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EDITORIAL

We are glad to introduce this third issue of the year 2015. In the couple of recent months, an increasing number of authors have submitted their manuscripts to the ERIES Journal. Consequently, this fact goes along with the continuous effort of the Editorial board for improving of the journal quality. Similarly as in the previous issues, we can announce that since the beginning of October, 2015, the ERIES Journal has newly been indexed in the Open Academic Journal Index (OAJI). We hope that this would result in a growth of journal recognition.

Nevertheless, we are also pleased that the new version of the instructions for authors, which was introduced during this year, has been positively accepted by the authors. We believe that our readers, reviewers and contributing authors will accept all future changes in the same way. The Editorial team is glad for any feedback, no matter whether positive or negative, which would lead to a better comfort of the authors and reviewers.

The third issue of the year 2015, which you hold in your hands, contains four articles from varied collective of authors from Masaryk University in Brno, Constantine the Philosopher University in Nitra, Karel Engliš College in Brno, and University of Economics in Prague.

In the first article, authors Jakub Fischer and Hana Lipovská analyse a profile of Slovak students at Czech higher education institutions. For this purpose the authors use a unique database based on the surveys EUROSTUDENT V and DOKTORANDI 2014. In this article, the authors analyse data on 4,311 respondents from secondary education in the Czech Republic and 266 respondents from secondary education in Slovakia. Authors explore differences between Czech and Slovak students with regard to their financial situation and the functionality of the intergenerational transmission mechanism. Slovak students come from highly educated middle and higher class families, and belong to the best secondary school graduates. Moreover, the results show that only 6% of Slovak doctoral students think of returning back to Slovakia after the completion of their studies.

The second article from authors Beáta Hockicková and Ružena Žilová presents a qualitative data from mentor training seminars, which are designed for a continuous professional training of teachers. The authors identify problems and needs of secondary school teachers in Slovakia. The authors analyse responses of 60 secondary school teachers collected during five seminars in February and March 2014. The analysis of the qualitative data focuses on mentors' expectations while observing a novice teacher, expressing possible weaknesses of novice teachers, and discussing how a good teaching should look like. The results show that the most common weaknesses of novice teachers are problems with motivation, insufficient use of teaching aids, and lesson timing. With regard to a good teaching practice, novice teachers should be able to express their ideas and thoughts, and work independently.

The third article from Jaroslav Komárek discusses some contradictions in the current management studies. The author points out different development in teaching of management studies in the Czech Republic and abroad. Therefore, three-year-long bachelor study program Business and Administration taught at the Business School in Berlin Potsdam and corresponding study program Business Economics and Management taught at the Faculty of Business and Administration, University of Economics in Prague are compared. Although it is difficult to compare these two study programs, the author stresses greater workload for theoretical courses in Prague. The author then explains Management studies from systemic point of view and provides characterization of the European and transatlantic models of Bachelor studies.

Last but not least, the fourth article from Jindřich Klůfa provides reports on an analysis of the entrance examinations at the Faculty of Informatics and Statistics at University of Economics in Prague. The author focuses on three different ways how students can be accepted for studies at the faculty, i.e. on the basis of tests in English and Mathematics

used by the University, on the basis national comparative exams (SCIO tests), and without entrance examination based on the results at high school. The analysis compares data from 849 entrance examinations with examination results from mathematical courses at the Faculty of Informatics and Statistics. The results show that there are significant differences between students who were accepted for studies by the three different ways regarding the examination results in mathematics. Students accepted for studies based on their good results at high school achieve the best results.

We would like to thank to all reviewers who contributed to this third issue. Nevertheless, we would also like to thank all the authors who have submitted their manuscripts to the ERIES Journal. Moreover, we hope that all our readers will find this third issue of the year 2015 interesting, and we also hope that the ERIES Journal will contribute to the field of efficiency and responsibility in education as it has contributed so far.

Sincerely,

prof. RNDr. Jaroslav Havlíček, CSc.

Editor-in-Chief

ERIES Journal

BRAIN DRAIN – BRAIN GAIN: SLOVAK STUDENTS AT CZECH UNIVERSITIES

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Highlights

- The emigration to the Czech Republic for education is serious problem for Slovakia
- The Slovak brain drain is a Czech brain gain, because Slovak students at Czech HEIs are recruited from Slovak elite
- Only 6% of the Slovak doctoral students think about returning back to the Slovak Republic

Abstract

The Slovak Republic is experiencing a growing brain drain of elite secondary school students. Slovak human capital flows chiefly to Czech Higher Education Institutes (HEIs). The aim of this paper is to analyse who these Slovak students are to create a complete profile of Slovak students at Czech HEIs. We used a unique dataset based on the surveys EUROSTUDENT V and DOKTORANDI 2014 to explore differences between Czech and Slovak students, their financial situation and the functionality of the intergenerational transmission mechanism. We have found that Slovak students at Czech HEIs come from highly educated families and from the middle and higher class families significantly more often than Czech students at Czech HEIs or Slovak students at Slovak HEIs. Approximately 80% of them came from grammar schools. Slovak students also often have better language skills. We have discovered that Slovak students at Czech HEIs enjoy certain social benefits, slightly more often they have higher monthly income compared to Czech students, and they work slightly less often during their studies. Finally, according to our findings, Slovak doctoral students are often reluctant to return back to the Slovak Republic or to stay in the Czech Republic.

Keywords

Brain gain, DOKTORANDI 2014, Eurostudent V, human capital, mobility, Slovak students

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Introduction

The most important of the any nation's assets is its human capital. However, human capital is such a complex combination of the human skills and abilities, that it is nearly impossible to measure it with the necessary accuracy. The most common proxy variable for the human capital level is, therefore, the highest education level of the individual (Mazouch, Fischer, 2011). This indicator is due to the unavailability of proper statistical data, further narrowed down to merely formal education. Formal education is supplied primarily by governments in current welfare states, which is connected to the funding from the public budget. Public funding of formal education is in many cases relatively expansive. The budget of the Ministry of Education, Youth and Sports of the Czech Republic accounts for 10% of the total state budget in 2015 (MF CR 2015). Most Western countries are therefore concerned with *brain drain* – the international transfer of human capital from developing to the developed countries (Rapoport 2002).

In the Central Europe region, brain drain is a serious problem, especially for the Slovak Republic. According to the Organisation for Economic Co-operation and Development (OECD), about 15% of Slovak students studied abroad in 2012 (OECD, 2014). The findings of the same report suggest that it is the third highest rate among OECD countries – after Luxembourg (where there is just one university so most of the students leave to Germany, France and Belgium) and Iceland (Icelandic students tend to study in Scandinavian countries and the United Kingdom).

Most of the Slovak students studying abroad settled in the Czech Republic (69 %, OECD 2014). This (ever growing) share is the logical result of the overall close relationships between the two bordering nations, which used to form a common federation. The similarity of languages, closeness of cultures and enduring family ties facilitate such an *emigration for education* (as called by Bahna, 2015). It has been made even easier thanks to the contract between the *Ministry of Education, Youth and Sport of the Czech Republic* and *Ministry of Education, Science, Research and Sport of the Slovak Republic* in 1999 (Bahna 2013). According to Bernát (2013), Slovak students accounted for 61% of students at the Faculty of Mechanical and Electro-technical Engineering at the Technical University of Brno during the interwar period 1918/1919–1939/1940 (for comparison, there were just 13% of the Czech students at the time). This can partly be explained by the lack of technical universities in Slovakia.

This *emigration for education* is such a serious problem that the *Ministry of Education, Science, Research and Sport of the Slovak Republic* developed a grant program "Návrat domov" (Home-coming) in Mai 2015. Over the period 2015–2018, three million euros will be paid for scholarships of 10 000 – 50 000 €. The recipients of these scholarships should be young Slovaks willing to return to the Slovak Republic (MSVVS SR, 2015).

The Slovak *brain drain* can be also considered as Czech *brain gain*. According to the recent surveys, Slovak students who study at Czech Higher Education Institutes (HEIs) belong to Slovak elites (Scio 2015 or Bahna 2015). Almost 70% of Slovak

high school elite (Scio 2015 defines “elite” as 10% of the best high school’s pupils) have considered studying in the Czech Republic (Scio 2015). Students from highly educated families dominated those willing to move (Bahna 2015), which supports the intergenerational transmission theory (Fischer, Lipovska, 2013). Nearly one half of Slovak students are going to remain in the Czech Republic even after graduation (Němec et al., 2015). Recent research by Němec et al. even tried to calculate the financial costs and benefits of Slovak students in the Czech Republic (ibidem). The international brain drain might be also beneficial in terms of the threat of academic inbreeding (Fischer, Lipovská, 2015).

In 2014/2015, three unique surveys have been conducted on Slovak students at Czech HEIs:

- *Brain drain 2014* – a survey conducted by the Institute for Sociology of the Slovak Academy of Sciences in 2014. The survey was carried out among 200 *parents* of Slovak students who studied abroad during period 1993–2012. The main aim of this survey was to discover who the Slovak students studying abroad are, how many of them remain abroad and the factors influencing their decision coming home (Bahna 2015).
- *Scio survey* – a survey conducted in 2014 among 14 224 Slovak pupils from 173 schools. This survey discovered who the Slovak pupils that consider studying in the Czech Republic are (Scio 2015).
- *Masaryk University, Faculty of Economics and Administration* – the main aim of this research was to quantify the costs and benefits associated with Slovak students at Czech HEIs, especially at Masaryk University. This research also included a survey based on snowball sampling among 580 Slovak students who have recently studied in the Czech Republic (Němec 2015).

Each of these three surveys deals with the Slovak brain drain from a very different point of view and focus on completely different goals. Although these results are really valuable, they do not (and cannot) discover the complete profile of Slovak students at Czech HEIs. The aim of this paper is to fill this gap in our knowledge using unique data from two nationwide surveys in the Czech Republic: Eurostudent V and DOKTORANDI 2014. The rest of the paper is organised as follows. We shall introduce the data and statistical methods we used. We will then present the results of our analysis. First, a basic profile of Slovak students in the Czech Republic is created. Second, we shall focus on the financial situation of these students, which might be an important input for further analysis. In the next part, the intergenerational transmission is analysed. Finally, the threat of a further brain drain of Slovak students – from the Czech Republic elsewhere – is examined.

Materials and Methods

Our research is based on two unique datasets. The EUROSTUDENT V¹ survey was conducted in 2013 among all Czech public and state HEIs and 29 private HEIs. In total 95,177 students of bachelor’s and master’s degrees were addressed with a response rate just below 7 % (Fischer, Vltavská, 2013). The final original dataset includes 4,664 respondents, whose responses were weighted according to the Union Students Register information system. For the aim of our research, this

dataset was further narrowed down to 4,577 respondents – Czech and Slovak high school graduates. This narrowed dataset was divided into two groups:

- Czech students – 4,311 respondents, who attained secondary education in the Czech Republic.
- Slovak students – 266 respondents, who attained secondary education in the Slovak Republic.

Slovak and Czech students could also be distinguished in a different way: according to their mother tongue, country of birth or their parents’ country of birth. However, these indicators were less suitable with regard to the objectives of our research, because most of the respondents were born during the Czechoslovak federation. Clustering respondents according to their country of education also better reflects the human capital investments problem. From a public budget point of view, it is indifferent if the country invested into the secondary education of the Czech, the Slovak or the Hungarian, the only thing which matters is that this human capital recipient participates in the “education emigration”.

For further analysis, two dummy variables were developed. The first dummy variable acquired a value of 1 if both parents received higher education (gained bachelor’s degree, master’s degree or a PhD) and a value of 0 if at least one of the parents gained lower level of education. The second dummy variable reflects the parental status in terms of blue-collar and white-collar workers (see Table 1). This dummy variable acquired a value of 1 if both parents are white-collar workers.

ISCO-08 ¹	White-collar	ISCO-08	Blue-collar
1	Managers	6	Skilled agricultural, forestry and fishery workers
2	Professionals	7	Craft and related trades workers
3	Technicians and associate professionals	8	Plant and machine operators, and assemblers
4	Clerical support workers	9	Elementary occupations
5	Service and sales workers		

Table 1: Blue-collar and white-collar workers

The concentration of HEIs in terms of student nationalities is measured with the *Herfindahl-Hirschman index* (HHI, see e.g.

Bauer et al., 2015), where s_i is the ratio of Czech (respectively

Slovak) students attending i th HEI. The Herfindahl-Hirschman Index (1) can range from 0 (large variance) to 1 (all students study at the same HEI):

$$HHI = \sum_{i=1}^n s_i^2 \quad (1)$$

The second dataset is based on the survey DOKTORANDI 2014², which was carried out in 22 public, 2 state, and 2 private HEIs among more than 24 thousand PhD students in spring 2014

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

² This survey was carried out in the Czech Republic within the project IPN KREDO CZ.1.07/4.1.00/33.0005.

(Fischer, Vltavská, 2014). The response rate was approximately 15% and the final data set consists of 3,283 respondents. This survey did not allow for making a direct distinction between Czech and Slovak students. To select Slovak students, we focused on the language of several open-ended questions (e.g. “Why did you decide to study PhD doctoral program?”). This method has considerable weaknesses: it does not allow us to distinguish Slovak students who write in fluent Czech, which could be a considerable majority of them. In addition to this, it guarantees that non Czech students would be labelled as a Slovak student. Under this procedure, we received a narrow down dataset of 70 Slovak students in the Czech doctoral programs.

The statistical software STATISTICA 12 was used to perform standard methods of descriptive statistics, an analysis of variance (Budíková et al., 2010).

Results

This section is divided into four chapters. First, we shall present a profile of Slovak students in the Czech Republic and compare them with Czech students. Then we will evaluate their financial situation in terms of their income, expenses and their working activity, again in comparison with Czech students. The third part is devoted to intergenerational transmission. The highest level of parental education, as well as parental occupation of Slovak and Czech students, is analysed. Last but not least, we shall focus on Slovak PhD students at Czech universities and their plans for the future.

1. Who are the Slovak students in the Czech Republic?

A profile comparison with Czech students

According to our dataset, among Slovaks at Czech HEIs, male students significantly prevail (see Fig. 1). While male students account for nearly half of Czech students (with female students holding a majority), among Slovak students they account for two thirds. Only 5% of Slovak students study at Czech private HEIs (compared to 11.4% of all respondents).

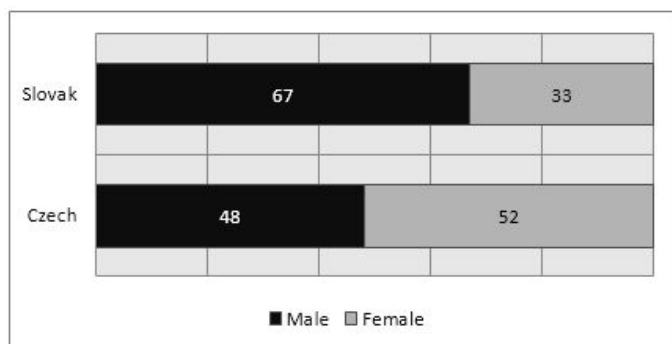


Figure 1: The proportion of male and female students among Slovaks and Czechs at Czech HEIs

There is also a significant difference between Slovak and Czech's fields of study. Slovak students relatively predominate in the field of Natural sciences, Healthcare sciences and Pharmacy, and Art. On the other hand, a majority of the Czech respondents major in Economics, Technical sciences and Education (see Figure 2).

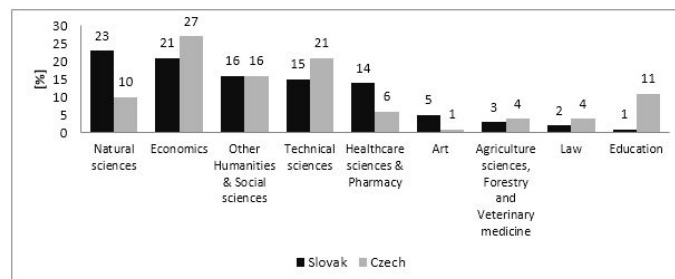


Figure 2: Field of study

Slovak students speak more foreign languages than Czech students (see Figure 3). Nearly 50% Czech students have some language skills in at least four foreign languages, which is considerably less in comparison with nearly $\frac{3}{4}$ of Slovak students at Czech HEIs. This is certainly caused by knowledge of Czech – 100% of Slovak respondents claim that they can use (even at a low-level) Czech. On the other hand only 4% of Czech students mentioned knowledge of Slovak. Nearly 100% of Slovak students claim to speak English (compared to 98% of Czech students), 95% self-evaluated their English knowledge as very good or good (compared to 79% of Czech students).

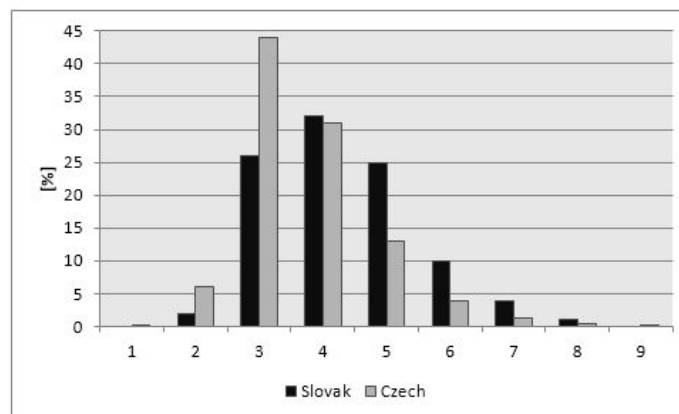


Figure 3: Number of languages students speak

There is also a smaller differentiation between the specific HEIs which Slovak students attend. While Slovak respondents study at 26 Czech HEIs, Czech respondents come from 56 Czech HEIs. Nearly two thirds of Slovak students study at only 4 HEIs (23% at Charles University, 19% at Masaryk University, 12% at the University of Economics in Prague and 10% at the Czech Technical University in Prague), while 65% of Czech students attend 8 HEIs (see Figure 4). The Slovak Herfindahl-Hirschman Index is therefore 0.12 compared to a Czech Herfindahl-Hirschman Index of 0.07.

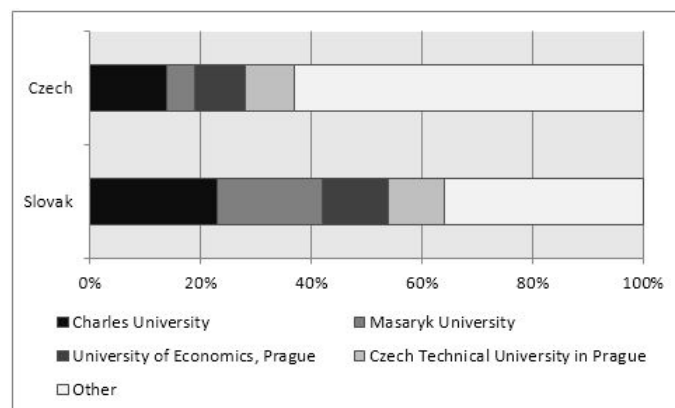


Figure 4: Slovak and Czech students at Czech HEIs

There is no significant difference in total satisfaction with a university's quality between Czech and Slovak students. 78% of Slovaks are satisfied or very satisfied and 77% of Czech

students. Nevertheless, significantly more Slovak students (37%) in comparison to Czechs (30%) are 'very satisfied'. The HEI at which they study was the first choice for 86% of Slovaks and only for $\frac{3}{4}$ of Czechs. Slovaks also feel to be integral part of their school slightly more often than Czechs (83% in comparison with 78%). For the Slovak students, the most important reason in decision to enter their study program was the career opportunities (79%) and interest in the subject (78%). On the other hand, the least important reason was the distance from their family (this factor is very important or important for just $\frac{1}{4}$ of Slovak students, in comparison with nearly $\frac{1}{2}$ of the Czech students). Most Czech and Slovak students would both enter their university again as mature students (89% of Slovak and 84% of Czech students).

2. Slovak students and a financial point of view

The average monthly disposable income of the Slovak students was 14,335 CZK, which is more than 3,000 CZK higher than the income of the Czech students (11,086 CZK). The difference between the median income is smaller, but also significant (8,500 CZK for Slovak and 7 200 CZK for Czech students).

The average monthly expenses of the Slovak students are 9,035 CZK. The students pay 42% out of their own pockets; while 68% of their average monthly expenses are paid by parents, a partner or somebody else (see Figure 5). Most of their expenditures are the Total accommodation costs (3,633 CZK, 40% of total expenditure) and Food (2,607 CZK, 29% of total expenditure). The students themselves pay out of their own pocket predominantly for their Social and leisure activities (62%), on the other hand 2/3 of their total accommodation costs are paid for them by somebody else.

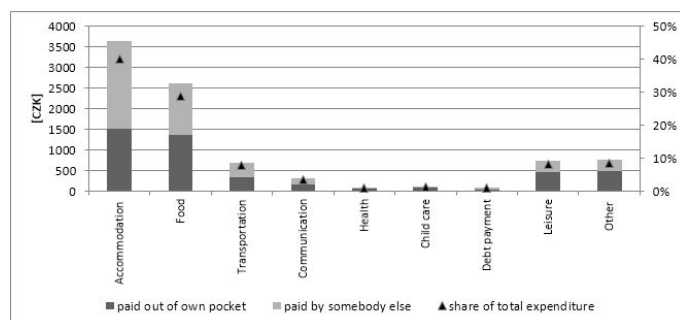


Figure 5: Average monthly expenses of a Slovak student [in Czech crowns CZK]

Slovak students live significantly more often in student accommodation during the semester. 53% of Slovaks live in halls of residence compared to only 31% of Czech students. Slovak students use public transport slightly more often (77% of Slovak and 70% of Czech students). Slovak students also claim that they do not have serious financial difficulties more often than the Czech students, (61% Slovaks compared to 56% Czechs).

Two thirds of the Czech students work during the whole term or at least from time to time during the term. This is true for only about half of the Slovak students at Czech HEIs. On the other hand, there is no significant difference in total hours spent on paid jobs or paid internships in a typical week in term time between Slovak students (23 hours) and Czech students (22 hours). Half of the working Slovak students claim that their job is not closely related to the content of their study program. On the other hand, only one third see a close or even very close relationship between their job and study program. This is not

very different from the situation of the Czech students (see Figure 6).

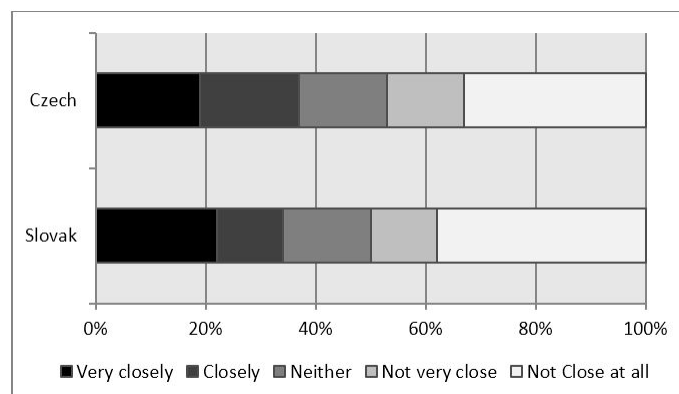


Figure 6: How closely related is the job of the Czech and Slovak students to their study program at Czech HEIs?

3. Intergenerational transmission

Slovak students come significantly more often from families with higher (tertiary) education. Nearly 70% of Slovak students at the Czech HEIs have at least one parent with higher education (compared to 46% of Czech students). The highest education level of the mother is even more important. The mothers of Slovak students at Czech HEIs reached tertiary education nearly twice more often than mothers of Czech students (see Figure 7). More than half of Slovaks at Czech HEIs have parents who both attained at least a bachelor degree, in comparison with nearly one third of Czech students.

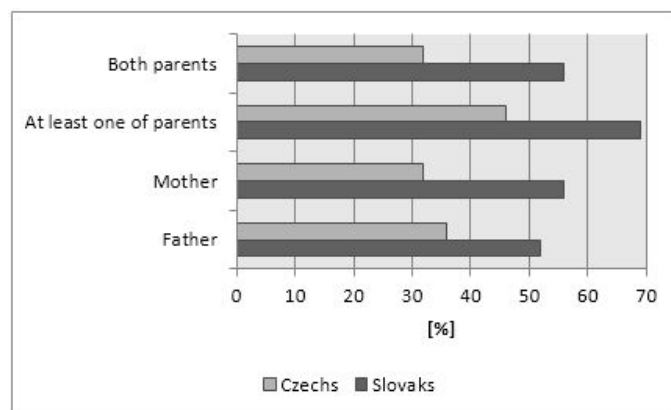


Figure 7: Parental higher education

There is no significant difference in the structure of parental occupation between the Slovak and Czech students. Nevertheless, as figure 8 clearly depicts, Slovaks who study at Czech HEIs come slightly more often from completely white-collar families (72% in comparison with 65% in the case of Czech students).

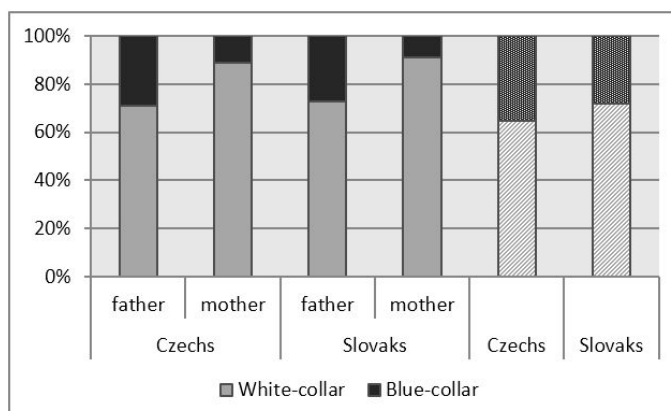


Figure 8: Parental occupation

As figure 9 clearly depicts, Slovak students at Czech HEIs are **significantly more often** graduates from grammar schools (80% in compared to 60% of Czech students).

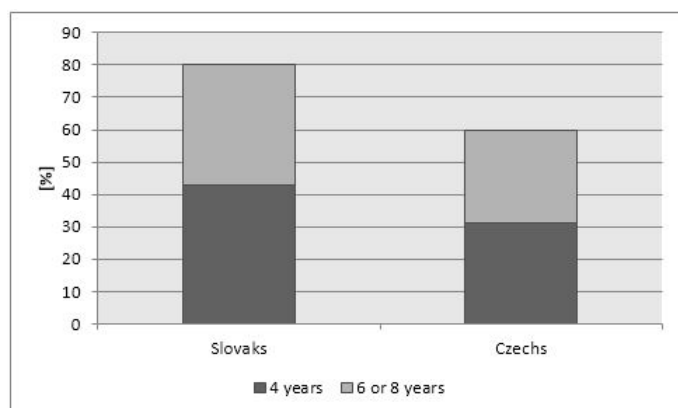


Figure 9: Proportion of grammar school graduates

4. Brain gain and brain drain

Slovak students participate slightly more often in the international mobility. While only 31% of Czech students studied or are planning to study abroad, the same is true for 44% of Slovak students.

Among the Slovak students in doctoral programs at Czech HEIs, only 34% want to stay in the Czech Republic, while 21% of them want to go abroad (outside the Czech Republic or Slovak Republic) and 6% are planning to go back to the Slovak Republic³. There is also a certain brain drain from academia – only 21% of PhD students are planning to stay in Czech or foreign academia.

Discussion

Most of the Slovak respondents from the EUROSTUDENT V survey major in Natural sciences, Economics and Other Humanities and Social sciences. This finding is inconsistent with the original plans of Slovak pupils according to the Scio survey (2015). Most of them were planning to study Economics, Healthcare services and Pharmacy and IT at Czech HEIs. In fact, 21% of Slovak students do study Economics at Czech HEIs, however, Healthcare services are studied just by 14% and Technical sciences by 15%.

Our findings on the average monthly expenses of Slovak students confirm the findings of Němec et al. (2015). According to Němec, the total expenses of Slovak students are 9 203 CZK (which is nearly the same result as our 9 035 CZK). The total accommodation costs account for 35% of total expenses according to Němec (in comparison with 40% according to our results).

Slovak students at Czech HEIs use social benefits more often than the Czech students. About half of them live in the halls of residence, which is entirely consistent with the findings published by Němec (53% and 48% respectively). Also, our results on the working activity of Slovak students are in accordance with other surveys. According to Němec, 51% of Slovak students work during the term, which does not significantly differ from our result of 54%.

Bahna (2015) points out that while 15% of Slovak students

³ The rest of the Slovak PhD students at the Czech HEIs do not revealed having clear future plans.

at Slovak HEIs are from highly educated families, with both parents being university graduates, the same is true for 46% of Slovak students studying abroad. This is consistent with our findings, however, this difference is even more marked: 56% of Slovak students at Czech HEIs claimed their both parents have at least a bachelor's degree. The most likely explanation for this lies in the intergenerational transmission mechanism (e.g. Fischer, Lipovska 2013 or Antoni 2011). According to this concept, children from families with a higher stock of human capital tend to accumulate more human capital. In case of Slovak students, it is likely that higher-educated parents are more aware of the lower quality of Slovak HEIs,⁴ so they want their children to study abroad. Moreover, most of these students came from middle or higher class families. According to Němec (2015), more than 80% of Slovak students at Czech HEIs claim to come from at least middle class families, which is entirely consistent with our results of nearly $\frac{3}{4}$ of students from fully white-collar families.

Our findings also confirmed the higher share of grammar school graduates among Slovaks studying in the Czech Republic. Our result of 80% is generally consistent with 86% according to Bahna (2015). Bahna also mentions that there are only 36% grammar school graduates among Slovaks. Even more alarming, in terms of Slovakia's human capital outlook, is the enormously high rate of grammar school pupils considering studying at Czech HEIs (40%–50% of pupils, according to the Scio survey 2015).

According to the Scio survey, 10% of Slovak pupils are going to remain in the Czech Republic if they study at a Czech HEI (Scio 2015). Němec points out that this rate grows to 40% after Slovak students spend a certain amount of time in the Czech Republic. While 18% of 'fresh' Slovak students at Czech HEIs think about home-coming, this rate falls to merely 11% after time spent in the Czech Republic (Němec 2015). We found that only 6% of Slovak PhD students want to return to Slovakia. This might be explained by the very long time PhD students spent in the Czech Republic – they create new social networks, learn the language, perhaps raise a new family and lose their original ties to Slovakia. On the other hand, Slovak PhD students are also more willing to leave even the Czech Republic and go further abroad. This finding is consistent with the presumed higher ambitions of these Slovak students (see Bahna 2015).

Conclusion

The Slovak brain drain to Czech HEIs is a widely discussed phenomenon. The popularity of this problem has grown over time as the number of young Slovaks leaving their country reaches new records. The Czech Republic is a natural receiving country because of the long and successful historical ties between both Slavic nations, the similarity of the Czech and Slovak language, the short distance between Slovak and Czech (especially Moravian) towns, and legislative arrangements.

Slovak students who leave their families and friends to enrol in Czech HEIs profit from a (probably) higher quality of education and social support. They live in halls of residence more often than Czech students, use international exchanges more frequently and make the most of the public/social services. For example, we have shown that Slovak students use public transportation slightly more often than Czech students, while from 2012, all

⁴ For more on the quality of Slovak HEI's, see e.g. reports of the Slovak Academic ranking and rating agency (ARRA 2014).

students from the EU countries have had the same price benefits as the Czech students (Povolný 2012).

According to Bahna (2015), more than 40% of Slovak graduates from foreign HEIs return to the Slovak Republic. This 40% are certainly beneficial for the Slovak economy. This part of Slovak human capital was financed from foreign budgets, but the real revenues will be harvested in the Slovak Republic. The serious problems for the Slovak economy are those who do not return. This almost 50%–60% of “lost brains” means not only a lost initial Slovak investment, but also unrealized intellectual potential. In the light of these results, the grant program “Home-coming” (initiated by the Ministry of Education, Science, Research and Sport of the Slovak Republic) seems to be a very logical effort. However, the four-year grant program managed bring back only *one third* of Slovak students who studied at Czech HEIs in 2013.

Our findings on the Slovak brain-drain to the Czech Republic confirm that these students are members of the Slovak elite. They come from highly educated middle and higher class families, they belong to the best secondary school graduates and they study promising sciences. According to Němec et al. (2015), the Czech costs on their education are more than repaid by their benefit to the Czech economy. Moreover, the higher rates of Slovak students at Czech HEIs help the respective school to do better in the intra-national as well as the international ranking and rating systems. Indeed, most of the rankings observe the number of foreign students at the HEI, with Slovak students considered as ‘foreign’.

The Slovak brain-drain seems to be a Czech brain-gain because of the high quality, as well as ‘internationality’, of the incoming students. The logical effort of the Slovak Ministry of Education to bring back these “educational emigrants” means a certain threat for the Czech stock of the human capital. It is a significant challenge of both Czech and Slovak HEIs and governments to find a satisfactory level of international cooperation. We suggest intergovernmental discussion between the Czech and Slovak Ministry of Education to unify the educational strategies and clarify the conditions of such federative consequences.

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SECONDARY SCHOOL MENTOR TRAINING IN SLOVAKIA

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Highlights

- The manuscript reveals most common weaknesses of novice teachers
- The manuscript reveals the most essential characteristics of “good teaching”

Abstract

The aim of the research study was to present qualitative data from a mentor training pilot designed as continuous professional training of teachers for the position of mentor. Accordingly, essential key competences referred to as representing teachers' further professional development were identified in the current research study. Based on the results collected from the pilot seminars carried out through the course of the research as well as results collected from completed questionnaires for mentors, actual and potential problems and the needs of secondary school teachers in Slovakia were identified. The presented research results are a summary of the collected research data.

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Key competences, lifelong education, mentor, novice teacher

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Introduction

Teachers' competences and ways in which to improve teachers' practice has been the focus of a variety of initiatives across Europe. Much of this has concentrated on the production of explicit indicators for teacher quality (Strong, 2011; Zumwalt and Craig, 2005), in terms of competence, standards (Fisher, 2005; Koster and Dengerink, 2008). The importance of career-long updating and development for practicing teachers has been recognized (Danielson, 2007; Key, 2010) and practicing teachers have become increasingly involved in the training of new entrants (Malá, Múglová and Hockicková, 2013) to the profession in many countries. To support this movement the European Commission has developed the Common European Principles for Teacher Competences and Qualifications (Common, 2005). But there is no common focus on the specific needs of those who will induct and support novices in schools, i.e. mentors. In several EU countries (as e.g. in the Netherlands, Portugal, Austria and Germany) mentors have become a valued and integral part of the pre-service training of teachers (Skaniakos, Penttinen and Lairio, 2014); in a few countries (e.g. in Ireland and Belgium), they are also involved in the induction and support of new entrants to the profession. However, as also Hopkins and Spillan (2014) state there are not many studies which focus specifically on mentors (“schoolhouse teacher educators”). In their study they focused mainly on such questions as who is doing the work of novice teacher education at schools and how these educators support novices, but there is nothing about support given to mentors. Similarly the study of De Angelis, Wall and Che (2013) examines the direct effects of preservice preparation quality and early career support on career intentions and decisions of novice teachers, but again it gives no data on mentors' support.

Novice teachers' professional induction in the Slovak Republic is legislatively guaranteed by Decree No. 445/2009 on the further education of teaching staff in § 4 and Act No. 317/2009 on teaching staff and professional employees officially introduces the role of mentor-teacher. The Act partially defines specific activities and responsibilities of mentors, but it says nothing about the necessary preparation or training for this position. The first attestation and several years of teaching experience are considered to be adequate preparation for this position (Zákon No. 317/2009, § 33, par. 3). Besides the official legislative standing, there is also a network of Methodology and Educational Centres (so-called MPC: Metodicko-pedagogické centrum) in all regional cities in Slovakia. These centres play quite an important role in raising teachers' awareness in many areas of education, including mentoring (Výbohová, 2012: 9-10). They organize various in-service courses and events for teachers and also publish supporting educational materials.

The main purpose of the research project *Key Competencies of Mentors Necessary for Efficient Mentoring of Newly Qualified Teachers* (supported by National Research Agency VEGA under the number 1/0677/12), carried out by a team of professional education instructors from the Faculty of Arts at the University of Constantine the Philosopher in the city of Nitra, Slovakia was to identify key competences necessary for highly professional mentoring of novice teachers at secondary schools in Slovakia. Furthermore, the project was aimed at designing practical tools for the structuring and developing of key competences by specifically designed theoretical and practical study materials. The project team of professionals built on the presumption that very little and non-systematic attention had been paid to the graduates of teaching programmes at faculties of education

in Slovakia (at such universities as Comenius University in Bratislava, Constantine the Philosopher University in Nitra, Presov University in Presov, Matej Bell University in Banská Bystrica et al.). Teachers have had no or very little practical or theoretical professional training or any kind of professional support in order to become educated and trained in the field of novice-teacher mentoring, nor have they had any or very little specific skills, abilities or competences developed and trained to be able to manage the role of novice-teacher mentor.

In order to improve education at secondary schools in Slovakia the project team of professionals directed their attention towards the research and analysis of both positions: mentor, as well as novice teacher. Apparently, the aim was to design a structural framework of mentors' key competences essential for the successful mentoring of novice teachers. Moreover, the results of the research study – theoretical and practical materials were officially published in a book *Formovanie kompetencií uvádzajúceho učiteľa* (Gadušová et al, 2014).

The aim of the paper is to present qualitative data from a mentor training pilot in which usefulness and quality of a selected number of tasks published in the book (Gadušová et al, 2014) were tested. The paper presents the ways in which the seminars were run and describes the reactions of the participants to the tasks, presents their opinions and suggestions regarding mentor training.

Materials and Methods

For piloting the materials designed for publishing in the book (Gadušová, 2014) five training workshops for mentors were organized in schools of western Slovakia in spring 2014. Out of about 100 tasks designed for the book due to limited time for allocated for workshops (90-120 minutes) from each chapter of the book only 2-3 tasks were selected in order to test the tasks from each area addressed in the book. The workshops were organized on voluntary basis so as to attract only those teachers who really are interested in the issue. Furthermore, the researchers wanted to have manageable groups of trainees (about 12-15 in each group) in order to have the workshops very interactive. The different training tasks selected for the workshops were presented one by one, first the workshop participants were given some thinking time to read the task, recall their experiences and prepare some comments which then were discussed in groups and subsequently with trainers.

Regarding terminology, key competences were defined variably depending on sources (Kramárová, 2010, Kasáčová and Kosová, 2006, Bagalová, 2005, Baumert, Kunter and Blum, 2011, Veteška and Tureckiová, 2008), therefore, in the research study the features of key competences were referred to as follows: dynamic, complex, active and procedural competences, which are measurable and certifiable.

Mostly, competences are related to knowledge, abilities and skills. Veteška and Tureckiová (2008: 31), for example, see the relationship between abilities and competences in the process of education as follows:

ABILITY	COMPETENCE
Input	→ Output
potential for action	effectively managed action

Teachers in contemporary society are assigned many roles, tasks and positions they need to manage throughout their teaching careers (Nálepová, 2013: 18). As for the key elements there are several essential competences covered in the following statements. Bauer (2002: 50) mentions that nowadays, several competences are considered to be key competences in education: targeted planning, time and class management, use of teaching methods and approaches, and the carrying out reflection on the learning and teaching process. Teaching is based on specific competences, such as subject competence, and scientific, didactic and psychological competences. However, non-cognitive or meta-cognitive competence is essential, too. It is referred to as the ability to co-operate, readiness to learn, and the ability to maintain one's own mental and physical health.

Referring to the abovementioned concepts, key competences in the presented research study are considered to be those which are stated in the National Educational Programme for ISCED 1-3 (Štátny vzdelávací program, 2008 - 2009). Out of the great variety of definitions of teachers' competences we tried to select those which will create a basis for mentor teacher competences.

We agree with Baumert, Kunter and Blum (2011: 31) who include among professional teachers' competences the following: Beliefs, Motivation, Self-regulation and Professional Knowledge. To these areas of competences they match the relevant skills in the way as it is listed in the Table 1.

Competence Areas	Competence Related Skills
Subject competences	Deep understanding of the subject taught
Special didactic competences	Ability to present and explain the subject Awareness of learners' thinking processes Awareness of assignments and tasks
Psychological competences	Knowledge about testing and evaluation Knowledge about learning and teaching processes Knowledge about effective class management
Organizational competences	Abilities to plan, co-ordinate, control, elicit activities, set limits, make decisions, and meaningfully assign tasks
Interpersonal (social) competences	Abilities to manage relationships with students, colleagues Abilities to communicate Abilities to care for others, be tolerant and flexible

Table 1: List of competences and skills

Referring to the abovementioned key competences the project team members selected the competences directly related to the research issues. These were the area of competences related to pedagogical and psychological knowledge and its inseparable parts, mainly: knowledge about teaching and learning processes. This competence is described in more detail in a published book (Gadušová et al, 2014) which is an output of the VEGA project results.

Based on the identification of the key competences specifically defined for the position of mentors and novice teachers after entering the teaching profession at school, the project team members designed a set of procedures for the formation and development of the identified mentor competences. Moreover, a set of practical and theoretical educational materials was designed on the basis of both real school examples as well as newly created ones. The educational materials were piloted and evaluated as a part of mentor-training seminars for about 60 secondary school teachers from various regions of Slovakia through the months of February and March 2014.

Among the key seminar topics were: communicative and interpersonal skills, mentoring skills, monitoring and observation skills, management skills, and skills of evaluation and self-reflection. The aim of the seminars was not only to introduce the philosophy behind the designed training materials for teachers but also to review, critically assess and get feedback about selected tasks and assignments from the planned academic publication.

Results and Discussion

Out of the designed materials (which have been published in the meantime) we selected several tasks to be piloted in the seminars and we present them below. The seminar participants answered the presented questions and they answers are summarized in the Table 2. The questions related to expectations of mentors while observing novice teachers as far as novices' efficiency of performance during lessons, then, they also expressed to what extent their expectations matched the situation and in which areas of novices' performance. We present examples collected from seminar participants. Their statements have been generalized and they addressed the following aspects of teaching.

Next, the samples of tasks follow. We present examples completed by seminar participants.

What did you expect when observing a novice teacher? Were your expectations met? If your response is YES, please, describe how. If your response is NO, please describe why.

Mentors expectations from novice teachers	Met expectations (state examples)	Not met expectations (state examples)
To get a new perspective of a lesson.	Approximately to 10%.	My expectations were 90% not met because students were scared; they were not creative enough; some teachers overestimate their abilities; some teachers were not prepared for lessons.
Students will use new teaching methods they learnt at university, will be enthusiastic and creative.	Students used new materials and new forms of teaching and were creative.	Some of their assignments were too easy and not appropriate for the learners' level of language proficiency; they were not aware of the extent of the language the learners have already acquired and, therefore, they were not able to describe assignments properly.

Students will be able to find additional teaching materials on the internet as they are highly computer literate.	It was not always so (i.e. mentor's expectations were not always met).	The novice teacher I was observing was not well prepared for the lesson. Young teachers often thought it is enough to appear in front of the class and speak without any planning ahead. Some of them were not confident enough; their language proficiency was not at an advanced level.
I expected well-executed lesson planning and fluent use of language.	Lesson plans were not always executed as it was planned due to lack of time.	They were not independent in lesson planning. Lesson planning had to be consulted with them. They could not differentiate between bilingual and non-bilingual classes.
I expected that a novice teacher would be able to begin, conduct and finalize the lesson; that they would be able to explain the language without any mistakes; they would be on good terms with young learners.	Met only partially (up to 40%).	They did not correct learners' errors and mistakes; they expected mentors to do it.
I expected that a novice teacher, who was just starting his/her career, would become aware of lesson content and its structure, as well as teaching forms.	Met to 90%, i.e. in majority of cases.	As they were just novice teachers they could not follow all the interactions in the lesson.
I expected that they would fill in the appropriate observation sheet during their lesson observation.	I could see that they filled the observation sheet.	They did not fill in the appropriate observation sheet as they didn't consult which one to fill in.
I expected that a novice teacher would consult his/her lesson plan with his/her mentor before the lesson begins.	Not every student did it.	Some of the novice teachers did not do that. The teaching material was not linked to the previous lesson.
I expected that the lesson plan would be prepared co-operatively.	Most of the lessons were well-taught.	The mentor didn't have time to reflect on the lesson with the novice teacher. The mentor did not point out the strengths and weaknesses of the lesson.

Table 2: Mentor's expectations from a novice teacher's observation

The seminar participants suggested that the cooperation with novice teachers should be based from the beginning on mutual understanding of the purpose of lesson observations. They should improve quality of novices' teaching, never humiliating or discouraging novice teachers.

One of the important aims of the pilot seminars was also to find the most serious drawbacks of novices that mentors can observe during the novices' first year at school. In the task there were listed 20 most frequent drawbacks of novices. The table was filled in by 60 of workshop participants, but they expressed their opinions only about 13 drawbacks. Their responses are presented in the Table 3 in the order of frequency of their answers about different drawbacks.

Based on your observations, which of the following issues do you consider to be novices' most common weaknesses? Use tick to mark your response.

	Most common weaknesses of novice teachers	Limitations
1.	Lack of subject knowledge.	16.65 %
2.	Lack of novice teacher charisma.	33.20 %
3.	Irresponsible attitude to teaching.	33.20 %
4.	Inappropriate use of teacher's voice during lessons.	50.00 %
5.	Problems with learners' motivation.	66.6 %
6.	Insufficient use of teaching aids.	83.2 %
7.	Insufficient lesson planning.	16.65 %
8.	Lesson plan not executed in real teaching.	100 %
9.	Anxiety of learners.	33.20 %
10.	Fear of being observed.	16.65 %
11.	Lesson timing not executed successfully.	100 %
12.	Grading of learners not objective.	16.65 %
13.	Lack of coherent flow of lesson procedures and activities.	33.20 %

Table 3: Weaknesses of novice teachers

Based on the feedback collected from informal discussions with the seminar participants, as seen in the Table 3, the biggest problems novice teachers have to face are the following: ability to follow lesson plans while teaching, lesson time management, and insufficient use of teaching aids. Furthermore, novice teachers experience some problems with motivation of learners in studying the subject. The other benefit of the seminars was that teachers shared their experiences and mutually discussed a variety of their suggestions on how to deal with different problem situations.

The last of the piloted tasks was aimed at finding the most important attributes of „good teaching“ out of those listed in the Table 4. (Meyer, 2004:17-18).

What do you think “good teaching” should look like? Select five features you consider the most essential.

Teaching should help learners to:	Limitations
learn what they will need in real life	100%
learn things they are interested in	24.5%
enjoy learning	35.2%
express themselves and discuss what they have learned	86.4%
work in groups	18%
express their ideas and thoughts	66.5%
work and think independently	59.2%
take part in decision-making processes regarding learning content and its extent	25.4%
learn what they are expected to achieve during week-days so that they are free on weekends	28.1%
learn appropriate ways of effective and successful learning	61.3%

Table 4: Features of good teaching

Based on evaluation of this task we have compiled the list of attributes with their importance for the “good teaching”. According to the mentors' opinions collected during the pilot seminars the following 5 attributes are the most beneficial for learners: learning what they need in real life, expressing themselves and discussing what they have learned, expressing their ideas and thoughts and learning appropriate ways of effective and successful learning and learning how to work and think independently. The other attributes were not considered to be of serious importance.

Considering the analysis of data collected from the questionnaires distributed at the end of seminars, we can say that teachers considered the seminars to be beneficial both theoretically and practically. In the following part we present statements of teachers regarding selected tasks and assignments from the project publication mentioned above:

- The answers in the questionnaires to the question “Which assignments and tasks do you find useful for the work of a mentor?” were as follows (in their answers teachers stated the tasks' focus):
 - Management skills.*
 - Observation, monitoring, expert teaching, evaluation and self-reflection.*
 - Each task was specific / all tasks were helpful as they enabled the realization and thinking about different aspects of mentors' work / they help develop awareness of the important and challenging aspects of the teaching job / in these tasks there was everything I would definitely use when mentoring a novice teacher.*
 - I liked the assignment about novices' weaknesses because it is interesting to know other teachers' findings, to confront them and discuss possible ways of dealing with them. This may help mentors' work.*
 - I found the assignment Features of Good Teaching as a useful one; a mentor could use it as a guiding example for novice teachers.*
 - I liked the assignments about monitoring and observation; they helped me to realize my own expectations and possibilities for their achievement as well as to reconsider students' readiness for the teaching profession.*
 - For mentors I found most beneficial the assignments about monitoring and observation as they provide*

a detailed view of the observation of the teaching process. Furthermore, they make mentors aware in detail of the different aims and types of observation as well as about the essential aspects of observation. Inspection and evaluation of the teaching process through observation is one of the most important elements of internal school assessment. However, it is essential to provide feedback in order to improve quality of teaching.

- The assignment related to management skills, as I think this is the issue where a mentor can pass valuable advice to a novice teacher and tell him/her how to solve problem situations using methods and techniques proven and tested in practical teaching at a school where a novice teacher starts his/her career.
- I liked the task about personal and professional development of mentors by means of reflection and self-reflection.

Summary No.1:

Teachers were impressed by the presented assignments; they tried to point to their justification and importance for mentor development. These tasks help them realize:

- the significance of novice teachers' mentoring
- the most important features of good teaching
- the partial aims of observations and their expected attainability
- the value of reflection and self-reflection for personal and professional development of mentors.

We can conclude that the project team selected the most vital topics from the area of mentor training and their further professional development.

2. The above mentioned conclusion can be exemplified by statements of seminar participants who were asked to express their opinion on whether they considered this type of training necessary and useful or not. The participants of the pilot training stated:

- Yes, this may unify the requirements of mentors regarding novice teachers and improve the work of mentors.
- It is essential to have a complex, non-subjective perception of the requirements of novice teachers. Some of the tasks were very useful even for me, though I have been teaching many years.
- It is a set of various requirements and abilities, which are familiar and routine for an experienced teacher but in this way are clearly structured and formulated.
- This kind of training helps mentors to identify and analyse limitations and problems of novice teachers and show ways of dealing with them. It helps mentors to cooperate better with novices and stimulate them to gain practical experience necessary for using their full potential in their school work, and to gain professional competences necessary for their independent performance in the field of teaching.
- The presented method of mentor training is useful because it is complex and it is aimed at the most frequent issues and situations which mentors face. Awareness of them helps mentors who are really interested in mentoring to mentor novices and assist them in

becoming professional teachers. I would appreciate the opportunity to participate in such seminars for mentors in the future.

Summary No. 2:

Teachers expressed strong support for the professional training of mentors. The need for further education in this field is based on their willingness to approach the role of mentor with ample responsibility. For the work of mentor the seminar participants find the most important the following issues:

- theoretical knowledge of mentors
- unifying mentors' requirements regarding novice teachers
- the opportunity to identify and analyse weaknesses of novice teachers in their teaching and ways of overcoming them.

3. The question in which seminar participants were asked about the specific activities and training techniques mentors' training should include was answered as follows:

- Possibility to analyse video-recordings of real lessons, novice teachers' lesson plans and analytical discussions of novice teachers with mentor teachers.
- Suggestions on how to guide novice teachers, how to motivate them to improve their work, as very often novices do not show enthusiasm and willingness to teach.
- Mentors' education and training should be oriented towards real school issues. Part of this training should comprise how to make a novice aware of the work (including administrative work and pedagogical documents) of a class teacher or a head of subject committee teacher.
- It should contain analysis and possible solutions for model situations taken from the real teaching experience of teachers involved in the training. This would show trainee teachers how to transform and apply their theoretical knowledge to the conditions of real teachers.

Summary No. 3:

Seminar participants have a clear idea about the content of their further professional training. They see their greatest reservations in the:

- lack of theoretical and practical knowledge in the methodology of subject teaching
 - lack of specific formulations and tasks of mentors' role
 - lack of specific formulations mentors need to analytically observe and evaluate novice teachers and their achievements.
4. The seminar-participants were also asked whether they would like to participate in this kind of training or whether they would recommend it to their colleagues. Their answers were as follows:
- Yes, I would recommend it. It is essential for any teacher to achieve their full potential and to realize what is really important in the teaching profession. Some teachers stagnate, thinking that they do not need any further education.

- *Certainly yes. There is no time to exchange and share experiences among mentors during the school year. The training would be useful for any mentor.*
- *Any teacher can become a mentor after some years of teaching experience. Apparently, it is vital for teachers to be prepared theoretically and practically for the position of mentor.*
- *This type of training is useful. Personally, I would be interested in participating in such seminars, if my school management creates suitable conditions for my participation. I would definitely recommend it.*

Summary No. 4:

Almost all seminar participants expressed interest in participation in this kind of training in future and would recommend it to other teachers. As the main reasons they stated the following:

- creating a common platform for sharing mentoring experience and gaining new knowledge about mentoring
 - creating conditions for training new mentors with participation of practising mentors
5. Finally, the seminar participants were asked whether the seminar helped them to see differently the role of mentor and how their view of mentors has changed. We present some of their answers:
- *After precise reading of the presented assignments I realized how important and responsible the job of mentor is. They must be experts in their job and be able to carry out the role of mentor, and have a responsible approach to the guidance of novices.*
 - *I realized how important it was to have a skilful, smart and empathic mentor.*
 - *Selected phenomena were clearly named and structured, so I will be able to communicate with novice teachers better; I will be more aware of what is important not only for their evaluation but mainly for their systemic guidance.*
 - *I have just started mentoring so I was happy to get theoretical background and summary of the role of mentor.*
 - *This training enabled me to gain a more complex overview of the job of mentor. A mentor should view novice teachers as equal partners. However, they should not avoid constructive criticism from both sides. Neither novice teacher nor mentor should forget to self-reflect and get feedback from their job. They should bear in mind that both sides are responsible for the improvement of education in our schools.*
 - *In my opinion the job of a mentor teacher is much more difficult than the job of a novice teacher. It is a mentor's job to introduce a novice teacher to the world, which at first reminds one of the galleys but later becomes his/her life. A mentor has to prepare a novice teacher for a demanding journey full of obstacles and bureaucracy. However, on the other hand, it is a journey full of beautiful experiences, friends for life, memories and what's more, it is also an opportunity to work with children.*

- *Mentoring novice teachers is very often accompanied by a lack of time which should be given to novices. Lack of time, in many cases, makes it impossible to fully commit them to mentoring.*
- *I gained a new point of view regarding mentoring novice teachers. I had the opportunity to realize various aspects that influence the work of mentors in the period of novices' induction. I also gained many ideas I could utilize in my continued role as a mentor.*

Summary No. 5:

Apparently, teachers received a more complex point of view on mentoring novice teachers. Specifically mentioned areas were as follows:

- seminar participants realized more deeply and in all particularities what the job of mentors comprises
- seminar participants gained a new point of view of the relationships between mentors and novice teachers; they view novice teachers as equal partners who need appropriate guidance in the field of subject teaching, methodology of their work and mainly improvement of their interpersonal competences.

Pilot workshops, in which a sample of 60 teachers from various regions of Slovakia took place, tested a selected number of tasks from the upcoming publication aimed at training of mentor-teachers from primary and secondary schools. The data collected during the workshops and from analyses of interviews with workshop participants clearly confirmed the need for development of training materials for mentors. As stated in the Introduction, the issue of mentors' support is, in general, paid little attention both abroad and in Slovakia. Thus, the published book represents the first, relatively complex, methodological materials for mentor training and their support in Slovakia. The universities and other educational institutions providing continuous professional development of teachers can make much use of the book when training not only prospective mentors, but also school leaders who - as stated in the legislative documents (Zákon No. 317/2009 Z. z., Vyhláška MŠ SR No. 445/2009), are responsible for induction phase of novice teachers. However, the book was designed not only for face to face use and training of teachers (whether the mentors or the school leaders) but it can also be used as the self-study material as it is freely available online at <http://www.ff.ukf.sk/index.php/pre-autorov/struktura-fakulty-all/15-dalsie/686-prehľad-publikácii-vydanych-ff-ukf> (the book opens after clicking on its cover page). As to its content, not only the book but also this paper, thus, increases the small number of publications dealing with the support of mentors both in national and international context.

Conclusion

Interconnection of theoretical knowledge and practical experience in teacher training is equally important for higher education institutions as for lower and upper secondary schools. It is a pity that this cooperation between both parties has not functioned in such a way that it is beneficial for both of them. That is why a team of university teachers (researchers) at the University of Constantine the Philosopher decided to take part in the research project VEGA 1/0677/12 *Key Competencies of Mentors Necessary for Efficient Mentoring of Newly Qualified Teachers* and thus contribute to the improvement of the existing situation. The project was aimed at the identification of the key

competences necessary for the high quality of professional mentoring of novice teachers. Furthermore, the project was aimed at identifying and analysing the needs of mentors and novice teachers. The research team verified the project outputs with lower and upper secondary school teachers in pilot seminars. The seminars were aimed not only at evaluating the designed study materials for mentor training but also at getting critical feedback on selected practical assignments from the developed educational materials.

Analysis of the data collected from the questionnaires distributed after seminars showed positive findings concerning the use of practical assignments as well as the theoretical basis of the academic publication. Mentor teachers expressed interest in this publication and the practical training assignments presented in the book.

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SOME CONTRADICTIONS IN THE CURRENT MANAGEMENT STUDIES

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Highlights

- The comparison of two Business Administration programs owing to the demands of practice
- The explanation of Management from systemic view
- The characterization of the European and transatlantic models of Bachelor study

Abstract

Domestic higher studies are criticised for their low efficiency owing to the demands of practice. The core of problem is supposed in the small share of practical preparation mainly, but another cause can be the concept itself. Management studies are still considered as a part of Business Economics compared with independent study programs of Management abroad. Business Economics and Management have undergone divergent evolution during past fifty years; the Business Economics has stayed nearly unchanged and the Management has developed into a number of separate specific disciplines. While in Europe the study program Management is classified under Business & Economics usually, independent Bachelor's and Master's degree programs are extended overseas, and common is also Doctoral study program in Management Science. Significantly specific is the Management of non-economic fields, which focuses both on the preparation for specific professional skills and always for the line management with respect to anticipated staffing positions. Some change can bring the intended transfer of accreditation competencies, but when regarding the proposed content of Areas of Education, there is no good news for the domestic practice there. Neither the requirements for professional or academic programs are distinguished, nor adequate managerial skills mentioned.

Keywords

Bachelor study, business economics, efficiency, demands of practice, general management, management

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Introduction

The quarter of a century in the new social-economic environment entitles to look back, but at the same time encourages reflecting on how to proceed. No coincidence that previously appeared critical reflections how the transfer of Management teachings from the world of market economy had contributed (Košturiak, 2005). In the recent years, however, gain contributions that the home state of the Management teachings assess negatively and point to the lack of support for the practice by theory. Bookstores are indeed full of other books on management, but those from abroad bring more stories than the methods and that domestic ones recycle generally known knowledge, sometimes not fully understood (Souček, 2012). Questions about the current and especially future development of the Management teachings are relevant also in the environment of traditional market economy. There are opinions that the development of Management is similar to that of many other phenomena logistic curve (Hamel, 2009). The influence of the first methods on productivity was significant, while the influence of a multitude of postmodern approaches, which quickly spread and were soon replaced by „more successful”, has been problematic one. Even more significant is domestic criticism directed to education because it does not meet the needs of the labour market and does not prepare properly managers (Co, 2013). These views are often subjective opinions of practice, but they are also supported by objective evaluation. Current study The needs of employers and readiness of school leavers (Úlovec, 2014) is based on more than one thousand questionnaires completed by employers from various practice areas. Employers look on the preparation of

college students mainly negatively and affirm that graduate-level academic institutions are not adequately preparing students for practice. So, is the problem in the unsatisfactory efficiency of current Management Studies?

The higher education of managers in the Czech Republic

How are actually prepared graduates in Management for the crucial area of the first application in practice, namely for the position of line manager? Some specific management study program for bachelor's degree does not exist, codified is the economic study program Economics and Management, in which are accredited various fields of managerial focus. The concept of the program is based on the principle that Management is an integral part of business and thus of the teaching of Business Economics.

The origin of the Business Economics approach is in German environment, which until recently has been reluctant to accept the term Management. Wöhe's Introduction to Business administration teachings (1960) presents a comprehensive view of all business decisions undertaken in the enterprise, including basic theoretical rationale and overview of the methods used. This book therefore includes decisions on corporate objectives and form, method of manufacturing and appreciation, and just corporate administration (planning and decision making, organization, human resources management, control, and information management). But such corporate administration

does not feature leadership and therefore not all of what is generally regarded as the content of Management. Nota bene the leadership is taken for the most important and as well the most difficult managerial activity at all.

Because Management is considered in business administration's approach as a part of economic science includes study program Economics and Management obligatory quota of mainly theoretical economic courses. To make this approach more consistently applied, the Accreditation Commission (2013) approved The standards for study programs in the field of applied management in the following interpretation: „Applied management means degree studies that combine specific professional disciplines (engineering, agriculture, arts etc.) with the education of experts in the (economics and) management. In addition to the management in the certain theoretical level supplemented with methods and techniques of management, human resources management, management skills and the basics of psychology and sociology, must be included other economic subjects - Principles of Economics, Marketing, Law (as the Basics of Law) or Statistics”. Principles of Economics are but Microeconomics and Macroeconomics, and the question is how memorizing dozens of macroeconomic graphs (some valid just to another Nobel laureate in Economics) will contribute to the success of the business. But if had been included in all the non-economic fields of study Fundamentals of Business Economics, so it would contribute to increasing the international competitiveness more than ten thousand partial projects of the Operational Program Education for Competitiveness funded in amount of CZK 52 billion (Komárek, 2014).

Study programs focused on entrepreneurship have similar content abroad, but the emphasis on the practical application of theoretical background and training in managerial skills. As an example of modern European management study can be mentioned a three-year Bachelor program Business Administration (with the focus on management positions at the small and middle level enterprise) offered by the Business School Berlin Potsdam (Business, 2009). If it is compared with the corresponding program Business Economics and Management offered by the Prague Faculty of Business Administration (Fakulta, 2014), significant differences are evident (Table 1). The structure of these programs as a whole is not easily comparable (e.g. foreign languages, State exam, projects), but it is obvious a greater workload for theoretical courses in Prague program (141:110). The program of Berlin includes courses focused in more detail on practical application and especially two projects (30 credits) for real contracting authority, solved partially in practice, and thereafter in practice implemented. Predominantly theoretical focus of the Prague program is even more apparent when the form of courses is considered. The courses such as Management, Marketing, Consumer Behavior and Psychology and Sociology are lectured only and so without exercises (Fakulta, 2014).

Business School Berlin Potsdam		Prague Faculty of Business Administration	
Basic courses			
Course	Credits	Course	Credits
Basics of Planning and Control	5	Management	4
Basics of of Organizing	5	Operational Management	6
Basics of Personnel and Leadership	5	Personnel Management	6
Elective subject	5	Quality, Environment, Health and Safety Management	3
Basics of National Economy	10	Macroeconomics	6
Basics of Business Economics	5	Microeconomics	6
Economic Policy and Globalization	5	Business Economics	6
Financing and Investment	10	Corporate Finance	6
Accounting and Controlling	10	Accounting	5
		Managerial Accounting	6
		International Business Operations	3
		Banking Products and Operations	6
Marketing	10	Marketing	3
		Consumer Behavior	3
		Psychology and Sociology in Management	5
Business Law	10	Law	5
Acquisition and Production	10	Logistics	7
Statistics	10	Statistics	6
Economic Mathematics	5	Mathematics for Economists	6
		Operations Research	6
Economic Informatics	5	Informatics	5
		4 program-wide electives (variant):	
		Crisis Management	6
		Firm Organization	6
		Corporate Governance	6
		Management Information Technology	6
		3 school-wide electives (variant):	
		Entrepreneur	5
		International Commerce	3
Subtotal	110	Subtotal	141
Practice oriented part			
Bachelor Colloquium	10	Bachelor Seminar (elective)	3
Foundation of the company and innovation	5	Entrepreneurship in small and medium business	3
Growth Management and Internationalization	5		
Business Cooperations	5		
Business Risk	5		
Research work	5		
Project I	15		
Project II	15		
Training of social skills	5		
		Bachelor Thesis Defense	3
		State Bachelor Examination	3
		Foreign language 1	4 x 3
		Foreign language 2	4 x 3
		Vocational subject in foreign language	3
Total	180	Total	180

Table 1: Comparison of study programs

Preparation of managers for the current practice requires corresponding knowledge, that is still less in the domestic academic environment, because the results achieved in practice are not counted in the hunt for impacts. But there is increasing share of academic staff with qualification obtained exclusively within the continuous studies Bachelor-Master-Doctor.

The essence of Management teachings

The binding of Management on entrepreneurship is common in the business world (Business Management, Business Administration), but with Business Economics at the same level (American, 2015), not as a pendant. But Management is fully applicable in public economics and technical fields, not only on the enterprise but on the organization generally. The basic question what is the essence of Management from a theoretical perspective tried to answer already Harold Koontz (1980), whose textbook of Management significantly influenced the teaching of Management in the Czech Republic (Koontz and Weihrich, 1993). Professor Koontz was not only one of the many authors of books on Management, but the long-time president of the International Academy of Management, a global organization currently helping to develop Management teachings in 114 countries. By him recommended and now the most widely used approach is to establish the Management teachings on typical activities (functions) that are necessary for the organizations generally: planning, organizing, staffing, leading and controlling. These features are unique to the core teaching of Management, but decidedly not theoretical, but rather eclectic ones because the theoretical knowledge is used from a variety of sciences, such as Psychology, Sociology, Economics, Mathematics, Industrial Engineering or System Science.

Although Harold Koontz has been unquestionably one of the gurus of Management, his approach cannot be considered for a universal solution. Joseph L. Massie (1987) added further two functions later - decision making and communicating. Koontz namely included communicating to the function leadership, although he writes, “even though communication accompanies all areas of management, especially for leadership has an extraordinary importance” (Koontz and Weihrich, 1993: 508). Management but without communicating cannot operate at all, only through communicating the entire process is set in motion: manager receives intention or directly goal, completes necessary information, and after selecting a specific alternative solution his decision gets through communicating with subordinates. Even the feedback controlling of realization can be ensured by communicating.

It is also evident that the most important intellectual legacy of Harold Koontz is systemic approach, which is characteristic of his entire textbook. At home, however small response, the functions are declared only, and no system. According to general systems theory is the control a deliberate process of influencing behaviour of the system to achieve a certain goal. Management teachings but can be defined analogically as a mental tool for achieving of goal in the group work. Let us try to characterize the core of Management through the simplified systemic model of goal-oriented behaviour (Figure 1).

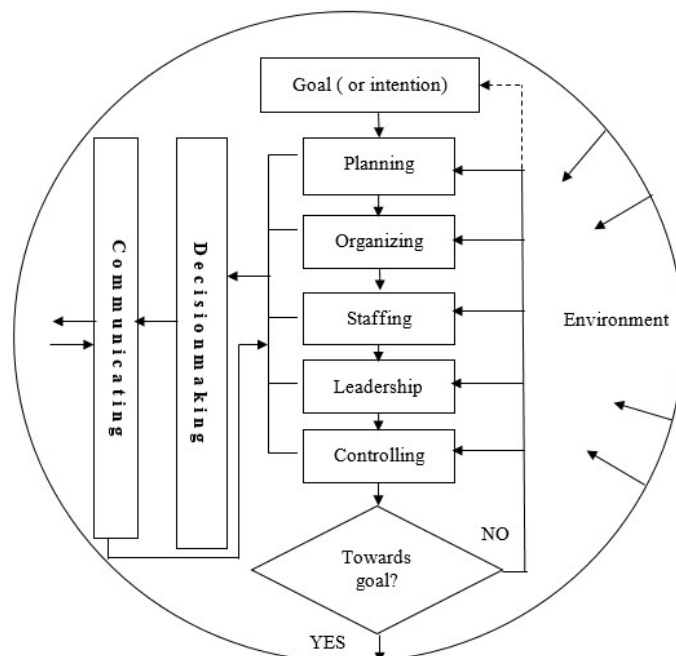


Figure 1: The simplified systemic model of Management (Komárek, 2013)

Planning is not ranked as the first managerial function for its own sake; it is the starting point for achieving the time-distant goal. The goal is communicated to the manager either directly or he has the power to determine it himself according to his intention. To meet the goal, it is necessary to determine the time sequence of corresponding actions, but their identification and coordination in relation to the arrangement of resources is contained in organizing, closely related with planning but different methodically and time independent. The fulfilment of the organization by human resources is staffing, and the essence of leading is influencing subordinates in order to perform tasks as they want (to best) and not only must. Controlling is essentially comparing achieved and desired state (goal, objectives, plans, parameters) and represents a feedback conditioning the function of system with the goal-oriented behaviour in general.

If the check reveals that current state does not ensure the successful achievement of the goal, it is necessary to take appropriate action (e.g. to change terms in plan or to restructure resources, to choose better staff, to change the style of leading, to introduce appropriate controlling or communicating). But there can be a situation that even the best variant of managerial functions does not ensure the achievement of the goal. Why, the goal has been determined incorrectly? Every plan is based on certain assumptions about the future state of environment (both external and internal). But when in the course of implementation the originally anticipated state has changed significantly (mostly beyond our control), the goal must be corrected (and not to waste resources in order to meet the goal “at any cost”). Each of these functions usually contains more variants of solution and therefore it is necessary to determine which one will bring the greatest effect. Decision making is so intertwined with all managerial functions; it is always about choosing the best solution from several options. Therefore decision making has the key role between managerial functions and when some decision is followed by an implementation, the way back may demand a significant cost, loss of authority or may not be possible at all (it is said that managers are paid for making decisions).

But what are crucial, Business Economics and Management have undergone divergent evolution over fifty years. Business Economics as a description of the corporate functions has unchanged essentially (Wöhe and Döring, 2013), and Management from the original ambiguously defined teachings has developed into number of separate disciplines. The new status as a higher education course and even study program has Strategic, Human resources, Crisis, Risk, Change, Knowledge, Project, Information, Business Process, Operational, Safety, Environmental, Quality and of course Business Management. An economic foundation may have in addition to Business Management also Strategic, Crisis and Risk Managements (if oriented to business), others are based largely on the humanities, systemic and technical sciences. And what was originally conceived as the Management is currently distinguished as the core of Management consisting of its four typical functions (planning, organizing, leadership, controlling) and called General Management (Nieuwenhuizen and Rossouw, 2008: 39). Only in the UK is the General Management defined as a doctrine for top management, but there is also everything different there (and that is why some reformers of the Czech higher education take pattern from there?). General management itself is a sufficient tool for line managers and other managements are actually add-on application of this general principle to a specific area of practice. These specific ones are for the middle-level mainly and the Strategic Management is for the top level. The role of General Management is not limited to the basic organizational level. Whether is a problem in any field of human work, and at any level, its solution requires always setting goals, planning, organizing resources, leading, controlling, and without communication and decision-making cannot work at all.

From the discussion, it is evident that Management is a process which involves designing and maintaining an environment with the main purpose of effectively attaining the chosen goals. The concepts found from these wide ranges of theories are important for managers for them to have an organized but practical knowledge concerning Management. Because for to carry out Management functions, managers have to rely on a number of managerial skills. "The three basic sets of skills which managers have to have are the conceptual, human, and technical skills. Conceptual skills means being able to apply all the above discussed theories of management to fit a given situation they are facing in the organization. Technical skills mean the ability to work and carry out actions which are professional. Finally the manager has to view the members of the organization as human beings who need to be supported in their psychological feelings, needs and emotions" (Kettner, 2002: 145).

Study program Management

While in Europe the study program Management is classified under Business & Economics (Bachelorsportal, 2015), independent Bachelor's and Master's degree programs are extended overseas, and common is also Doctoral study program in Management Science. Doctoral studies are a crucial precondition for the autonomy of study program, because it has its own science. The foundations of Management Science are analytical and simulation models for to support decision-making (Operations Research), with emphasis on the methodology of systems modelling and the application of advanced mathematical and statistical methods (The University of Texas, 2015).

Due to the content are essentially analogous to the Management studies also the study programs in Organizational Science

and in Administration Science, usually aimed at any kind of organization more generally (The George Washington University, 2015). Orientation in the study programs abroad is not easy, because they are not rigidly arranged (accredited is the institution, not the study program) and they can be considerably individualized by wide selection of elective courses.

There are two different models in principle, the European and the transatlantic ones. Bachelor study in Europe (Bachelorsportal, 2015) is usually three years (in the UK also two years) and with respect to Management studies, two approaches are apparent according to the focus. Management of Business is presented mostly as Business Administration and in that the economic basis prevails with varying degrees of orientation to practice (up to domestic interpretations of Bachelor studies as a preparation for immediate Master studies mainly). But significantly different is the Management of non-economic fields, which focuses both on the preparation for specific professional skills and always for line management with respect to anticipated staffing positions in practice. *Nota bene* the basic condition for the existence of mankind at all is the material production and its distribution, and within them has a decisive proportion the industrial mass production, that requires a mass of line managers in various specializations. Therefore, neither universal manager can be a solution; of crucial importance are just specific Applied Managements.

The transatlantic model (e.g. USA, Canada, and Latin America) is a four-year Bachelor study as a general basis for life-long learning, because there is no exaggerated hunt for the Master degree. The difference in the concept is evident: in the first year compulsory natural sciences (Mathematics, Physics, Chemistry or Biology), optional humanities and social sciences, and Writing and Rhetoric (The MIT Sloan School of Management, 2015). The managers in the industrial society control the human-machine systems and therefore the importance of Physics (Mechanics, Electricity) for the study of Management. If degree programs in Management are not focused on business (e.g. Management Science and Engineering), economic courses are just additional as elective ones, and no pure theory, but Economic Analysis or Accounting (Stanford University, 2015). Another fundamental difference is that so conceived Bachelor study is sufficient for entering Doctoral study. This is one of the factors of the high efficiency of this model, and ultimately also of the competitiveness at all. The broad general basis significantly promotes flexibility of the entire educational system, because the Master study may be more interdisciplinary than domestic rigid link to the original Bachelor field of study. This is typical for the Master study in Project Management or in Human Resources Management that can follow after any Bachelor field of study, which is still possible also in Europe (Masterstudies.com, 2015).

Conclusion

Some change can bring the intended transfer of accreditation competencies on the educational institutions, which would give more flexibility in creating programs to the needs of social-economic practice. Although is the study program Management expected next Business Economics (Návrh Nařízení vlády, 2015), the question is what demands will result from affiliation to the economic science, especially for Applied Management (Basics of Economics or Business Economics?). But when regarding content of all foreseen Areas of Education (Návrh Nařízení vlády, 2015), there is no good news for the domestic practice

there. Primarily are not distinguished undoubtedly different requirements for professionally oriented or academic study programs. Furthermore, the content of each Area of Education is not formally unified, even though its structure (education descriptors), has been unambiguously defined in the project Q-Ram (Černíkovský et al., 2012). But what is significant: in almost all fields with an outlet to practice is referred to the applicable range of Bachelor graduates for elementary to middle level management, but no mention of adequate managerial skills. It seems that will be still a long way to increasing the efficiency of higher education regarding the needs of current, and especially future practice.

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COMPARISON OF THE WAYS OF ACCEPTANCE STUDENTS AT UNIVERSITY

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Highlights

- Dependence of the study results at University on the ways of acceptance students

Abstract

The paper reports on an analysis of the entrance examinations at the Faculty of Informatics and Statistics at University of Economics in Prague. Applicants can be accepted to this faculty by three ways. The aim of this paper is to compare these ways of acceptance students at the Faculty of Informatics and Statistics at University of Economics in Prague and to study dependence of the results of entrance examinations in mathematics on test variants. Results of this analysis can be used for improvement of the entrance examinations at the Faculty of Informatics and Statistics at University of Economics in coming years.

Keywords

Analysis of variance, course Mathematics for economists and course Mathematics for informatics and statistics, entrance examinations, Kruskal-Wallis test, Scheffe's method, test of independence in contingency table

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Introduction

Applicants can be accepted to study Faculty of Informatics and Statistics at University of Economics in Prague by three ways:

- on the base of tests in mathematics and English, which is used at University of Economics in Prague (VSE tests)
- on the base of the national comparative exams - the tests of general academic prerequisites (SCIO tests)
- without entrance examinations (on the base of results in mathematics and English at grammar school etc.).

The relations between the ways of acceptance applicants to study Faculty of Informatics and Statistics and study results in mathematics are studied in this paper. Similar problem (the dependence of study results and results of the learning potential tests) is solved in Kubanová and Linda (2012), Linda and Kubanová (2013). On the other hand, analysis of the study results in basic courses in mathematics at University of Economics is in Kaspříková (2012), Otavová and Sýkorová (2014). This paper is an extended version of the paper Klůfa (2015) – other group of students was analyzed.

In the second place we shall study dependence of the results of entrance examinations in mathematics on test variants. The math tests are prepared by the Department of Mathematics of the Faculty of Informatics and Statistics. These tests are the multiple choice question tests. The tests in mathematics have 10 questions for 5 points and 5 questions for 10 points (100 points total). Questions are independent. Each question has 5 answers (one answer is correct), wrong answer is not penalized. The number of points in the test in mathematics can be

0, 5, 10, 15, 20, 25, 30, 35, 40, 45, . . . , 90, 95, 100.

These tests are used to the three faculties of the Prague University of Economics (Faculty of Informatics and Statistics, Faculty of Finance and Accounting, Faculty of Business Administration). The multiple choice question tests for entrance examinations at University of Economics in Prague from probability point of view are analysed in Klůfa (2013), Klůfa and Kaspříková (2012), Klůfa (2012).

The second aim of this paper is to analyse the entrance examinations in mathematics (similar problems are solved in Brožová and Rydval (2013), Hrubý (2013), Mošna (2013), Kučera, Svatošová and Pelikán (2015)) at the Faculty of Informatics and Statistics at University of Economics in Prague from point of view test variants. We shall study dependence of number of points in the test in mathematics on test variants. These results will be used to further improve of the preparation of test variants in coming years.

Material and Methods

The analysed data are the results of the entrance examinations of 849 applicants in mathematics. Four test variants (denoted A6, A7, B2, B3) were parallelly used for the entrance examinations in mathematics at the Faculty of Informatics and Statistics in 2013 (variants are randomly selected immediately before the test). The analysed data are sorted according to test variants (contingency table).

On the other hand the results in mathematics of 104 students in

summer semester of the 2013/2014 academic year in the course Mathematics for informatics and statistics (ident 4MM103) and the results of 472 students in winter semester of the 2014/2015 academic year in the course Mathematics for economists (ident 4MM101) are analysed. The number of points in the test in the course Mathematics for informatics and statistics and in the course Mathematics for economists can be in interval $[0,40]$, the multiple choice question tests are not used. The analysed data

are sorted according to ways of acceptance students to study Faculty of Informatics and Statistics at University of Economics in Prague – see Table 2 and Table 4.

Some statistical methods are used for an analysis of the entrance examinations at the Faculty of Informatics and Statistics – see e.g. Anděl (1978), Rao (1973).

For study dependence of number of points in the test in mathematics on test variants we shall use χ^2 test of independence in contingency table. Statistic χ^2 is

$$\chi^2 = \sum_{i=1}^r \sum_{j=1}^s \frac{(n_{ij} - n_{ij}^o)^2}{n_{ij}^o}, \quad (1)$$

where r is number of rows, s is the number of columns in contingency table and n_{ij}^o is the expected frequency in case of independence. When

$$\chi^2 > \chi_{\alpha}^2((r-1)(s-1)), \quad (2)$$

where $\chi_{\alpha}^2((r-1)(s-1))$ is critical value of χ^2 distribution, hypothesis of independence is rejected at significance level, which is asymptotically equal to α .

For comparison of the ways of acceptance applicants to study we shall use nonparametric Kruskal-Wallis test. When (statistic Q see e.g. Anděl (1978: 231))

$$Q > \chi_{\alpha}^2(k-1), \quad (3)$$

where $\chi_{\alpha}^2(k-1)$ is critical value of χ^2 distribution for $k-1$ degrees of freedom (k is number of the ways of acceptance applicants), hypothesis “distribution of number of points in mathematics is the same for all three ways of acceptance students” is rejected at significance level, which is asymptotically equal to α .

Further for comparison of the ways of acceptance applicants to study we shall use a one-way analysis of variance (ANOVA). We shall verify the validity of the null hypothesis: mean number of points in mathematics is the same for all three ways of acceptance students. When (the test statistic F see e.g. Rao (1973: 280))

$$F > F_{\alpha}(k-1, n-k), \quad (4)$$

where $F_{\alpha}(k-1, n-k)$ is critical value of Fischer-Snedecor

distribution with $(k-1)$ and $(n-k)$ degrees of freedom ($k=3$), hypothesis is rejected at significance level α .

Results

Dependence on test variants

Results of the entrance examinations in mathematics in 2013 are in Table 1 (for example 6)

Points in test	Variants				Sum
	A6	A7	B2	B3	
0	2	1	0	1	4
5	2	0	0	2	4
10	6	3	1	6	16
15	4	4	2	8	18
20	9	7	7	7	30
25	12	10	8	6	36
30	18	10	8	11	47
35	15	9	16	16	56
40	22	17	21	10	70
45	19	18	21	15	73
50	17	13	22	19	71
55	15	14	17	15	61
60	17	14	12	15	58
65	26	12	19	9	66
70	9	9	11	13	42
75	11	10	17	11	49
80	7	12	13	10	42
85	3	13	11	7	34
90	5	7	10	5	27
95	0	5	4	7	16
100	5	11	7	6	29
Sum	224	199	227	199	849

Tab. 1: Distribution of number of points in test in mathematics (contingency table)

students with variant A6 obtained 10 points in test in mathematics, i.e. 6 is absolute frequency n_{31} in 3rd row and 1st column of the contingency table) and Figure 1.

Now we shall study dependence of number of points in the test in mathematics on test variants. Null hypothesis is

H_0 : number of points in the test is not dependent on the test variant.

χ^2 test of independence in contingency table is used for the decision on the validity of the hypothesis H_0 . In the first step we calculate according to (1) statistic χ^2 (for example $n_{11}=2$ (see Tab.1) and expected frequency $n_{11}^o = 4 \times 224/849 = 1.055$). Because of the small expected frequencies, we combine first 3 rows of the contingency table. We have

$$\chi^2 = 63.89 \quad (5)$$

Critical value of χ^2 distribution for 54 degrees of freedom and significance level $\alpha = 0.05$ is $\chi_{0.05}^2(54) = 72.15$. Since

$$\chi^2 = 63.89 < 72.15, \quad (6)$$

null hypothesis H_0 is not rejected at approximately 5%

significance level. Moreover p value is 0.168 (null hypothesis H_0 is not rejected also at 16% significance level). For calculation

we used MS Excel version 10 – see Marek (2013). We can say that the number of points in the test does not depend on the test variant.

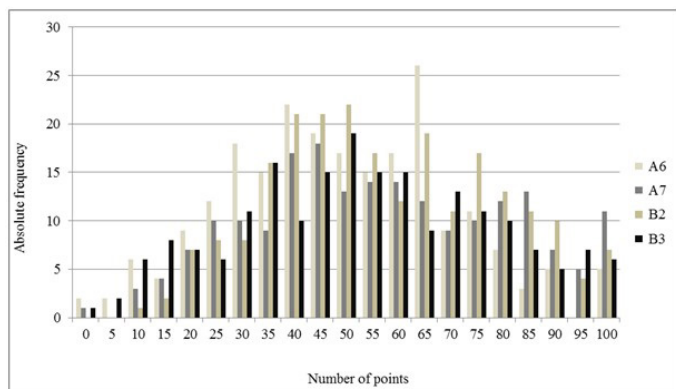


Fig. 1: Distribution of number of points in test in mathematics in 2013 – test variants A6, A7, B2, B3 (histogram)

Differences between the ways of acceptance applicants

Now we shall compare the ways of acceptance applicants to study Faculty of Informatics and Statistics. Results in mathematics in the course Mathematics for informatics and statistics sorted according to the ways of acceptance applicants are in Table 2 (see Appendix).

We shall test null hypothesis

H_0 : distribution of number of points in mathematics is the same

for all three ways of acceptance students (VSE tests, SCIO tests, other)

Some parameters of distribution of number of points in mathematics are in Table 3. From Table 3 it seems that the distributions of number of points in mathematics (VSE tests, SCIO tests, other) differ, i.e. hypothesis H_0 is not valid. For objective decision we shall use a statistical test. To verify the validity of the hypothesis H_0 we shall use Kruskal-Wallis nonparametric test.

	VSE Tests	SCIO Tests	Other
Average	27.119	22.182	31.039
Median	28.000	23.000	32.000
Modus	28.000	19.000	32.000
Std. Deviation	8.500	10.944	6.135
Kurtosis	-0.248	-0.215	-0.095
Skewness	-0.496	-0.633	-0.550

Tab. 3: Descriptive statistics for number of points in the course 4MM103

Value of statistic Q is (Q is calculated on the base of rank of values in Table 2 - see Anděl (1978: 231))

$$Q = 9.95 \quad (7)$$

This statistic has asymptotically χ^2 distribution for 2 degrees of freedom. Critical value of χ^2 distribution for two degrees of

freedom and significance level $\alpha = 0.01$ is $\chi^2_{0.01}(2) = 9.21$. Since

$$Q = 9.95 > 9.21, \quad (8)$$

null hypothesis is rejected at significance level, which is approximately equal to $\alpha = 0.01$. With high probability (approximately 0.99), we can say that there are significant differences between ways of acceptance students to study Faculty of Informatics and Statistics (VSE tests, SCIO tests, other).

Remark. Similar result gives ANOVA: null hypothesis “mean number of points in test in the course Mathematics for informatics and statistics is the same for all three ways of acceptance students” is rejected ($F = 7.088 > 4.822$) at significance level $\alpha = 0.01$ – see Tab. 5. Assumption of ANOVA: null hypothesis “variance of number of points is the same for all three ways of acceptance students” is not rejected at 1% significance level (Bartlett’s test - see e.g. Anděl (1978: 155)). Since this hypothesis is rejected at 5% significance level, we used also corresponding nonparametric Kruskal-Wallis test.

Source of variability	Sum of Squares	Degrees of freedom	Fraction	F	P value	F crit
Ways of acceptance	847.999	2	423.999	7.088	0.001	4.822
Rezidual	6041.96	101	59.8214			
Sum	6889.96	103				

Tab. 5: Results of ANOVA for course 4MM103

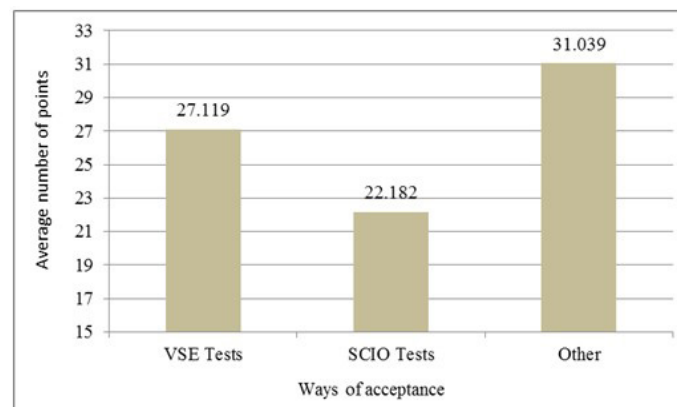


Fig. 2: Average number of points in test in mathematics in the course 4MM103

Finally we shall study which pairs of averages differ significantly. We use Scheffé’s method – see e.g. Anděl (1978: 154). Pairs of averages differ significantly if absolute value of difference in averages exceeds critical value (see Tab. 2 ($n_1=42, n_2=11, n_3=51$) and Tab. 5)

$$\sqrt{\left(\frac{1}{n_i} + \frac{1}{n_j}\right) \times 2 \times 59.8214128 \times 4.821677} \quad (9)$$

Pair of test variants	Absolute value of difference in averages	Critical value (9)
VSE tests , SCIO tests	4.937	8.135
VSE tests, Other	3.920	5.005
SCIO tests, Other	8.857*	7.985

* Significant difference for $\alpha = 0.01$

Tab. 6: Scheffé’s method

From Tab. 6 it is seen that a significant difference is at 1% significant level only between SCIO tests and Other.

On the other hand, results in mathematics in the course Mathematics for economists (ident 4MM101) sorted according to the ways of acceptance applicants are in Table 4 (see Appendix). We shall test null hypothesis

$$H_0: \mu_1 = \mu_2 = \mu_3, \quad (10)$$

i.e. mean number of points in test in the course Mathematics for economists is the same for all three ways of acceptance students (VSE tests, SCIO tests, other).

Ways of acceptance	Frequency n_i	Sum	Average number of points	Variance
VSE tests	305	7276	23.85574	100.3804
SCIO tests	58	1361	23.46552	104.8497
Other	109	2876	26.38532	113.0724

Tab. 7: Descriptive statistics for number of points in the course 4MM101

To verify the validity of the hypothesis (10) we use ANOVA. In the first step we verify assumption (the same variance of number of points in ways of acceptance) of this method by Bartlett's test. Test statistic B (see e.g. Anděl (1978: 155)) is $B = 0.58$. Critical value of χ^2 distribution for 2 degrees of freedom and significance level $\alpha = 0.05$ is $\chi^2_{0.05}(2) = 5.99$. Since

$$B < 5.99,$$

assumption of ANOVA can be considered to have been met (the differences between variance

$$s^2_{VSE} = 100.38, \quad s^2_{SCIO} = 104.85, \quad s^2_{Other} = 113.07$$

in the course Mathematics for economists (see last column of Tab. 7) are not statistically significant).

Results of ANOVA we got with MS Excel – see Tab. 8.

Source of variability	Sum of Squares	Degrees of freedom	Fraction	F	P value	F crit
Ways of acceptance	570.59	2	285.29	2.75	0.065	3.015
Rezidual	48703.9	469	103.85			
Sum	49274.49	471				

Tab. 8: Results of ANOVA for course 4MM101

Since

$$F = 2.747 < 3.015,$$

null hypothesis (10) is not rejected at 5% significance level. The differences between average number of points in test

$$\bar{x}_{VSE} = 23.86, \quad \bar{x}_{SCIO} = 23.47, \quad \bar{x}_{Other} = 26.39$$

in the course Mathematics for economists (see Tab. 7) are not statistically significant.

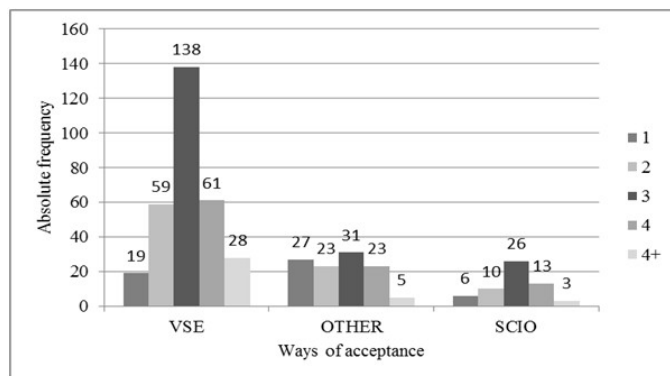


Fig. 3: Distribution of the final results (test + oral exam) in mathematics in course 4MM101 – ways of acceptance (histogram)

Discussion

Similar problem as in this paper is solved in Kubanová and Linda (2012). There is studied the dependence of study results and results of the learning potential tests (SCIO tests). The insignificant correlation was detected between results in learning potential test and study results. In this paper was solved other problem - dependence between study results in mathematics and SCIO tests (ways of acceptance students) has been proven.

On the other hand, analysis of the study results in basic courses in mathematics at University of Economics is in Otavová and Sýkorová (2014). There is studied whether the score from final test depends on the score from mid-term test. Similar methods as in this paper show that dependence between the score from final test and the score from mid-term test exists.

The multiple choice question tests for entrance examinations at University of Economics in Prague from probability point of view are analysed in Klůfa and Kaspříková (2012). Disadvantages of such type of test is that a student can obtain certain number of points in the test purely by guessing the correct answers. Results of the paper show that risk of success of students with lower performance levels is negligible. The analysis of entrance examinations in this paper (the dependence on the test variants) also shows that these tests are suitable for entrance examinations at University of Economics.

Relation between results of the entrance examination test in mathematics and examination in mathematics at University of Pardubice is studied in Linda and Kubanová (2013). This paper had demonstrated the dependence of the test results in math on the results of entrance tests in mathematics (in contrast to SCIO tests). This finding should lead to the conclusion that the schools should focus on admission process, students should be accepted on the basis of own admission. Similar results we obtain also in this paper.

Conclusion

From χ^2 test of independence in contingency table it follows that the number of points in the test in mathematics does not depend on the test variant. From the results of this paper we can say that significant changes in test variants in mathematics in the coming years are not needed.

There are significant differences between students which were accepted to study Faculty of Informatics and Statistics on the base VSE tests, SCIO test and without entrance examinations from the point of view test score in mathematics (see also Figure 2). The best results from the point of view number of points in

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The manuscript must also deal with one of the key topics of the ERIES Journal (issue of efficiency and/or responsibility), otherwise it cannot be published in the ERIES Journal.

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- Please use text font Times New Roman of the size 12, normal spacing and justified.
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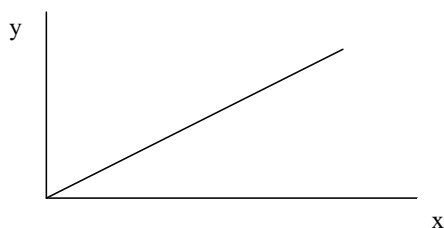


Figure 1: The name of the figure, 2000-2012 (source: Adair, 1988)

Alternative	Costs	Benefits
Alternative 1	12	20
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- Equation(s) should be inserted in invisible tables for alignment, see example below. Each equation(s) need to be numbered, use bold numbers in thin parenthesis on the right side. All equations must be numbered continuously

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$$\Omega_i = \frac{b_i}{\alpha_{ik}} \quad (1)$$

We recommend using MS Word's integrated equation editor.

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