style, while the burnout level increased 1.81 points for each standard score of negative coping style.

Discussion

Our study works with three hypotheses derived from previous research. First, we expected that those teachers who preferred positive coping (problem-centered coping) would score high in self-efficacy (Hypothesis 1) and who prefer negative coping (emotion-centered coping) would score low in self-efficacy (Hypothesis 2). Both hypotheses were confirmed. However, the correlation between positive coping strategies and self-efficacy is stronger than that between negative coping strategies and self-efficacy. Positive and negative coping were negatively intercorrelated which means that teachers using positive coping often avoid negative coping and vice versa, but the weak value of correlation also show that in some cases both coping strategies can be employed by a teacher in one moment. Our results correspond with some previous studies on coping and self-efficacy (e.g. Janke and Erdermann, 2002; Austin, Shah, and Muncer, 2005; Chwalisz, Altmaier and Russell, 1992).

Second, we expected that positive coping (problem-centered coping) and high self-efficacy would be strong predictors of low burnout syndrome among teachers (Hypothesis 3). This hypothesis was confirmed as well. Findings about partial connection between burnout and coping or self-

efficacy correspond with some previous studies. Austin, Shah, and Muncer (2005) found that teachers who report lower stress levels use more often positive coping, while teachers who report higher stress levels use more often negative coping. Skaalvik and Skaalvik (2007, 2014) showed that teachers with high self-efficacy scored lower on burnout symptoms and vice versa. Unlike previous studies, we found significant intercorrelations between all three variables. The strongest connection was found between negative coping and burnout symptoms. However, positive coping and self-efficacy were found to be significant predictors of burnout. The predictive function of negative coping was the strongest again. These results support the assumption that both coping and self-efficacy can prevent burnout syndrome.

Conclusion

This study has confirmed the close relationship between burnout, self-efficacy and coping styles among Czech grammar school teachers. The data were collected from Czech teachers who had not previously participated in any international research on this topic. The Czech educational system is different from systems in countries where the majority of research comes from. The study conducted in the Czech Republic as a new research location in this field can be, therefore, taken as a validation of previous findings about correlation between the burnout and self-efficacy and the burnout and coping strategies. At the same time, it suggests that these concepts may not be culture-dependent.

Acknowledgement

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ANALYSIS OF MOTIVATIONAL AND PERSONALITY CHARACTERISTICS OF THE GENERATIONAL GROUP Z

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Abstract

The paper deals with the analysis of personality and motivational characteristics of the generational group Z in the educational process, which influences the motivation. The researches put the focus on different generational groups to show declining internal motivation and worsening educational and work performance. The sample includes the students of the Faculty of Materials Science and Technology, the Slovak University of Technology in Bratislava. The authors of the paper used standardised questionnaires D-M-V (D – Questionnaire, M – Motivation, V – Performance) and NEO (Neuroticism, Extraversion, Openness) for data collection. The obtained data were evaluated in the statistical program SPSS along with descriptive statistical analysis in MS Excel. The significant relationships and differences between conscientiousness item and anxiety supporting the power and between neuroticism item and anxiety lowering the power were revealed by the statistical evaluation..

Keywords

Educational process, generational group Z, motivational characteristics, personality characteristics

Introduction

"Generation Z starts with people born around 1990 till early 2000s. Various researches indicate that generation Z people are specific as they grew up surrounded by advanced ICT technologies" (Mladkova, 2016). "Many people from generation Z are at the beginning of their academic activities. This generation has peculiar characteristics that might be a challenge in the labour market" (Barreiro and Bozutti, 2017). "Questions of educational relevance have surfaced frequently among educators, philosophers, and social scientists for centuries. Recently motivation scientists have reinvigorated such questions and are directing considerable empirical attention to develop interventions to help students make connections between what they do in school and their lives" (Albrecht and Karabenick, 2018; Stacho, Stachova and Vicen, 2017). "Through academic achievement students can fully actualise their talents and capabilities in line with educational goals. In fact, academic achievement is considered as one of important criteria of educational quality", criteria must be in accordance with cognitive and affective goals. (Hakimi, Hejazi and Gholamali, 2017; Vnouckova, Urbancova and Smolova, 2017). The educational process is primarily used in educational institutions and then is reflected in educational activities in business processes in enterprises and organisations. "Intellectual capital consists of stocks and flows of knowledge, skills and abilities" (Jurík and Sakál, 2014). "It is important to have managers in working process and educator in educational process which not only predict the future, but also influence it by their decisions" (Hrablik Chovanová and Hrablik, 2012). The decisions of the persons responsible for the business and educational process must be in line with the objectives of the institution. "Motivation is one of the most important issues in education that can significantly

support efficiency of educational process and the motivation influences positive on academic results" (Krejcova and Berkova, 2016; Vnouckova et al, 2016). "Properly set educational goals enable to management concentrates educational activities in such a way as to reflect current and future needs of the organisation" (Babeľová et al, 2010).

Materials and Methods

The aim of the research was to analyse and further characterise the motivational and personality characteristics of the selected generational group that influence the motivation in the educational as well as in the work process.

The research sample was composed of students of the Faculty of Materials Science and Technology in Trnava, the Slovak University of Technology in Bratislava. The authors of the paper classified them into the generational group Z. For greater representativeness of the sample, the authors of the paper decided to carry out the research among the first year university students (the 1st year of Bachelor form of study) and the fourth year university students (the 1st year of the Master form of study). The research was carried out from January 2015 to March 2015. The authors of the paper chose a sample of respondents based on unlikely quote. In total, 100 questionnaires were distributed, of which 93 were returned. This shows about 93 % success rate of the questionnaire data collection method. The quota selection assured the same or similar layouts of one feature in group. The chosen feature was the number of students from both years (the first and the fourth one), where were distributed 50 and 50 questionnaires to each group. In Figure 1 it is shown the composition of the research sample.

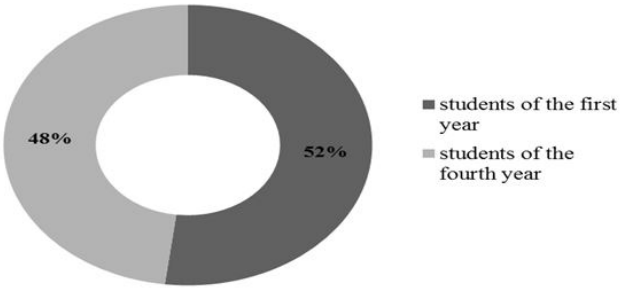

Figure 1: Composition of the research sample (source: own elaboration, 2018)

The data collection tools

In the research, there were used standardised psycho-diagnostic methods to diagnose and carry out the overall research intention. The distributed questionnaire was composed of the following three parts:

1. **Socio-demographic questions** that were focused on the selected generational group of respondents.
2. **NEO Questionnaire** – five factors personality inventory (BIG FIVE). Included items such as Neuroticism, Extraversion, Openness, Friendliness and Conscientiousness. For the view of personality characteristics, the authors of the paper have used two items - neuroticism and conscientiousness. **Neuroticism** - the core of the item is a general tendency to experience negative influences such as fear, anxiety, sadness, threats, anger, guilt, suffering, and so on. Neurotics have problems with controlling their impulses and worse handling with stressful situations. Neuroticism affects performance in different environments. Conscientiousness - the sign of consciousness is the regulation of desires and the control of impulses. Self-control

also involves more active planning, organising, and performing tasks. A conscientious individual is purposeful, reliable and with strong will. High conscientiousness is associated with academic and professional performance and leads to greater overall efficiency. Conscientiousness can be considered as the most reliable performance criterion (Ruisel and Halama, 2007).

3. **The questionnaire of motivation performance D-M-V** (D – Questionnaire, M – Motivation, V – Performance). The questionnaire contains three scales - scale of (MV - Performance Motivation), which is understood as one of the essential parts of achievement motivation by the authors, followed by a scale of (AB - Anxiety lowering the power) and a scale of (AP - Anxiety supporting the power). "The first entry of the questionnaire is used for instruction only and it is not evaluated. Furthermore, the questionnaire contains fifty-two factors that are evaluated on a six point scale: it does not apply for me at all, it does apply seldom for me, it never applies for me, it often applies for me, it mostly applies for me, it entirely applies for me" (Pardel and Hrabocská, 1984).

The research methods

To evaluate the collected data, the authors of the paper have used several methods: descriptive and quantitative statistical ones (histograms of frequencies, pie charts and additional analysis in table form). Secondly, the authors have used parametric and non-parametric tests - correlation Pearson test (r), Student's t-test and Kolmogor-Smirn's test.

Research questions (RQ)

RQ 1: What score the respondents achieve in the selected personality characteristics of the NEO questionnaire?
RQ 2: Are there differences in personality characteristics measured by the NEO questionnaire between students in the first and the fourth year and are these differences statistically significant?
RQ 3: What score the respondents achieve in the individual scales of the D-M-V questionnaire?

Research hypotheses (H)

H1: There is a statistically significant relationship between the values measured in the scale MV - Performance motivation from the D-M-V questionnaire and the values measured in the item conscientiousness from the NEO questionnaire.
H2: There is a statistically significant relationship between the values measured in the scale AB - Anxiety lowering the power from the D-M-V questionnaire and the values measured in the item neuroticism from the NEO questionnaire.

Results and Discussion

The evaluation of the research questions

RQ 1: What score the respondents achieve in the selected personality characteristics of the NEO questionnaire?
The first research question expects the answer concerning to the composition of the number of respondents that were classified into three groups according to achieved score (high, average and low) in the selected personality characteristics of the NEO questionnaire. Table 1 shows the absolute frequency of the respondents according to the achieved score. Figure 2 shows the graphical representation of Table 1.

NEO - measured values Σ			
Item / Score	High	Average	Low
Neuroticism	25	34	34
Conscientiousness	12	44	37

Table 1: The NEO questionnaire – the absolute frequency (source: own elaboration, 2018)

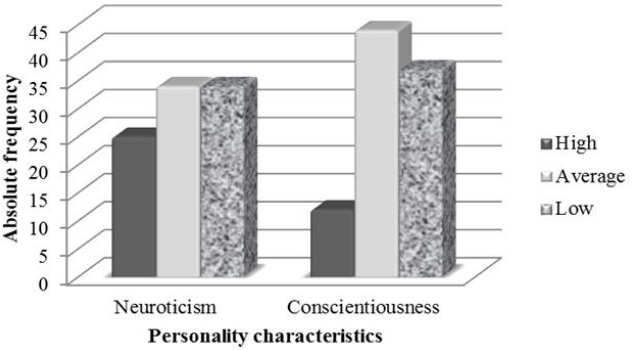

Figure 2: The NEO questionnaire – achieved score (source: own elaboration, 2018)

In Figure 2 are listed the absolute frequencies by achieved score by the first year students and the fourth year students together in selected personality characteristics of the NEO questionnaire. The absolute frequencies in Table 1 and Figure 2 were further converted to the relative frequencies. In the neuroticism item, it was found that high score achieves a total of 27 % of respondents, medium score achieves 37 % of respondents and low score achieves 36 % of respondents. It follows from this that in the research sample is approximately the same number of persons who reach high, medium and low scores. In the conscientiousness item, it was found that high score achieves a total of 40 % of respondents, medium score achieves 47 % of respondents and low score achieves 13 % of respondents. The authors of the paper conclude that respondents have large differences between high and low scores in given personality characteristics.

RQ 2: Are there differences in personality characteristics measured by the NEO questionnaire between students in the first and the fourth year and are these differences statistically significant?

The second research question identifies whether there are significant statistical differences in the measured values at the selected personality characteristics of the NEO questionnaire among students in the first and the fourth year. All parameters follow normal distribution of data in the population, which can be seen in Table 2 which shows the results of the Kolmogor-Smirn test for normality for selected items of the NEO questionnaire.

Characteristic / Year		Kolmogor-Smirn test		
		Statistic	df	Sig.
NEO - neuroticism	First year	.113	48	**.162**
	Fourth year	.087	45	**.200***
NEO - conscientiousness	First year	.101	48	**.200***
	Fourth year	.082	45	**.200***

Table 2: Kolmogor-Smirn test for items of the NEO (source: own elaboration, 2018)

All variables indicate the normal distribution of data in the population, so the authors can proceed to the parametric Student's t-test for two independent samples.

The results of Student's test (see Table 3) show a statistically significant difference

between the groups of the first year students and the fourth year students in neuroticism item (t = 2.708, sig. = 0.008). The value of practical significance estimated by Cohen's *d* parameter is d = 0.578, which can be considered a medium effect size (Soukup, 2013). For item conscientiousness there was no visible significant differences between the groups (t = - 0.795, sig. = 0.429). From additional analysis in MS Excel, it has been shown that the first year students have much higher values in the high score for the item neuroticism, in contrast to the fourth year students (Vasiľová, 2012). In the Table 3 are listed the values, which refer to significant differences between the groups of respondents.

Selected personality characteristic		Levente test for equality of dispersion		Student t-test		
		F	Sig.	t	df	Sig. 2
NEO- neuroticism	Expects the same deviations	4.081	**0.046**	2.687	91	0.009
	Does not expects the same deviations	-	-	**2.708**	88.248	**0.008**
NEO- conscientiousness	Expects the same deviations	0.001	0.977	**-0.795**	91	**0.429**
	Does not expects the same deviations	-	-	-0.796	90.896	0.428

Table 3: Student's t-test of differences between the first year and the fourth year students for items of the NEO questionnaire (source: own elaboration, 2018)

RQ 3: What score the respondents achieve in the individual scales of the D-M-V questionnaire - performance motivation questionnaire?

The third research question expects the answer concerning to the composition of the number of the respondents that were classified into three groups according to achieved score (high, average and low) in the D-M-V questionnaire. Table 4 shows the absolute frequency of respondents according to the achieved score. Figure 3 shows the graphical representation of Table 4.

DMV – measured values Σ			
Scale / Score	High	Average	Low
scale MV	35	57	1
scale AB	6	65	22
scale AP	4	65	24

Table 4: The D-M-V questionnaire - the absolute frequency (source: own elaboration, 2018)

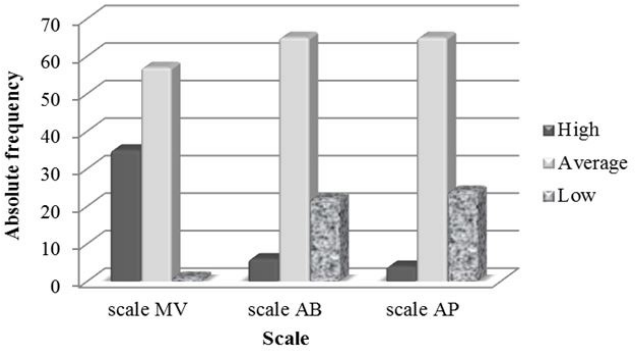

Figure 3: The D-M-V questionnaire – achieved score (source: own elaboration, 2018)

In Figure 3 there are listed the absolute frequencies by achieved score of the first year students and the fourth year students together in all scales of the D-M-V questionnaire. The absolute frequencies in Table 4 and Figure 3 were further converted to the relative frequencies. In the MV performance motivation scale, it was found that high score achieves a total of 38 % of the respondents, medium score achieves 61 % of the respondents and low score achieves only 1 % of the respondents. From the additional analysis, where the research sample has been divided to students in the first and the fourth year, it is evident that the first year students have much higher scores in the MV scale, than the fourth year students. The authors of the paper view positively that the analysed respondents have a sufficient degree of motivation in terms of high and medium score for the MV scale. Within AB scale – Anxiety lowering the power, the authors of the paper recorded the following values: high score achieves 6 % of the respondents, medium score achieves 70 % of respondents and low score achieves 24 % of the respondents. The authors of the paper evaluated the results positively because the respondents have very low values in risk high score. The last scale is AP – Anxiety supporting the power. The given values were found in the following scale: high score achieves 4 % of the respondents, medium score achieves 70 % of the respondents and low score achieves 26 % of the respondents. The authors of the paper state that the respondents have very similar score in AP scale and AB scale, where they reached almost the identical values (Stareček et al, 2017).

The evaluation of hypotheses

Through the parametric Pearson´s correlation test were evaluated the individual correlations.

H1: There is a statistically significant relationship between the values measured in the scale MV - Performance motivation from the D-M-V questionnaire and the values measured in the item conscientiousness from the NEO questionnaire.

The result of the Pearson´s correlation test shows that there is a statistically significant relationship between the MV scale - Performance motivation and conscientiousness. These variables correlate after removing of influence of AB scale - anxiety lowering the power. Mentioned scale was removed due to a partial correlation at sig. = 0.001 Pearson´s correlation coefficient r = 0.594. The authors of the paper accept hypothesis 1 and it can be confirmed that there is a strong dependence between the researched variables.

H2: There is a statistically significant relationship between the values measured in the scale AB - Anxiety lowering the power from the D-M-V questionnaire and the values measured in the item neuroticism from the NEO questionnaire.

The result of the Pearson´s correlation test proves that there is a statistically significant relationship between AB scale - Anxiety lowering the power and neuroticism item. These variables correlate at sig. = 0.001 of the Pearson´s correlation coefficient r = 0.644. The authors of the paper do not reject hypothesis 2 and it can be confirmed that there is a strong dependence between measured values of scale AB and neuroticism.

Conclusion

On the basis of the article aim, the authors have analysed the motivational and personality characteristic of the generational group Z. The statistical analyses proven that up to 64 % of the total number of the respondents (27 % high score and 37 % average score) tend to neuroticism. The mentioned finding points to lowering the power, activities in situations with increased load and also negatively affects the results in educational and work process. The next monitored item in the NEO questionnaire was conscientiousness. On the basis of the result, the authors of the paper conclude, that only 13 % of the respondents achieve the high score, while 87 % of the respondents achieve average and low score. The mentioned facts indicate that the analysed group of the respondents cannot regulate their desires and resist the impulse from the environment. The low

percentage (13 %) of the high score in item conscientiousness has a negative impact on academic and work performance. In the research was also proven the significant difference between the students of the first year and students of the fourth year. The authors can conclude that the neuroticism is changing in age. On the other hand, there was no statistically significant difference in the conscientiousness item. The authors of the paper conclude that the results are generalizable without monitoring age diversity. Monitored personality characteristics are considered as a key in human resource management whether in educational or in working process.

The D-M-V questionnaire was the second standardised tool which was used for analysing the generational group Z. The mentioned questionnaire includes three scales (MV, AB and AP). The results from the MV scale – Performance motivation indicate that the generational group Z has high score in the MV scale (38 %). On the basis of mentioned results, the authors of the paper consider the MV scale as the most important in achieving the objectives in the work and educational process. The authors of the paper evaluated the results from the AB scale – Anxiety lowering the power positively because the generational group Z has very low values in the high risk score (6 %). As the negative finding, the authors of the paper consider high values in the low score (26 %) in scale AP - Anxiety supporting the power. The mentioned fact affects a personality in a negative way.

The research hypotheses were determined for detailed characteristics of the selected variables. By quantification of the research hypotheses the authors monitored the relationship between the variables. The result of the Pearson´s correlation coefficient $r = 0.594$ indicates that there is a significant relationship between the MV scale - Performance motivation from the D-M-V questionnaire and the conscientiousness item from the NEO questionnaire. From the above obtained findings, the authors of the paper can conclude that positive motivation can be also influenced by the personality assumption of conscientiousness which has a positive effect on achieving of the work performance. The last finding was the quantification of the relationship between the AB scale - Anxiety lowering the power from the D-M-V questionnaire and neuroticism item from the NEO questionnaire. The calculation proves significant relationship at $r = 0.644$ and the authors can conclude, that there is a strong dependence between monitored variables. The authors of the paper can conclude that the generational group Z is negatively affected by the personality characteristics of neuroticism and related anxiety lowering the power.

The students and employees are significant capital not only in educational institutions but also in enterprises. Achieving objectives and increasing the efficiency of the process can be reached by properly carried out stimulating and motivating. The authors of the paper in the near future plan to deepen the research in the area of the motivational and personality characteristics of different generational groups.

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GENERATIONAL GROUPS AND EDUCATIONAL ACTIVITIES IN THE SLOVAK INDUSTRIAL ENTERPRISES

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Abstract

The aim of the article is to further characterise the generational composition of employees in the Slovak industrial enterprises and to characterise motivational factors and educational activities that prefer selected generational groups of employees. The research selection consists of 190 employees in 13 industrial enterprises. The authors of the paper have decided to collect the data by using the standardised questionnaire HO-PO-MO, specifically the questionnaire MO – Performance motivation, which was supplemented by the socio-demographic questions together with own questions in the field of educational activities of involved enterprises. The collected data were evaluated by using the quantitative statistical methods in program SPSS and MS Excel. The authors of the paper as the greatest benefit consider the characteristics of the generation composition in the selected Slovak industrial enterprises as well as the identification of significant relationships at sig = 0.05 with a r = 0.512 between the generational group Y and the composite score of motivation factors "interesting work" and "the joy of work results".

Keywords

Educational activities, generational groups, industrial enterprises, motivational factors, personality of employees

Introduction

Currently, the industrial enterprises and their personnel department are increasingly in touch with the problem of employee's differentiation by generational groups. The age of employees plays an increasing role in management process as well as in learning process. The negative prognoses of demographic curve raise the question of completing the missing need in the labour market. "Personnel planning must be an integral part of business planning and must be aimed at increasing the enterprise competitiveness" (Koltnerová and Samáková, 2011). "Managers work under pressure to ensure productivity and are aware of the importance of job applicants selection" (Harris and Fleming, 2017; Vnoučková et al, 2016). So far, one solution is to keep the older generations in working vitality. Education of employees can be considered as one of the main tools for the maintenance of employees in the best possible working condition. Synergy of different generational groups can be considered as an important tool of enterprise performance. "Work motivation is a topic of crucial importance to the success of organisations and societies and the well-being of individuals" (Kanfer, Frese and Johonson, 2017; Komárek et al, 2017). One of the perception of motivation is as follows: "Motivation resources and problems determine students' internal, external, and negative motivation" (Yardimci et al, 2017). It follows from the above that the realization of the educational activities is directly determined by the internal motivation of employees in enterprises. Internal motivation deals with the fact that the student learns because he or she is interested in a topic, issue, and other activities. Student works actively

and independently without paying pledges or guaranteed praise or a threat of penalty. Within external motivation – the students learn primarily because they want to get some external reward or in order to avoid punishment for failure in performing the task" (Hayes, 2003). To transfer the theoretical knowledge in the enterprise practice, it is necessary to know the generational structure in industrial enterprises as well as preferences of employees (motivational factors, educational activities). According to Koltnerová, Kanfer and Komárek, an integral part of the human resource management is planning and ensuring human resources along with a focus on the motivational factors that affects employees. "Learning represents a life-long on-going activity that allows innovation of processes by establishing new ways of execution in organisations" (Davidekova, Mjartan and Gregus, 2017; Stacho, Stachova and Vicen, 2017). "Considering the similarities and differences of generations, academics and practitioners benefit from business diversity and creativity. However, it also provides the ability to develop personnel strategies for the recruitment and retention of employees from different generations" (Sarraf et al, 2016). Managing human resources in enterprises and focusing on different generational groups is the key to success and competitiveness in the business market. "The success of any enterprise can be measured in different ways. Generally, it can be considered - the social and economic success" (Vaňová, Gyurák Babeľová, 2014). "Management of enterprise must inform employees clearly what is expected from them (set goals), create the conditions for the work and give feedback to employees" (Gyurák Babeľová, Kučerová and Homokyová, 2015). "Effective communication helps to gain interpersonal acceptance and commitment and can also serve as a good motivating factor" (Samáková, Šujanová and Koltnerová, 2013). There is currently a problem of selecting learning activities based on preferences of selected generational groups. The theoretical definition of educational activities and realization of relevant researches from the mentioned area is inadequate. Professional literature often does not synthesize the education, motivation or management of different generational groups.

Materials and Methods

The aim of the research was to further characterise the generational composition of employees in the Slovak industrial enterprises and to characterise motivational factors and educational activities that prefer selected generational groups of employees.

Research questions (RQ)

RQ1: What is the generational structure of employees in selected industrial enterprises in Slovakia?
RQ2: What are the most important motivational factors (MO questionnaire) for employees in the selected industrial enterprises in Slovakia?
RQ3: What are the most preferred educational tools in selected industrial enterprises in Slovakia and is there a statistically significant difference of preferences between selected generational groups?

Hypotheses (H)

H1: There is a statistically significant relationship between the motivation factor "salary amount" and educational activity "course".
H2: There is a statistically significant relationship between the generational group Y and the composite score of motivation factors *"interesting work"* and *"the joy of work results"*.

Research sample

The research sample consisted of employees from 13 selected Slovak industrial enterprises. The industrial enterprises were selected on the basis of the size criterion (number of employees), subject of business (production enterprises) and geographic location (western Slovakia). In total, 195 employees were involved in the research. In order to ensure the representativeness of the sample, the authors of the paper have used the unlikely quota selection of employees in the technical-economic positions without any age difference of employee's education. The research was conducted from September 2017 to November 2017. In total, 195 questionnaires were distributed, of which 190 were returned fully and correctly filled in. The mentioned value means about 97.4 % success rate of the data collection. The quota selection consisted of ensuring the same or similar layout of one character in the sample. The chosen character was the gender of employees. The authors of the paper distributed questionnaire to 110 females and 85 males. Returned and evaluated were 106 questionnaires (female) and 86 questionnaires (male).

The data collection tools

Within the research, the authors of the paper used two primary tools for the data collection. The first tool was the HO-PO-MO psycho-diagnostic standardised questionnaire. HO-PO-MO, the full title is the questionnaire for finding value orientations, attitudes to values and motivation to performance. The internal consistency of the questionnaire makes it possible to use separate parts according to the distributor´s requirements. The authors of the paper chose the 10 item MO questionnaire – motivation to performance, which includes the factors (incentives) that relate to interests, subjective survival of achievements, material rewards, process conditions, vertical and horizontal interpersonal relationships and social added value of work results. It is necessary to sort the individual motivation factor with the highest weight to the lowest weight when filling in the questionnaire (Vonkomer, 1991). The second collection tool consisted of questions created by the authors of the paper. The mentioned tool consisted of four questions divided into two areas. The first two questions were aimed at detecting the composition of generational groups in industrial enterprises. The third and fourth ones from the questionnaire were focused on the analysis of educational tools in the selected enterprises.

The research methods

To evaluate the collected data, the authors of the paper have used the several methods: descriptive and quantitative statistical methods (histograms of frequencies, pie charts and additional analysis in table form). Secondly, the authors have used parametric and non-parametric tests - correlation Pearson´s test (r), Student's t-test, Marginal tests and Kolmogor-Smirn's test.

Results and Discussion

The following part of the paper presents the results of the research. Based on the evaluation of the research questions and the hypotheses, the authors of the paper interpreted the conclusions of the studied issue.

The evaluation of research questions

RQ1: What is the generational structure of employees in the selected industrial enterprises in Slovakia?

The first research question looks for an answer to the composition of generational groups (table 1) in the industrial enterprises that took part in the research. The authors of the paper used the theory of generational structure that classifies generational groups into five groups: Baby Boomers (born

from 1946 to 1964), generational group X (born from 1965 to 1976), generational group Y (born from 1977 to 1993), generational group Z (born from 1994 to 2000), and generational group α (born from 2001) that are currently on the labour market. The result of the quantitative analysis shows the composition of the research sample according to gender.

Generational group	Gender		Together
	Male	Female	
Baby boomers	3	9	12
Generational group X	26	37	63
Generational group Y	38	34	72
Generational group Z	16	23	39
Generational group α	1	3	4
Together	84	106	190

Table 1: Structure of generational groups by gender (own elaboration, 2018)

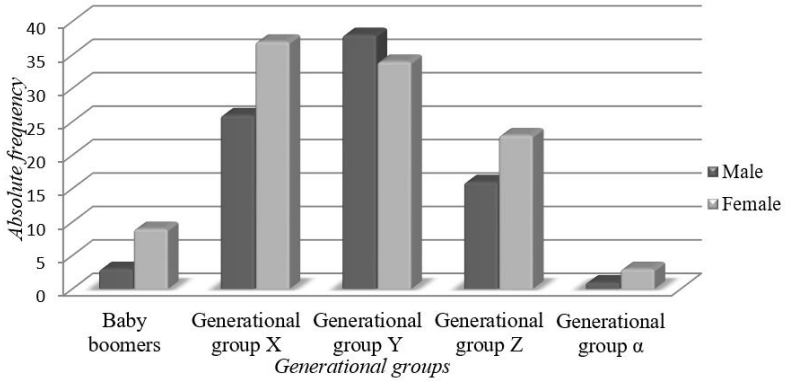

Figure 1: Graphic structure of generational groups by gender (own elaboration, 2018)

The figure 1 shows that the smallest group in the industrial enterprises in Slovakia is the generational group α, which is currently predominantly located in school facilities. The mentioned condition shows that students begin to work in an early age. The second smallest group consists of baby boomers, who are employees in pre-retirement age. In spite of the higher age, this group of employees is relatively large. The third least group is generational group Z which according to the theoretical base is a transition group from school facilities to enterprise practice. The mentioned group is the most formidable and will be almost whole on the labour market in the coming years. The two most numerous groups are the generational group X and Y, which are composed of people in active working life. These groups are the main creators of added value and work performance on the labour market nowadays. From the gender perspective, it is possible to make the same representation of men and women. This fact is evident due to ensuring the heterogeneity of the respondents' gender without age differentiation.

RQ2: What are the most important motivational factors (MO questionnaire) for employees in the selected industrial enterprises in Slovakia?

The second research question was focused on influencing the motivational factors within the different generational groups. The main reason is that only a satisfied (motivated) employee is productive. To ensure the validity of the results, a standardised MO questionnaire – motivation to performance was used and brought to the authors of the paper an idea of the most preferred

motivational factors within the various generational groups. The table 2 shows the frequency for each scale factor (high, average and low factor).

Scale / Score	High	Average	Low
a) interesting work	77	67	46
b) the joy of work results	29	82	79
c) exciting situations	13	75	102
d) flexible work arrangements	42	89	59
e) salary amount	92	63	35
f) the possibility of career progression	34	71	85
g) team competitions	7	47	136
h) benefit to society	15	53	122
i) recognition from co-workers	29	74	87
j) manager s recognition	42	56	102

Table 2: Motivational factors and their importance (own elaboration, 2018)

However, on the basis of the evaluation, it is clear that the salary amount, interesting work and manager´s recognition are three the most important motivational factors. When counting the composite score of the high and average scale, three the most important motivational factors are the salary amount, interesting work, and joy of work results. These three factors are considered to be the most important. The first motivational factor is based on biological needs and it can be perceived as a stimulus. In many cases, the industrial enterprises cannot influence it due to small financial possibilities. On the contrary, the identified factors of interesting work and the joy of work results can be used by the management and with its help for achieving the higher performance of the employees. Both motivational factors are considered as internal motives and motives that can exponentially increase the employee performance and productivity.

RQ3: What are the most preferred educational tools in the selected industrial enterprises in Slovakia and is there a statistically significant difference of preferences between selected generational groups?

The third, the last research question is divided into two parts. The first part looks for the preferences of selected generational groups in the field of educational activities in industrial enterprises in Slovakia. In the table 3, are evident the answers of individual respondents.

Education/ Generational group	Baby boomers	Generational group X	Generational group Y	Generational group Z	Generational group α	Together
instructing	1	12	9	9	1	32
training	0	8	4	2	0	14
upskilling	4	15	18	5	0	42
self-education	0	7	9	1	0	17
restraining	2	4	7	3	0	16
course	5	15	18	8	1	47
development	0	1	3	2	0	6
e-learning	0	1	4	9	2	16
Together	12	63	72	39	4	**190**

Table 3: Evaluation of preferences for educational activities (own elaboration, 2018)

It is clear from the table 3 that age of employees changes preferences for selected educational activities. Without the differentiation of employees into generational groups, these are three the most preferred educational activities: training, upskilling and instructing. The least preferred activity is development. The second part of the third research question looks for the answer to the

difference between different generational groups and educational activities. Due to the fact that the representation of individual generational groups is not homogeneous, the authors of the paper have decided to use only three the largest generational groups (generational group Y, generational group X and generational group Z) for the further analysis. Based on the marginal averages test, the authors identified statistically significant differences between the selected generational groups. Based on the expert selection, course and e-learning were labelled as critical educational activities. The results can be seen in the table 4, which shows the statistical differences.

Marginal diameter test		Mean Difference		Std. Error		Sig.	
		course	e-learning	course	e-learning	course	e-learning
Generational group Z	GS - X	-1.22*	-1.75*	0.512	0.473	0.056	0.046
	GS - Y	-1.39*	-1.96*	0.426	0.476	0.033	0.019
Generational group X	GS - Z	1.22*	1.75*	0.503	0.473	0.056	0.046
	GS - Y	**-0.16**	**-0.19**	0.525	0.686	**0.943**	**0.854**
Generational group Y	GS - Z	1.39*	1.96*	0.426	0.476	0.033	0.019
	GS - X	**0.16**	**0.19**	0.525	0.686	**0.943**	**0.854**

Table 4: Marginal diameter test for educational activities (own elaboration, 2018)

It is clear from the statistical tests that the two educational activities (course and e-learning) showed a statistically significant difference between the generational group Z and the generational groups X and Y. There was no statistically significant difference between the generational group X and the generational group Y. Therefore, the authors of the paper can argue that generational group Z has a positive relationship to the educational e-learning activities and, on the contrary, less prefers educational activity course. The generational groups X and Y prefer educational activity course and do not have a positive relationship to educational activity e-learning.

H1: There is a statistically significant relationship between the motivation factor *"salary amount"* and educational activity *"course"*.

The Spearman correlation test results show that there is a statistically significant relationship between the motivation factor *"salary amount"* and the educational activity *"course"*. This variable correlate at sig = 0.05 with Spearman's correlation coefficient $r_s = 0.416$. Significance value reached the required level (sig <0.05). Therefore, the authors of the paper do not reject this hypothesis and could confirm that there is a moderate correlation between the monitored variables.

H2: There is a statistically significant relationship between the generational group Y and the composite score of motivation factors *"interesting work"* and *"the joy of work results"*.

The result of the Pearson´s correlation test proves that there is a statistically significant relationship between the generational group Y and the composite score of motivational factors *"interesting work"* and *"joy of the work results"*. These variables correlate at sig = 0.05 with a Pearson´s correlation coefficient r = 0.512. Significance value reached the required level (sig <0.05), and therefore the authors of the paper do not reject this hypothesis and could confirm that there is a moderate relationship between the observed variables.

Conclusion

The main objective of the paper was to further characterise the generational composition of employees in the Slovak industrial enterprises and to characterise motivational factors and educational activities that prefer selected generational groups of employees. On the basis of the analyses carried out, it was shown that all five generational groups are already present on the labour market. Even the youngest generation groups (Z and α) are in the workplace. The research results showed that even without age selection, there are approximately similar numbers of employees

of different gender in enterprises. Another analysis has shown that employees are still motivated by the financial rewards. "Motivation and flexibility play a key role in getting job performance and as a result in the financial success of the organisation" (Bran and Udrea, 2016). The authors of the paper consider as more important fact to identify the motivators (interesting work and joy of the work results), which can be used to increase the satisfaction and efficiency of employees. The authors of the paper consider as an interesting finding that employees recognise courses, upskilling and instructing to be the most effective educational activities. On the other hand, the development activity is considered to be of the utmost importance. This could be also influenced by the fact that it is not implemented in a sufficient extent in enterprises. By statistically evaluating marginal averages, the authors of the paper found that there are statistically significant differences in course and e-learning activities between generational group Z and generational groups X and Y. The most important findings identified the significant relationships between salary amount and course when the authors can claim that employees, who prefer as a motivational, factor the amount of salary, also prefer educational activity and course. Another significant relationship is related with composite score of interesting work and joy of the work results that is mostly preferred by generational group Y. All the results from the analysis were presented to the management of the involved industrial enterprises. On the bases of the interviews with senior HR managers, the authors of the paper recommended an increase in generational tracking in industrial enterprises. Another recommendation for improving the performance and competitiveness of the industrial enterprises is to focus on the most important motivational factors along with the differentiated approach to educational activities focusing on different generational groups. The authors of the paper consider all the findings to be significant from the enterprise practice point of view. The results will be published in the scientific reports and all involved industrial enterprises will be informed about the research results.

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ANALYSIS OF FACTORS INFLUENCING THE LEVEL OF PROCRASTINATION AMONG STUDENTS AT THE UNIVERSITY OF LIFE SCIENCES PRAGUE

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Abstract

The present paper measures the level of procrastination among students of chosen bachelor's programs at FEM, CULS in Prague by means of statistical data, and the dependency between chosen factors and the level of procrastination.
The research included collecting data using the questionnaire method. The data was assessed by means of Lay's scale of procrastination and the statistical testing of the relationship between categorial data. The null hypotheses were set. The results show that from among the respondents, 46 are light procrastinators, 83 average, and 39 heavy procrastinators. For the null hypotheses, no relationship between the factors was confirmed. A significant relationship was confirmed only between the grade point average (performance) and the degree of procrastination.

Keywords

Lay's scale, procrastination, student, study results, university

Introduction

According to the Electronic dictionary of foreign words (2017), **procrastination** is: *"a significant and chronic tendency to put off one's duties and tasks (especially those of uncomfortable nature) for a later time and a risk phenomenon for mental health".* The term "prokrastinace" comes from the English term "procrastination" and Latin "procrastinates". There are many other definitions based on research results, e. g. in Michalowski et al. (2017): „*…Procrastination is a failure of self-regulation in which people delay some actions despite knowing that their behavior will lead to discomfort…"*
A number of researches point out a more or less significant dependency between one's efficiency and procrastination. Procrastination affects not only people of a productive age, but also students of elementary schools, high schools and universities. According to Vnoučková et al. (2016), the importance of the quality of education grows with the number of people who are motivated to study. Among these students, a lower degree of procrastination during the course of study may be expected. A logical question is, what it actually is that draws away students' attention, giving them an opportunity to procrastinate. A possible answer is offered by Meier et al. (2016), where he states: „*1. Using Facebook (FB) to procrastinate tasks is common among students. 2. Trait self-control (TSC), FB habits, and FB enjoyment predicted procrastination. 3. Procrastination with FB increased students' academic stress and FB-induced strains.4. Procrastination mediated the effects of TSC, habits, and enjoyment on well-being. 5. Procrastinating with FB can impair users' well-being.*"

Clarry H. Lay has conducted a large amount of research. Schouwenburg and Lay (1995) and Stainton and Lay (2000) tested procrastination within the five-factor personality structure -Neuroticism, Extraversion, Agreeableness, Openness, and Conscientiousness. In Schouwenburg and Lay (1995), a study of self-ratings on trait adjectives relevant to procrastinatory behavior, procrastination was largely associated with the lack of conscientiousness. Ludwig (2013) and Lay (1986) deal with the question of how procrastination may be effectively hindered. Špok (2014) describes the relationship between efficacy and self-control on a time scale: higher self-efficacy for near-future effortful tasks was reported by high self-control individuals and low self-efficacy by low self-control individuals, whereas for distant-future effortful tasks it was vice versa. To sum up the evidence, one must but agree that procrastination is a serious behavioral problem, which cannot be effectively healed by simply imposing deadlines on oneself (Ariwly and Wertenbroch, 2002).

The goal of the present paper is to measure the level of procrastination among students of chosen bachelor's programs at the Faculty of Economics and Management (hereinafter FEM), Czech University of Life Sciences Prague (hereinafter CULS) by means of statistical data, and the relationship between the chosen factors and procrastination.

Materials and Methods

The secondary sources providing the theoretical basis for the methodology used in this paper include reviewed scientific articles, reference books and scientific journals. The primary data have been acquired by conducting research.

The research was based on a questionnaire survey, which was conducted at FEM CULS in Prague, in selected bachelor's programs during the period of December 5, 2017 to January 18, 2018. The data was collected through an internet application Vyplnto.cz. 168 respondents answered, wherefrom 94 (56%) were students of Business Administration and 74 (44%) were students of Informatics. The questionnaire consisted of 35 questions divided into two parts. The first part contained questions concerning procrastination, the second part focused on sociodemographic characteristics. A first version of the questionnaire was piloted among 3 students of Business Administration and 1 student from The University of Economics in Prague. The questionnaire was then adjusted, and the final version was distributed among the students of the selected years of the bachelor's program.

The basic sociodemographic characteristics were as follows: the ratio of men versus women was 54% (90) to 46% (78).

Two methods were used to interpret the acquired data. The first method was Lay's scale of procrastination (Lay, 1986). Lay's scale obtains 20 questions and each has 5 options to answer. The each answer is scored from 1 to 5 points where ten items are scored in the reverse manner (3, 4, 6, 8, 1, 13, 14, 15, 18, 20). This method was applied by means of a questionnaire pertaining to it. All points were summed for all items, giving the final score for each respondent. On the basis of the result score, Lay (1986) divides respondents into 4 categories:

- Non-procrastinators: 20 – 28 points
- Light procrastinators: 29 – 52 points
- Average procrastinators: 53 – 63 points
- Heavy procrastinators: 64 – 100 points

The second part of the research utilized the descriptive statistical method to process the acquired data. It consisted of testing the categorial data acquired from the questionnaire. The data were structured into contingency tables and a null hypothesis of independency was tested by the chi-square test (Agresti, 2002). The decision based upon the test was established from the result

value of the test criteria and the p-value. If the p-value was lower than the significance level 0,05, the null hypothesis of independence was rejected. The results were processed by the statistical software IBM SPSS.

The following hypotheses were the object of analysis:

- $H_0$1: The degree of procrastination does not depend the gender of the respondent.
- $H_0$2: The degree of procrastination does not depend on the amount of time the respondent spends on social networks.
- $H_0$3: The degree of procrastination does not depend on the age of the respondent.
- $H_0$4: The degree of procrastination does not depend on the grade point average of the respondent.

Results

The data acquired in the first part of the research are laid out on the Lay's procrastination scale. Table 1 presents the results:

Legend	Points	Score
Non-procrastinators	20 – 28	0
Light procrastinators	29 – 52	46
Average procrastinators	53 – 63	83
Heavy procrastinators	64 – 100	39
Total sum		168

Table 1: Procrastination in respondents (source: Authors' own research, 2018)

The data in Table 1 show that based on Lay's scale of procrastination, 46 (27%) of respondents from the group of respondents (n = 168) are light procrastinators, 83 (49%) average procrastinators and 39 (23%) heavy procrastinators.

Gender	Light procrastinators	Average procrastinators	Heavy procrastinators	Total sum
Women	25	39	14	78
Men	21	44	25	90
Total	46	83	39	168

Table 2: Contingency table for the gender of the respondent and the degree of procrastination (source: Authors' own research, 2018)

On the basis of the results shown in Table 2, it may be stated that there has been no dependency found between the gender of the respondent and procrastination at the 5% level of significance (chi-square = 2.909, p-value 0.233). Thus it cannot be claimed that the degree of procrastination is different in men and in women.

Time spent on social networks	Light procrastinators	Average procrastinators	Heavy procrastinators	Total sum
0.1 – 1 hour	17	23	10	50
1.1 – 2 hours	15	32	13	60
2.1 – 3 hours	9	17	8	34
More than 3 hours	5	11	8	24
Total sum	46	83	39	168

Table 3: Contingency table for the times spent on social networks and the degree of procrastination (source: Authors' own research, 2018)

The results of Table 3 show that there has been no dependency proved at the 5% significance level (chi-square = 3.024, p-value 0.806). The degree of procrastination does not associate with the time the respondent spends on social networks.

Age	Light procrastinators	Average procrastinators	Heavy procrastinators	Total sum
≤ 22 years	5	15	5	25
23 years	15	28	11	54
24 years	20	23	12	55
25+ years	6	17	11	34
Total sum	46	83	39	168

Table 4: Contingency table for the age of the respondent and the degree of procrastination (source: Authors' own research, 2018)

Table 4 shows that at the 5% significance level there have been no dependency found between the age of the respondent and the degree of procrastination (test criterion chi-square = 6.143, p-value 0.407).

Grade point average	Light procrastinators	Average procrastinators	Heavy procrastinators	Total sum
To 2.0	27	46	13	86
Over 2.0	19	37	26	82
Total	46	83	39	168

Table 5: Contingency table for the grade point average of the respondent and the degree of procrastination (source: Authors' own research, 2018)

The results in Table 5 show that at 5% significance level, the null hypothesis of independence may be rejected. The degree of procrastination can be stated to associate with the grade point average (GPA). Students with a better GPA (to 2.0) have a lesser tendency to procrastinate than students with a worse GPA (chi-square = 6.609, p-value 0.037).

Discussion

Results of questionnaire survey show that all students are procrastinators (almost half of the respondents on an average level, 27% are light procrastinators and 23% are heavy procrastinators). Lee (2005) shows that a significant role is played by the students' self-determination on one hand and amotivation with no sense of self control on the other. Howel'´s et al. (2006) studies revealed „strong behavioural evidence of temporal discounting, especially among those who identified themselves as procrastinators".

According to the results there has been no dependency proven between the degree of procrastination and that men and women do not differ in the degree of procrastination, this is consistent with the results of Ferrari et al. (2007) The results, however, contradict the findings of Balkis and Duru (2017) and Yockey (2016) from whose research it follows that men procrastinate more than women. The discrepancy may be ascribed to cultural and societal differences between the Czech Republic and Turkey, among whose university students the above-mentioned research was conducted. Lowinger et al. (2014) have likewise registered a gender difference, pointing out that among women, there is a significant dependency of academic procrastination and academic self-efficacy.

No dependency has been found at the significance level, in other words, the degree of procrastination does not associate with the time spent on social networks. In their study, Meier et al. (2016), on the other hand, propose that the dependency might indeed be significant and

that regarding uncontrolled and dysfunctional media use, procrastination might be investigated as a specific pattern of such misuse.

Regarding the age of the respondents, it is possible to state that the degree of procrastination does not associate with age, which is confirmed also by the research of Lowinger et al. (2014) and Gupta, Hershey and Gaur (2012), respectively. On the other hand, authors' results concerning the respondents age are in contrast with the results of Arif et al. (2014) which have proved that younger individuals (less than 20 years) tend to procrastinate more than the older individuals (above 20 years).

Based on the survey, students with better study results (GPA to 2.0) have a lower tendency to procrastinate than students with a worse study results. This is consistent with results of Klassen, Krawchuk and Rajani (2008) who stated that daily procrastination and self-efficacy regulation significantly influence academic performance. Despite of Lay's (1986) pointing to a strong link between procrastination and organization/disorganization measures, it was shown not to detract from the procrastinator's performance. Procrastination may also lead one to quit their studies. In this context, Vlk, Stiburek and Švec (2016) note that the drop-out rate has been increasing over the past few decades and the official authorities financing education have become more alert as to the question of the efficiency of the current study systems. Saele et al. (2017) look at procrastination from the point of the individual. In their study, academic achievement and procrastination are connected via individual learning approaches: a better GPA was predicted by deep and strategic learning approaches, where the latter was also associated with lesser procrastination. However, procrastination itself did not necessarily predict GPA. Last but not least, Kim and Seo (2015) conducted a meta-analysis of 33 procrastination studies by different authors, asserting that procrastination and negative academic performance are indeed associate.

Conclusion

The results of the presented research aimed at the degree of procrastination in students of FEM indicate that the problem is of a rather serious nature. University level study is directly connected to personal responsibility and to the students' approach towards their duties. From the overall number of the respondents (n = 168), the results show that from among the respondents, 46 (27%) are light procrastinators, 83 (49%) average, and 39 (23%) heavy procrastinators.The examined factors related to procrastination are statistically relevant in the case of the GPA. It is the students with a worse GPA who have a higher tendency to procrastinate.

Procrastination is currently an important phenomenon that affects the student‘s ability to complete university studies and to be successful at the labor market. Further research in the field of procrastination will be focused on conducting an exploratory factor analysis. The present questionnaire will serve as a basis from which data will be taken.

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TEACHING OF INTERNATIONAL ACCOUNTING STANDARDS IFRS AT THE UNIVERSITY LEVEL

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Abstract

The worldwide importance of the International Financial Reporting Standards (IFRS) in the area of accounting harmonization confirms the relevance of teaching IFRS in accounting education. The paper assesses the merits of teaching IFRS in general and in the Czech University of Life Sciences Prague (CULS) and presents the results of the questionnaire survey conducted amongst the master´s program students of Business Administration field. The results show that most students regard the subject "FRS Accounting," as being of medium difficulty and its information load as appropriate. Students express a desire for the lessons to be more practical. Statistical evaluation of the results did not prove a correlation between the difficulty of the taught material and its information load on one hand and the students´ work experience, gender or age on the other. In the end, the authors outline the possible focus of teaching IFRS at CULS in the following years.

Keywords

Czech University of Life Sciences (CULS), information load, International Financial Reporting Standards (IFRS), level of difficulty, student, taught material, teaching

Introduction

It is self-evident that IFRS is an answer to the call for a unified financial reporting system. Currently, the IFRS Foundation states that they have complete profiles for 166 jurisdictions, (IFRS Foundation, 2017a) which represent around 98% of the world´s gross domestic product (GDP) (Pacter, 2017). IFRS are supported by major governmental and international organisations, such as the G20 (IFRS Foundation, 2017b).

It is desirable that the implementation of IFRS takes place eventually. As a high quality, internationally recognised set of accounting standards, it provides transparency, accountability and efficiency to financial markets around the world (IFRS Foundation, 2017b). This means IFRS can be of immense help in decision making, both for investors and other financial market participants, and for regulators and other users (Jermakowicz and Hayes, 2011). What obstacles are there to the full-scale implementation of these standards? First, of course, the costs. Soderstrom and Sun (2007) propose that while changing a country's overall institutional infrastructure is difficult, the least costly means will be perhaps addressing financial reporting incentives. As Márquez-Ramos (2011) points out, adopting a high-quality set of harmonized accounting standards fosters trade and foreign direct investments as the improvement in accounting information, in turn, fosters financial transparency and comparability and reduces information asymmetries and unfamiliarity among agents in different countries.

The Czech companies which trade their shares on regulated financial markets are required to

use IFRS for the preparation of their consolidated and individual (non-consolidated) financial statements. Other companies have the option to choose IFRS over the Czech accounting regulations (PWC, 2009; Accounting Act, 1992). It is imperative that the students understand IFRS principles. One reason is that after their study, they can find work in companies reporting their financial statements in IFRS both in the Czech Republic and abroad. Furthermore, the Czech national standards are adjusting more and more to IFRS principles. All changes in the amendment of the accounting law valid from January 1, 2016 comply with IFRS principles. Students who have mastered these principles have no difficulty to work with IFRS based financial statements as well as to grasp the evolution of national accounting. In more general terms, successful competition in the market requires constant contact with the flow of data and information (Šilerová et al. (2017). Based on the above mentioned, it can be said that teaching of IFRS is an important area of accounting education in the Czech Republic and in the field of international accounting harmonization. The objective of this paper is to assess the teaching of IFRS in general, assess some of the experience of educators with the teaching of IFRS at the Faculty of Economics and Management (hereinafter FEM), Czech University of Life Sciences Prague (hereinafter CULS) and last but not least, to assess the CULS master´s program students (Business Administration) opinions regarding the information load of the taught material and its difficulty in dependency on their work experience, gender and age.

Materials and Methods

For the theoretical background of the paper, the method of desk research was applied. Information from professional resources about the extension of IFRS and about the approaches to the teaching of IFRS was searched, collected and assessed. For the basic characteristics of the teaching of IFRS at CULS, information from the university information system (hereinafter referred to as UIS) was used. The description of the general perception of accounting and the methods of the teaching at CULS is based on the experience of teachers within the subjects of financial accounting and especially, "IFRS Accounting".

A questionnaire survey was conducted amongst the students of the subject, "IFRS Accounting" at the FEM CULS. The questionnaire´s aim was to find out whether the teachers at CULS set the teaching of IFRS in at a suitable level of difficulty and information load for the students and whether there exists a relationship between the answers and students work experience, their gender and age. The survey was conducted in an electronic form during January 2018 (semester of 2017/18). From a total of 208 students (UIS CULS, 2017), the questionnaire was answered by 125 students, i.e. 60% return. Basic sociodemographic factors of the reference group of respondents were as follows:

- All respondents were Master's degree students in their 2nd year. From the total number of respondents (n = 125), 60% (75 respondents) were regular students and 40% (50 respondents) were distance learning students.
- As to the gender of the respondents, the ratio is 80% (100) of female respondents to 20% (25) of male respondents. The imbalance parallels the overall gender ratio of students at CULS Prague.
- The age structure of the respondents was as follows: 55.2% (69) from the age group of 20 – 24, 32.8%, (41) from the age group of 25-29, 12% (15) from the age group over 30 (distance learning students).

The following Null hypotheses regarding the subject, "IFRS Accounting" were tested:

- $H0_1$: The opinion of the students regarding the level of difficulty in understanding the taught material does not depend on their experience with the subject matter in practice.

- $H0_2$: The opinion of the students regarding the information load of the taught material does not depend on their experience with the subject matter in practice.
- $H0_3$: The opinion of the students regarding the level of difficulty in understanding the taught material does not depend on their gender.
- $H0_4$: The opinion of the students regarding the level of difficulty in understanding the taught material does not depend on their age.
- $H0_5$: The opinion of the students regarding the information load of the taught material does not depend on their gender.
- $H0_6$: The opinion of the students regarding the information load of the taught material does not depend on their age.

To evaluate the outcomes of the survey, methods of multiple response analysis (absolute and relative frequency, testing of independency between set qualitative characteristics and power dependency measures) and the Pearson´s Chi-square test has been applied. If the calculated χ^2 value was greater than the selected critical value on selected level of significance $\alpha = 0.05$, a Null hypothesis for a Chi-square test of Independence was rejected (Hindls et al., 2007). As additional information, theoretical expected frequencies have been presented in the prepared tables.

The questionnaire contained an optional open question wherein the students could express their suggestions regarding the improvement of the way the subject is taught. For the regular students, the question was divided into two parts: suggestions for seminars, which are taught biweekly (44% of regular students responded, 33) and for the lectures, which are taught weekly (25%, 19). The distance learning students have lectures and seminars as a study block, therefore the questions were not divided. 10 students responded (20% of the distance learning students). All responses were analysed, similar suggestions were merged. Suggestions with the highest frequency are presented in the Results.

The results of the paper have been compared with the results of other authors in the discussion section and the direction of further research is outlined.

The paper reflects the authors´ personal views, which are influenced by the evolution of financial accounting in the Czech Republic as well as on professional and personal experiences during the teaching of IFRS - limitations and biases included.

Results

IFRS standards (subject “IFRS Accounting”) are taught at FEM CULS in the 2nd year of the Master´s degree, within a Business Administration programme (hereinafter BA), both for regular and distance learning students. Due to historical developments, accounting is considered to be an exact discipline with the main task of recording business transactions in line with mandatory legal requirements, where the accountant´s own inventive approach might be often understood as deceptive practice coming close to a fraud. This stereotypical understanding may be true to some extent within national accounting, but not within IFRS. An accountant has to apply a great number of estimates within IFRS (e.g. present value of future cash-flows) and judgements and also explain them properly. The role of the educators is to steer the students towards the grasping of IFRS principles so that the students are prepared to work within the process of international harmonization of accounting. Students who attain the bachelor´s degree in a BA study programme at CULS, have completed the subjects Accounting Theory and Accounting for Entrepreneurs. Having mastered the fundamental principles of accounting in general before they start with IFRS can be beneficial for better understanding the practical effects of IFRS principles.

The experience of the authors with the teaching of IFRS shows that it is important from the beginning to stress the basic IFRS principles of the financial statements preparation, captured in

the Conceptual Framework. However, the results of the questionnaire show that it is not necessary to start with its full information load. It might be better to point out its relevant parts when discussing a particular standard and link the Conceptual Framework principles to the discussed topics gradually, step by step. The role of the educator is not only to choose which standards will be discussed, so that all the fundamental areas of financial reporting are included, but also the extent of detail. Considering the fact that the original set of standards has more than 2000 pages, it is not an easy task.

The questionnaire survey results are presented in Table 1 – Table 3 and in the related text.

Null hypothesis $H0_1$: The opinion of the students regarding the level of difficulty to understand the taught material does not depend on their experience with the subject matter in practice.

Respondent´s experience/ Level of difficulty	Medium difficulty	High difficulty	Total
Experience - Yes	16 (14)	2 (4)	18
Experience - No	84 (86)	23 (21)	107
Total	100	25	125

Table 1: The relationship between the opinion of students regarding the difficulty of the subject IFRS Accounting" and their experience with the subject in practice, theoretical frequencies rounded to the integer are in the brackets (source: Own research, 2017)

No respondent rated the subject, "IFRS Accounting" as an easy one. The difficulty of understanding the taught material was rated by 80% of respondents as medium, by 20% as high. Therefore the hypothesis was tested only for these two columns. The calculated Chi-square (χ^2)1.04 is lower than the critical value at degrees of freedom 1 at the significance level of 0.05, which was 3.84. Therefore, the Null hypothesis cannot be rejected. Dependency between the perception of the students regarding the difficulty to understand the subject, "IFRS Accounting" and their practical experience with the subject was not proved.

Null hypothesis $H0_2$: The opinion of the students regarding the information load of the taught material does not depend on their experience with the subject matter in practice.

Respondent´s experience/ Information load of taught material	Not extensive enough	Appropriate	Too extensive	Total
Experience - Yes	0 (0)	12 (10)	6 (7)	18
Experience - No	3 (3)	60 (61)	44 (43)	107
Total	3	72	50	125

Table 2: The relationship between the opinion of students regarding the information load of taught material and their experience with the subject in practice, theoretical frequencies rounded to the integer are in the brackets (source: Own research, 2017)

There was a too small number of responses in category, "Not extensive enough" to apply the Chi-squared test (the test would detect a false dependency at these low numbers). These responses were therefore merged with the category "Appropriate". The calculated Chi-square (χ^2) 1.04 is lower than the critical value at degrees of freedom 2 at the significance level of 0.05, which was 5.99. Therefore, the Null hypothesis cannot be rejected. Dependency between the perception of the students regarding the information load of taught material within the subject, "IFRS Accounting" and their practical experience with the subject was not proved.

The summarized results of the tested hypotheses $H0_3$, $H0_4$, $H0_5$ and $H0_6$ are shown in Table 3. No dependency was confirmed between the opinion of students in regard to the difficulty of understanding the taught material and between their gender ($H0_3$), or age ($H0_4$). Similarly, it is not possible to reject the Null hypotheses $H0_5$ and $H0_6$.

Value types	HO_3	HO_4	HO_5	HO_6
Degree of freedom	1	2	1	2
Critical value	3.84	5.99	3.84	5.99
χ^2	2.81	0.49	1.08	2.88
Results of the tested hypotheses	Not rejected	Not rejected	Not rejected	Not rejected

Table 3: Summarized results of tested hypotheses HO_3, HO_4, HO_5 and HO_6 (source: Own research, 2017)

Although it is possible to say that students at CULS consider the subject, "IFRS accounting" to be of medium difficulty and with a suitable information load, most suggestions by regular students (19 from 33.58%) regarding to the improvement of seminars were related to the increase of the time frame, because there is not enough time to cover all examples and there is a need for a quite extended home study. The most frequent answer (8 from 19.42%) regarding the improvement of the lectures was an acknowledgment for managing the lectures, followed by a need for more practical examples, together with the need to invite professionals who work in the field (5, 26%) and the note about the high speed of the lessons (4, 21%). Some of the answers overlapped.

Half of the responses from the distance learning students (5) are suggestions regarding the need for greater connection with a practice, mainly in form of case studies. 2 students (20%) rated the subject too extensive. One of the reasons why the students feel the need for practical application may be the fact that the last lecture is given by a professional from an existing company and the students felt it very beneficial. However, the offered suggestions of students´ may depend on their personality type and their preferences as to the methods of the teaching.

It is up to the educators if whether they will reduce the information load of the taught material and to consider the consequences, because only 5% (6) of students from the total number of respondents pointed out the large information load and high speed of the teaching. Further research may focus on the possibility and the methods to include more practical applications into the regular teaching. This need was expressed by 8% (10) of students from the total number of respondents.

Discussion

Albu, Albu and Gîrbină (2012) try to define the core of the problem by analysing society´s attitude towards accounting in the national context and comes to the conclusion that the main cause of rigorous adherence to strict rules lays in the very way students are educated in accounting. They learn a certain stereotype, whereas IFRS, on the other hand, requires more of a professional intuition rather than rigorousness. What is the highest importance for the success of the global adoption of IFRS is to promote the principle-based IFRS by good teaching resources (Jackling, 2013). To put it in Wells´ words (2011), financial statements that conform to IFRS are based on estimates, judgements and models rather than exact depictions.

Although surveys point out that the students´ evaluation of courses quality is necessarily biased by the students' specific areas of interest Vnoučková, Urbancová and Smolová (2017), the question still remains; what to include specifically in these financial accounting courses. Through subsidiary companies, IFRS is infiltrating even countries where it has not been adopted (Larson and Street, 2011). Although challenging, IFRS might be mastered via the help of a growing number of resources (Larson and Street, 2011). Tan, Chatterjee and Bolt (2013) suggest that these resources should be a greater deal more problem-based, so that the students may grasp the principle rather than the mere figure. Materials available are utilizing the ISBA Framework (Larson and Street, 2011). The newly acquired skill of accountants to work within IFRS may even have a positive outcome, such as the accountants´ ability to move more freely from one country to another in

pursuit of employment. Such an outcome was shown in the joint research between the University of Chicago and Humboldt University of Berlin, on the effects of the recent EU harmonization of accounting (Deloitte, 2016).

Conclusion

IFRS as a uniform financial reporting system is currently the most widely used instrument of accounting harmonization around the world. Within the European Union, entities who have their shares listed on a European stock-exchange market, have to prepare their financial statements in compliance with IFRS. In the Czech Republic, the recent changes in the national accounting legislation are influenced by the principles of IFRS and it is assumed that this trend will continue. The task of educators is to prepare the students for the challenges related to the global accounting harmonization process and at the same time to ease their perception regarding the mandatory accounting stereotypes imposed upon companies by the existing national accounting legislation. There is a great amount of easily accessible quality educational material in English regarding IFRS. The set of IFRS standards is very extensive, therefore it is a challenge for the educators to choose which topics should be discussed in greater detail and to incorporate the basic principles of IFRS into the timeframe of lectures and seminars in an understandable manner.

The results of the questionnaire conducted amongst the students of the study field Business Administration at FEM CULS showed that most students regard the subject, "IFRS Accounting" to be of medium difficulty and the information load of this subject appropriate. The statistical evaluation did not prove dependency between the level of difficulty and information load of this subject and the work-experience, gender or age of the students. The answers to the optional open question in the questionnaire brought in valuable feedback about the real need to include more practical applications and case studies in the teaching of IFRS and the insufficient time-frame of seminars. The future course of teaching will challenge the educators to consider whether or not to slightly reduce the extent of taught material and focus more on specific examples and case studies. Limitations of our research are related to the number of respondents and to only one University being included. For a possible future research, cooperation with educators from other universities teaching this subject and a comparison of the results would be beneficial for finding inspiration to improve this very important subject within accounting education.

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CASE STUDIES IN ACCOUNTING COURSES FOR MANAGERS: CZECH AND SLOVAK COMPARISON

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Abstract

In our study we focus on introducing real-life case studies into accounting education at management faculties - one in the Czech Republic and one in Slovakia. We were interested how future managers would perceive the inclusion of case studies in the tuition. In addition, we aimed to find out whether there are any differences in the perception of this form of teaching among Czech and Slovak students and whether there is any influence in terms of gender. The study was based on a questionnaire survey of 205 students (68 Czechs and 137 Slovaks). The data were then statistically processed using multiple regression analysis. The results clearly pointed out that the students evaluated the inclusion of case studies in accounting education positively. At the same time, this form of education is perceived more favourably by men than women, and students in Slovakia compared with students in the Czech Republic.

Keywords

Accounting, case study, didactics, introductory accounting course, teaching

Introduction

The aim of a teacher in accounting courses is to make students understand the topic and be able to apply curriculum from the theoretical level into the practical level. The importance of perceiving new learning methods and evaluation courses by students is devoted to many research studies (Chui, Martin and Pike, 2013; Persico, Manca and Pozzi, 2014; Rodgers, Simon and Gabrielsson, 2017). Although accounting didactic approaches are relatively advanced, the learning outcomes of introductory accounting classes have been limited at many business schools to an elementary and rather passive understanding of the key principles. One possible cause may be the unwillingness of many faculties to adopt new learning technologies (Stanley and Marsden, 2012; Watty, McKay and Ngo, 2016).

In today's world, where we are surrounded by information of varying quality, it is very important to support the ability of students to think critically. The importance of future manager accountancy knowledge is high and can be seen especially in a decision-making process (Hall, 2010; Silviu-Virgil, 2014). As Adler, Milne and Stringer (2000) state, lecturers have begun to realize that it is necessary to change teaching methods in accountancy courses for business students to improve their creative thinking skills and ability to perceive broader business context. The same view is taken by Singer and Wiesner (2013), who point to the fact that accounting education in the USA is

based on an obsolete model of lectures. Students are encouraged to remember accounting rules in a structured problem only. When they are confronted with a more detailed and different problem, their solution is not complete.

In this study, we focus on introducing case studies into accounting education. In the field of accounting, a combination of traditional case studies coupled with calculations proved to be more effective in terms of learning outcomes than using calculations only (Stewart and Dougherty, 1993). Research results by Weil, McGuigan and Kern (2011) pointed out that the use of case studies in accounting education brought benefits to students in terms of their ability to identify relevant data in the case, the ability to summarize available information and, above all, to think critically. The contribution of case studies to the development of soft skills such as communication, team collaboration and a practical motivation emphasizes on the basis of research findings authors, e. g. Boyce et al. (2001), Cullen, Richardson and O´Brien (2007), Healy and McCutcheon (2010), Vondra (2017).

There is a need to experience the learning and to become an active player in the learning process for better outcomes (Rock, 2007). Authors emphasize participative and problem-based learning (McCormick, Kinzie and Gonyea, 2013; Smith et al., 2005). Speer et al. (2009) attempted to find out by using magnetic resonance that the brain was activated when reading the story and unveiled that the brain activity was the same as if the readers were doing the described activities themselves. Stories may even be a substitute for practical experience. Storytelling has been a powerful tool for teaching accounting in particular for both instructors and students (Krom and Williams, 2011).

Using stories in the classroom highlights the real people behind these stories and their wish to communicate them (Simmons, 2006). Yet such stories must be authentic and real, rather than (even if very well) artificially contrived. The use of real-life stories has been found effective in other domains such as language higher education (Pathan, 2013) or very commonly in high school science (Crawford, 2012) and even art teaching (Rufo, 2014). Authentic stories induce a certain emotional attachment and allow long-term preservation of the information in the human brain (Rock, 2007).

The aim of the research is to find out whether accounting teaching supplemented with real-life case studies would be more useful for students who will be future managers (not accountants). The concept of real-life case studies was used by Štrach and Stejskalová (2015) and represents authentic articles from the business press related to accounting issues. Particularly, we would like to answer the following two research questions:

RQ1: How do management students perceive the inclusion of case studies in accounting education and is there a difference between men and women?

RQ2: Does the attitude towards this form of teaching differ between Czech and Slovak students?

Materials and Methods

The implementation of real-life case studies has proven an innovative method within the tuition of accountancy degrees aimed at managers. To explain further, students were able to work with selected articles taken from papers dealing with economics, which were also supplied with accounting exercises. Students were asked to establish what kind of accountancy knowledge could be applied to an issue described in the article, then a detailed accounting analysis followed. Thereafter they were required to make decisions leading to the successful resolution of that situation.

The introduction of this method into tuition is based on constructive research, which due to the evaluation of new practical tuition methods helps to distinguish better teaching from worse, as it results in the evaluation of the quality of teaching (Slavík, Dytrtová and Fulková, 2010).

The essence of the research was based on the principles of transdisciplinary didactics (Slavík

et al., 2017). It means that the new teaching techniques were focused on the development of knowledge through a dialogue. In addition to accounting, we have also dealt with less common sociobiological and cultural stereotypes in tuition. The role of the student and teacher has changed from passive to active. We started from theories based on the assumption that the teaching by a new method and searching for a context is a creative process (Slavík, Chrz and Štech, 2013). The main purpose of introducing real-life case studies was to teach students something that has an instrumental use in the way so that they understand the content of economic reports and are able to discuss the context and explain and justify their understanding in communicating with others (Slavík et al., 2017).

The study was carried out in the academic year of 2015/2016. Two faculties of management were included in the study – the Faculty of Management, which is a part of the University of Economics, Prague (CZ); and the other one was the Faculty of Economics and Management, which is a part of the Slovak University of Agriculture in Nitra (SK). At both faculties, the same tutor was giving lectures focusing on real-life case studies within the introductory accounting course framework at bachelor's degree level. The accounting course was taught at the Czech faculty in the same range as in Slovakia (2 hours of lectures and 2 hours of tutorials). Czech students have this course in the third semester, whereas Slovak ones have it in the second semester. At the end of the semester course, students were required to complete a questionnaire which was concerned with the perceived suitability of the inclusion of real-life case studies within the tuition of accountancy degrees for future managers. The questionnaire was completed by 205 students in total (68 in CZ and 137 in SK). The return rate on the questionnaire was 68% for CZ and 90% for SK. The division of respondents is shown in Table 1.

Country	Male	Female	Total
CZ	26 (38.2%)	42 (61.8%)	68
SK	35 (25.5%)	102 (74.5%)	137
Total	61 (29.8%)	144 (70.2%)	205

Table 1: Distribution of students according their gender and the country of their faculty: Absolute (raw relative) frequencies, 2015-2016 (source: own calculation)

The inclusion of real-life case studies was evaluated in two ways. The first evaluation was based on four-degree ordinal scale expressing the students preferences (0 – cancelling the real-life case studies in tuition, 1 – less inclusion of real-life case studies in tuition compared to the current situation, 2 – the same inclusion of real-life case studies as in current situation, 3 – inclusion of more real-life case studies in tuition compared to the current situation). The second evaluation was based on the ratio scale where $\boldsymbol{p}$ expressed the time rate devoted to case studies in the tuition shown in per cents (100-p shows percentage tutorials time ratio related to exercises).

Multiple regression analysis was used to answer the research questions, specifically 1/ ordinal regression for an ordinal response and 2 / linear regression for a quantitative response. The responses from the questionnaire were processed and analysed in the statistical software R (R Core Team, 2018). Statistical significance was judged at a 5% significance level.

Results and Discussion

This section is divided into two parts according the type of analysed variable.

Ordinal Scale

Students were required to evaluate the inclusion of regular lectures, exercises and real-life case studies within the subject framework using ordinal scale (0-cancel, 1-less, 2-equal, 3-more). Figure

1 represents the respondents' opinions based on gender and country where they study. Looking at the graphs, it is apparent that respondents would welcome a higher amount of accountancy case studies to be included at the expense of lectures. Real-life case studies were perceived in a relatively positive way, more by male respondents, or Slovak respondents, respectively.

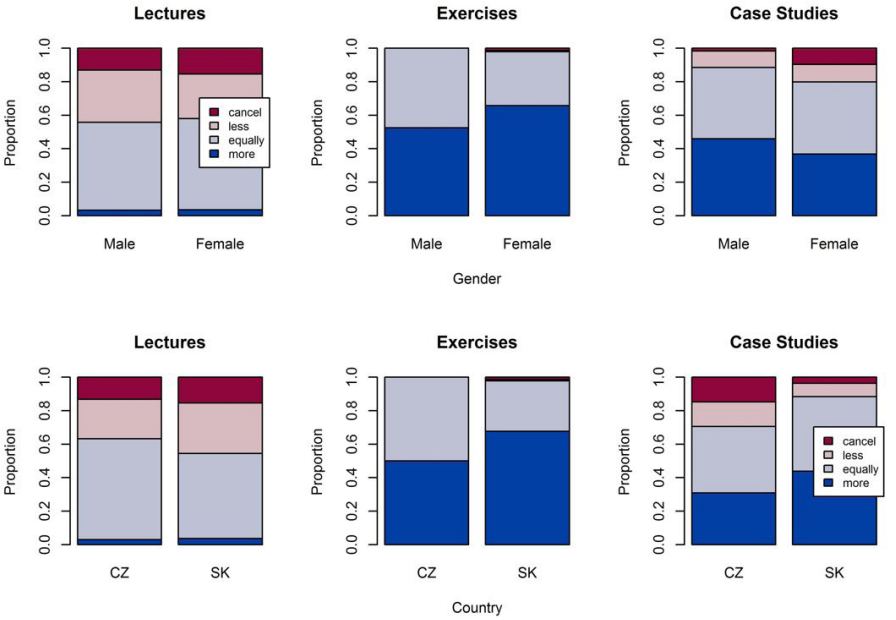

Figure 1: The assessment of lectures, exercises and case studies according to the respondent's gender (upper bar charts), resp. the country where respondent studies (bottom bar charts), 2015-2016 (source: own calculation)

The dependency of case studies evaluation based on gender, or country of study, respectively, was analysed with regard to the dependent variable using multiple ordinal regression, particularly proportional odds cumulative logit model without an interaction (with respect of its statistical insignificancy: $p = 0.995$). Reference category for explanatory variable "gender" was male and for country, it was the Czech Republic. The results of the study are shown in Table 2.

Effect	Estimate for OR	95% Conf. Int. for OR	P-value
Gender (Female vs Male)	0.52	(0.29, 0.93)	0.027
Country (SK vs CZ)	2.55	(1.45, 4.47)	0.001

Table 2 Ordinal regression results: Estimates and 95% confidence intervals for odds ratios (OR) and the corresponding p-values, 2015-2016 (source: own calculation)

Opinions related to the inclusion of real-life case studies in tuition differed, which is apparent in Figure 1. The difference based on ordinal regression showed as statistically significant in the case of gender ($p = 0.027$), as well as country ($p = 0.001$). Lower values in answers ($OR < 1$), and hence lower inclusion of case studies, are more likely for females than males from the same country. The results of some studies (e.g. Doran, Bouillon and Smith 1991) have shown that men achieve in accounting better results than women. The results of the study by Bebbington, Thomson and Wall (1997) point out that students of accounting show a tendency to possess masculine gender,

rather than feminine. Our conclusion may therefore be that men are more than welcome to an innovative way of teaching. Higher values in answers (OR > 1), and therefore higher inclusion of case studies, are more likely for Slovak students in the same gender check.
In this context, it is worth mentioning Košovská, Ferenczi Vaňová and Váryová (2014) research study, which was conducted at the Slovak faculty mentioned above. These study results showed that teachers mostly used more monologues as teaching methods than dialogues with students (the answer ratio was 79:21). Further, respondents from that study also pointed out that teachers did not use the methods of developing creativity.

Ratio Scale

It is apparent from the respondents´ responses related to preferences in integrating case studies from real life into the tuition (see Table 3) that 31% of the time at tutorial should be devoted to real-life case studies and 69% on exercises. Slovak male students would even prefer the case studies in the ratio of 42:58. Similarly to the previous analysis, statistically significant differences in the case studies assessment were demonstrated using multiple linear regression for gender ($p = 0.002$), as well as for country ($p < 0.001$), see Table 4.

Country	Male	Female	Total
CZ	24.8 (9.4)	20.0 (14.8)	21.8 (13.2)
SK	42.1 (19.7)	32.7 (15.2)	35.1 (16.9)
Total	34. 7 (18.2)	29.0 (16.1)	30.7 (16.9)

Table 3: The preference in inclusion of real-life case studies into tuition expressed by proportion of time devoted to real-life case studies: Means (and standard deviations) for percentages, 2015-2016 (source: own calculation)

Effect	Estimate for Diff.	95% Conf. Int. for Diff.	P-value
Gender (Female vs Male)	-7.63	(-12.30, -2.95)	0.002
Country (SK vs CZ)	14.22	(9.68, 18.75)	<0.001

Table 4: Linear regression results: Estimates and 95% confidence interval for difference in means (Diff.) and the corresponding p-values, 2015-2016 (source: own calculation)

Conclusion

The research shows that using real-life case studies in accounting courses for undergraduate students is a desirable didactic approach. Nevertheless, it can be said that using real-life case studies help students in the framework of the story to experience real-life situations which they seem to encounter in their professional lives. According to Vnoučková, Urbancová and Smolová (2017), connection with practice is one of the factor of education quality. Moreover, the use of stories as a teaching tool helps cement the teaching outcomes, while forming important logical connections. Stronger and long lasting mental connections might be created, resulting in a larger mental map (Rock, 2007).
One of the key skills for managers is the ability to verify and reflect on real-life situations while possessing a critical understanding of what has been written (Štrach and Stejskalová, 2015). Furthermore, this type of teaching and learning is more enthusiastic and creates a more enjoyable atmosphere in classrooms. Overall, the research results can be summed up in such a way that students would welcome shorter case studies that address a minority of issues. Students also rated lectures as not very interesting method of education. These results are consistent with the conclusions of Abbott and Palatnik (2018).
In our further research, we will focus on finding out how students' perceptions of new learning methods change when intervention is applied at the beginning of the lesson. The use of intervention would clarify the reason and possible benefits of using the new teaching method.

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WORK EXPERIENCE AS A PREREQUISITE FOR THE SUCCESS OF GRADUATES IN THE JOB MARKET

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Abstract

The acquisition of specific work experience during studies is proving to be of increasing importance for university graduates. Work experience is currently an essential prerequisite for future success in the job market. Paper presents the partial results of a survey conducted among students in the bachelors' degree program at the Economics and Management Faculty of the CULS over a five-year period from 2013 to 2017. The goal of the paper is to define the degree to which students were engaged in employment during their studies at university, their reasons for entering employment and the areas where the students most frequently worked. Most students are aware of the significance of acquiring work experience and skills in parallel with theoretical preparation. The students were most frequently employed in the form of part-time jobs which represent a flexible form of employment and at the same time can be well combined with university studies.

Keywords

Employment, graduate, job market, studies, university, work experience

Introduction

The issue of the employment of graduates is proving to be highly significant worldwide. As Dimian (2011) points out, the unemployment of young people is negatively related to per capita GDP, but positively correlated in the case of a delayed unemployment rate. For example, if the per capita GDP rises by an average of 1%, youth unemployment falls by about 0.3% in the case of unqualified workers and by about 0.1% in the case of qualified job seekers. According to some studies, education has a negative impact on the future job opportunities for graduates in times of unfavourable economic conditions (Kawaguchi and Murao 2014). A causal link between youth unemployment and the level of GDP and inflation has also been discovered using econometric analyses, where it has been found that a change in inflation and GDP has a direct influence on employment (Condur and Bolukbas 2014). By contrast, economic globalization has had a positive impact on the integration of young people into the job market (de Lange et al., 2014).

The precondition for better graduate employment involves an attempt to reconcile the specialist content of study courses with the requirements of the job market from the point of view of essential work skills. The least qualified secondary school leavers are most affected by any cyclical changes in the economic conditions. In this case, the degree of participation in further education positively corresponds to the degree of unemployment in the job market, especially in the period of an economic recession when unemployment rises (Rice, 1999). On the other hand, students who complete their education at the tertiary level are more significantly affected by the current trends in work skills (Gangl, 2002). It is possible to state the change in the demands for job skills within the context of the branches, professions and education using computer technology as an example of the changing trends in the job market (Levy, Murnane, 2003).

In recent years, the increase in the number of university-educated individuals in the job market has been noticeable. Despite this, the share of the tertiary educated population in the Czech Republic is still well below the European average (22% vs 30%) (NOZ, 2016). More than 1.1 million individuals with tertiary education were employed in 2014. This is almost twice the number in 2000. Their representation among employed individuals rose from just under 13% to 23% in this period. The number of individuals with a bachelor's degree increased by more than 11 times in the stated period. Whereas there were less than 15 thousand such people employed in the Czech Republic in 2000, the number had risen to almost 180 thousand by 2014. The number of individuals with a master's degree increased from under 540 thousand to 841 thousand, i.e. by approximately 56% (Lepič and Coll., 2015). The number of individuals with completed tertiary studies is not, however, completely decisive. The quality of the education and the structure of the content structure of the graduates' achieved education is of far greater significance. The quality of tertiary education is important from the point of view of the competitiveness of the workforce. The goal of the paper is to define the degree to which students were engaged in employment during their studies at university, their reasons for entering employment and the areas where the students most frequently worked. The introduction defines the theoretical background of the point at issue. The Materials and Methods section of this paper describes how the primary research was conducted. The Results section presents the findings which are then discussed and compared with similar research into the given issue.

Materials and Methods

The theoretical background of this paper is based on an analysis of the secondary sources, which were drawn from scholarly papers, specialized literature and official web portals. The main data source of the primary information was the survey undertaken among the students.
The goals of the analysis were as follows:

- the acquisition of information on the extent of the acquired work experience among bachelor's degree students during their studies,
- the acquisition of information on the development of the job market's requirements as they pertain to university graduates and the options for their employment,
- the acquisition of an overview about the development of the employment structure in the job market in the Czech Republic.

The primary data has been acquired from our own research with the use of a questionnaire. The survey was conducted among 2nd and 3rd year full-time EM students at the Faculty of Economics and Management of the Czech University of Life Sciences in Prague. It was realised in electronic form during the month of February in the period from 2013 to 2017. The sample group was deliberate. A total of 1078 students took part in the research during the monitored period.

Gender	2013	2014	2015	2016	2017	Total
Male	72 (31.72%)	78 (36.11%)	93 (36.05%)	87 (34.52%)	48 (38.4%)	378 (35.06%)
Female	155 (68.28%)	138 (63.89%)	165 (63.95%)	165 (65.48%)	77 (61.6%)	700 (64.94%)
Total	227	216	258	252	125	1078

Table 1: The demographic structure of the students addressed within the framework of the research (%) (source: own calculation)

The data was processed and subsequently evaluated using the Microsoft Excel spreadsheet program. Statistic SAS 9.4 was used to statistically handle the dependence of characters from research part of 2017. To assess the validity of hypotheses, a χ^2 - good compliance test was used together with Fisher´s test.

To determine the dependence of the selected characters, the following hypotheses were tested:
H1: gender does not affect employment during studies,
H2: gender does not affect the reasons for employment during study,
H3: reasons for employment during study do not affect the area in which the student is employed,
H4: the professional area in which the student is employed does not affect the field of application after graduation,
H5: employment during studies does not affect the reasons for studying at university.
Hypothesis H2-H5 could not be evaluated. The reason is a small file range and placement of response rates. The frequency table contained too much zero and the measured values could not be tested using the chi quadrate test. At the same time, it was not possible to use Fisher's test because of the number of variables.

Results

In addition to the theoretical preparation attained during students' university studies, the continuous acquisition of work experience and habits is also becoming increasingly significant. Work experience is currently an essential prerequisite for the future success of university graduates in the job market. It is possible to state that most students are aware of this fact based on the conducted survey (Figure 1). Only about one tenth of students are unemployed and the overall number of non-working students had a slightly falling tendency during the monitored period from 2013 to 2017. The number of working students in this case is higher than the Eurostudent study shows (less than two thirds of students work) (EUROSTUDENT, 2016). The students were most frequently employed in the form of regular or occasional part-time jobs which represent a flexible form of employment and at the same time can be well combined with their theoretical preparation. The fact that there has been a slight increase in part-time jobs which probably involve more specialised work was a positive finding.

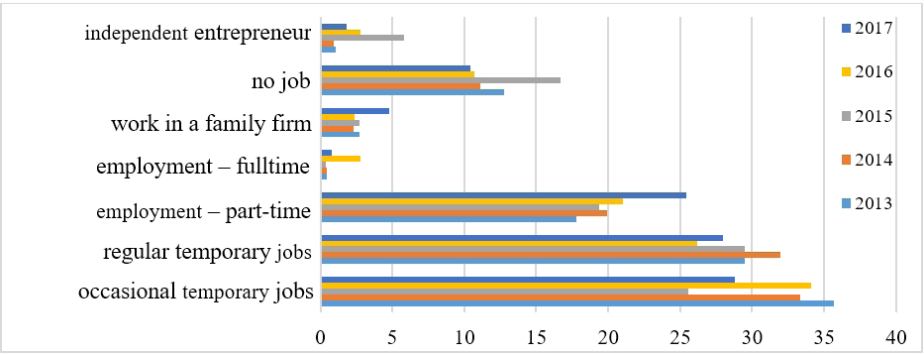

Figure 1: The employment of students during their studies

It was found that gender has an impact on employment during study. On the significance level 0.05 (P= 0.002, χ^2=16.554) there was a correlation between the employment rate and the student's gender. The strength of this dependence is weaker (Phi = 0.345).
The most frequent reason for employment stated by almost two thirds of the students was their economic situation. Employment activities are a usual source of income, including for students. This reason was always given as the most significant in the monitored period (the value ranged from 74.09% in 2013 to 72.73% in 2017). The second most frequent reason for employment involved the targeted building up of a work career during the period of their studies. Approximately half

the students were aware of the significance of this aspect. The fact that this aspect had a slightly increasing trend is positive (the value ranged from 46.63% in 2013 to 49.09% in 2017).
The fields where the students worked constituted important information in the case of the parallel employment of students (Figure 2).

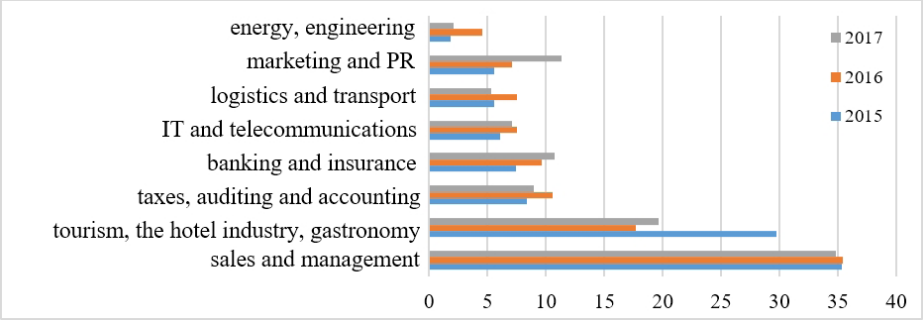

Figure 2: The area – focus of the current job

The students' employment activities were most frequently focussed on the area of sales and management. These two fields are a stable subject of the greatest interest among students. Between 2015 and 2017, there was a fall in the interest in the areas of tourism, the hotel industry and gastronomy, which have long been facing economic problems. On the other hand, greater interest amongst students can be noted from the point of view of their work activities in areas such as taxes, auditing and accounting, banking and insurance and marketing and PR. According to the conducted survey, there is a clear connection here with where the students see their future employment as university graduates (Figure 3).

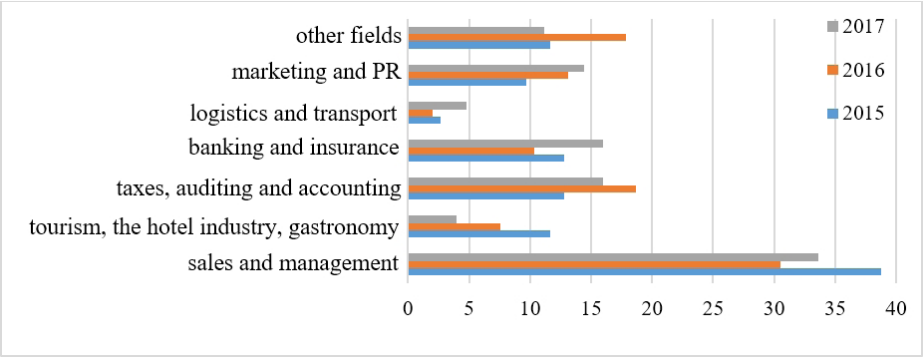

Figure 3: Expected areas of employment after graduation

The fields, which the students planned to enter after the completion of their theoretical preparation, essentially copied the fields of their current employment. In this case, it was clear that the students were aware of the importance of acquiring expert knowledge from the given area. Work experience was therefore often focussed on precisely the field where they expected to be employed after the completion of their university studies.
The students' perception of the benefits of theoretical preparation during the course of their studies for their future employment can be seen as positive (Table 2). From this point of view,

almost half the students described the theoretical preparation as significant or highly significant. About one third of students considered the theoretical preparation to be unimportant, while 2 – 4% of students described it as being of absolutely no importance.

Evaluation (%)	2015	2016	2017
somewhat significant	49.22	48.81	52.8
highly significant	11.63	7.14	5.6
somewhat unimportant	36.82	35.71	37.6
completely unimportant	2.33	8.33	4

Table 2: The perception of the benefits from the theoretical preparation during studies in relation to the students' expected future employment

There is space here for the greater convergence of courses with the requirements of the job market.

Discussion

In order to be able to find suitable jobs for graduates, it is necessary to minimise the differences between the job market's requirements and the actual abilities of the individuals. The employability and placement of graduates are among the most significant characteristics pertaining to the quality and relevance of universities' educational activities.

The acquisition of specific work experience during their studies is proving to be of increasing importance for secondary school and university graduates. As Brown, Lauder and Ashton (2012) have stated, the statement that a tertiary education is the prerequisite for greater employment success has long since ceased to be true. The amount of time dedicated to study is gradually being replaced with time devoted to the acquisition of practical skills. The numbers of students in fulltime studies is falling (Babcock and Marks, 2011) in favour of students making use of a combined form of study.

Work skills and habits play a greater role than their theoretical knowledge during the employment of graduates (Allen and van der Velden, 2001). As Fischer and Lipovská (2014) found, there is even a direct connection between the amount of the salary and the employment of students during their studies, if this involves jobs which are related to their field of study. The study undertaken by Cockx, Goebel and Robin (2013) shows that part-time work has a significantly positive influence on the subsequent transition into fulltime employment. This assumption can also be applied in the case of students and the acquisition of work experience during their studies. The fact that fixed period contracts represent a kind of springboard to permanent employment has also been confirmed by Booth, Francesconi and Frank (2002).

The difference between the demand in the job market and the supply of knowledge and skills by graduates in individual fields of study is significant in the case of bachelor's degrees when compared with master's degrees (Maryška and Doucek 2012). Inappropriate education in the sense of 're-qualification" can even result in a worse pay grade. As the research undertaken by Dolton and Vignoles (2002) indicates, the return on any excess education in the case of a disproportionately high level of education is lower than the return on the required education. Mobility during students' studies is a tool for reducing graduate unemployment (Eliasson, Lindgren and Westerlund, 2003).

Conclusion

The acquisition of practical experience during university studies has been proven to be a key precondition for the future employment of university graduates in the current job market. The finding that almost all bachelor's students (90% of them in the monitored period) were in some way permanently or temporarily employed is a positive result of the conducted research. The most

frequent reason for employment stated by almost two thirds of the students was their economic situation. However, the building of a work career during one's studies played no less a significant role. The students' employment activities were most frequently focussed on the area of sales and management. These two fields are a stable subject of the greatest interest among students. Students were also found to be interested in work activities in areas such as taxes, auditing and accounting, banking and insurance and marketing and PR. Unfortunately, due to the small scale of the respondent, in 2017 it was not possible to test dependencies of the selected variables.

This paper's limiting factor can be considered to lie in the fact that the survey was only conducted among students from one economic field of study. The possible direction of any follow-up research could be to focus on a comparison of the work experience of bachelor's and master's students. A further area of interest involves any eventual changes in any of the aspects of the students' employment. A follow-up comparison of the actual area of employment for master's degree graduates with their originally anticipated area of employment could also be very interesting.

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UTILIZATION AND THE EFFECTIVENESS OF LMS MOODLE TOOLS IN SELECTED STUDY PROGRAMMES

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Abstract

Utilization of e-learning platforms in both distance and full-time forms of studies is becoming increasingly important. The aim of this paper is to identify those LMS Moodle tools that influence its the effectiveness and utilization by the bachelor's degree students from the Faculty of Economics and Management at the Czech University of Life Sciences Prague. A modified version of the Delphi method in addition to the MaxAgr method, based on Shannon entropy, was used for research purposes. The results characterize the popularity of partial LMS Moodle tools as well as current the effectiveness of the system's utilization as a whole. Furthermore, they identify the aspects and tools which students consider effective when using them. The conclusion contains recommendations for the lecturers in these study programmes which reflect the findings about insufficient LMS tools as well as those tools that students consider essential to increase the effectiveness of using the e-learning support.

Keywords

Delphi method, e-learning, MaxAgr, modified version, study, student

Introduction

The current trend in university education leads to a decrease in contact teaching lessons. Simultaneously, self-study and the use of e-learning materials are emphasized (Houska and Berankova, 2011). Students can devote their studies based on their individual needs and time possibilities through the e-learning (Kucirkova, Kucera and Vostra Vydrova, 2014). Kerimbayev et al. (2017) state that the main software tool of electronic learning is learning management system (LMS). Now many different scientists discuss problems of developing and using LMS. Some LMSs provide custom services developed to support adaptive mobile learning and ensure online exams integrity, while others are able to improve learning capabilities via social and gaming tools (Fenu, Marras and Meles, 2017).

Current education requires access to an e-learning platform connected with active communication and with a range of tools that enable development of competencies. Supporting such a platform is important not only for distance learning programmes for which it was initially designed, but e-learning support is increasingly used for full-time study programmes as well. According to Kultan and Kerimbayev (2015), LMS Moodle is one of such platforms. Learning in this environment enables organization of active individual work for students and provides permanent

access to information regardless of time. This way it contributes to flexible learning by means of various tools, including videoconferences.

Egerova and Muzik. (2010) note that being concerned with the effectiveness of e-learning allows finding an answer to the question how and under what circumstances it is possible to utilize e-learning in the most effective way. In addition, evaluating the user's experience is a challenging task, particularly in e-learning (Fenu, Marras and Boratto, 2016). Being acquainted with these aspects is one of the prerequisites in order to successfully integrate e-learning into university education.

The aim of this paper is to identify LMS Moodle tools which influence the effectiveness of utilization of this e-learning instrument by the students of full-time and distance forms of bachelor's study programmes from the Faculty of Economics and Management at the Czech University of Life Sciences Prague.

The research questions are as follows: a) How and under what conditions is e-learning support in LMS Moodle in its current state used by the students of bachelor's degree programmes and how do students evaluate the current the effectiveness of its partial tools? b) How do students evaluate the effectiveness of using LMS Moodle as a whole with regard to its utilization for successful completion of examinations? c) Which tools in LMS are insufficient and at the same time considered essential by the students in order to increase the effectiveness of utilizing the e-learning support?

Materials and Methods

The research methodology uses basic framework of analysis of interest groups (Rowe et al., 1994), in which an interest group has been addressed, namely the full-time and distance bachelor's degree students at FEM CULS Prague. The Delphi method frequently complements the analysis and is based on utilizing a panel of experts by means of a structured communication process designed in order for the panel to deal with a particular problem as a whole (Linstone and Turoff, 2011).

In the standard application of the Delphi method, all the responses in the panel are summarized by the facilitator after each round and reported back to the panellists who then have an opportunity to revise their responses considering other participants in the group. The process continues until a predefined level of stability in the answers is achieved. This method causes laboriousness; therefore, its employment is also expensive (Fitzsimmons and Fitzsimmons, 2006).

Misrepresentation and misinterpretation of the overall results might occur in evaluation and, subsequently, the panellists decide based on untruthful data, and the number of repetitions decreases the experts' performance, mainly when their concentration weakens (Gupta and Clarke, 1996). For this purpose, the MaxAgr method, based on Shannon entropy, was applied to achieve consensus among the participants (Vrana et al., 2012). The method enables determination of the value of an expertly evaluated parameter which corresponds with the best consensus of the participating experts' opinions. The consensus is the value from the interval [0, 1] which determines the degree of agreement of the participating experts regardless of which viewpoint will be established as common in averaging. The consensus equals 1 provided that the experts' opinions are identical and equals 0 if half of the experts represent a different viewpoint from the second half. The consensus might be regarded as a probability value of the statement "The experts concur in their opinions".

15 panellists – students of full-time bachelor's degree programmes – and 15 panellists – students of distance bachelor's degree programmes from the Faculty of Economics and Management at CULS Prague who actively use LMS Moodle as learning support participated in the survey. Overall, 39 statements were formulated on the record sheet which the panellists were asked to

express their agreement or disagreement with, using the Likert scale from 1 (strong disagreement) to 5 (strong agreement). The return rate amounted to 100%.
The survey was conducted in January 2018 and was anonymous. The major advantage of anonymity is the fact that it diminishes the influence of dominant individuals. Another advantage is the non-existence of social-psychological pressure on the participants (von der Gracht, 2012). Subsequently, the collected data were evaluated using the MaxAgr method and software, with respect to the form of study (full-time vs. distance).
An example of the formulation of the results: In question number 1 "I use Moodle as part of my learning every day of tuition", value 4 is the value corresponding to the greatest consensus according to the MaxAgr method. The highest calculated value for the MaxAgr indicator = 0.801 (the greatest degree of consensus of an expert estimate) is for value 4. For the sake of clarity, the summarized results are encapsulated in tables 1-3. Subsequently, recommendations for the lecturers who work with LMS Moodle are formed based on these.

Results and Discussion

The first task was to identify how and under what conditions the e-learning support in LMS Moodle in its current state is used by the bachelor's degree students, and what their evaluation of the current the effectiveness of utilizing its partial tools is. Table 1 contains the results of utilization of individual types of tools for both forms of studies.

Frequently utilized type of tool (if available)	Bachelor's full-time studies		Bachelor's distance studies	
	Likert scale value	MaxAgr value	Likert scale value	MaxAgr value
optional content recommended by the lecturer	2	0.8177	3	0.8251
learning materials (power point presentations, word and pdf files)	**5**	0.8454	**5**	0.9291
learning materials in „scorm packages instead of textbooks	3	0.9101	4	0.8419
video lectures	**4**	0.8115	**4**	0.8548
self-tests	**4**	0.8076	**4**	0.8481
interactive texts (texts with functional links)	2	0.8352	4	0.8696
terminological dictionary	2	0.7866	3	0.8291
encyclopaedic pages (wiki pages and others)	2	0.8372	3	0.7886
section News	2	0.8115	3	0.8419

Table 1: Tools used by students in LMS Moodle (sources: own calculation)

By a considerable margin, the most frequently used tools in LMS Moodle are learning materials in the form of power point presentations, word and pdf files. Their popularity is slightly more evident in the distance form of studies. Working with the uploaded documents is undemanding and quick for both the lecturer and the student. Therefore, the popularity of this tool can be expected. However, Zainuddin, Idrusand and Jamal (2016) warn in their study, that the results show that despite having great potential, Moodle is mainly used as a repository for materials. Moreover, lecturers recognize the importance of the use of other functionalities of this platform in order to promote the success of the teaching and learning process.
The agreement of the respondents in both forms of studies has also been evident in the popularity of using video lectures and self-tests; however, only if these are available. In addition, interactive texts with active links and learning materials using so-called scorm packages instead of textbooks are popular with the students from distance form of studies. Unlike the full-time students, the distance students use these frequently. The students from the full-time study programmes do not

use interactive texts, terminological dictionaries, encyclopaedic pages very often, nor read the News section regularly.

Subsequently, the panellists commented on the effectiveness of using LMS Moodle as a whole, with respect to its utilization for successful completion of examinations. The results are summarized in Table 2. Both groups use LMS Moodle in every subject during the semester, namely for self-study or as a tool used directly in tuition.

Using LMS Moodle as a tool	Bachelor's full-time studies		Bachelor's distance studies	
	Likert scale value	MaxAgr value	Likert scale value	MaxAgr value
used in each subject during the particular semester	**4**	**0.8162**	**5**	**0.9338**
primarily for self-study	4	0.9081	**5**	**0.8508**
used more in tuition	4	0.8204	4	0.8696
primarily for credit tests and self-tests	**4**	0.8419	3	0.8271
primarily using the content assigned for tuition and exams	**5**	**0.8953**	4	0.8567
using optional content recommended by the lecturer	2	0.8177	3	0.8251
majority of courses in Moodle are beneficial for studies	4	0.8676	4	0.8696
majority of courses in Moodle help to successfully complete exams	4	0.8973	**5**	**0.9081**
there are subjects in which Moodle is not used, although the course has been created	3	0.7718	2	0.7886
there are subjects in which Moodle is used more than in others	**5**	**0.9358**	3	0.8419
there are differences in the quality of the courses in individual subjects	4	0.8649	4	0.8656
utilization of the course in Moodle depends on the quality (content and form) of the course	**5**	**0.9101**	4	0.8528
utilization of the course in Moodle depends on the compulsory tests which I had to take	**4**	0,7690	3	0,8419

Table 2: evaluation of the effectiveness of utilizing LMS Moodle (sources: own calculation)

According to the panellists from full-time bachelor's degree programmes, there is a significant difference between the quality of presentation and subsequent utilization of the courses in LMS Moodle for the taught subjects. The utilization largely depends on the quality of the presentation of a particular course. Furthermore, it is also important for the full-time students whether the course in Moodle contains partial tests which are compulsory, for example, to pass the credit test. In connection with the previous prevalence of utilization of the tool "upload document", more extensive use of these sources for studying is apparent here. On the contrary, optional items which expand the discussed topics are not used frequently by the students of either form of a study programme.

The results indicate that the support in LMS Moodle is used more frequently by the students from distance study programmes. Nevertheless, both groups of panellists agree that the majority of courses in LMS Moodle are beneficial for them, and they help the students of distance study programmes in particular to successfully complete examinations. This corresponds with the conclusions of Kucirkova, Kucera and Vostra Vydrova (2012), that e-learning method can be considered as an equally efficient method as the face-to-face method. It could be offered for distance students and lifelong learning centres and of course this method can be used for other

students. A different opinion on the effectiveness of LMS Moodle is represented by Popovic et al. (2017) who states that most of the students agreed that Moodle was easy to use and it complemented traditional teaching very well, but it could not completely replace traditional face-to-face lectures.

Required tool	Bachelor's full-time studies		Bachelor's distance studies	
	Likert scale value	MaxAgr value	Likert scale value	MaxAgr value
traditional learning materials (power point presentations, word and pdf files)	**4**	0.8439	**4**	0.8953
traditional learning materials in the form of scorm packages instead of textbooks	3	0.8548	4	0.9061
self-tests	**4**	0.8481	**4**	0.9101
interactive materials (texts with functional links)	3	0.8419	3	0.8696
terminological dictionary	3	0.8271	3	0.8548
video lectures – general	**5**	0.8656	**4**	0.8824
encyclopaedic pages (wiki pages and other)	2	0.8629	3	0.8567
sound recordings of lectures (mp3 files)	**4**	0.7542	**4**	0.8567
recommended sources expanding the discussed topic (beyond the compulsory requirements)	3	0.9081	3	0.8696
News section	2	0.8224	3	0.8973
lecturer's feedback when uploading tasks via Moodle	**4**	0.8649	**4**	0.8696
video lectures focused on the selected part of the studied area	**5**	0.9081	**4**	0.9229
audio lectures (e.g. in mp3 format) focused only on selected parts of the studied area	**4**	0.7710	**4**	0.8649
in Moodle courses, if possible, I would prefer video to audio lectures	**4**	0.7710	**4**	0.8372
in Moodle course, I would appreciate a higher level of the lecturer's activity in the discussion forum.	**3**	0.82709	**3**	0.9081
I consider the current state of Moodle courses with regard to benefit to my studies as effective.	**4**	0.9229	**4**	0.8824

Table 3: The tools which should have greater representation in courses (sources: own calculation)

The final part consisted of questions referring to the missing or insufficiently presented tools in LMS, although students consider these essential to increase the effectiveness of using the e-learning support. The results of the panel survey are presented in Table 3.

The students of both forms of study programmes would commonly welcome a more frequent occurrence of both traditional video lectures and, to some extent, video lectures referring to partial (selected) topics of the discussed area in the LMS Moodle courses. These tools are more important to the distance students. Furthermore, the students expressed their interest in a more frequent occurrence of self-tests and audio lectures in the mp3 format. Should the students of both forms of studies be able to choose, they would prefer audio to video lectures.

Despite the considerable extent of the current tools for using traditional learning materials, for instance, in the form of a power point presentation, word and pdf files, these are still evaluated as insufficient. In order to increase the effectiveness of utilizing LMS Moodle, both groups of panellists would appreciate the expansion of the use of these tools by the lecturers. There is also slightly greater interest in materials in the form of so-called scorm packages by the distance students.

Both groups of students would appreciate being provided with feedback from the lecturer in the

tasks uploaded via LMS Moodle. The students of bachelor's degree programmes are not interested in more information in the News section or in encyclopaedic pages; regarding other tools, both groups held a neutral view.

Conclusions

LMS Moodle as a platform for the support of tertiary education is frequently discussed. It offers a range of tools which can provide different benefits for students, also with regard to the learning form. It might be assumed that this e-learning platform is more frequently used by distance students. By using the MaxAgr method, the purpose of this paper was to attempt to identify those tools of LMS Moodle which influence its effectiveness and utilization by the students of bachelor's degree programmes at FEM CULS Prague. The results suggest that the students use the support in Moodle frequently, although they conclude that individual courses differ in the quality of presentation. Uploading documents prevails with both groups of students and is considered an effective instrument. In addition, the students regard self-tests (slight prevalence by the full-time students), interactive texts (slight prevalence by the distance students) as effective. In addition, the students prefer video lectures, alternatively, they would appreciate audio lectures of a "podcast" type in the mp3 format. Simultaneously, they believe that video lectures (audio lectures) should be shorter and focused on the key topics of the discussed area to be more effective. At the same time, all these tools have been evaluated as insufficiently used, that is with greater potential for utilization.

In conclusion, a recommendation for the lecturers responsible for the preparation of the support materials in LMS Moodle may be formulated, namely that they concentrate on the above-mentioned tools. It is also recommended that the lecturers devote more attention to "feedback", that is to assessment and comments related to the tasks which students submit via LMS Moodle. All these factors can increase the effectiveness of utilizing LMS Moodle as a whole by the monitored group.

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FINANCIAL LITERACY OF UNIVERSITY STUDENTS IN THE AREA OF EXTERNAL FINANCING

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Abstract

The objective of this paper is to examine the level of financial literacy among full-time university students in terms of their knowledge of basic concepts related to the possibility to draw on external financial resources. The primary data presented here were collected through a survey (n = 446) conducted in 2017 among students at the Faculty of Physical Education and Sports, Charles University. The survey suggests that 64.35% of respondents know the difference between the terms debit card and credit card, but only 50.87% of them are able to define the difference correctly. As few as 29.60% of respondents know the acronym APR, of whom 84.09% can explain the term. The ability to explain the meaning of the term lease and loan was shown by 38.12% of respondents. Statistical analysis of the data indicated a demonstrable correlation between the level of study and the answers to the questions above.

Keywords

Education, financial literacy, knowledge, student, university

Introduction

An individual's position in the society changes with the evolving economy and an ever-increasing number of financial products and economic opportunities is one of the typical characteristics of this development. Logically, the pressure put on consumers' knowledge in order for them to understand and be able to navigate through the offers also grows. Particularly important is the consumer's ability to assess the benefits provided by a financial product, and even more so to be aware of the most serious risks inherent in the use of these products.

Financial literacy is defined by the Financial Education National Strategy (Ministry of Finance, Czech Republic, 2010: 11), as ´a set of knowledge, skills and standpoints of the citizens which they need to implement in order to financially secure themselves and their families within the current society and, moreover, to actively operate on the financial products and services market´. Hesová (2013) sets forth that financial literacy comprises three components: monetary, price, and budget literacy, of which well-developed reading and mathematical literacy is a prerequisite. The Organisation for Economic Co-operation and Development defines the issue as follows: ´financial education is the process by which financial consumers/investors improve their understanding of financial products and concepts and, through information, instruction and/or objective advice, develop the skills and confidence to become more aware of financial risks and opportunities, to make informed choices, to know where to go for help, and to take other effective actions to improve their financial well-being.´ (OECD, 2005: 26).

Experts investigating global financial literacy generally support the opinion that most consumers do not achieve the necessary level of financial literacy (Allgood and Walstad, 2016; Perry, 2008).

In particular, they fail to achieve a level that, together with sufficient information, would make it possible for them to make decisions in the financial markets (Van Rooij, Lusardi and Alessie, 2011; Mandell and Klein, 2009). Young people especially are the most endangered group in this respect (Edsberg, et el., 2016; Lusardi, Mitchell and Curto, 2010). A similar trend can be observed in the Czech Republic (Beranová et al., 2017; Chmelíková, 2015; Paseková a kol., 2013; Pavelková, 2013).

Considerable attention is being paid to the improvement of financial literacy in the Czech Republic. This issue has been included in the framework curricula for basic and high schools (Belás et al., 2016). In addition to that, there are numerous other opportunities to support the instruction of financial literacy within employment and life-long learning support programmes (Fond dalšího vzdělávání, 2015; Hesová, 2013). Still, it is not clear whether the knowledge acquired by students who are of age and, thus, can use a full range of financial products, reaches an adequate level in terms of these activities. In view of the above, it can be concluded that financial literacy of young people in relation to basic financial knowledge represents an important issue of interest for the future social and economic development of not only the Czech Republic, but also for all economically developed countries worldwide.

The purpose of this paper is to examine the level of financial literacy among full-time university students of both economic and non-economic bachelor and master degree programmes and to assess this through primary research in relation to basic terms and concepts linked to the possibility to draw on external financial resources.

Materials and Methods

The theoretical background of this paper is based on an analysis of secondary sources gained from scholarly papers, specialized literature, and official web portals. Primary data have been obtained through the survey conducted by the authors.

The survey was conducted by means of printed questionnaires during the winter trimester of the 2017/18 academic year among full-time students of Physical Education and Sports (non-economic studies) and Management of Physical Education and Sports (economic studies) at the Faculty of Physical Education and Sports, Charles University. The sample was purposefully selected and 446 respondents took part in the questionnaire survey of financial literacy. Each question asked in this survey has only one objectively correct answer and all questions were related to the knowledge of financial terminology, financial products, mathematics, and macroeconomics.

Basic socio-demographic factors of the reference group of respondents were as follows:

Gender	Females	37.00
	Males	63.00
Level of study	Bachelor degree	56.50
	Master degree	43.50
Field of study	TVS	49.55
	MNG	50.45
Permanent Residence	Prague	38.34
	Central Bohemian Region	23.99
	Ústí Region	4.04
	South Bohemian Region	6.05
	Hradec Králové Region	6.50
	Pardubice Region	4.93
	Vysočina Region	2.47
	Plzeň Region	4.48
	Moravian-Silesian Region	1.45
	Karlovy Vary Region	2.24
	Liberec Region	4.26
	South Moravia Region	0.90
	Zlín Region	0.90
	Olomouc Region	0.45
Size of Place of Residence	up to 500 inhabitants	5.61
	501 – 2 000 inhabitants	7.17
	2 001 – 5 000 inhabitants	5.16
	5001– 10 000 inhabitants	8.52
	10 001 – 50 000 inhabitants	21.52
	over 50 000 inhabitants	52.02

Table 1: Sociodemographic factors of respondents in % (source: own research, 2017)

Statistical Means for Analysis

The contingency table is used for transparent visualization of the mutual relations of two statistical variables. The type of the contingency table is given by the number of rows r and the number of columns s, is means $r \times s$ (Hindls, 2007). Obviously, χ^2 is a measurement of the overall dissimilarity of n_{ij} and m_{ij}. The bigger the difference between the observed and expected values, the higher the test statistic χ^2.

$$m_{ij} = \frac{n_i . n_j}{n} \tag{1}$$

$$\chi^2 = \sum \frac{\left(frequency\,observed - frequency\,expected \right)^2}{frequency\,expected} \tag{2}$$

$$\chi^2 = \sum_{i=1}^{r} \sum_{j=1}^{s} \left(n_{ij} - m_{ij} \right)^2 / m_{ij} \tag{3}$$

i and j are indexes of rows and columns, n_{ij} are observed marginal frequencies, ni and nj are marginal totals, n is grand total of observations, mij are expected frequencies. We compare χ^2 to the critical value χ^2 with a chi-square distribution of (r-1)(s-1) degrees of freedom at the chosen

level of significance. We reject the hypothesis if χ^2. is larger than the table value. This test is valid asymptotically, and thus can only be applied if there are a sufficient number of observations. All expected values ought to be higher than one (Hendl, 2009); at the same time, the table should not contain more than 20% of theoretical incidence rates (frequencies) of less than 5. Where zero values occur in any of the fields, we proceed to analyse a derived table, created by merging a small number of categories (Hendl, 2009). Cramer's V was used to determine the degree of association between the variables.

Data analysis has been performed for the following tested hypotheses.

- H01: The fact that the student knows the difference between the credit card and the debit card is independent of the field of study.
- H02: The fact that the student knows the difference between the credit card and the debit card is independent of the level of study.
- H03: The fact that the student knows the meaning of the acronym APR is independent of the field of study.
- H04: The fact that the student knows the meaning of the acronym APR is independent of the level of study.
- H05: The fact that the student knows the difference between the loan and the lease is independent of the field of study.
- H06: The fact that the student knows the difference between the loan and the lease is independent of the level of study.

The following abbreviations are used in this paper: APR = Annual Percentage Rate (RPSN); TVS = Physical Education and Sports; MNG = Management of Physical Education and Sports; FTVS = Faculty of Physical Education and Sports; UK = Charles University; OECD = Organisation for Economic Co-operation and Development.

Results

The following chapter presents the findings of the primary research focused on financial literacy of university students, including comments.

Field of study / Response	Yes	No	Total
MNG	157	68	225
TVS	130	91	221
Total	287	159	446

Table 2: Relation between the student's knowledge of the difference between a credit card and a debit card, and the student's field of study (source: own research, 2017)

In Table 2 as many as 64.35% (287 respondents) of the total number of 446 respondents believe they know the difference between a credit card and a debit card. The calculated chi-quadrate value of 5.83 is higher than 3.84, which is the critical chi-square value for the 0.95 level with 1 degree of freedom. Thus, the zero hypothesis can be rejected. The knowledge of the difference between a credit card and a debit card depends on the field of studies.

Level of study / Response	Yes	No	Total
Bachelor degree	161	91	252
Master degree	126	68	194
Total	287	159	446

Table 3: Relation between the student's knowledge of the difference between a credit card and a debit card, and the student's level of study (source: own research, 2017)

The calculated chi-quadrate value of 0.05 is lower than 3.84, which is the critical chi-square value for the 0.95 level with 1 degree of freedom. Thus, the zero hypothesis cannot be rejected. It is important to emphasize that of the total number of respondents who answered they knew the difference between a debit card and a credit card (64.35%) only 146 respondents were able to define the difference correctly (i.e. 50.87% of those who answered they knew the difference and only 32.74% of the total number of respondents) (Table 3). The knowledge of the difference between a credit card and a debit card is independent of the level of study.

Field of study / Response	Yes	No	Total
MNG	72	153	225
TVS	60	161	225
Total	132	314	446

Table 4: Relation between the student's knowledge of the meaning of the acronym APR, and the student's field of study (source: own research, 2017)

As few as 132 (29.60%) respondents answered that they knew the meaning of the acronym APR (Table 4). The calculated chi-quadrate value of 1.26 is lower than 3.84, which is the critical chi-square value for the 0.95 level with 1 degree of freedom. Thus, the zero hypothesis cannot be rejected. The knowledge of the acronym APR is independent of the field of studies.

Level of study / Response	Yes	No	Total
Bachelor degree	57	195	252
Master degree	75	119	194
Total	132	314	446

Table 5: Relation between the student's knowledge of the meaning of the acronym APR, and the student's level of study (source: own research, 2017)

In relation to Table 5 the calculated chi-quadrate value of 13.54 is higher than the critical distribution value for the 0.95 level with 1 degree of freedom. Thus, the zero hypothesis can be rejected. The knowledge of the acronym APR depends on the level of study. Further analysis of this result revealed that of those respondents who claimed their knowledge of the acronym APR (29.60%) as many as 84.09% of them (111 respondents) were able to define this term correctly.

Field of study / Response	Yes	No	Total
MNG	85	140	225
TVS	85	136	221
Total	170	276	446

Table 6: Relation between the student's knowledge of the difference between a loan and a lease, and the student's field of study (source: own research, 2017)

Of the total number of respondents, 38.12% of them (170 respondents) were able to define the difference between a loan and a lease correctly (Table 6). The calculated chi-quadrate value of 0.02 is lower than the critical distribution value for the 0.95 level with 1 degree of freedom. Thus, the zero hypothesis cannot be rejected.

Level of study / Response	Yes	No	Total
Bachelor degree	64	188	252
Master degree	106	88	194
Total	170	276	446

Table 7: Relation between the student's knowledge of the difference between a loan and a lease, and the student's level of study (source: own research, 2017)

The calculated chi-quadrate value of 39.74 is higher than the critical distribution value for the 0.95 level with 1 degree of freedom. Thus, the zero hypothesis can be rejected. The knowledge of the terms lease and loan depends on the level of study. While only 25.40% of students in the bachelor degree programme answered correctly, the rate of correct answers in the master degree programme achieved 54.64% (Table 7) A positive trend is apparent mainly among the students of economic studies (Management of Sports). The disappointing results achieved originally in the bachelor programme (28.24%) have improved in the follow-up master degree programme where the knowledge of the difference between a loan and a lease achieved 67.27%. The progress among the students of the non-economic studies (Physical Education and sports) can also be considered as non-negligible (from 19.51% up to 49.64%).

Discussion

Financial literacy of university students is an issue that has been scientifically studied for quite some time. Chen and Volpe (1998) concluded that a lower level of the surveyed knowledge was observed among university students of non-economic programmes and junior university students. Although of the total number of respondents ($n = 446$), 64.35% answered they knew the difference between a debit card and a credit card, only 32.74% of them were able to explain the difference correctly. The knowledge of the difference between a debit card and a credit card and their use among U.S. university students was investigated by Cude et al. (2006). The results of their study suggest that students of U.S. universities have, unlike Czech university students, better knowledge in this area. The main factors identified by the authors as those having a positive impact on the results achieved by U.S. university students include the influence of their parents and tutors, and also the fact that the related information is easily accessible and provided in an adequate manner by financial institutions. The survey of the knowledge of the difference between a debit card and a credit card shows dependence on the field of study. Students of the economically focused programme demonstrated better knowledge. It can be concluded that the knowledge and use of products offered by financial institutions grow with economic specialization of the programme. The same results were demonstrated by Özdemir et al. (2015) and also in the comparative study of this knowledge among Korean and American students (Jang, Hahn and Park, 2014).

The APR rate turned out to be the biggest weakness in terms of the respondents' knowledge. More than 70% of all respondents did not know the meaning of this acronym. This is rather disappointing mainly because, in practice, the annual percentage rate is the most important piece of information to assess whether the considered loan is a good choice or not. In the Czech Republic, APR gives an indication of the interest rate accrued over a year, including fees for drafting a loan agreement, insurance, management fees, current account fees, etc., that are charged by the financial institution. Similar insufficient knowledge of basic rates and financial products can be found in a survey performed at U.S. universities (Lusardi and Mitchell, 2010). The knowledge identified in this respect was related to socio-demographic characteristics and financial transactions performed by the student's family. On the other hand, a similar survey among university students in Australia (Beal and Delpachitra, 2003) provided more satisfactory results; the authors attribute the good results to quality instruction of financial literacy at all types of schools.

A relatively high level of ignorance of the difference between the terms lease and loan is alarming. More than 60% of respondents are unable to define the difference between these two terms. Here too, the statistical dependence between the knowledge of these terms and the level of study was proved. The same opinion is held also by Mouna and Anis (2017) who studied financial literacy determinants and concluded that financial literacy, and understanding the specific contents of certain financial terms in particular, is influenced by the level of study and the highest degree of education.

Conclusion

Since 2013, financial literacy has been taught as compulsory part of curricula at all high schools. However, the results of the study performed at the Faculty of Physical Education and Sports, Charles University, in 2017 showed relatively low knowledge of basic terms and concepts related to the possibility to draw on external financial resources. The knowledge of students in both the economic programme represented by Management of Sport, and the non-economic programme represented by Physical Education and Sports was compared. Even though the level of knowledge identified among the students of the former programme was significantly higher, still it cannot be considered as good, even if compared to the knowledge shown by students of foreign universities. Statistical dependence between the level of study and the selected knowledge in the field of financial literacy was proved.

The theoretical contribution of this paper consists in highlighting the issue of financial literacy in relation to basic terms and concepts in this area, while the practical contribution is to present the financial literacy results achieved by the students of FTVS UK and, by doing that, prove the existing relation to the level of study.

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BACHELOR'S DEGREE GRADUATES PERCEPTIONS TOWARDS PURSUING THEIR ACADEMIC STUDIES

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Abstract

The goal of the paper is to analyze the reasons why faculty graduates do not wish to pursue their academic studies within a master program and their perceptions about their Bachelor degree studies as well as their career perspectives. The research paper conducts a case study at a faculty in Romania through quantitative and qualitative research with data analysis on the experience of graduate students and their views upon the educational process. Results provide insights on how important students' expectations, experiences and academic results are in influencing their perceptions and motivation to pursue their studies within a master program. Results show that graduates tend to make their choice based upon career goals, specific personal and professional targets and they are generally not too satisfied with the level of academic teaching and training they received in their graduated faculty.

Keywords

Career perspectives, higher education, master program, pursuing academic studies, teacher responsibility

Introduction

One of today's most recent challenges for most universities in Romania is the effect of the declining number of potential students, both in the Bachelor's degree as well as in the master's degree programs, which is mainly due to the recent demographic decline and lower high school graduation rates that are hindering universities to have a larger choice of high quality students which enroll for academic studies after graduating high school (Alina et al, 2017). An effective educational process should be nevertheless capable to overcome these drawbacks and provide good quality graduates with good fundamental knowledge, skills and a certain amount of training for them to be able to have a good start in their professional careers (Draghici et al, 2015). In this sense universities have started to focus more on the assessment of their internal teaching processes in order to improve the effectiveness of their study programs, based on students' and teachers' evaluations and views upon the quality of the educational process and the teachers' performance in their activity (Flegl et al, 2017). After conducting these assessments feedback and recommendations should be made individually and the general expectations of the university's teaching policy should be reminded as to strengthen the educational principles on which it leads its activity regarding the technical competence, ethical values and personal skills of its future graduates (Gadusova et al, 2017). Students' reasons to enroll in university studies for Bachelor's degree have also changed over the last decades (Hansmann et al, 2017) and their choice is influenced by external factors as well (parents' educational background and/or jobs, friends' and colleagues clear career choices, opportunities after graduation – mainly financial), which have become more decisive than their actual motivation to pursue studies in a domain they would be attracted to (Hellingman et al, 2017). This also brings about the tendency of the prospective students to focus more on the degree itself, instead of the knowledge, skills and value

of their studies, which ultimately means a lower extent of mastering those specific features upon graduation (Lavangnananda and Kankhetr, 2017).
The present paper focuses on a case study conducted within the Politehnica University Timisoara at the Faculty of Management in Production and Transportation regarding its Bachelor's degree graduates perception and motivation upon pursuing their academic studies and highlights the results of graduates from the 5 specialization groups of the faculty, their diploma exam results and the role of the faculty professors in their career choices. The aim of the paper is to provide a comprehensive overview upon the reasons which lead to a very low rate of enrollment of Bachelor degree graduates within the faculty's master programs and provide insights to better understand the role of the teachers within this process.

Materials and Methods

The research in question uses the case research method to analyze student results from the 5 specialization groups in the diploma exam session of 2017 by using quantitative and qualitative data. A year-to-year comparison of the results from the graduation exam is provided, as well as applying an anonymous questionnaire through online tools as is Google Form to the students of the fourth year (i.e. the graduation year) and analyzing the enrollment figures from the 3 master programs of the Faculty of Management in Production and Transportation. The main research questions refer to analyzing why the level of fundamental knowledge the students have upon graduation is so superficial (Research question 1: How aware are students of their educational background gap from high school and how do they manage to adjust their learning effort in order to pass exams and semester evaluations successfully?), why certain students generally prefer non-demanding subjects and teachers, although they are perceived as complaisant (Research question 2: What are the goals of the students during their studies and what are their expectations upon graduation?) and why lowering standards in the teaching activity and process has a negative impact upon the motivation of students willing to learn and upon those graduates willing to pursue their academic studies (Research question 3: What are the main reasons for the low interest of the students with very good academic results to not pursue a master degree program after graduation?).
The sample used was composed of the students within the fourth and final year at the Faculty of Management in Production and Transportation from the specializations Engineering and Management and Administrative Studies, which are comprised of a total of 5 groups (124 graduates). The selection criteria considered the diploma exam results from the last 2 graduation classes for all five groups (each group having a different specialization area). The instruments used for the case study were the grade register of the faculty, the final exam reports for the five specialization areas, the Google Form online questionnaire, individual interviews (85 of the 124 graduates, 68% of all graduates), a focus group (31 of the 124 graduates, 25% of all graduates) and comparative data gathered by the teachers involved in the diploma exam commission, other teachers' views upon the last year's experiences and enrollment figures from the faculty's master programs. 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 individually conducted interviews.

Results

	Multiannual average	Exam – Theory	Defense – Project	Diploma exam
Group 1 average grade	8.49	8.25	9.52	**8.88**
Group 2 average grade	6.74	6.46	7.56	**7.01**
Group 3 average grade	6.82	6.58	8.18	**7.38**
Group 4 average grade	7.19	6.97	7.55	**7.26**
Group 5 average grade	7.99	7.25	8.48	**7.86**
Overall class average	**7.44**	**7.10**	**8.25**	**7.67**

Table 1: Average grades per group for overall and diploma exam results, 2016 (source: own processing)

Table 1 shows the results of the diploma exam from 2016, with very average results for 4 out of the 5 groups of the overall class of 123 students. Grading in Romania is from 1 to 10, with 10 being the maximum. The minimum passing grade for an exam or semester activity is 5, however, for the diploma exam the minimum is 6 out of 10. The evaluation is done at the end of each semester for all subjects of that semester (with written and/or oral exams) within a special exam session of 4 weeks – for the first 7 semesters, whilst the end of the last semester is dedicated to the diploma exam (usually, the last week of June). Group 1 with 38 students scored the highest average grade of 8.88 (out of 10), more than 1.5 points better than 3 of the other 4 groups and 15% higher than the class average. The group also scored the highest average results in the multiannual average (8.49 over the 4 year Bachelor degree studies and 14% better than the class average), in the theoretical part of the diploma exam (8.25 and 16% better than the class average) as well as for the defense of their individual thesis subjects (an highly impressive average of 9.52 and 15% better than the class average). Group 5 (22 students) also scored a pretty good multiannual average grade of 7.99 and has the second best average in both the theoretical part and the defense of the individual project within the diploma exam, averaging a 7.86 for the diploma exam, just 0.13 under the multiannual average of the group, the only group which did not manage an increase in overall results for the diploma exam compared to the multiannual average. Groups 3 and 4 have similar overall results. Group 3 (21 students) scores an overall average of 7.38 for the diploma exam and has the second least good multiannual average of the class with 6.82, only 0.08 higher than group 2. The group scores a good result in the individual part of the diploma exam (8.18, only 1% under the class average), despite a very weak 6.58 in the theoretical part of the exam, where candidates had to score at least a grade of 5.00 in order to pass.

Group 4 (26 students) had the third multiannual average of 7.19 (almost 1 point lower than group 5 and 1.3 points lower than group 1), however scored only 6.97 for the theoretical part of the exam (0.2 points lower than the overall multiannual average) and achieved the least best results in the defense with only 7.55, meaning 0.7 points lower than the class average. The results of group 4 are however the most balanced of the class, because the difference between theory and defense averages only 0.58, whereas the average difference is of 1.15, with group 3 having a 1.6 points difference between the two parts of the exam (39% higher than the class average). Group 2 (16 students) achieves the least good overall of all groups, the group just barely making it over the 7, with an entire result of 7.01 (the minimum passing grade for the diploma exam is 6.00). The group scores only 6.74 for the multiannual average and a very worrying 6.46 for the theoretical part of the exam (0.64 points lower than the class average). For the presentation of the individual project, group 2 just overcomes group 4 by 0.01 points, whilst a total of 3 students did not pass the theoretical part of the exam (from groups 3, 4 and 5) and their grades were not considered for the average results, as only passing grades were taken into account for the analysis.

	Multiannual average	Defense – Theory	Defense – Project	Diploma exam
Group 1 average grade	7.99	8.98	9.21	**9.09**
Group 2 average grade	6.96	7.86	7.84	**7.85**
Group 3 average grade	6.61	7.48	7.90	**7.69**
Group 4 average grade	7.53	8.65	8.49	**8.56**
Group 5 average grade	8.01	8.25	8.60	**8.43**
Overall class average	**7.42**	**8.24**	**8.40**	**8.32**

Table 2: Average grades per group for overall and diploma exam results, 2017 (source: own processing)

A decision from the university (after some changes to the Law of Education) at the beginning of the academic year 2016/2017 meant that faculties could choose how they would evaluate their candidates for graduation, whether they chose to uphold the written theoretical exam that was to be handed in by students according to the existing procedure, or if they chose to evaluate their students' knowledge upon the theoretical aspects of their studies as part of the oral presentation of their projects, which would ease the administrative burden associated with this part of the examination. After gathering feedback from both former and current students as well as consultations with the faculty teachers and staff, the Faculty Council decided to introduce the oral examination of the theoretical and fundamental knowledge of the graduation candidates as a replacement of the previous procedure (written exam), which was considered too stressful by the students and too much work for the teachers (preparing subjects, correcting exams from 15 thematic areas and the associated administrative procedure: reports, signatures and archiving all files). This was seen as a positive decision by the students, as they would not have to face the complex theory exam anymore, which meant no more reviewing for Physics, Mathematics, Operational Research, Management, Economics, Marketing, Logistics, Quality Management and other specialization subjects from where they would usually receive between 2 and 5 basic knowledge questions. Teachers saw it as a relief as well due to simplified procedures, but this also meant the risk that students' knowledge would become once again superficial and they would not have acquired the basic engineering and management concepts, as it was the case when this complex theory exam was introduced by the university as part of the diploma exam 5 years ago.

Table 2 shows the results of the diploma exam from 2017, with good results for 3 out of the 5 groups of the overall class of 124 students. Group 1 with 28 students scored the highest average grade of 9.09, almost 1.5 points better than 2 of the other 4 groups and 9% higher than the class average, being the group with the best diploma exam results. The group had the second best average results in the multiannual average, but achieved the best average in the defense of the theoretical part within the diploma exam (8.98 and 9% better than the class average) and for the defense of their individual thesis subjects (an impressive average of 9.21, being the only group to score an average of over grade 9.00, and 9% better than the class average). Group 4 (25 students) had the third multiannual average of 7.53 (less than half a point under the average of group 5 (0.48 points) and 0.46 points lower than group 1), however the group achieves a very balanced result within the defense as the difference between the 2 parts of the diploma exam was of only 0.16 on average, perfectly matching the class average. The group scored 8.65 for the theoretical part of the exam (1.13 points higher than the overall multiannual average) and achieved an average of 8.49 in the project defense, being one of the two groups which had lower results in the individual project grade average than in the theoretical part. The final average grade of 8.56 meant an increase of 1.03 points from the multiannual average (an improvement of 13%).

Group 5 (26 students) scored the best multiannual average grade of the class (8.01) and has the third best average in the theoretical part (8.65, which meant 5% better than the class average)

and the second best average in the defense of the individual project within the diploma exam (8.60 and a 2% improvement as opposed to class average), averaging a 8.43 for the diploma exam, 0.42 points better than the multiannual average of the group. Groups 2 and 3 have similar overall results. Group 2 (19 students) has the second least good overall result of all groups, with an overall average result of 7.85, being one of the only two groups to score an overall average under the grade 8.00, having a very low academic record of only 6.96 for the multiannual average. The group achieves the best balanced result within the diploma exam with an average of 7.86 for the theoretical part of the exam (0.38 points lower than the class average) and 7.84 for the presentation of the individual project (0.56 points lower than the class average), which is still an improvement of 0.89 points when compared to their multiannual average (a 12% improvement). Group 3 (26 students) scores an overall average of 7.69 for the diploma exam and has the lowest multiannual average of the class with 6.61 (1.40 points lower than group 5 and 0.81 points lower than the class average). The group scores a pretty good result in the individual part of the diploma exam (7.90, only 6% under the class average), but only achieves an average grade of 7.48 in the theoretical part (1.5 points lower than group 1 and 0.76 points lower than the class average). As opposed to the previous year, in 2017 all candidates for graduation passed their diploma exam.

	Multiannual average		Defense – Theory		Defense – Project		Diploma exam	
	2016	2017	2016	2017	2016	2017	2016	2017
Group 1 average grade	8.49	7.99	8.25	8.98	9.52	9.21	**8.88**	**9.09**
Group 2 average grade	6.74	6.96	6.46	7.86	7.56	7.84	**7.01**	**7.85**
Group 3 average grade	6.82	6.61	6.58	7.48	8.18	7.90	**7.38**	**7.69**
Group 4 average grade	7.19	7.53	6.97	8.65	7.55	8.49	**7.26**	**8.56**
Group 5 average grade	7.99	8.01	7.25	8.25	8.48	8.60	**7.86**	**8.43**
Overall class average	**7.44**	**7.42**	**7.10**	**8.24**	**8.25**	**8.40**	**7.67**	**8.32**

Table 3: Comparison of overall and diploma exam results, from 2016 and 2017 (source: own processing)

The effects of having an oral theory exam instead of a more complex written one, can be seen very well when comparing the last two diploma exam sessions, as the level of academic activity and results of students entering the graduation exam was almost perfectly matched (multiannual average class grades of 7.44 for the class of 2016, compared to an average of 7.42 for the class of 2017). There was a very slight improvement in the individual project defense, as the overall level increased from an 8.25 average in 2016 to 8.40 in last year's session (0.15 points increase and 2% improvement), which is marginal and can be related to more time availability to prepare for the candidates own graduation project and less stress associated with the previous theoretical written exam in 15 different subjects. This also meant that the amount of work going into the theoretical part would decrease and that the evaluation could not be as thorough as in previous years, as well as the fact that in an oral exam the possibility to be more understanding with candidates could as well increase due to their obvious nervousness, therefore grades should have improved due to these factors. This was also the case, as the average grades in the theoretical part improved by 1.14 points compared to 2016 (an important 16% increase), although the level of the students' knowledge did not necessarily rise in the 2017 diploma exam session. The average grades of the diploma exam in 2017 improved by 0.65 points (an 8% increase) when compared to the 2016 graduation exam session, but this difference was mainly brought about by the increased grades for the theoretical part (88% of the increase), so there were little consistency changes, only grades improvement, not the level of the candidates preparation and performance, which is also outlined by the President of the diploma exam commission of 2017: "We changed the procedure for this exam to help students focus on their individual projects more and for them to be more at ease and

be less nervous and more confident. The results are indeed better, however their level was not the one we expected, as many of them did not really rise up to the occasion, unfortunately. I cannot really say the level of this year's graduation exam session (i.e. diploma exam session of 2017) is better than last year's one, there were no notable differences, which is a bit disappointing." The Secretary of the diploma exam commission was even harsher: "By easing the diploma exam, the level of expectancy from the teachers was automatically reduced in the mind of the graduate candidates and they adapted to this and performed in line with this mindset. It is very normal, the actual results are the same, if not worse this year, although when you look at the grades you may think different. There were students which would have never passed the written exam this year, if there would have been one, because even their individual project levels were quite low and many of the students' answers to the theoretical part were even worse than those from last year, so I cannot say we have improved their levels, which is worrying."

Thus, although the level of expectancy from students was significantly eased, their performance and results were surprisingly weak. Research question 1 (How aware are students of their educational background gap from high school and how do they manage to adjust their learning effort in order to pass exams and semester evaluations successfully?) can thus be answered as follows: Students are aware of their educational background gap, but also aware of the teachers' reputation of lowering their passing standards within exams and evaluations, so they adjust their learning effort accordingly.

	Diploma: Project	Balanced	Diploma: Theory	Diploma exam	Average improvement
Group 1	9	17	2	28/28	1.10
Group 2	5	5	9	17/19	0.89
Group 3	17	8	1	22/26	1.08
Group 4	3	9	13	25/25	1.03
Group 5	18	8	0	26/26	0.42
Overall class	**52**	**47**	**25**	**118/124**	**0.90**

Table 4: Performance and grade improvements from diploma exam results, 2017 (source: own processing)

Table 4 shows how the candidates for graduation performed and to what extent did they improve their results compared to their multiannual average grade. The average improvement was of 0.9 points, 3 of the 5 groups managing to improve their grades by more than an entire point (group 1 by 1.1 points, meaning a 22% improvement when compared to the class average improvement, group 3 by 1.08 points (20% improvement) and group 4 by 1.03 points, an improvement of 14%), only group 2 scoring under one point (0.89 points improvement) and group 5 even scored less than half a point in improvement (0.42 points, 53% lower than the class average). As far as the students are concerned almost each and every graduation candidate (118 from 124 students) managed to improve his diploma exam results when compared with their multiannual average, meaning a 95% improvement. All students from groups 1, 4 and 5 managed to increase their grades at the diploma exam, only 2 students from group 2 (representing 10%) and 4 students from group 3 (representing 15%) did not manage to obtain higher grades at the graduation exam. The results and improvements shown by the figures are however to be interpreted with care because the level of difficulty of the questions the candidates received for the theoretical part of the exam were average at most, the commission showing much indulgency towards the graduation candidates and their iffy answers. There were 47 students who had a balanced performance, obtaining the same result in their project presentation as well as in their knowledge upon their area of studies, meaning that 38% of the class had a balanced performance at their graduation exam. 52 students achieved a better result in their individual project presentation (42% of the class), which is

understandable because the amount of effort and attention to detail is usually much higher in one's personal project than in very large and complex theoretical aspects related to the other part of the evaluation. Surprisingly however 20% of the class scored higher in this part of the diploma exam, and by judging from the opinions expressed by the commission members, this is rather due to poor overall preparation and performance of the own project as well as weak abilities to defend their work, rather than a more impressive performance in the theoretical part.

	Master 1	Master 2	Master 3	Master (elsewhere)	No Master
Group 1	0	6	0	20	2
Group 2	0	2	2	5	10
Group 3	0	6	2	5	13
Group 4	0	1	6	12	6
Group 5	7	1	12	0	6
Overall class	**7**	**16**	**22**	**42**	**37**

Table 5: Bachelor degree students' choice after graduation, 2017 (source: own processing)

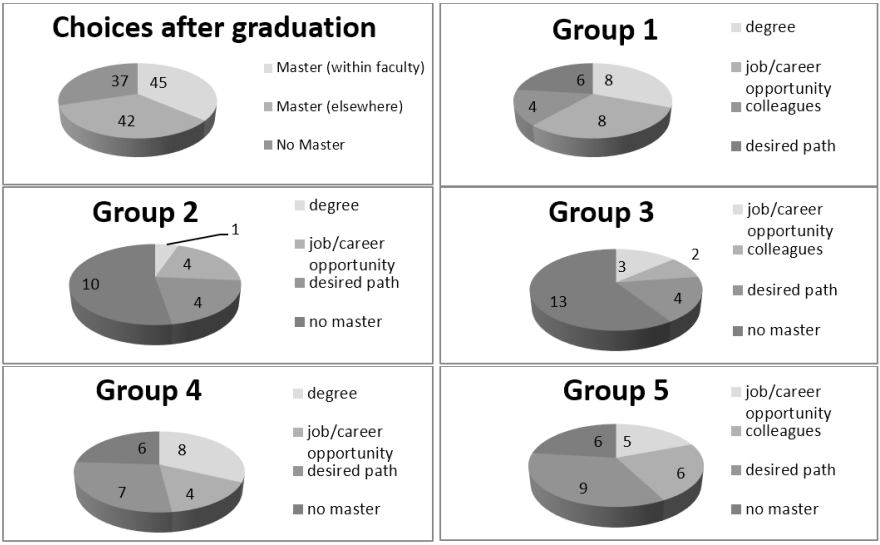

Figure 1: Overview of students' choices after graduation – overall and per group, 2017 (source: own processing)

The Faculty Council was surprised that an important part of their graduates have not chosen to pursue their studies within one of the 3 master programs and preferred to study elsewhere. Thus only a third of the 2017 graduates (45 graduates, representing around 36%) decided to pursue their master degree studies within the faculties master programs, whilst another third chose to pursue their studies elsewhere (42 students, representing around 33%) and the rest deciding not to continue their studies in favor of either getting a job immediately after graduation or just taking some time to figure out their career plans. This is a second consecutive year low rate of student retention at the faculty, which was used to having around two thirds of their graduated students enrolling within the faculty's master programs in the last decade, with just a couple of exceptions where this figure would tend towards 50% (twice) or 75% (three times). An overview of these results and the main reasons for this change in the graduates' career choices is shown in figure 1. When asked about their choices after graduation, the students had a variety of reasons to explain

their decision. In group 1 around 30% of graduates decided to choose master programs elsewhere in the attempt to get a degree easier, whilst 53% had made their choice in regards with their specialization, skills and career opportunities, as shown by some of their statements: “I want to continue with a master’s degree, but one where attendance requirements are eased, because I would like to start work and I don’t know if I will be able to participate too often.”, “I want to try something new, which is more focused on engineering, on the technical part, because it would help me at my current job.”, “Most of my colleagues chose that master, so I decided to do the same.”, “I know from other colleagues that our faculty’s master programs are quite good, but I just want a degree, I do not really care that much about the rest.” Group 2 has more than 50% of graduates which decided not to enroll in any master program, whereas the rest had a pretty good idea of what they wanted: “I know our faculty has a very good master program in logistics from several acquaintances, as well as a double degree opportunity with a university from France, so for me the choice was simple.”, “I have a job opportunity in one of the domains of our faculty’s master programs.”, “I have some personal plans and they do not involve a master program, I actually never thought of enrolling.”, “I do not want to enroll in any master program just yet, because I want to see what my job opportunities are in the near future and then decide what master I choose.” Group 3 also had a rate of 50% of graduates which did not enroll in any master program, whilst only 26% had a clear idea of what they expected from a master program and a further 15% targeted only the degree in itself elsewhere, not the specialization or the acquired skills: “Why did I choose this master program? It do not know, it was an on-the-spot decision, I did not think too much about it.”, “For me, the degree is more important than the skills I gain, the specialization area sounds good, attendance requirements are low and I can focus on other things in the meanwhile.”, “I just wanted to have a degree in engineering, now that I have it, that is enough for me.”

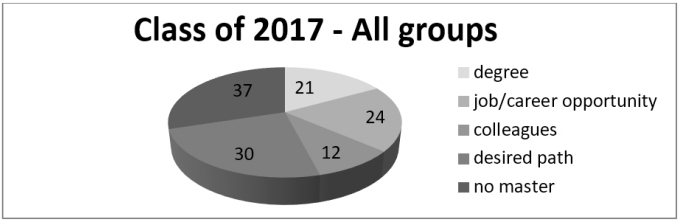

Figure 2: Overview of the reasons for students’ choices after graduation, 2017 (source: own processing)

In group 4 a total of 44% of graduates had made their choice in view of their specialization and future career plans, with 32% preferring to source a master program elsewhere for an easier access to another degree: “I knew the master program I wanted and I am looking forward to learning new things about logistics that can help me improve in my job.”, “I know that the master programs at our faculty are more demanding than others, but I think I prefer to learn these things now and then apply them at work, rather than struggle in my job and wait a couple of years before deciding to do so.”, “I want something which allows me to get the master’s degree without too much effort and attendance requirements, that is why I chose to go elsewhere.”, “I do not think knowledge is so important, the degree is what counts, because you can manage after that.” Group 5 has around 53% that are focused on their career opportunities with regard to their choice in the master program, whilst 23% decided not to pursue their studies after graduation. “I was interested in our master in logistics, it sounded like an interesting challenge, so I did some research and I decided to enroll for this master program.”, “I wanted to focus my attention on something which offers some

job opportunities and perspectives in the future, so I chose this master program.", "I heard about this master program at our faculty, it has some really good references, so I am quite sure it is the best decision for my master studies".

Most of the graduates are very pragmatic and only think about the outcome (the degree), without really considering the importance of the specialization area compatibility, preparation and experience a master program has to offer for improving their skills and performance within their jobs. Research question 2 (What are the goals of the students during their studies and what are their expectations upon graduation?) can thus be answered as follows: With some exceptions, an important part of the students merely focus on obtaining the degree, regardless of their actual level of acquired knowledge and skills.

Figure 2 presents an overview of these reasons and motivation for students' choices after their graduation, which gives some worrying conclusions: almost a third of graduates (30%) do not wish to pursue their academic training, although the biggest challenge for the Western area in Romania is to find well-trained workforce within a highly competitive and low unemployment region. Their reasons are mainly related to the lack of time, either to even think about enrolling in a master program, to their thoughts of not being able to keep up with a master program while simultaneously having a job, the need to take a break in order to think things out or due to personal plans (moving to another city, country, other personal reasons). Of the other two third of the graduates, 51% have chosen to continue with a master program within the faculty, whilst the other half chose to enroll in a master program elsewhere. What is however worrying is the motivation of these graduates, as only 34% chose their master program in reference to their skills and professional motivation, whilst another 27% in regards to career opportunities, meaning that less than two thirds (around 62%) of those willing to pursue their studies are doing so for the right reasons (54 graduates of the entire class of 124 students, meaning only around 43%). A number of 21 graduates (representing around 24% of graduates) are only focused on getting the degree, not in their actual training and expanding of their skills, whilst 13% have chosen their master program according to the choice of other fellow colleagues, meaning that around 37% of the entire class has a different view upon the importance and relevance of their master studies.

Some of the graduates have some pertinent explanations for this situation: "There are very few teachers which are passionate about their work and who inspire us to learn something, while teaching us new and useful things which we can relate to after graduation, all the others are however boring and uninterested in our development and we do not want to enroll in a master program for only one or two teachers and/or subjects, it is not enough. We also do not really know what we want, we do not like anything in particular, we want the faculty to give us these ideas and skills, but we are most often not willing to put an effort into this process and unfortunately neither do the teachers know how to gain our attention and interest. So why choose a master program within the same faculty, where after 4 years you do not feel to have really gained something?", "Everyone has their own ideas and goals, some are more ambitious, others are more complacent. Very few of us know what they actually want in life, from their career and even personal lives, I cannot say the faculty is at fault for that, it is clearly also a matter of personal management, but most of the faculty teachers do not really invest themselves in teaching us anything, let us pass the exam easily and get good grades and they think they have done their job properly. Of course it is convenient while you are a student, but only after do you realize that all of this is actually not in your favor, not at all, so you start to question the probability to see a change in the master program. Who would be willing to think that the same teacher will change his style radically just because he teaches in a master program?", "Most of my colleagues want to go down the easy road in life, but that is not the best decision and they will probably realize it sooner or later. Me, I prefer to work hard for my knowledge and skills, even if it is more difficult, because I want to gain something

out of this master program when I finish in two years, to be able to apply most of these things I learned on my job. Most of them are disappointed that they did not learn too many things during these 4 years, but they are happy to have obtained the degree, so happy that they forgot that that piece of paper is not worth too much these days.", "The reason why most of us decided not to continue the master program at our faculty is because most subjects we had and some projects as well throughout the 4 years were somewhat repetitive and this is not what we wanted. We want to learn new things, which are useful, practical and that can be applied at our future jobs, subjects and projects that focus on developing our skills that bring added value to us and to the companies where we would decide to work. There is not an actual preoccupation by most of the teachers to teach us anything like this, we mostly see them being superficial in class, sometimes they do not even come and when they do, we finish early because we do not have time to do what we have to and the teacher is not willing to put in an extra effort, so we almost do nothing and go back to the campus early and do nothing productive all day. This is the perspective most of us have for the master program as well, so who would be willing to waste a further two years doing this?", "Me and my colleagues are aware of the challenges that await us during the master program, but we want to focus on this area of specialization and work hard to acquire the needed skills to help us be prepared for our jobs. We heard many good things about one of the faculty's master programs, so we are confident that our choice is a good one. We also know some of the teachers who will be giving lectures at that master, we know they are willing to help us understand and learn, so we are looking forward to starting the courses in autumn. We are also a bit disappointed after the Bachelor degree, but we hope that the master program will be different."

Results show that students are generally disappointed with the lack of involvement of most of their teachers as they feel they do not acquire a sufficient level of knowledge and skills during their Bachelor's degree studies, which is quite worrying from an academic point of view. Research question 3 (What are the main reasons for the low interest of the students with very good academic results to not pursue a master degree program after graduation?) can thus be answered as follows: The part of the students which would really want to expand their knowledge and level of skills is hindered by a very scarce preoccupation for the educational process by most of their teachers.

	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Master 1	81	96	87	91	83	74	64
Master 2	47	49	50	52	50	37	42
Master 3	53	71	86	85	99	74	71
Overall	**181**	**216**	**223**	**228**	**232**	**185**	**177**

Table 6: Students enrolled in the faculty's master degree programs, 2011-2018 (source: own processing)

After having worked to develop a good reputation for its master programs and a 28% increase in the overall number of enrolled master students in the last 5 years in the academic year 2015-2016, with Master 3 having the most impressive growth of 86% and the most number of master students enrolled, 19% more than Master 1 and twice as much as Master 2, in 2016-2017 and 2017-2018 the figures suddenly dropped. In 2017 the total number of enrolled master students decreased by 20% (11% for Master 1, 26% for Master 2 and 25% for Master 3) and in 2018 by a further 5% (14% decrease for Master 1 and 4% for Master 3, whilst Master 2 grew with 13%), meaning the faculty now had 55 master students less than 2 years ago and less enrolled students than in 2011-2012. Master 1 is at a record low level of only 64 students (after 4 consecutive years of decrease), Master 2 has only 42, despite the growth in 2018 (in 2017 only 37 students were enrolled in the specialization area of the master program), whereas Master 3 is at the level from 2012-2013 (28% less than in 2015-2016).

Discussion

Results provide interesting insights upon the way students assess their Bachelor degree experience and how these years of studies have shaped their perceptions upon pursuing their studies within a master program or not. The faculty's management is worried about the decreasing number of their graduate students which enroll within their master programs, but this is only the outcome, whereas the reasons lie within some of the teachers' capability of properly performing their jobs as teachers with responsibility and awareness. Graduates feedbacks show signs that there is a general lack of commitment towards wanting to actually teach the students useful, practical and valuable things, which may serve them at their future jobs after graduation. This lack of involvement from the teachers generates a tendency to loosen up from the students, which brings about very weak levels of motivation and preparation for semester evaluations, exams and other faculty related activities, making their overall experience with academic studies a superficial one (Vnoučková, Urbancová and Smolová, 2017; Horakova, Krejci and Rydval, 2017). Moreover, students do not receive any kind of career perspective advice and they are not capable of projecting themselves into the future or to think about their professional goals and how these are linked to a solid and proper educational background (Rydval and Brožová, 2017). Besides their lack of fundamental knowledge within their specialization (Měsíček, Petrus and Kovářová, 2017), they also lack personal ethics, as there is a growing tendency to cheat in an increased number of exams and evaluations, as well as the urge to sometimes try using different types of excuses as to why they should be granted an exam or a higher grade, which often convinces teachers to give in and cede (Blumenfeld, 2015). The increased number of cases where "understanding students and their difficulties" have increased and some of these cases have become quite disturbing as some teachers acknowledged: "I have had students in the 3rd year who did not know how to perform elementary calculations, not even with a calculator, which was shocking at first, but when I heard they passed subjects like "Algebra and Geometry" or "Mathematical Analysis", you cannot help question the way these students managed to pass those exams", "The level is really low, I see this every year, but what is more disturbing is the fact that they do not show interest into wanting to raise their level, being complacent that they will somehow eventually pass, which makes them care even less", "I teach in the last year (i.e. the academic year when a class of students graduates) and I have sometimes thought about how such weak students manage to actually make it this far, it's a real question mark for me and I cannot figure out how they succeed into passing pretty complicated exams if they are not able to perform simple and basic thinking tasks at my subject" (Wolter, Diem and Messer, 2014). It is clear that some additional effort is required from the teachers to help fill I some knowledge gaps and help enhance and develop the skills of the students, but this effort needs to be common for the outcome to be visible at a larger scale (Orosz et al, 2015). Faculties and universities have the role to provide good graduates with an appropriate level of training and skills acquired throughout their Bachelor degree study years, which should be reinforced by high ethical and moral values as part of their educational background (Mládková, 2017). The educational system in general, but especially higher education, should be a reference in both providing relevant skills to their students and future graduates as well as a solid base in proper conduct in order for the image and the credibility of these institutions and their graduates to be one of trust (Samuel, Donovan and Lee, 2018; Neeß, 2015). The end results should reflect the efforts undertaken by both the teaching staff as well as the students to source high potential graduates that are qualified to start work and help increase the level of well-being for the present and future generations (Schwager et al, 2015). If faculties and universities are not capable of providing this kind of expected results then their role in today's educational system is questionable and they are on their way to failing the most important exam of all: responsibility in education (Turi, Mocan and Pujol, 2016).

Conclusion

The paper emphasizes the need to constantly adapt the content of the courses taught in the Bachelor's degree in order to provide appropriate subjects and practical projects to students and underlines the increased importance of the teacher's role to gain student attention and attract interest in each subject. The students need to see the fact that what they are learning is new, challenging, useful and practical and can be applied in their current or future jobs as a mean of increasing their productivity and efficiency. The authors imply they need to feel the benefits of the educational process, understand its relevance and have a partner in the entire process in the role of the teacher who should know how to adapt his style in order to reach the maximum number of students with the content of the subject for them to feel that he has an active role in their professional development and act as their support when they have difficulties or need guidance.

Students, on the other hand are very dynamic and are quickly projecting themselves into the future, due to the increased pressure social media has brought about related to having a well-paid job, the associated opportunities and career perspectives as well as their image within their social environment and/or on social media. They have high aspirations and want to have things quickly (their own place: house or apartment, car and travel opportunities), which is why their priority is getting a job and then they see their studies as being merely in their way of advancing in their careers and having higher salaries. What they tend to forget is the fact that they live in a competitive environment, where everyone wants to get ahead somehow, and if they lack theoretical knowledge, skills and practical abilities, then their chance of growth at their workplace is hindered by the very thing they see in their way of success: education. The authors thus feel they need to focus on having a proactive approach towards learning and continuous development in order to be flexible and adaptable to all their professional projects, challenges and goals in order to succeed, but this has to come from them and their own inner motivation, not from their teachers.

Learning is a never-ending process, especially in today's rapid technological development and increased need for adaptability. This is also true in education and even more in higher education, where the link between theory and practice has to be even more obvious, as well as the ability to be flexible and adaptable to all sorts of professional challenges. Teachers and students need to realize that they are actually a team in the educational process with the same interests and that working together is in the benefit of both parties for the development and success of both the teachers and their current and future students and only through common efforts can this process be sustainable in the long-term by sourcing valuable results for both the faculty and its graduates. This will in turn maybe also enhance the graduates' awareness of wanting to further deepen their knowledge through a master program, which will raise their professional level and help increase the overall level of education, not just the number of issued degrees.

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BEHAVIOUR AND DISCIPLINE IN SCHOOLS AS AN EDUCATIONAL PROBLEM FROM THE VIEWPOINT OF STUDENT TEACHERS

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Abstract

This paper presents the results of qualitative research based on text content analysis. The research set primarily consisted of 120 submitted and defended Analyses of Educational Situations. They are part of the final state examination in the Master's Degree programmes for upper primary school teachers at the Faculty of Education, University of South Bohemia in České Budějovice. The paper is only focused on the topic of behaviour/discipline that appeared in 57 Analyses, i.e. in nearly 50% of the cases. The objective of this paper is to understand what questions are asked by future teachers in relation to behaviour and discipline, how they present their feelings and emotions raised by the situation, and what strategies they choose when designing a potential solution to the situation. The paper is based on partial results of the project Readiness of Students' and Fresh Graduates' from the Faculty of Education, University of South Bohemia, to Solve Educational Problems of Pupils.

Keywords

Analysis of educational situation, discipline, educational problem, novice teacher, student

Introduction

The paper is based on two commonly discussed topics, namely behaviour/discipline and the preparedness of students studying to become teachers to control miscellaneous educational situations when they begin their teacher career. The prerequisite allowing for an analysis of this topic is the form of the final state examination in the study programme for upper primary school teachers. With this framework, students present and evaluate a specific situation they deemed important based on their monthly practical training (traineeship).

The key subject of the paper is discipline. If we focus on current views, this topic is seen as conscious compliance with certain rules and standards. Bendl (2011) studied the issue of behaviour and discipline in a broader historical context, indicating that changes in the over-technologized world are also transforming human behaviour. According to Miňhová and Lavasová (2010), the increase of risk behaviour manifestations, or the tendency to seek out risk behaviour forms, and the increasing number of neurotic children and failure by children to stay within educational boundaries are among the topical issues of the teacher profession. Chudý and Neumeister (2014) stated that the lack of discipline has become a common part of the school environment. We treat it as a phenomenon commonly encountered in schools and which is a natural part of schools, i.e. an important topic for teacher training. Stará (2009) mentioned that what teachers are most bothered with and concerned about are frequent discipline problems of children, their aggression and behaviour that disrupts the course of instruction and hampers or prevents themselves and other students from learning in the classroom.

However, a difficult moment in teacher training is the ambiguous understanding of what discipline and misbehaviour actually are, and where the limits are of acceptable and unacceptable behaviour.

Each teacher understands this concept differently, so there exist different views of misbehaviour resulting in different opinions on how to deal with specific educational situations. Moreover, the solution is not only based on the actual individual situation, but even the personality of the individual student and, in particular, the teacher's personality. To identify how students at colleges for education and novice teachers feel ready to manage discipline problems is among the goals of the project entitled *Readiness of Students and Fresh Graduates from the Faculty of Education, University of South Bohemia, to Solve Educational Problems of Pupils*. In this context, the partial results recently published indicate that students do not feel ready to manage discipline problems and point out the lack of subjects from which students can gain confidence that they are prepared to cope with difficult situations in practice (cf. Procházka, Vítečková and Gadušová, 2016; Procházka, Vítečková and Špačková, 2017; Vítečková, Procházka, Sulková and Melková, 2017). Similar results were obtained by Šimoník (1994), however within the context of the 1990's. His research conducted in the period 1990-1992 arrived at similar results concerning the preparedness to manage discipline problems (83% of novice teachers said they were not ready to deal with discipline offences, n=141). Practical training covering all fields and teaching experience was also assessed as below average in a survey conducted in 2000 by the Faculty of Education, Charles University in Prague (Vašutová, 2004). As mentioned by Vašutová (2004), practical experience (traineeship) during university studies only provides a small touch of the profession, because the everyday life and everyday professional work strain and responsibility are different and cannot be acquired from study experience. Similar to Čapek (2014), we uphold that students of colleges of education should have a curriculum offering model problem situations that may be encountered in schools and should learn how to manage them successfully. In practice, the established class management procedures can be used (cf. e.g. Cangelosi, 2006; Holeček, 2010; Podlahová, 2002, 2004; Stará, 2009) but fully adopting them would be misleading. As fittingly explained by Podlahová (2002), pupil misbehaviour is a spontaneous, unexpected, and diverse phenomenon. Moreover, as mentioned by Lefstein and Snell (2014), situational context is very important. One method may work here but will fail there. Therefore, students should be trained to manage discipline problems not only in a broader theoretical context, but they should build self-confidence and self-esteem associated with dealing with unexpected situations, thus reinforcing their personal competencies. At the same time, it is important to develop the social competencies of teachers necessary to create a positive environment (Lomnický et al., 2017) as discipline, behaviour, and environment often go hand in hand. Further, we cannot ignore the issue of teacher authority (Vališová, 2010) related to professional skills, to interaction behavioural schemes in the educational environment, with the situational behaviour of those involved, and with the overall social climate.

The changing quality and content of undergraduate training of future teachers is related to innovation of the concept of the final state examination for teachers. The goal is to link theory to practice even at the very end of studies. Discussions about the form of the final state examination at the Faculty of Education, University of South Bohemia in České Budějovice are, among others, are based on research studies recently conducted by the staff of the Department of Pedagogy and Psychology. They map the student view of university training, but also the areas where students and novice teachers feel insecure (cf. Vítečková, Gadušová and Garabiková Pártlová, 2014; Garabiková Pártlová, Bílková and Procházka, 2014; Vítečková, Procházka, Gadušová and Stranovská, 2016; Procházka, Vítečková and Najmonová, 2018). Further, for example, from the survey presented by Vašutová et al. (2008). The results of all above surveys most often discuss the issue of readiness for solving discipline problems. Students feel unready to cope with the most stressful situations. They describe the need to gain knowledge applicable in practice and

practical experience. Students believe that practical experience is the essential quality standard of education and is primarily an integral part of educational psychology training.

At the Faculty of Education, University of South Bohemia in České Budějovice, the new structured model of the upper primary school teaching programmes allows to accentuate the role of practical training (traineeship) reflection by students. *Analyses of Educational Situations* have currently become a part of the final state examination. Based on their practical experience from studies, students will select a situation they consider important, or difficult and challenging, and on the contrary as well managed but worthwhile, to mention and perform a deeper analysis. The students will consequently elaborate a written document to reflect their own role, feelings, and experience in the given situation and present a justified solution of the situation. Considering the fact that *Analysis* is a part of the final state examination where this written document is presented and defended in verbal form, the reflection becomes formally relevant as well.

Greater use of knowledge from practice, within the meaning of better quality reflection, is developing the ability of students to apply the acquired theoretical knowledge and understand and solve professional and life situations. Practical experience thus becomes an intermediary between the student and educational reality in schools, highly promoting their professional socialization. This trend is corresponding to teachers training based on the model of teacher as a reflective practitioner. It accentuates the gradual maturation of the teacher personality arising from the ability to reflect situations they might encounter in real life (Kosová et al., 2012). Reflection covers a variety of activities where the individual gains insight into his/her behaviour and interactions and evaluates them within the meaning of planning next steps and strategies. The ambition is to see behaviour from the outside, with the benefit of hindsight, with the aim of improving the present interactions, experience, and behaviour (Gadušová et al., 2014).

The actual document entitled *Analysis of Educational Situation* (hereinafter referred to as *Analysis*) has a predefined structure which the student must follow in content and form. Part I describes the environment where the situation occurred and characterizes the persons involved in the situation. The student mentions how the players communicated and how they treated one another. The next part captures the self-reflection of the situation as experienced by the student. They describe their own feelings and ideas that come to mind while they observed the situation. This allows them to realize their own feelings, imaginations, ideas, and impulses leading to superficial reactions as well as their bodily experience of the situation. According to Švec, Svojanovský, and Pravdová (2016), an understanding of the feelings, fears, concerns, confusion, and indignation experienced or assumed by a novice teacher in unexpected situations will help to strengthen their personal competencies. Based on research, the categorisation of subjects focused on self-knowledge, practiced self-reflection, and social skills training are also accentuated by Juklová (2013).

In the next part, *Analysis* defines the problem and describes the nature of the situation that is later discussed by the student looking for an answer. Before the student proceeds to suggest various solutions to the situation, he/she should first analyse the related literature and learn how to combine the intuitive need to find a solution based on application of theories and models. This allows him/her to describe the situation in more detail and understand all of its substantial aspects. This theoretical analysis of the situation is used for the subsequent formulation of their own solution proposals. Students are directed to apply their own creativity and not to blindly adopt solution models from elsewhere but learn to combine theory and practice. The final part of *Analysis* is intended to develop self-reflection competencies. The student looks back on the process of *Analysis of Educational Situation* and their solution to the problem, or to the solution to the problem in practice if it was implemented, and he/she describes and evaluates this process. In their publication, Šeďová, Švaříček, Sedláček, and Šalamounová (2016: 282) point out the development of practical wisdom. According to the authors, the key is not to present a correct

theory to teachers and ask them to follow, but to allow their practical wisdom that the application of theory in practice permits: *"Imitation without reflection and development of practical wisdom is simply inefficient."* Efficient teacher training should not rely on adopting ideas and procedures, but on the reflective incorporation of them in the professional competencies of teachers who can further observe and verify their functionality during their own practice. Korthagen et al. (2011) points out an important reflection effect as a way how to create a professional identity. If the student (teacher) is willing to learn from his/her own experience in changing conditions, he/she will gain "growth competence". This guarantees the capability to grow further, providing a basis for innovative changes and promoting the innovative capacity of the teacher.

The objective of this paper is to present the results of the *Analyses* focused on behaviour and discipline. We identify questions asked by f

uture teachers of upper primary schools in relation to behaviour and discipline, and how they present their feelings and emotions raised by the situation. Further, we observe which strategies they choose to design a potential solution to the situation.

Materials and Methods

As initially mentioned, *Analysis of Educational Situation* forms a part of the final state examination of the programme for upper primary school teachers at the Faculty of Education University of South Bohemia in České Budějovice. The presented research was based on text content analysis. Initially, 120 written documents were analysed to identify the topics of *Analyses*. Consequently for the purposes hereof, analyses discussing the issue of behaviour and discipline were sorted out and reviewed for quality. This paper presents the results based on the content analysis of 57 degree works submitted and defended in 2017. The analysis was done by one researcher; therefore there was no risk of a disagreement in this case. Open coding was used. The acquired codes were grouped into categories and the "card reading" (Švaříček, Šeďová et al. (2007) technique was used for consequent interpretation.

Results

The research was initially based on 120 *Analyses of Educational Situation* defended by students of the Master's Degree programme for upper primary school teachers during the year 2017. The topics selected by students for their *Analyses*, i.e. categories, are listed in Table 1 and ordered by frequency (for more details see Procházka, Vítečková and Najmonová, 2018). The most frequent topic of *Analyses* was the issue of behaviour and discipline. The findings correspond to repeated expressions of the feeling that students are not prepared to deal with the given topic during university studies and to the needs of novice teachers (for more details see Procházka, Vítečková and Gadušová, 2016; Procházka, Vítečková and Špačková, 2017; Vítečková, Procházka, Sulková, and Melková, 2018). The selection of topics was also subject to research conducted in 2015 (survey research, n=144) in which the focus of presented situations was examined and the difficulty, and the benefits of the entire model of teachers training were evaluated (Procházka, Vítečková, and Žlábková (2015).

The questions asked by students in relation to behaviour and discipline, i.e. problems defined in their *Analyses*, can be divided into the following categories: ***solution***, ***cause***, ***prevention***.

Category one, ***solution***, is presented by the following questions, for example: *"How to discipline a shouting pupil?"; "What measures can be used against a disruptive pupil in class?"*; *"Did the pupil commit a breach of discipline and if so, what adequate penalty should be imposed by the teacher?"*; *"What appropriate response should be made by the teacher in an unexpected situation to resolve a disciplinary issue (offence) in an adequate manner while not losing control and threating teacher authority?"* The common indicator of this approach is the orientation of the

student (future teacher) towards procedures, guides, specific tactics, and strategies, or "recipes" on how to manage discipline problem situations. We feel the tendency here to find solutions in the category of thinking "How?" can the problem be solved. This approach is interpreted in that the student builds self-confidence through guidance and seeking out support at the methodical level of the solution. The extreme manifestation of this approach is one-sided overestimation of practice and efforts to reduce teacher training to merely simple methods and recommendations.

Problem Definition	Quantity of *Analyses* (absolute frequency)	Quantity of *Analyses* (relative frequency)
Classroom misbehaviour	54	45.0 %
Student with special educational needs	25	20.9 %
Motivation	8	6.7 %
Class climate/teamwork	7	5.8 %
Forms and methods of teaching	5	4.2 %
Talent/aptitude	4	3.3 %
Conflict	3	2.5 %
Assessment	4	3.3 %
Collaboration	3	2.5 %
Communication	2	1.7 %
Authority	2	1.7 %
Personal revenge	1	0.8 %
Self-confidence problem	1	0.8 %
Alcohol in school	1	0.8 %
	120	100 %

Table 1: Topics of Analyses of Educational Situation (source: own calculation)

Category two, ***cause***, is presented by questions in which the student is considering the situation as a whole with its causes and consequences: *"How efficiently to deal with misbehaviour and punish students to avoid such behavioural problems?", "What are the reasons for student disruptions, and how should the teacher respond to repeated disruptions?"* The etiological aspect hidden behind this approach can be considered a key to finding a strategic solution to behavioural problems. We can feel that the superficial "How?" changes to a conceptual "Why?". The actual strengthening of diagnostic competence of the future teacher becomes a key topic for scientifically based reflection. The teachers' ability to the know children who are placed in their custody for educational care and recognize the qualities of the group of children and to timely identify any negative relationship and their own deficiencies or problems reflected in children behaviour are the basis for resolving misbehaviour.

The ***prevention*** of misbehaviour only appeared in a few cases. Based on experience, students ask the question of what all can be done to prevent a situation from occurring, i.e. to avoid misbehaviour: *"How to avoid the occurrence of problem behaviour, and how to deal with students who show behaviour disorders?"* Prevention is interpreted as the ability to realize prophylactic factors that can be used to set up rules of behaviour in the classroom. It allows the teacher to systematically work with the realized boundaries. It is a system the teacher can use to help children to define the required and undesirable behaviour and to understand its meaning. It is interesting in this context that students did not record in any of the presented situations in which teachers would enforce the rules of behaviour in the classroom or the devised system of mutual rules of behaviour. This prompts the question as to what extent teachers are able to apply this approach to manage discipline problems in practice.

As far as feelings are concerned, most *Analyses* show the ***uncertainty*** of future teachers, ***fear of failure***, and ***primary shock*** from a situation that is unexpected. Students describe inadequate responses during the interaction of players; they often express their concerns about how the situation was managed by the teacher they observed during their practice. This raises more questions and uncertainties which deepen in cases where the situation was not reviewed and explained by the teacher. Occasionally, however, there are ***confident individuals*** among students who "are clear". However, they typically choose a strategy to resolve a misbehaviour/educational problem "by force".

When proposed solutions are formulated, a dominant need is felt to go for a quick response. This is considered normal, since most situations are based on a dynamic sequence of events and the need to intervene promptly. The primary solution to the situation as later proposed by the students themselves is based on the ***trial/error*** principle. If the student can see the causes of the situation and reviews the individual phases of the situation, seeds of some strategies can be found in the document. Despite a certain simplification, the following established procedures can be identified: ***strategies focused on the regulation of external conditions of the educational situation*** (*"coming closer"*, *"moving the pupil to another desk"*, but even a proposal for an *"isolation room"*). The second strategy is a ***consultative and cooperative procedure*** based on cooperation with parents and other teachers or the headmaster, in which the student expects a solution through communication with other counterparts. The transfer of authority to another person is typical of student responses (*"solution by a superior"*). This shows an unanchored role of the student who is perceived by pupils as a faculty student and not a teacher. The third strategy is ***internal transformation of the teacher approach based on identified causes.*** This is about strengthening personal competencies (*"calm"*, *"level-headed"*, *"humorous"*) as well as professional and didactic competencies *("interesting tasks"*, *"stimulating learning through games"*; *"changing different methods"*), or pedagogical and psychological competencies (*"motivation"* or *"positive assessment of pupils"*).

Discussion

Students' responses to discipline problems and their grasp of this problem reflects what is mentioned by Podlahová (2002), namely abruptness and diversity. Students very often respond by choosing the trial/error strategy, trying to resolve the situation immediately. Nevertheless, in the case of discipline problems, the issue of immediate response (e.g. on the spot solution) is questionable. *Analyses* that are not only included in the final state examination but which are prepared and analysed within an optional subject towards the end of the studies help students learn to deal with problems based on reflection. Students are thus directed to what is pointed out by Šeďová, Švaříček, Sedláček, and Šalamounová (2016). The objective of teacher training is not to blindly adopt the models, procedures, and ideas of others, but that students should reflect their experience on the background of theoretical knowledge to build their professional competencies. In addition, students should be aware of situational context as highlighted by Lefstein and Snell (2014). *Analyses* very often featured the concept of authority that is inherently involved in discipline and behaviour and in building the climate as provided, amongst others, by Vališová (2010). It is important to understand that students who are disrupting wish to say something to the teacher. Unfortunately, students very often ask themselves questions aimed at using a penalty or reward to solve the problem. Thus, they are looking for a quick and immediate solution and only later do their considerations lead them to find the causes (often they do not concentrate on causes at all). It is also important that while students are primarily focused on understanding the teacher's approach and evaluating the teacher's erroneous or positive responses in their analyses, the cause of a discipline problem might be somewhere else. Similarly, this fact was pointed out

by Holeček (2010). It may be an ADHD pupil currently finding him/herself in a bad situation (e.g. unsatisfied need, negative experiences in their family, stronger emotions experienced at that moment, or illness). It may be a pupil who feels inferior or has a negative self-esteem. Of course, it may also be pupils who have a negative attitude towards school, a specific teacher, or learning. It is surprising to hear statements of future teachers after five years of studies, for example: the pupil should be *"disciplined"*, the teacher should *"intervene"*, or the teacher must *"make"* the pupil do something. *Analyses* show that students are partly naive and partly too self-confident. Here *Analyses* reveal the intellectual world of future teachers, feeling helpless or clueless, sometimes naive and sometimes self-confident.

In the next part of the research we will work with the results of *Analyses*, which are handled by the novice teachers in a similar assignment. Using this *Analyses* they present their professional problems and educational and development needs in the courses of lifelong learning. Work with *Analyses* is an impulse to innovate both undergraduate and postgraduate education of teachers.

Conclusion

The focus of the final state examination at the Faculty of Education, University of South Bohemia is in line with the trend of teacher training: training focused on developing the ability to reflect situations experienced in practice. Students are thus directed to strengthen their professional competencies. The conclusion based on *Analyses* and students' feedback is that students are successful in combining all parts of *Analyses* into one whole. This task allows them to understand the significance of the connection between theory and practice. In their solutions, students sometimes rely on a one-sided consideration of behaviour and discipline, being aware of the consequences of behaviour and punishment. Some texts include wording such as responding "correctly" or a "correct" solution, leading us to consider problems in terms of black and white.

It is important to understand some essential facts related to behaviour and discipline. Discipline is a phenomenon that is part of the everyday practice of teachers, reflecting the class as a living and variable organism. Given the wide range of discipline problems and situational context, clear and straightforward solutions to educational situations that teachers may encounter cannot be defined. The key is to work with future teachers and build their healthy self-esteem and confidence, and to develop their skills and competencies that they should be able to modify in practice based on the current situation, and to teach them strategies of self-reflection. In conclusion, we should understand what Holeček (2010:129) stated: *"Each teacher has to comes to terms with the fact there will always be a certain small percentage of children who can never be managed by anyone."*

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