CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

ERIES JOURNAL

JOURNAL ON EFFICIENCY AND RESPONSIBILITY IN EDUCATION AND SCIENCE

The ERIES Journal is being managed by an international editorial board as a regular scientific journal. A rigorous process of papers' reviews (double-blind peer review) is fully supported by a web-based submission system. The journal is published electronically four times a year, on March 31, June 30, September 30 and December 31 of the current year.

The journal is indexed in:

- BASE - Bielefeld Academic Search Engine
- Directory of Open Access Journals
- EBSCO database
- Emerging Sources Citation Index - Web of Science™ Core Collection
- ERIH PLUS
- Google Scholar
- Open Academic Journals Index (OAJI)
- ResearchBib
- SCOPUS
- The list of reviewed periodicals in the Czech Republic

www.eriesjournal.com

Scientific journal of the Czech University of Life Sciences Prague JOURNAL ON EFFICIENCY AND RESPONSIBILITY IN EDUCATION AND SCIENCE, distributed by the Faculty of Economics and Management. Published quarterly. Executive editors: Ing. Igor Krejčí, Ph.D. and Ing. Martin Flégl, Ph.D., Editorial Office**:** ERIES Journal, Czech University of Life Sciences Prague, CZ 165 21 Prague 6 - Suchdol, Czech Republic, email: editor@eriesjournal.com, tel: +420 224 382 355.

volume 12
issue 1

2019

An international peer-reviewed journal published by
Faculty of Economics and Management
Czech University of Life Sciences Prague

editor@eriesjournal.com
www.eriesjournal.com
Online ISSN: 1803-1617
Printed ISSN: 2336-2375

EDITORIAL BOARD

EDITORIAL OFFICE

ERIES Journal, Czech University of Life Sciences Prague, CZ 165 21 Prague 6 - Suchdol, Czech Republic
email: editor@eriesjournal.com * tel: +420 224 382 355

Registration number: MK ČR E 21414 © Czech University of Life Sciences Prague, Czech Republic, 2019

INSTRUCTIONS FOR AUTHORS

The Journal on Efficiency and Responsibility in Education and Science publishes papers of the following categories: full research papers, short communications, review studies and book reviews (on invitation only).

- FULL RESEARCH PAPERS
- SHORT COMMUNICATION
- REVIEW STUDY

Papers are published in English. A paper may comprise an empirical study using an acceptable research strategy, such as survey, case study, experiment, archival analysis, etc. It may contain a theoretical study aimed at advancing current theory or adapting theory to local conditions or it may arise from theoretical studies aimed at reviewing and/or synthesizing existing theory. Concepts and underlying principles should be emphasized, with enough background information to orient any reader who is not a specialist in the particular subject area.

Submission checklist

The paper. The paper is carefully formatted according to the template of the journal (see bellow). Special attention is paid to the exact application of the Harvard referencing convention to both continuous citations and list of references. If an electronic source has the DOI number assigned, also it will be provided in the list of references. Manuscripts are submitted via the editorial system in the DOC.

Research highlights. The core results, findings or conclusions of the paper are emphasized in 1-3 bullet points (max. 100 characters per bullet point including spaces). The highlights are submitted as a text into the submission form in the editorial system.

Copyright form. The submission of a paper will imply that, if accepted for publication, it will not be published elsewhere in the same form, in any language, without the consent of the Publisher. The manuscript submitted is accompanied by the copyright form signed by the corresponding author who declares the agreement of all authors with the conditions in the Form. The Form is submitted into the editorial system in the PDF format.

Suggested reviewers. It is required to suggest two experts appropriate to evaluation of the paper. The experts should be out of the affiliation of the author(s), Czech University of Life Sciences Prague, and also both experts should be from different affiliations. The reviewers are submitted into the text fields in the submission form of the editorial system.

Preparation of the manuscript (technical notes)

Authors are responsible for applying all requirements that are specified in the journal's paper template in individual sections. Especially, the paper must provide a short review of current state in the area of the paper's aim in Introduction. The paper should refer significant sources, particularly scientific journals or monographs.
Papers must be closely scrutinized for typographical and grammatical errors. If English is not author's first language then the paper should be proof-read by a native English-speaking person, preferably one with experience of writing for academic use. Spelling should follow the Oxford English Dictionary.
Tables, graphs and illustrations should be drawn using a suitable drawing package. Colour may be used. Place all diagrams and tables where you wish them to appear in the paper. Ensure your diagrams fit within the margins and are resizable without distortion.

Review procedure

Following Editorial recommendation, papers are submitted to a double-blind peer review process before publication. Commentary by reviewers will be summarized and sent by email to authors, who can choose to revise their papers in line with these remarks. Re-submitted papers should be accompanied by the description of the changes and other responses to reviewers' comments (see above), so that the desk-editor can easily see where changes have been made.

Copyright

Authors are fully responsible for the paper's originality and for correctness of its subject-matter, language and formal attributes. Author's statement should be enclosed declaring that the paper has not been published anywhere else.

The submission of a paper will imply that, if accepted for publication, it will not be published elsewhere in the same form, in any language, without the consent of the Publisher. Before publication, authors will be asked to complete a copyright release, giving the publisher permission to publish the paper in a specific issue of this Journal. Overall copyright ownership of the paper, however, remains with the author/s. It is the authors' responsibility to obtain written permission to quote material that has appeared in another publication.

With the first issue of the year 2019 (Vol. 12, No. 1) that you hold in your hands, we are more than pleased to announce that ERIES Journal has reached a new important milestone. ERIES Journal is now indexed in SCOPUS abstract and citation database. So far, all volumes published in 2018 have been backwardly included in the database. Furthermore, the Journal begins using iThenticate plagiarism detection software to ensure that all published content meets the highest publication and ethical standards. With this issue, we have also finished the period of modernisation and destructuralisation of our system, webpages and overall journal presentation leading to new article layout. New layout provides more flexible tool for our technical editors, gives better presentation of authors' results as, among others, provides better arrangement of tables and figures in text, as well as better text flow for readers. We hope that all these announced changes will lead to broader national and international journal recognition.

One of the main objectives of each education institution, and mainly of higher education institutions, is to provide high "quality of education" to its students. The term "quality of education" can have many meanings, understandings and measures. One of many definitions links the quality to the education institutions capability to prepare students to perform well in standardized examinations, as well as to prepare students for their future professional careers. Many factors influence educational outcomes, such as students' motivation to study and students' socio-economic background, among others. As we live in a globalized world full of new technologies and innovations, it is of high importance for education institutions to secure the up-to-date syllabuses of their course. Teachers play a crucial role in this process. To catch students' attention, it is important to constantly innovate course and incorporate non-traditional teaching methods. Students must perceive that what they learn has practical applications and helps them to get a competitive advantage on the labor market. Non-traditional innovative teaching approaches could be the key factor to attain higher education reputation. The non-traditional teaching methods and students' success is the central topic of the articles presented in this issue.

The first article from Irena Stejskalová, Lenka Komárková, Martina Bednářová and Pavel Štrach from University in Economics in Prague and Škoda Auto University, Czech Republic, examines a new teaching method consisting of a real-life case study in accountancy. The main focus of the study is to examine the different ways that students might accept the new teaching method. The active form of teaching brings a variety of advantages into teaching, as students must carefully think through the whole defined problematic situation and find its solution. In total, 463 students (70.84% females) participated in the research during two consecutive years. Results indicate that male students perceive the use of case studies positively. However, the introduction of innovative teaching methods should be carefully explained that students understand its concept. In addition, the effect of these non-traditional teaching methods should be continuously revised to eliminate possible inaccuracies.

The second article from Ivana Čechová, Jiří Neubauer and Marek Sedlačík (University of Defense, Czech Republic) presents a longitudinal study to observe students' performance and outcomes from entrance exams to state exams. Continuous analyses of students' performance are valuable sources for identification of areas of opportunities to enhance education quality. The analyzed sample consists of 61 military and 59 civilian students of the bachelor degree who begun their studies in 2013 and successfully finished them in 2016. Statistical analysis revealed that there is a correlation between the results of the admission tests and the study results, especially the connection between the results of the entrance test and the chance of successful completion of studies. The better the result achieved in the entrance exam, the higher the point evaluation, but in terms of grades it is reversed. This observation could have a direct impact on institutional policies, as each institution can pay higher attention to those students with lower entrance examination results to improve their chances to finish their studies.

The last article from a collective of authors Ladislav Pilař, Pavel Moulis, Jana Pitrová, Petr Bouda, George Gresham, Tereza Balcarová and Stanislav Rojík from Czech University of Life Sciences Prague and University of South Bohemia examines communication content of Instagram social network users via hashtag #gamification. Gamification is a technique that can increase participants' motivation, especially in the field of education. Data were collected using a script to capture communication on the social network Instagram during the period from March 2017 to January 2017. During this period, 17,994 Instagram photos were selected on the basis of hashtag #gamification. In total, the analysis contains 198,850 unique words. The hashtag #gamification is principally tied to education and business, as most associated hashtags were motivation, business, university, education, industry, inspiration, design, start-up, innovation and teacher. The benefit of the presented analysis for the education area is the identification of the university's links between education and entrepreneurship. Similarly, teacher and trust are important in the connection between education and enjoyment. This non-traditional method can be considered as an additional method in teaching management skills.

We would like to thank all authors who have submitted their manuscripts to ERIES Journal and special thanks to all reviewers for their effort in revising the manuscripts. We hope that all our readers will find this first issue of the year 2019 interesting. We also hope that the published articles will positively contribute to the field of efficiency and responsibility in education.

Sincerely

Martin Flégl
Executive Editor
ERIES Journal

www.eriesjournal.com
www.linkedin.com/company/eriesjournal/
erie.pef.czu.cz

CONTENT

Full research paper

STUDENT ADOPTION OF A NON-TRADITIONAL TEACHING METHOD IN ACCOUNTING: HOW PREVIOUS EXPERIENCE IMPEDES WILLINGNESS TO CHANGE

Irena Stejskalová[1]
Lenka Komárková[2]
Martina Bednářová[2] ✉
Pavel Štrach[3]

[1] Department of Management, Faculty of Management, University of Economics Prague, Czech Republic

[2] Department of Exact Methods, Faculty of Management, University of Economics Prague, Czech Republic

[3]Department of Marketing and Management, Škoda Auto University, Czech Republic

✉ arinna@tiscali.cz

ABSTRACT

This research paper examines a new teaching method consisting of a real-life case study that is used in accountancy and its introduction at two universities. The research was conducted at universities that specialise in preparing students to become managers. The main focus of the study is to examine the different ways that students might accept the new teaching method. We consider the utilisation of an active form of teaching, as opposed to a passive form, which is the more prevalent form of teaching accountancy in the Czech Republic. Since the use of active forms of teaching brings a range of advantages, case studies are rarely used, so we were interested to see the students' reaction. The research was conducted over two consecutive academic years and the main factors that were examined to assess the introduction of real-life case studies were country, gender and previous experience with accountancy education at secondary school. The results clearly show that men accept the new way of teaching better than women. Students with previous experience perceived case studies negatively. The results of the study indicate that when introducing changes to teaching, the need to introduce the changes must be appropriately clarified.

KEYWORDS

Accounting education, change acceptance, managerial decision-making, problem-based learning, real-life case studies

HOW TO CITE

Stejskalová I., Komárková L., Bednářová M., Štrach P. (2019) 'Student Adoption of a Non-Traditional Teaching Method in Accounting: How Previous Experience Impedes Willingness to Change', *Journal on Efficiency and Responsibility in Education and Science*, vol. 12, no. 1, pp. 01-11. http://dx.doi.org/10.7160/eriesj.2019.120101

Article history
Received
August 28, 2018
Received in revised form
December 14, 2018
Accepted
January 21, 2019
Available on-line
March 31, 2019

Highlights

- *Real-life case studies are considered by students as an appropriate supplement to the accountancy tutorial.*
- *Men prefer the use of real-life case studies in accounting courses more than women.*
- *The intervention regarding the inclusion of real-life case studies into tuition has a positive effect on students´ acceptance of this non-traditional teaching method.*
- *Students who have previous experience with traditional accounting education perceive real-life case studies less positively.*

INTRODUCTION

The twenty-first century can be called a century of continuous change. For some, a change may be a challenge and a form of an adrenalin game while for others it may be a source of fear and anxiety (McGrath and Bates, 2013). Assuming that a change is communicated well and participants can listen actively, there is a better chance of its acceptance (Wales, 2002). Changes are also related to education and the teaching methods used. Teaching has been largely founded on using passive forms of teaching, for instance, lectures that are based on the ability to remember facts (Singer and Wiesner, 2013). On the contrary, the core of active teaching is to engage students in the process of teaching (Ciobanu, 2018). The emphasis is placed on the students and the way they use various purposeful teaching activities plus the fact that they are required to think about and analyse what they

do (Bonwell and Eison, 1991) and understand the heart of a problem (Boyce et al., 2001). An example of these teaching methods is case studies.

The research, conducted by many authors such as Cullen, Richardson and O´Brien (2007), Healy and McCutcheon (2010) and Vondra (2017), implied that case studies can improve soft skills. Accounting has traditionally been a rather conservative discipline (Leventis, Dimitropoulos and Owusu-Ansah, 2013), which includes the utilisation of instruction methods (Bonk and Smith, 1998). With traditional accounting lectures and exercises, students only learn to correctly view the selected business operation in the accounting system. They are not trained to apply their acquired accounting knowledge to managerial decision-making in business. However, the problem is that graduates of such traditional university accounting courses should not become accountants, but instead, users of the acquired accounting information who must be able to consider the consequences of their decisions. In order for a graduate to learn to think in context, real-life case studies were introduced into introductory accounting courses.

In this article, we want to build on the conference paper (Stejskalová et al., 2018) that compared the perception of usage of real-life case studies in accounting bachelor courses by Czech and Slovak students in the field of management and we aim to find out which antecedents and factors determine student acceptance of real-life cases in accounting courses. Therefore, and within the theoretical background, attention is focused on the two areas combined in the study: the introduction of non-traditional methods into accounting education and accepting the change in a teaching technique.

THEORETICAL BACKGROUND

Non-Traditional Methods in Accounting Education

Changes in the company have put pressure on the key competencies of accountants. Thus, responsible accounting teachers should prepare their students for teamwork, i.e. teach them how to inspire and motivate others to achieve common efficient results (Kermis and Kermis, 2010). Turner and Baskerville (2013) point to a new learning perspective in the work with a lot of information. They recommend that learning abilities development in the first years should be supported by deep learning in the form of individual learning tasks that contribute to the development of the integration of new information into existing knowledge. Furthermore, Goleman (1996; 2011) demonstrated that when an educational programme focuses solely on analytical and technical skills, it will have a negative impact on work performance. Educational programmes should also involve the part of the brain that controls feelings and impulses, i.e. emotions.

On the other hand, Buzan (2010) states that current educational systems are designed to actually suppress creative thinking. He notes the drop in creativity from 75% at primary school to 25% at university. This is why, within the boundaries of possibilities, it is appropriate to abandon established rules that do not support creative thinking and instead seek alternative solutions. Creative and critical thinking is closely connected with the decision-making process, which plays an important role in managerial work. Accountancy knowledge can be applied very well in the decision-making process (Hall, 2010; Silviu-Virgil, 2014). This is confirmed in the study by Burnett (2003), which furthermore, states that accounting education programmes must continue to innovate the methods used. The combination of school teaching with business practice teaching is the most appreciated in this study. The best form of this outside-the-classroom learning is an internship.

Stahl III and Dunning (2013) point out that accounting education is very often devoted to many separate topics without any attempt to address their integration. McWilliams and Peters (2011) created artificial case studies using financial statements in order to connect accounting and economic knowledge. Similarly, Stahl III and Dunning (2013) propose to foster thinking in the context via Case Studies in Hypo Corporation, where the basic objective is to prepare a set of basic financial statements. Alternative teaching techniques and methodologies for accounting majors include the utilisation of Twitter in introductory courses (Osgerby and Rush, 2015) and more complex simulations for advanced courses such as an audit (Mason Burdon and Munro, 2017).

Weil, McGuigan and Kern (2011) use online forums in the on-going accounting course, where the discussion centres around a case study with the focus on the preparation of the final accounts. Although the specific type and format of such a case study have remained unpublished, it is proposed that the discussions reflect proposals from other available information sources including mass media. The identified benefits of these online discussions were an improvement in students' critical thinking and strengthening of the motivation for a more detailed study of the analysed accounting phenomenon in a wider context. Several other studies focus on using IT technology in accounting education. These include the digital game (Carenys and Moya, 2016) and the educational computer program (Chan et al., 2016) based learning. The Wooten (2016) study compared students' results in classical teaching and teaching supplemented by the use of new methods, namely online courses, out-of-class and open-book exams. As a result, the positive impact of using IT technology for improving student learning has been identified.

Students of traditional introductory accounting courses are confronted with a huge volume of new information that may remain underutilised. This is associated with "information blindness" (Eppler and Mengis, 2004; Sinclair and Ashkanasy, 2005), a phenomenon where human beings are unable to store too much information if it is received in large quantities; therefore, students can easily fall into this trap and only partially use what has been explained to them (Buck, McInnis and Randolph, 2013). "Information blindness" can be prevented, for example, via real-life case studies, where students have to choose explicit or varied options based on the questions asked. This process is sometimes called "creative dysfluency" because students have to make an extraordinary mental effort when making decisions (Alter, 2013; Oppenheimer, 2008).

Stanley and Marsden (2012) have shown that solving real-life

cases develops the ability to ask questions, to work in teams, and the ability to solve real problems. Therefore, close attention should be paid to the process of introducing alternative teaching methods, not just in accounting. Simon (2007) points out that when teaching accountancy, relatively little attention is devoted to the concept of mapping, i.e. the learning process based on drawings and diagrams. On the other hand, Leauby, Szabat and Maas (2010) could not confirm that students would have achieved better test results if the traditional method of teaching would have been complemented by activity mapping. Moreover, this method requires the acquisition of the necessary mapping software.

Hosal-Akman and Simga-Mugan (2010) analysed the learning success in relation to the teaching method used. As part of the experiment, they split the students into two groups. The first group used traditional teaching methods while the second group applied the new teaching method based on cooperative learning in the form of artificially created case studies. However, the new teaching method did not have any significant effect on the student's results.

The concept of real-life case studies utilised in this paper builds on previous research by Štrach and Stejskalová (2015). Real-life case studies represent slightly edited articles from business newspapers and magazines that address a particular business situation in a company or a specific situation in the industry (An example of a simple real-life case study is presented in the Appendix). The internal motivation of students to study, which is the result of subconscious brain activity, is essential for the development of education and its effectivity (Berková and Krejčová, 2016). Internal motivation activates the right choice decisions. Participants in the decision-making process feel they have things under control. In reality, it is more about the application of will, and the related willingness to participate in the education process (Becker, 1997; Flowerday, Schraw and Stevens, 2004; Reeve, Nix and Hamm, 2003; Dweck 2006). This finding was applied in the accounting course when introducing real-life case studies.

Student Adjustment to Change in Accounting Courses

In his study, Mladenovic (2000) addressed how to reduce the negative perception of introductory accounting courses because a negative perception is one of the factors that influence students when choosing their profession. He states that the introduction of non-traditional methods of teaching, such as various non-numerical exercises, newspaper articles, or a critical analysis of current issues is not enough to limit the negative perception of accounting courses. On the contrary, the direct intervention of the lecturers in the form of continuous questioning on the course evaluation and the subsequent discussion of this evaluation significantly alleviates the overall negative evaluation of the course by the students. This conclusion was also confirmed by Wessels and Steenkamp (2009) from the South African University.

Similarly, Kanter (2007) and Duhigg (2013; 2016) emphasise the importance of communication in the process of change as the new procedures cannot be simply ordered and instead, the rules that the participants will be willing to accept as a new procedure must be established first. However, Egan (2013) points out that it is necessary to learn how to negotiate and choose different communication strategies for different types of people or interest groups. This can be learned through discussion and reflection. Moreover, according to McGrath and Bates (2013), changes can only be made as fast as the slowest member of the team can adapt.

Adopting a change in accounting education is linked to the fact that some students have become accustomed to acquiring knowledge in previous accounting courses. To change this habit according to Duhigg (2013) means to first realise that our understanding of the approach to teaching is actually a deep-rooted habit. At the same time, students should know that awareness of a habit means taking personal responsibility for its change. However, the problem is that this habit cannot be changed from the outside, i.e. by pressure from the teacher. This can only be done if the student accepts the new teaching method themselves. It is possible to form a new habit by identifying incentives and rewards and then finding alternatives (Duhigg, 2013).

In summary, whereas international researchers concentrate their focus on utilising real-life case studies in teaching and how it impacts on students, this topic is largely unexplored in the context of the Czech Republic. As it has been presented in the study by Machková and Machek (2017), insufficient utilisation of case studies in accountancy education can be identified in the Czech setting. The research results of Košovská, Ferenczi Vaňová and Váryová (2014) also pointed out that passive forms consisting of monologues are used by teachers more than dialogues during instruction, partly due to typical class size and partly due to differentiating classes into lectures and tutorials (seminars). Thus, there exists the potential for the research of real-life case studies in the context.

The aim of our study is to assess the influence of gender and the country on the student adoption of real-life case studies from the conference contribution by Stejskalová et al. (2018) on a larger research sample and, in addition, to consider the influence of other factors related to the change management, namely the previous student experience with traditional accounting education and the introduction of a possible change in teaching.

MATERIALS AND METHODS

Data were obtained from two faculties of management, one based in the Czech Republic and the other in Slovakia. Namely, the Faculty of Management, the University of Economics in Prague and the Faculty of Economics and Management, the Slovak University of Agriculture in Nitra. Real-life case studies were used at both faculties in the introductory accounting course (within the corresponding extent of two-hour-long lectures and two-hour-long tutorials) for a bachelor's degree and were taught by the same (female) lecturer at both faculties. A traditional one-semester introductory accounting course was supplemented

by three real-life case studies. These real-life case studies replaced classical tutorials and represented approximately 25% of the whole teaching time of the tutorials. Students worked on each real-life case study in teams. They discussed and argued their solution process among all team members, i.e. within a group of about 20 students. Finally, the students' result was compared with the teacher's recommended result. If there was any difference, the teacher discussed and justified her proposed result. At the end of the relevant semester (in the Czech Republic it was the winter semester and in Slovakia the summer semester), students were asked to complete a short questionnaire analysing their opinions on the inclusion of real-life case studies into the teaching of the accountancy subject for future managers. As opposed to the study by Stejskalová et al. (2018), more items were examined and our study was extended by including another academic year.

Our data is related to the opinions of students completing two academic years in 2015/16 and 2016/17, whereas in the academic year 2016/17, greater attention was paid to introducing real-life case studies into teaching with the intervention that was intended to ensure students did not refuse case studies a priori, despite not being familiar with these from secondary schools. Intervention at the beginning of real-life case study was done by the teacher, lasted almost one hour and included two main parts. The first part included the explanation of the students´ approach to new teaching methods. This means the way how past habits control and do not allow them to accept a new method without reservations. The second part consisted of a detailed explanation of real-life case study meaning and purpose. As LeClair, Thompson and Binks (2018) stated in their study, the process of successful transformation of the learning environment into an active one consists of five steps and the first step is based on articulating the change of teaching. Apart from gender, and also previous interventions and experiences of accountancy education, another factor considered was the country of study, which enabled to conduct a follow-up of the study by Stejskalová et al. (2018).

	Czech Republic (CZ)		Slovak Republic (SK)		Total	
Year	Male	Female	Male	Female	Male	Female
2015/16	26 (10)	42 (29)	35 (26)	102 (66)	61 (36)	144 (95)
2016/17	24 (7)	40 (16)	50 (25)	144 (114)	74 (32)	184 (130)
Total	50 (17)	82 (45)	85 (51)	246 (180)	135 (68)	328 (225)
	132 (62)		331 (231)		463 (293)	

Table 1: Distribution of respondents given their gender, the country of their faculty and the academic year, 2015-2017 (source: own calculation)

In total, 463 students completed the questionnaire: 205 in the academic year 2015/16 and 258 in the academic year 2016/17. The number of students is summarised in Table 1 according to their gender, the country in which they were studying and the academic year in which accountancy was taught. The number of respondents that studied accountancy at secondary school is shown in brackets. In total, 293 (63.3%) students had already taken an accounting course during secondary education.

Within the scope of this study, two areas were focused on:

1. The required teaching time dedicated to real-life case studies;
2. The perceived pros and cons of real-life case studies.

The required length of time dedicated specifically to real-life case studies was evaluated by respondents through a ratio scale where the value p represented the ratio of time given to real-life case studies (aside from typical exercises) within the tutorial stated in per cent (thus the value 100-p demonstrated the percentage ratio of time given to traditional exercises within the tutorial). With regards to the pros and cons of real-life case studies, the respondents selected as many items as they wanted from the following:

- Appropriate tutorial supplement for accountancy;
- Possibility to combine knowledge from more subjects;
- Possibility to partially substitute work experience;
- Fun part of accountancy;
- Wasted time;
- Boring way of teaching;
- Ineffective way of teaching;
- Too difficult to understand.

To analyse the answers in terms of the selected factors, linear or logistic regression was used that was conducted in the statistical software R (R Core Team, 2018). The statistical evidence was assessed at the 5% significance level.

RESULTS

Required teaching time dedicated to real-life case studies

First, descriptive statistics were carried out. According to the average answer of the respondents included in the study, it followed that a third of tutorial time should be dedicated to case studies and the remaining two thirds to exercises. This ratio seems considerably different when focusing on particular groups of respondents, see Table 2. It is apparent that the Slovak respondents accepted real-life case studies better than the Czech respondents and, furthermore, men better than women. Higher average values were achieved in the academic year 2016/17 than in 2015/16, that is, real-life case studies were accepted better in the second observed term

where a slight intervention occurred. Educational experience with accountancy at secondary school lowered the values of achieved averages in most cases, that is, respondents who were familiar with accountancy taught in the way of exercises at secondary school wanted less time given to real-life case studies on average. The most favourable ratio - 44:56 - for real-life case studies was achieved by the men at the Slovak faculty with an accountancy tutorial in the academic year 2016/17. On the contrary, the least favourable result (one-sixth of teaching time) was for the women at the Czech faculty in the academic year 2015/16 with the previous educational experience of accountancy at secondary school.

Multiple linear regression was subsequently carried out, whereas all four factors entered the linear model via 0-1 dummy variables (Experience: 0 – No, 1 – Yes, Gender: 0 – Male, 1 – Female, Country: 0 – CZ, 1 – SK, Year: 0 – 15/16, 1 – 16/17). Observed differences arising from descriptive statistics proved to be statistically significant even after

Year	Czech Republic (CZ)		Slovak Republic (SK)		Total	
	Male	Female	Male	Female	Male	Female
2015/16	24.8 (18.0)	20.0 (16.6)	42.1 (43.8)	32.7 (31.8)	34.7 (36.7)	29.0 (27.2)
2016/17	32.6 (37.1)	28.0 (28.1)	43.8 (39.2)	36.0 (33.5)	40.2 (38.8)	34.2 (32.8)
Total	28.5 (25.9)	23.9 (20.7)	43.1 (41.6)	34.6 (32.9)	37.7 (37.6)	31.9 (30.4)
	25.7 (22.1)		36.8 (34.8)		33.6 (32.1)	

Table 2: Mean responses given the respondents' characteristics as the gender, country and academic year. In brackets are the means listed separately for respondents with previous experience of accounting lessons from a secondary school, 2015-2017 (source: own calculation)

Rank by Effect Size	Factor	Difference	Estimate for Diff.	95% Conf. Int. for Diff.	*p*-value
1	Country	SK vs CZ	12.75	(9.63, 15.87)	< 0.001
2	Gender	Female vs Male	-6.32	(-9.38, -3.26)	< 0.001
3	Experience	Yes vs No	-5.61	(-8.55, -2.68)	< 0.001
4	Year	16/17 vs 15/16	4.19	(1.43, 6.95)	0.003

Table 3: Linear regression results in the form of estimates for the difference in means and the related 95% confidence intervals and *p*-values, 2015-2017 (source: own calculation)

adjusting the impact of other observed factors (condition ceteris paribus), see the results of the regression analysis represented in Table 3 where the *p*-value is significantly lower than 5% for all four factors. The greatest difference in the perception of real-life case studies was ceteris paribus between the countries of study. Slovaks studying a management degree preferred more time for case studies, precisely by 12.75 percentage points more on average than their Czech colleagues with the same tracked characteristics. From the observed factors, the intervention used in the academic year 2016/17 had the least impact on the result but is still statistically significant.

Perceived pros and cons of real-life case studies

The respondents selected mostly positive items in their answers rather than negative ones. The majority (74.7%) of respondents considered the real-life case-based studies as an appropriate supplement to the accountancy tutorial in particular. About 40% of respondents were in favour of partially replacing practical experience with them. The third most common answer was that real-life case studies combine knowledge gained from other subjects (39.1%). It can be seen in Table 4 that respondents who have had experience with accountancy education at secondary school perceived real-life case studies in a more critical light than those who have not had a similar experience, even though they viewed them as a fun part of learning.

The impact of intervention in the academic year 2016/2017 was confirmed as expected through the respondents' answers. Positive items were selected more frequently compared to the last academic year and negative items were selected less frequently.

Table 5 represents the results from eight models of multiple logistic regression corresponding to eight items in the questionnaire (arranged according to how frequently they were selected) where the response is formed by the 0-1 quantity characterising the selection of a particular item (0 – not selected, 1 – selected). When focusing on the pros of real-life case studies (items 1 to 4 in Table 5), it is apparent that the tendency direction is diversified in the Country column. According to point estimates for odds ratios (ORs), it is more likely that items 1 and 4 are selected by the Slovaks (estimate for OR > 1) and, moreover, it is more likely that items 2 and 3 are selected by the Czechs (estimate for OR < 1). However, these tendencies are not statistically significant ($p > 0.05$). The Experience factor impacts the perception of case studies as anticipated, apart from item 4 "Fun Part of Learning" where the probability of selecting this positive item is higher amongst

Year	Country		Gender		Experience		Year		Total
	CZ	SK	M	F	N	Y	15/16	16/17	
+ Appropriat Teaching Supplement	74.2	74.9	77.0	73.8	79.4	72.0	70.7	77.9	74.7
+ Partial Compensation for Real Experience	41.7	39.6	44.4	38.4	43.5	38.2	36.6	43.0	40.2
+ Combining Knowledge from More Subjects	43.9	37.2	37.8	39.6	42.4	37.2	28.3	47.7	39.1
+ Fun Part of Learning	13.6	16.9	12.6	17.4	11.8	18.4	14.6	17.1	16.0
- Too Difficult to Understand	13.6	2.4	3.7	6.4	4.7	6.1	10.7	1.6	5.6
- Boring Way of Study	5.3	5.1	2.2	6.4	1.8	7.2	6.8	3.9	5.2
- Useless Waste of Time	7.6	3.9	4.4	5.2	2.4	6.5	6.8	3.5	5.0
- Ineffective Way of Teaching	5.3	3.6	2.2	4.9	2.4	5.1	5.9	2.7	4.1

Table 4: Percentages of responses given the respondents characteristics as the gender, country and academic year, 2015-2017 (source: own calculation)

students with previous educational experience of accountancy at secondary school.

The effect of the Gender factor on the perception of case studies has not been statistically confirmed; nevertheless, women tended to perceive real-life case studies as "Combining Knowledge from More Subjects" or "Fun Part of Learning" more frequently (ceteris paribus) than men. Intervention impacts positive items as anticipated. In the academic year 2016/17, the pros of real-life case studies were selected more frequently. In particular, for item 3 "Combining Knowledge from More Subjects", the difference in rating among the years is statistically significant.

No.	Item	Country SK vs CZ	Gender Female vs Male	Experience Yes vs No	Year 16/17 vs 15/16
1	+ Appropriate Teaching Supplement	1.10 (0.68, 1.79) $p = 0.685$	0.88 (0.54, 1.43) $p = 0.607$	0.67 (0.42, 1.07) $p = 0.090$	1.45 (0.95, 2.21) $p = 0.088$
2	+ Partial Compensation for Real Experience	0.95 (0.62, 1.46) $p = 0.824$	0.81 (0.53, 1.22) $p = 0.307$	0.84 (0.56, 1.26) $p = 0.398$	1.32 (0.90, 1.92) $p = 0.155$
3	+ Combining Knowledge from More Subjects	0.69 (0.45, 1.07) $p = 0.101$	1.16 (0.75, 1.79) $p = 0.503$	0.85 (0.56, 1.28) $p = 0.433$	2.39 (1.61, 3.55) $p < 0.001$
4	+ Fun Part of Learning	1.11 (0.61, 2.01) $p = 0.737$	1.33 (0.73, 2.40) $p = 0.350$	1.59 (0.90, 2.82) $p = 0.110$	1.19 (0.71, 1.98) $p = 0.509$
5	- Too Difficult to Understand	0.15 (0.06, 0.36) $p < 0.001$	2.34 (0.81, 6.75) $p = 0.117$	1.54 (0.61, 3.88) $p = 0.357$	0.15 (0.05, 0.45) $p < 0.001$
6	- Boring Way of Study	0.78 (0.30, 1.99) $p = 0.596$	2.65 (0.77, 9.18) $p = 0.123$	4.03 (1.16,13.94) $p = 0.028$	0.55 (0.23, 1.29) $p = 0.167$
7	- Useless Waste of Time	0.42 (0.17, 1.03) $p = 0.058$	1.10 (0.41, 2.93) $p = 0.848$	3.36 (1.09,10.40) $p = 0.035$	0.56 (0.23, 1.33) $p = 0.188$
8	- Ineffective Way of Teaching	0.59 (0.22, 1.59) $p = 0.298$	2.18 (0.61, 7.76) $p = 0.227$	2.22 (0.71, 6.97) $p = 0.171$	0.47 (0.18, 1.23) $p = 0.123$

Table 5: Logistic regression results in the form of estimates for odds ratios and the related Wald's 95% confidence intervals and *p*-values, 2015-2017 (source: own calculation)

In terms of cons related to case studies (items 5 to 8), four statistically significant results were identified. The negative item "Too Difficult to Understand" was influenced by the Country and Year factors. The Czechs were more likely to select this item than the Slovaks with the same characteristics, or as the case may be, in the academic year 2015/16 as opposed to the following year for students of the same type. In other words, intervention seemed to help to reduce the negative perception of real-life case studies as difficult to understand the form of tutorial. With regards to a previous educational experience of accountancy, this experience

seemed to mainly impact the higher probability of perceiving real-life case studies as a boring tutorial or a waste of time.

DISCUSSION

The effectiveness of methodologies and methods in the process of knowledge acquisition depends on the circumstances and the environment in which they are formed (Lopes, 2015). This is consistent with the results of our research that the adoption of real-life case studies is related to the previous experience of the traditional ways of accounting education. Teachers must be able to pass the information onto students who previously attended accounting classes as well as to students who are complete beginners. In terms of students with previous experience, this concerns breaking the barrier associated with previous habits (and possibly changing previous attitudes towards the subject) and in terms of students without previous experience, it is easier to implement new teaching practices or to arouse their interest in the given subject. Our study shows how teacher communication with students can change the perception of new teaching practices in accounting. This result is consistent with the conclusions of Mladenovic (2000) or Wessels and Steenkamp (2009). On the other hand, if we consider students´ previous work experience, Ballantine and Larres (2004) stress that these students do not perceive the benefits of using case studies in accounting any differently than those students who have not yet had experience of accounting.

A good teacher should definitely aim to help students to become wiser. According to Goldberg (2006), wisdom is usually observed in people who are able to almost instantly, and seemingly with little effort, resolve a difficult or unexpected problem. This ability is not defined solely by a large number of "pattern" situations, phenomena or behaviours, i.e. by a large number of facts stored in the left hemisphere of the brain. The traditional accounting education method contributes to managers' wisdom to a much lesser degree than education based on real-life case studies. The ability to solve problems better after the introduction of the case studies into accounting education is also confirmed by Stanley and Marsden (2012). A teaching method itself is one of the key components of teaching quality and delivery of learning outcomes (Bidabadi et al., 2016; Leeman and Wardekker, 2011; O´Neill, 2012), which can be assessed by reflecting on feedback from learners. It can be said that the use of real-life case studies in accountancy education is not only innovative but also contributes to education quality. As stated by Vnoučková, Urbancová and Smolová (2017), the current university environment is highly competitive and to ensure quality is paramount.

There is a number of other studies that explore the possible determinants of study success in accounting courses. Doran, Bouillon and Smith (1991) investigated the dependency of study results in the introductory and ongoing accounting course using gender, previous study results, and if they had experienced accountancy classes in their secondary school. While the previous study results turned out to be decisive, the study of accountancy at secondary school, the gender of the student and the teacher had no statistically significant effect on learning success. In our case, we did not focus on the subject's study results but investigated the acceptance of case studies with respect to similar determinants. However, in our study, student gender and their previous experience with accounting courses during secondary education had a statistically significant influence.

In addition, this study confirmed that the approach of learners to accounting has been influenced by previous experience with the discipline, hence in line with deep-rooted habits as suggested by Duhigg (2013). In our study, previous experience with accounting had a significant effect on adoption of real-life case studies. Students with previous exposure to accounting classes expressed a less positive view on the introduction of novel teaching method.

The real-life case studies, however, have undoubtedly expanded students' thinking and according to our study, students considered them beneficial. Therefore, we came to similar conclusions as Stanley and Marsden (2012). Berényi and Deutsch (2018), who have conducted research about the most useful teaching methods state that business students prefer active participation in teaching and simulations and that case studies were evaluated better than lectures. On the other hand, if we take into account the subject being taught, here accounting, lectures have been identified by students as a suitable teaching method.

However, our study is limited as it is based on the results of a questionnaire survey from two academic years at two universities. Moreover, the questionnaire, although containing semi-open questions, was the only data acquisition method used. In addition, the adoption of new practices in accounting education is explored in this article only from the students' point of view. Future studies could consider the impact of real-life case studies on the acquisition of learning outcomes, the satisfaction of instructors or classroom dynamics. Other contingent factors and antecedents such as previous practical experience with accounting (in line with Ballantine and Larres, 2004), overall student results (in accordance to Hosal-Akman and Simga-Mugan, 2010) or retention (as suggested by Sargent, Borthick and Lederberg, 2011) could be considered as well.

CONCLUSION

Our study suggests a number of particular results related to the inclusion of real-life case studies into accountancy teaching and its acceptance by students. It is evident that the introduction of novel teaching methods such as the real-life case studies shall be performed with caution in the discipline of accounting and that there might be several factors to consider. Firstly, men seem to prefer the use of case studies in teaching and perceive them positively. This could be linked to them being more open to and accepting of changes in a better way. Secondly, the significance of previous intervention regarding the inclusion of real-life case studies into tuition by tutors has been confirmed. If students are informed, and the concept of the new teaching method is explained, this reflects in a more positive perception of the case studies. It is important to emphasise that students should be well informed. Consequently, students understand what is to be expected so can, therefore, prepare themselves for the situation of the new way of teaching. In addition, our

study examined the differences between students who have previously experienced an accountancy tutorial at secondary school and those who have not. The results have clearly indicated that students with previous accountancy tutorial experience perceive real-life case studies less positively than their colleagues. A possible explanation for this could be a combination of a whole range of aspects. Students are already familiar with a certain way of teaching and are not inclined towards a change in teaching. They might automatically view a barrier in the new way of teaching that could not be easily overcome. Another factor could be the tutor's personality and the students' personal traits. Furthermore, students with previous experience with accounting may need a different intervention/explanation for an instructor than other students. We plan to extend the study with a follow-up research paper, which will cover two main areas. Having identified the importance of using interventions at the beginning of the learning process, we intend to focus on different types of interventions and their impact on the adoption of case studies by students. Furthermore, we aim to investigate changes in students' abilities before and after using real-life case studies in the accounting course.

ACKNOWLEDGEMENTS

This paper was supported by the Czech Science Foundation (GAČR) under the grant, number 18-01159S.

REFERENCES

Alter, A.L. (2013) 'The benefits of cognitive disfluency', *Current Directions in Psychological Science*, vol. 22, no. 6, pp. 437-442. https://doi.org/10.1177/0963721413498894

Ballantine, J.A. and Larres, P.M. (2004) 'A critical analysis of students' perceptions of the usefulness of the case study method in an advanced management accounting module: the impact of relevant work experience', *Accounting Education*, vol. 13, no. 2, pp. 171-189. https://doi.org/10.1080/0963928041000167688 5

Becker, D.A.A. (1997) 'The effects of choice on auditors' intrinsic motivation and performance', *Behavioral Research in Accounting*, vol. 9, pp. 1-19.

Berényi, L. and Deutsch, N. (2018) 'Effective teaching methods in business higher education: a students' perspective', *International Journal of Education and Information Technologies*, vol. 12, pp. 37-45.

Berková, K. and Krejčová, K. (2016) 'Effect of teachers' abilities on students' motivation with varying levels of intellectual abilities in the economics', *Journal on Efficiency and Responsibility in Education and Science*, vol. 9, no. 3, pp. 81-87. https://doi.org/10.7160/eriesj.2016.090304

Bidabadi, N.S., Isfahani, A.N., Rouhollahi, A. and Khalili, R. (2016) 'Effective teaching methods in higher education: requirements and barriers', *Journal of advances in medical education & professionalism*, vol. 4, no. 4, pp. 170-178.

Bonk, C.J. and Smith, G.S. (1998) 'Alternative instructional strategies for creative and critical thinking in the accounting curriculum', *Journal of Accounting Education*, vol. 16, no. 2, pp. 261-293.

Bonwell, C.C. and Eison, J.A. (1991) *Active Learning: Creating Excitement in the Classroom,* 1991 ASHE-ERIC Higher Education Reports, ERIC Clearinghouse on Higher Education, The George Washington University, Washington, DC.

Boyce, G., Williams, S., Kelly, A. and Yee, H. (2001) 'Fostering deep and elaborative learning and generic (soft) skill development: the strategic use of case studies in accounting education', *Accounting Education: An International Journal*, vol. 10, no. 1, pp. 37-60. https://doi.org/10.1080/09639280121889

Buck, J.L., McInnis, E. and Randolph, C. (2013) 'The new frontier of education: The impact of smartphone technology in the classroom', *American Society for Engineering Education*, vol. 1, no. 1, pp. 1-11.

Burnett, S. (2003) 'The future of accounting education: A regional perspective', *Journal of Education for Business*, vol. 78, no. 3, pp. 129-134. https://doi.org/10.1080/08832320309599709

Buzan, T. (2010) *Use your head: How to unleash the power of your mind.* Pearson, BBC Active, Harlow, England.

Carenys, J., Moya, S. (2016) 'Digital game-based learning in accounting and business education', *Accounting Education*, vol. 25, no. 6, pp. 598–651. https://doi.org/10.1080/09639284.2016.1241951

Chan, S.H., Song, Q., Rivera, L.H., Trongmateerut, P. (2016) 'Using an educational computer program to enhance student performance in financial accounting', *Journal of Accounting Education*, vol. 36, pp. 43–64. https://doi.org/10.1016/j.jaccedu.2016.05.001

Ciobanu, N.R. (2018) 'Active and Participatory Teaching Methods', *European Journal of Education*, vol. 1, no. 2, pp. 69-72. https://dx.doi.org/10.26417/ejed.v1i2.p69-72

Cullen, J., Richardson S. and O'Brien, R. (2007) 'Exploring the teaching potential of empirically-based case studies', *Accounting Education*, vol. 13, no. 2, pp. 251-266. https://doi.org/10.1080/09639280420001676648

Doran, B.M., Bouillon, M.L. and Smith, C.G. (1991) 'Determinants of Student Performance in Accounting Principles I and II', *Issues in Accounting Education*, vol. 6, no. 1, pp. 74-84.

Duhigg, C. (2013) *The Power of Habit: Why We Do What We Do, and How to Change*, Random House, London, United Kingdom.

Duhigg, C. (2016) *Smarter Faster Better: The Secrets of Being Productive*, Random House, New York.

Dweck, C.S. (2006) *Mindset: The New Psychology of Success*. Random House Books, New York, USA.

Egan, G. (2013) *The skilled helper: A problem-management and opportunity-development approach to helping*, Cengage Learning, Belmont, USA.

Eppler, M. and Mengis, J. (2004) 'The Concept of Information Overload: A Review of Literature from Organization Science, Accounting, Marketing, MIS, and Related Disciplines', *The Information Society*, vol. 20, no. 5, pp. 325-344. https://doi.org/10.1080/01972240490507974

Flowerday, T., Schraw, G. and Stevens, J. (2004) 'The role of choice and interest in reader engagement', *The Journal of Experimental Education*, vol. 72, no. 2, pp. 93-114. https://doi.org/10.3200/JEXE.72.2.93-114

Goldberg, E. (2006) *The wisdom paradox: How your mind can grow stronger as your brain grows older,* Penguin, New York, USA.

Goleman, D. (1996) 'Emotional Intelligence. Why It Can Matter More than IQ', *Learning*, vol. 24, no. 6, pp. 49-50.

Goleman, D. (2011) *What Makes a Leader?*, Harvard Business School Publishing, Boston, USA.

Hall, M. (2010) 'Accounting information and managerial work', *Accounting, Organizations and Society*, vol. 35, no. 3, pp. 301-315. https://doi.org/10.1016/j.aos.2009.09.003

Healy, M. and McCutcheon, M. (2010) 'Teaching with Case Studies: An Empirical Investigation of Accounting Lecturers' Experiences', *Accounting Education*, vol. 19, no. 6, pp. 555-567. https://doi.org/10.1080/09639284.2010.501577

Hosal-Akman, N. and Simga-Mugan, C. (2010) 'An assessment of the effects of teaching methods on the academic performance of students in accounting courses', *Innovations in Education and Teaching International*, vol. 47, no. 3, pp. 251-260. https://doi.org/10.1080/14703297.2010.498176

Kanter, R.M. (2007) 'The enduring skills of change leaders', *NHRD Journal*, vol. 1, pp. 53-59. https://doi.org/10.1002/ltl.40619991305

Kermis, G. and Kermis, M. (2010) 'Professional Presence and Soft Skills: A Role for Accounting Education', *Journal of Instructional Pedagogies*, vol. 2, pp. 1-10.

Košovská, I., Ferenczi Vaňová, A. and Váryová, I. (2014) 'Tvorivosť učiteľa ako predpoklad skvalitňovania vzdelávacieho procesu', *Dnešné trendy inovácií*, pp. 88-95.

Leauby, B.A., Szabat, K.A. and Maas, J.D. (2010) 'Concept Mapping—an Empirical Study in Introductory Financial Accounting 1', *Accounting Education: An International Journal*, vol. 19, no. 3, pp. 279-300. https://doi.org/10.1080/09639280903412334

LeClair, R.J., Thompson, K.H. and Binks, A.P. (2018) 'A Universal Guide to Transitioning Didactic Delivery into an Active Classroom', *Medical Science Educator*, pp. 1-8. https://doi.org/10.1007/s40670-018-0599-1

Leeman, Y. and Wardekker, W. (2011) 'Redesigning vocational education: The possibilities of design-based research' *Journal of Curriculum Studies*, vol. 43, no. 3, pp. 313-331. https://doi.org/10.1080/00220272.2011.557838

Leventis, S., Dimitropoulos, P. and Owusu-Ansah, S. (2013) 'Corporate governance and accounting conservatism: Evidence from the banking industry' *Corporate Governance: An International Review*, vol. 21, no. 3, pp. 264-286. https://doi.org/10.1111/corg.12015

Lopes, I.T. (2015) 'Research methods and methodology towards knowledge creation in accounting', *Contaduría y Administración*, vol. 60, pp. 9-30. https://doi.org/10.1016/j.cya.2015.08.006

Machková, E. and Machek, O. (2017) 'Using Case Studies in Accounting Education at the Czech Universities', *Paidagogos-Journal of Education in Contexts*, vol. 16, no. 2, pp. 107-124.

Mason Burdon, W. and Munro, K. (2017) 'Simulation–is it all worth it? The impact of simulation from the perspective of accounting students', *The International Journal of Management Education*, vol. 15, no. 3, pp. 429-448. https://doi.org/10.1016/j.ijme.2017.07.001

McGrath, J. and Bates, B. (2013) *The Little Book of Big Management Theories:...and how to use them*, Pearson, London, United Kingdom.

McWilliams, V.B. and Peters, M.F. (2011) 'An integrated approach to beginning financial accounting and finance courses', *Issues in Accounting Education*, vol. 27, no. 1, pp. 299-336. https://doi.org/10.2308/iace-50090

Mladenovic, R. (2000) 'An investigation into ways of challenging introductory accounting students' negative perceptions of accounting', *Accounting Education*, vol. 9, no. 2, pp. 135-155. https://doi.org/10.1080/09639280010000147

O'Neill, D.K. (2012) 'Designs that fly: What the history of aeronautics tells us about the future of design-based research in education', *International Journal of Research & Method in Education*, vol. 35, no. 2, pp. 119-140. https://doi.org./10.1080/1743727X.2012.683573

Oppenheimer, D.M. (2008) 'The secret life of fluency', *Trends in cognitive sciences*, vol. 12, no. 6, pp. 237-241. https://doi.org/10.1016/j.tics.2008.02.014

Osgerby, J. and Rush, D. (2015) 'An exploratory case study examining undergraduate accounting students' perceptions of using Twitter as a learning support tool', *The International Journal of Management Education*, vol. 13, no. 3, pp. 337-348. https://doi.org/10.1016/j.ijme.2015.10.002

R Core Team (2018) 'R: A language and environment for statistical computing', R Foundation for Statistical Computing, Vienna, Austria, available at: http://www.R-project.org/

Reeve, J., Nix, G. and Hamm, D. (2003) 'Testing models of the experience of self-determination in intrinsic motivation and the conundrum of choice', *Journal of educational psychology*, vol. 95, no. 2, pp. 375-392. https://doi.org/10.1037/0022-0663.95.2.375

Sargent, C.S., Borthick, A.F. and Lederberg, A.R. (2011) 'Improving retention for principles of accounting students: Ultra-short online tutorials for motivating effort and improving performance', *Issues in Accounting Education*, vol. 26, no. 4, pp. 657-679.

Silviu-Virgil, C. (2014) 'The importance of the accounting information for the decisional process', *Annals Of The University Of Oradea, Economic Science Series*, vol. 23, no. 1, pp. 593-603.

Simon, J. (2007) 'Concept mapping in a financial accounting theory course', *Accounting Education*, vol. 16, no. 3, pp. 273-308. https://doi.org/10.1080/09639280701430306

Sinclair, M. and Ashkanasy, N.M. (2005) 'Intuition myth or a decision-making tool?', *Management Learning*, vol. 36, no. 3, pp. 353-370. https://doi.org/10.1177/1350507605055351

Singer, R.A. and Wiesner, T. (2013) 'The Future of Undergraduate Accounting Programs and Curricula', *Management Accounting Quarterly*, vol. 14, no. 4, pp. 22-31.

Stanley, T. and Marsden, S. (2012) 'Problem-based learning: Does accounting education need it?', *Journal of Accounting Education*, vol. 30, no. 3-4, pp. 267-289. https://dx.doi.org/10.1016/j.jaccedu.2012.08.005

Stahl III, C.E. and Dunning, G.R. (2013) 'Instructional Case-Hypo Corporation, The Financial Accounting Educative Process, A Void! ' *Journal of Accounting and Finance*, vol. 13, no. 6, pp. 209-221.

Stejskalová, I., Bednářová, M., Komárková, L. and Bartošová-Vrbová, M. (2018) 'Case Studies in Accounting Courses for Managers: Czech and Slovak Comparison' In: *Proceedings of the 15th International Conference Efficiency and Responsibility in Education 2018* (ERIE 2018) Prague: Czech University of Life Sciences Prague, 2018, pp. 373–379.

Štrach, P. and Stejskalová, I. (2015) 'New Didactic Approaches in Accounting: Moving Beyond the Calculation Exercise', In *Proceedings of Business and Management Conferences*

(No. 2304424), International Institute of Social and Economic Sciences.

Turner, M., Baskerville, R. (2013) 'The experience of deep learning by accounting students', *Accounting Education: An International Journal*, vol. 22, no. 6, pp. 582-604. https://doi.org/10.1080/09639284.2013.847323

Vnoučková, L., Urbancová, H. and Smolová, H. (2017) 'Factors Describing Students' Perception on Education Quality Standards', *Journal on Efficiency and Responsibility in Education and Science*, vol. 10, no. 4, pp. 109-115. https://doi.org/10.7160/eriesj.2017.100403

Vondra, Z. (2017) 'Quality Control and Improvements Mechanism of Study Field - Focused on Professional Study Field', *Journal on Efficiency and Responsibility in Education and Science*, vol. 10, no. 1, pp. 16-23. https://dx.doi.org/10.7160/eriesj.2017.100103

Wales, S. (2002). Why coaching? *Journal of change management,* vol. 3, no. 3, pp. 275-282. https://doi.org/10.1080/714042542

Weil, S., McGuigan, N. and Kern, T. (2011) 'The usage of an online discussion forum for the facilitation of case-based learning in an intermediate accounting course: A New Zealand case', *Open Learning*, vol. 26, no. 3, pp. 237-251. https://doi.org/10.1080/02680513.2011.611685

Wessels, P.L. and Steenkamp, L.P. (2009) 'An investigation into students' perceptions of accountants', *Meditari: Research Journal of the School of Accounting Sciences*, vol. 17, no. 1, pp. 117-132.

Wooten, T. (2016) 'Leveraging online testing to enhance student learning', *Advances in Accounting Education*, vol. 19, pp. 141–163. https://doi.org/10.1108/S1085-462220160000019006

APPENDIX - An Example of a Real-Life Case Study

BASIC ACCOUNTING CATEGORIES

Objective:

If a student is able to answer the questions asked, and solve the underlying calculations in order to support their own decision-making process following a real-life case study, then they will be able to verify for themselves the understanding of the context between the selected basic accounting categories and will be able to place them on the balance sheet. At the same time, they are able to learn how the value of certain accounting categories affects managerial decisions. The case study is based on the article of the same name by Iva Špačková, ČTK.

Source:

http://ekonomika.idnes.cz/hospodareni-ceske-pojistovny-dke-ekoakcie.aspx?c=A120323_171207_ekoakcie_spi

Assignment:

Česká pojišťovna saw their profit fall last year by two-thirds to 3.5 billion CZK

(truncated text)
Česká pojišťovna is part of Generali PPF Holding B.V., which operates in fourteen Central and Eastern European countries. Generali PPF Holding manages assets of 15 billion EUR (over 375 billion CZK) through subsidiaries and provides their services to more than 13 million clients in the region. The holding headquarters is based in the Netherlands and its main branch office is based in Prague. It is a joint venture of Assicurazioni Generali with a 51% stake and the PPF Group, which owns a 49% stake in the holding.
Česká pojišťovna earned two-thirds less in 2011 than in 2010 when profits fell to 3.55 billion CZK. The largest insurer on the Czech market collected insurance premiums of 33.4 billion CZK, which was one-tenth less than the previous year.
The equity of Česká pojišťovna at the end of 2011 amounted to 17.5 billion CZK and the balance sheet total was 116.5 billion CZK. The total gross technical provisions amounted to 86.3 billion CZK.
"Last year we started to fundamentally change Česká pojišťovna. Starting with the introduction of procedural changes to strengthen the performance and dynamics of the business network, we introduced a number of new products and services and began to change the culture within the company. Our share of newly concluded policies has grown once again," says Pavel Řehák, the CEO of Česká pojišťovna commenting on last year's results.
In his opinion, the changes had a positive impact on operating profit, which has increased year-on-year by 548 billion CZK. One-off operations were a contributing factor to the huge gain. The year-on-year loss on insurance premiums was predominately due to the continuing decline in the car insurance market and a smaller volume of life insurance products", added Řehák.

Tasks to Solve:

1. After reading the article, how would you assess Česká pojišťovna? Is it a successful, trustworthy company, does it have financial problems that it is unable to deal with …?
2. Select the basic accounting categories from the first three paragraphs of the text and place them in the prepared balance sheet table. Assess the relationship between the balance sheet total and equity; also the relationship between the balance sheet sum and the technical provisions.
3. What does the company have to do in order to prevent a decline in profit?
4. Explain: "One-off operations were the contributing factor to the huge gain"?
5. What is the difference between the accounting categories for "technical reserves" and the "reserve fund"?
6. How did your opinion change in terms of the financial situation of Česká pojišťovna after solving the above-mentioned tasks?

Balance Sheet:

Assets	Gross	Correction	Net	Liabilities	Net

Full research paper

TRACKING THE UNIVERSITY STUDENT SUCCESS: STATISTICAL QUALITY ASSESSMENT

Ivana Čechová[1]
Jiří Neubauer[2]✉
Marek Sedlačík[2]

[1] Language center, University of Defence, Czech Republic

[2] Department of Quantitative Methods, University of Defence, Czech Republic

✉ jiri.neubauer@unob.cz

ABSTRACT

Higher education institutions are continually striving to make education relevant to the working environment students will encounter upon graduation. One of the tools for enhancing an institution's quality and sufficiently informing students about their outcomes and learning opportunities is a quality assessment. Quality assessment is a long process which establishes measurable student learning outcomes, then analyses and interprets them. This enables students to receive feedback on their learning and helps them to improve their performance. The authors' objective was to gather empirical data on students´ learning in order to improve the process of learning and to refine study programmes. A longitudinal study was used to observe students' performance and outcomes from entrance exams to state exams. Statistical analysis revealed that there is a correlation between the results of the admission tests and the study results, especially the connection between the results of the entrance test and the chance of successful completion of studies. No statistically significant correlation was found between the overall results of military students' studies. An interesting issue is a comparison between military and civilian students, as well as civilian students´ results. As a continuous process, assessment of students' performance was observed up until the Final State Examination.

KEYWORDS

Statistical quality assessment, students' performance, quality assurance, learning outcomes, military and civilian students, higher education

HOW TO CITE

Čechová I., Neubauer J., Sedlačík M. (2019) 'Tracking the University Student Success: Statistical Quality Assessment', *Journal on Efficiency and Responsibility in Education and Science*, vol. 12, no. 1, pp. 12-25. http://dx.doi.org/10.7160/eriesj.2019.120102

Article history
Received
October 23, 2018
Received in revised form
January 31, 2019
Accepted
March 6, 2019
Available on-line
March 31, 2019

Highlights

- *No statistically significant correlation was found between the overall results of entrance tests and the results in military students' studies.*
- *There is a significant difference in the entrance test results between successful and unsuccessful students.*
- *The entrance test results can help predict the probability of successful completion of studies.*

INTRODUCTION

The term 'Education' derives from the Latin words 'Educere' (in English 'Educare'), which denotes the act of teaching, and 'Educatum' meaning to train or mould. As a general concept, it is not limited only to school-based teaching and learning processes, which are perceived as activities taking place in an educational environment and involving the learning of a subject.

In its broadest sense, education is the key to learning, understanding, and successfully meeting the challenges of the contemporary world. The importance of education in Europe has been endorsed at the highest level in the last decades. The European Union, and the Czech Republic as a member, pay constant attention to education in all its forms: formal, non-formal, and informal. According to strategic documents: 'Education and training systems must adapt to the new realities of the 21st century. The European Union and its special commission for education work closely with particular policymakers to support the development of higher education policies in EU countries in line with the Education and Training 2020 strategy' (ET2020). The modernisation agenda link outside the EC domain for higher education fixes five key priorities for higher education in the EU:

- increasing the number of higher education graduates
- improving the quality and relevance of teaching and learning

- promoting the mobility of students and staff and cross-border cooperation
- strengthening the "knowledge triangle", linking education, research, and innovation
- creating effective governance and funding mechanisms for higher education (ET 2020)

Politicians, stakeholders, teachers, and parents consider schools and universities to be a place where students are supposed to learn. Students themselves consider schools and universities to be a place where they are supposed to be taught. Kurtus (2012) defines the educational process as: 'a general process for providing education to students, such that they understand the information, are able to use or apply it and retain what they have learned'. For Peter Senge (1990), real learning gets to the heart of what it is to be human. We become able to re-create ourselves. This applies to both individuals and organizations.

The face of higher education has been changing rapidly, especially in recent decades. In her report, Knight (2006: 7) emphasizes: 'Higher education is subject to mounting pressures. It is expected, for example, to engage with the challenges of sustainable development and to accommodate itself to mounting demands for lifelong learning'. Cech, Chromy a Skupinova. (2015: 189) emphasize: 'Education has been crucial for successful career and life, for growth, careers, and jobs'.

Moreover, new trends and challenges posed by the growing commercialization of higher education require that increased attention be paid to such issues as the quality of higher education provision and the portability of higher education qualification. 'New providers, such as virtual universities, branch campuses in other countries and corporate universities, are creating a new paradigm of higher education largely as a response to new demand, but also as a way of taking advantage of technological developments' (Knight 2006: 12).

Concern over quality in higher education, or generally in education, is not a new phenomenon and occurs in strategic documents such as UNESCO and Bologna process, among others. Article 11(a) of the World Declaration of Higher Education (UNESCO, 1998) declares: 'Quality in higher education is a multidimensional concept, which should embrace all its functions, and activities: teaching and academic programmes, research and scholarship, staffing, students, buildings, facilities, equipment, services to the community and the academic environment'.

In Europe, ministers responsible for higher education created and adopted the standards for quality assurance. The European Association for Quality Assurance in Higher Education was established to represent quality assurance, promote European cooperation in the field of quality assurance in higher education, and disseminate information and expertise among its members and to stakeholders in order to develop and share good practice and foster the European dimension of quality assurance (The European Association for Quality Assurance in Higher Education, 2005). Quality assurance is emphasized in the Bologna Process materials and places great emphasis on strengthening quality assurance.

QUALITY ASSESSMENT IN HIGHER EDUCATION

Quality assessment of teaching and learning is one of the core values of modern higher education. It is difficult to articulate one definition of quality assessment as each individual has their own instinctive understanding of what it means. Liu (2016: 16) combines many authors' experience and research and claims 'Quality is a relative concept. It depends upon a "benchmark", and it means different things to different stakeholders, governments, employers, students, academics, society, and so on'. Quality, assessment, and their related concepts and goals have become increasingly prominent in almost all sectors of our lives. For students, quality of education is connected to the contribution to individual development and the preparation for a position in society. Academic workers are more likely to define quality as a good academic training based on good knowledge transfer, a good learning environment and a good relationship between teaching and research (Vroeijenstijn, 1995). Quality assessment is used for purposes of accountability and the improvement of teaching and learning. In addition, stakeholders such as employers and government funding councils rely on assessment to provide them with data which ensures the quality of provision and standards of education (Hinett and Knight, 1996).

Increased access to higher education has resulted in unprecedented growth in the number of students attending universities in the world, and the Czech Republic is no exception. The rapid expansion of higher education over the last decade in Europe has raised serious public concerns about the adequacy of existing institutions for sustaining academic quality and standards and has led to the initiation of quality assessment in a number of countries.

The concept of 'quality' has become an established topic, and the concept of quality assurance and quality enhancement are widely used in higher education institutions (Noha, 2015). Moreover, Noha claims that 'quality' was originally derived from industries and businesses, and its definition in an educational context should be different from its meaning in other areas. This is mainly because the education process is very complicated and includes many elements, such as students, instructors, administrators, curriculum, teaching and assessment methods, which work with each other in a complex manner (Noha, 2015).

Higher education providers emphasize service quality because of its strategic role in enhancing competitiveness, attracting new students and retaining existing students (Sultan and Wong, 2013). Many authors have studied the impact of quality assessment on universities and found that it relates to the characteristics of external quality assessment schemes and the national and institutional context of the evaluated universities, as well as their initiatives and responses (Haapakorpi, 2011; Malau-Aduli, Zimitat and Malau-Aduli, 2011). According to Liu (2016), the growth and diversification of higher education, along with associated changes in pedagogy, require higher education systems to surrender any idea of broad common standards of academic performance between institutions, and even between subjects within a single university. Students gain their degrees or credentials with widely varying levels of proficiency and at different levels of difficulty. The same

qualifications have different values for students from different universities or departments. Consequently, quality assessment has been initiated as a way to regulate the quality of provisions in various higher education institutions, as well as to publish information about quality to stakeholders (Liu, 2016).

The successful mastery of academic content, once viewed entirely as the learners' responsibility, is considered as a shared responsibility between the student, the teacher, and the educational institution (college, university). At the individual student level, learning outcomes are used to express what learners are expected to achieve and how they are expected to demonstrate that achievement. Learning outcomes can be defined as student attainment due to engagement in a particular set of teaching and learning experiences (Tam, 2014).

Satisfaction with their university, but not their perceptions of themselves as university customers, is a predictor of educational involvement. Not surprisingly, students who were more involved in their education tended to be older, have higher grade point averages, and attend class more often. However, these students also felt more entitled to outcomes, although they did not differ in their perceptions of whether or not they were customers of the university (Finney, Gillespie and Finney, 2010). According to Sapri, Kaka and Finch (2009) students' satisfaction plays an important role in determining accuracy and authenticity. Barnett (2011) claims that the satisfaction of students is important, as it is the only performance indicator of service quality for service providers of higher education.

There are many approaches to explaining or predicting students' performance and assessing quality in education (Geiger and Cooper, 2010; Kappe and van der Flier, 2012; Shahiri, Husaina and Rashida, 2015; Okubo et al., 2017; Gerritsen-van Leeuwenkamp, Joosten-ten Brinke and Kester, 2017). Mohamadi uses an instrument-electronic writing forum to get data for both formative and summative assessment (Mohamadi, 2018, Mazouch et al., 2018). However, the authors decided on the observation of students' performance, from entrance tests to their final exams, at one faculty of the University of Defence.

Many studies in this area have been conducted to assess the relationship between secondary school final exams and students´ future academic performance (Platt, Turocy and Mc Glumphy 2001; Wharrad, Chapple and Price, 2003). Some studies focus on the eligibility test scores and academic performance (McIntosh and Munk, 2007; Winter and Dodou, 2011) All these studies were conducted among medical students or related specializations, however, no studies focus on the military environment were found.

Some authors concentrate their attention on the relationship between entrance examination and university/college performance, for example, Ferguson, James and Madeley (2002). Rigney (2003) claims that students with higher scores in entrance exams performed better in their university studies. The Rignys' research and his outcomes became a source of inspiration of the authors' research.

In this article, the authors publish the results of their work on bachelor studies, which are three years in duration, and focus on a quantitative part of their research. The objective of this article is to find out whether the entrance examination is a prerequisite for the successful completion of studies at the university. First, studies at the Faculty of Military Leadership with a focus on bachelor study programmes and entrance exams is described. The authors then concentrate on methodology. In this section, they give details about data collection and statistical analysis of outcomes. Next section concentrates on the discussion, followed finally by the authors' conclusions.

MATERIALS AND METHODS

Studies at the Faculty of Military Leadership

The research was carried out at the Faculty of Military Leadership (FML), which is a part of the University of Defence (UoD). The UoD is a military tertiary institution intended to educate military professionals in line with Czech military forces' requirements and ensures the education of both Czech Army specialists and civilian students within accredited bachelor, master and doctoral study programmes. All these programmes have two basic forms of study – full-time and combined, which are legalized by Act no. 111/1998 Coll., on universities § 44. The UoD strives to accommodate the interests of military and civilian study candidates who wish to complement their existing education in accordance with the rising demands on qualifications and respond to the change of professional orientation or the needs of requalification. In doing this, the UoD is reflecting European and worldwide life-long learning trends. Students of both categories are required to fulfil the same requirements, although students of the combined form must combine their studies with a regular job and everyday duties.

Bachelor study programme at the Faculty of Military Leadership

FML provides university education in a Bachelor's degree programme, Follow-up Master's degree programme, Continuous Master's degree programme, and PhD degree programme.

The Bachelor's degree programme, Economics and Management, focuses particularly on the study of theoretical subjects in the field of economics and management and their application in the specific area of security and state defence, including the peculiarities arising from the functioning of military organizations. The study programme is conceived as a professionally oriented study; therefore, the thematic blocks focusing on the practical application of the theoretical knowledge delivered to the students within the subjects of the curriculum play a significant role in the study programme.

The study is designed for both military and civilian students, both in full-time and combined form. The study programme for military students is focused on the basic managerial skills necessary for the command and other functions of units, for organizing structures of other players of the state security system, and for fulfilling tasks within the framework of the obligations arising from the membership of the Czech Republic in the EU and NATO. In completing the study programme, civilian students become competent in the operation of the basic management positions associated with securing state security, both in the public and private sectors.

The Economics and Management study programme includes three fields of study – Economics of State Defence, Military Management, and Security Management. The professional orientation of the study required an increase in the study modules within the structure of the study programme. Students are enrolled in study modules, which creates more space not only for teaching specific subjects of study modules but also for more effective interconnection of more theoretically conceived subjects of programme and field curricula into the specifics of particular study modules. The study modules correspond to the professional requirements of personnel in individual specializations (professions) in the Czech Army or groups of professions in the non-military sector of the state security system.

Entrance exams for the Faculty of Military Leadership

Applicants for military full-time study programmes take the following tests as part of their entrance exam: Learning Potential Test (LPT) – written test; English language (ELT) – written test; and Physical fitness (PF) – practical test. Applicants for the military part-time study programme and civilians (both full time and part time) take only the Learning Potential Test.

The Learning Potential Test is divided into three sections; each section contains ten questions. The first section deals with numeric thoughts and logic, the second focuses on spatial imagination and abstract thinking, and the last concentrates on basic mathematical skills. The Learning Potential Test result is assessed between 0 to 60 points; the pass mark for this test is 30.

The English Language Test examines reading comprehension, vocabulary and grammar. The minimal entrance level should be at least A2 according to the Common European Framework of Reference for Languages, or SLP 1 (Standardized Language Profile) according to NATO STANAG 6001. The English Language Test is assessed between 0 to 50 points; the pass mark for this test is 25.

The applicant's physical fitness is verified in two disciplines: a twelve-minute run and sit-ups for one minute, the result of each discipline being rated between 0 and 50 points. If the candidate in one of the two disciplines scores 0 points, his total point score from the fitness score is 0 points.

The candidate can reach a maximum of 160 points in the admission test. To determine the ranking of candidates who have successfully passed the admission test conditions, the weighted average ranking achieved by the candidate in the various parts of the admission test is used. This weighted mean is calculated via the following equation:

$$\frac{60 \times rank\ in\ PLT + 50 \times rank\ in\ ELT + 50 \times rank\ in\ PF}{160} \quad (1)$$

The ranking of candidates, in the case of the same weighted average, is determined firstly by a higher point assessment of the Learning Potential Test, followed by a higher point assessment of the English Language test, and lastly a higher point assessment from the physical fitness test. At the same point, the test scores from the Learning Potential Test, the English Language Test, and the Physical Fitness check are placed in the same order. An applicant who has earned 0 points in any part of the admission test fails to comply with the admission procedure.

SAMPLE DESIGN AND DATA COLLECTION

Examining aspects of the wide range of issues related to the service of men and women in the Army of the Czech Republic has been the subject of many standard research activities in the past. Saliger (2017) claims that the education of military professionals is of crucial importance and suggests education activities for competency development of leaders at the middle level in the military school system. Ullrich, Pokorny and Ambrozova (2017) carried out research on skills and abilities necessary for military professionals to perform their activities and functions in challenging conditions in a military environment, especially at the University of Defence. The authors placed their emphasis on the bachelor study programme of the FML, and for three years observed all students involved in this programme.

The target population for this study were all students studying at the University of Defence within an accredited study programme for the Faculty of Military Leadership. The survey was conducted as a longitudinal study whose objective was to observe students' success as well as difficulties, to identify reasons for their failures, and to create conditions necessary for changes and the creation of a new study programme. The authors assumed that the results of the entrance examinations are a prerequisite for the successful completion of studies and determined the following hypotheses:

$H_{1:}$ There is a correlation between the results of entrance exams and study results.

- H_{1a}: There is a correlation between the results of LPT and study results.
- H_{1b}: There is a correlation between the results of ELT and study results.
- H_{1c}: There is a correlation between the results of PF and study results.

H_2: The study results of military and civilian students are comparable.

H_3: According to the results of entrance exams, the probability of successful completion of studies can be predicted by the logistic or probit regression model.

- H_{3a}: According to the results of LPT, the probability of successful completion of studies can be predicted.
- H_{3b}: According to the results of ELT, the probability of successful completion of studies can be predicted.
- H_{3c}: According to the results of PF, the probability of successful completion of studies can be predicted.

This part of the analysis focuses on students (military and civilian) who successfully finished their studies in 2016. We have data from 61 military and 59 civilian students of the bachelor degree at Faculty of Military Leadership, University of Defence in Brno, Czech Republic. The students began their study in autumn 2013 and finished in summer 2016. To describe their study path we have acquired the following data: entrance examination results (entrance examination for military students consists of the Learning Potential Test, English Language Test

and the Physical Fitness Test; civilian students have to pass only the Learning Potential Test), the weighted average of grades for each term (three-year bachelor study comprises of 6 terms, we use coding: A = 1, B = 1.5, C = 2, D = 2.5, E =3), results of the final language test, the weighted mean for the whole study, results of bachelor thesis defense, and the finals (we use coding: excellent = 1, very good = 2, good = 3, fail = 4), see Figure 1.

RESULTS

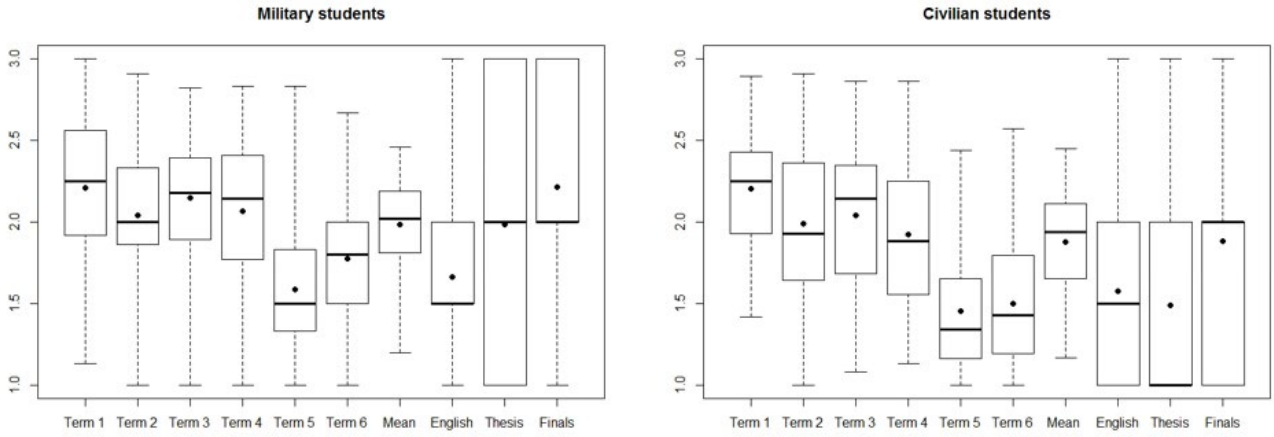

Figure 1: Boxplots of study results (military and civilian students); boxplots show the minimum, lower quartile, median, arithmetic mean (points), upper quartile and maximum

The results of LPT are on a scale from 0 to 60, results of ELT and PF tests are on a scale from 0 to 50. The scales were unified for reasons of comparison (from 0 to 100). A significant difference can be found between each part of the entrance test (Figure 2 and 3).

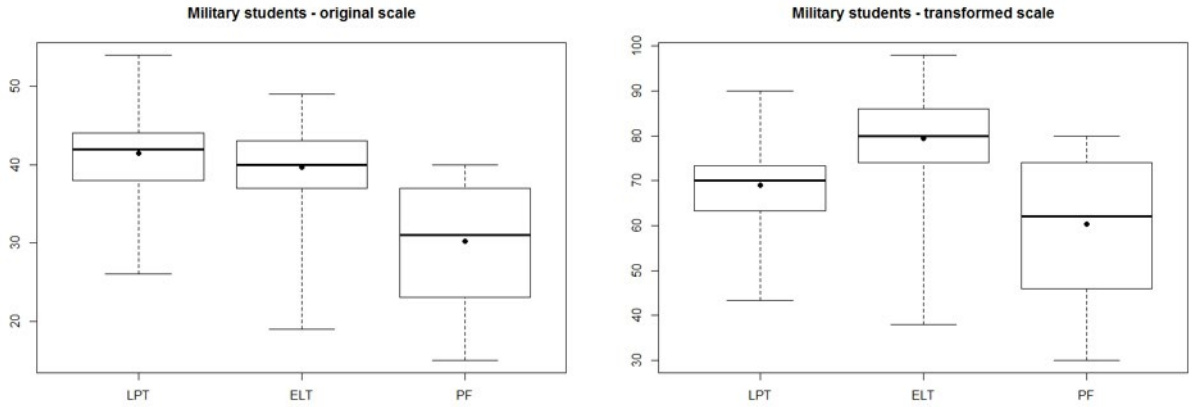

Figure 2: Boxplots of entrance test results of military students (original and transformed scale); boxplots show the minimum, lower quartile, median, arithmetic mean (points), upper quartile and maximum

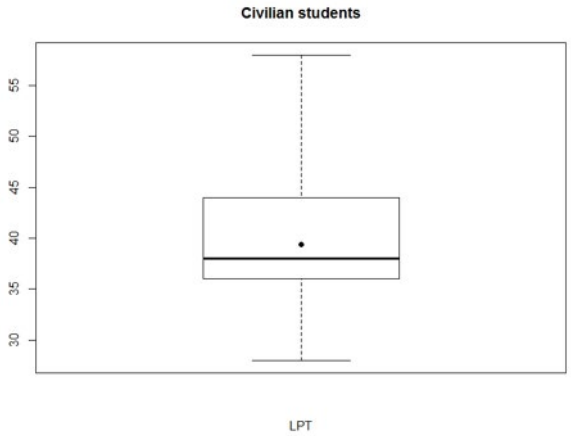

Figure 3: Boxplot of entrance test results of civilian students; boxplots show the minimum, lower quartile, median, arithmetic mean (points), upper quartile and maximum

Printed ISSN 2336-2375 Electronic ISSN 1803-1617
ERIES Journal volume 12 issue 1

Table 1 and Table 2 contain pairwise correlations between the students' entrance exam results and study results (Pearson's and Spearman's correlation coefficients and tests of their statistical significance). Our aim is to check a possible positive or negative effect of the entrance exam results on study evaluation. The individual parts of the entrance test are not significantly correlated. The correlation coefficients are mostly negative; if we look at the statistically significant values (see Table 1 and Table 2), all coefficients are negative. The statistically significant correlations at the significance level 0.05 are highlighted in bold, those at the significance level 0.10 are in italics. It should be noted that the better the result achieved in the entrance exam, the higher the point evaluation, but in terms of grades it is reversed (the lower the number of the grade the better). The results in Table 1 show that the correlation between the study results for the military students and the results in the entrance exams are significant mainly for the ELT, not for LPT and PF tests. It can be deduced that the significant correlation for the study results and the overall results is predominantly caused by the correlation with the language test. On the other hand, the study results of civilian students are correlated with the LPT test (see Table 2).

We applied the correlation coefficient significance test in order to determine the correctness of the H_1 hypothesis. The null hypothesis of this test claims that there is no correlation between analysed variables. This hypothesis is rejected mainly in case of study results and ELT test. According to this finding, we can say that hypothesis H_1 is valid partly only. There is a correlation between ELT tests and study results, however, there is no relationship between both LPT and PF tests.

	Overall entrance exam results				LPT			
	Pearson	*p*-value	Spearman	*p*-value	Pearson	*p*-value	Spearman	*p*-value
Term 1	-0.249	*0.053*	-0.217	0.093	-0.178	0.170	-0.254	**0.048**
Term 2	-0.178	0.170	-0.098	0.455	-0.063	0.630	-0.063	0.628
Term 3	-0.252	*0.050*	-0.183	0.157	-0.127	0.331	-0.142	0.277
Term 4	-0.204	0.114	-0.194	0.133	-0.252	*0.050*	-0.313	**0.014**
Term 5	-0.234	*0.070*	-0.259	**0.044**	-0.077	0.555	-0.128	0.324
Term 6	-0.046	0.727	0.025	0.847	0.086	0.512	0.083	0.524
Mean	-0.271	**0.035**	-0.203	0.117	-0.145	0.264	-0.173	0.181
English	-0.244	*0.058*	-0.274	**0.033**	-0.212	*0.100*	-0.188	0.147
Thesis	0.035	0.787	0.049	0.705	0.087	0.503	0.057	0.664
Finals	0.094	0.472	0.101	0.439	-0.033	0.803	-0.050	0.704
	ELT				PF			
	Pearson	*p*-value	Spearman	*p*-value	Pearson	*p*-value	Spearman	*p*-value
Term 1	-0.246	*0.055*	-0.224	*0.082*	-0.001	0.997	-0.002	0.990
Term 2	-0.350	**0.006**	-0.256	**0.046**	0.089	0.493	0.129	0.320
Term 3	-0.462	**0.000**	-0.389	**0.002**	0.131	0.314	0.172	0.185
Term 4	-0.289	**0.024**	-0.310	**0.015**	0.156	0.230	0.186	0.152
Term 5	-0.355	**0.005**	-0.392	**0.002**	0.041	0.753	0.016	0.905
Term 6	-0.181	0.164	-0.253	**0.049**	0.021	0.874	0.016	0.902
Mean	-0.428	**0.001**	-0.394	**0.002**	0.095	0.465	0.126	0.335
English	-0.316	**0.013**	-0.369	**0.003**	0.097	0.459	0.075	0.566
Thesis	-0.282	**0.028**	-0.239	*0.063*	0.206	0.111	0.221	*0.087*
Finals	-0.217	*0.093*	-0.185	0.154	0.322	**0.011**	0.326	**0.010**

Table 1: Correlation coefficients – military students; statistically significant correlations are emphasized (level α = 0.05 in bold, level α = 0.10 in italics)

	LPT			
	Pearson	*p*-value	Spearman	*p*-value
Term 1	-0.432	**0.001**	-0.365	**0.004**
Term 2	-0.330	**0.011**	-0.275	**0.035**
Term 3	-0.350	**0.007**	-0.229	*0.082*
Term 4	-0.218	*0.097*	-0.200	0.130
Term 5	-0.277	**0.034**	-0.313	**0.016**
Term 6	-0.235	*0.073*	-0.141	0.286
Mean	-0.395	**0.002**	-0.322	**0.013**
English	0.058	0.661	0.111	0.404
Thesis	0.003	0.979	0.097	0.465
Finals	-0.225	*0.086*	-0.184	0.164

Table 2: Correlation coefficients – civilian students; statistically significant correlations are emphasized (level 0.05 in bold, level 0.10 in italics)

Comparison of military and civilian studies

Figure 4 contains boxplots of the LPT results for the military and civilian students. The mean for military students is 41.41, the median is 42 and the standard deviation is 5.35, while the mean for civilian students is 39.42, the median is 38 and the standard deviation is 38. We apply two sample t-test and two sample Wilcoxon test for comparison reasons (Montgomery and Runger, 2011). The *p*-values of the tests are $p = 0.058$ and $p = 0.032$, and we can say that military students are a little better according to the entrance test results (see Table 3).

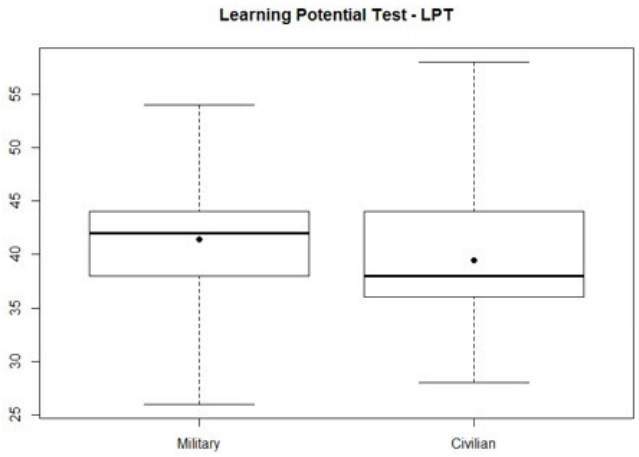

Figure 4: Results comparison of Learning Potential Test; boxplots show the minimum, lower quartile, median, arithmetic mean (points), upper quartile and maximum

Table 3 contains the results of the comparison between military and civilian students. Besides LPT, it summarizes comparisons of study achievements between analysed groups. In terms of the study results, civilian students perform better than military students. This can be confirmed by the Hotteling test, which is able to say that multivariate means of the analysed variables are significantly different ($p = 0.006$).

	Military		Civilian					
	Mean	Median	Mean	Median	t-test	*p*-value	Wilcoxon test	*p*-value
Test	41.41	42.00	39.42	38.00	1.91	*0.058*	2,206	**0.032**
Term 1	2.21	2.25	2.20	2.25	0.06	0.955	1,867	0.725
Term 2	2.04	2.00	1.99	1.93	0.61	0.545	1,981	0.342
Term 3	2.15	2.18	2.04	2.14	1.38	0.169	1,983	0.337
Term 4	2.06	2.14	1.92	1.88	1.70	*0.091*	2,151	*0.065*
Term 5	1.59	1.50	1.45	1.34	1.89	*0.061*	2,240.5	**0.021**
Term 6	1.78	1.80	1.50	1.43	4.18	**0.000**	2,551.5	**0.000**
Mean	1.98	2.02	1.88	1.94	1.89	*0.061*	2,168.5	*0.053*
English	1.66	1.50	1.58	1.50	0.91	0.364	1,974	0.339
Thesis	1.98	2.00	1.49	1.00	3.94	**0.000**	2,431.5	**0.000**
Finals	2.21	2.00	1.88	2.00	2.32	**0.022**	2,211	**0.022**

Table 3: Military and civilian students' comparison; statistically significant differences are emphasized (level α = 0.05 in bold, level α = 0.10 in italics)

Hypothesis H_2 was rejected. Despite the fact that military students' results in the LPT test were better than the results of civilian students, in the second part of their study civilian students achieve better learning outcomes than military students.

The next aim of our analysis deals with the comparison of entrance exams for all applicants who successfully passed the entrance exam, students who successfully finished their studies, and students who began but did not finish their studies at the faculty. The analysis is performed separately for military and

civilian students. We start with military students. The number of applicants who successfully passed the entrance exam was 168, the number of students who successfully completed their studies was 61, and the number of unsuccessful students was 59. The means and the medians of the analysed groups are summarized in Table 4. Using the pairwise comparison (two sample t-test and Wilcoxon test) and Tukey method we determine a statistically significant difference between the groups (see Table 5). We concluded that the results of LPT significantly differ within the analysed groups. There are no significant differences in ELT and PF tests. It can be deduced that differences in overall results are caused by the results of the Learning Potential Test.

Test	Mean			Median		
	Accepted	Successful	Unsuccessful	Accepted	Successful	Unsuccessful
LPT	39.38	41.41	37.97	40	42	38
ELT	39.53	39.67	39.14	40	40	40
PF	28.82	30.16	28.15	28	31	28
Overall	107.73	111.28	105.25	107	112	105

Table 4: Military students – Means and medians of tests results according to the following groups; Accepted (applicants successfully passed the entrance exam), Successful (students successfully finished their studies) and Unsuccessful (students began but did not finish their studies)

	LPT			ELT		
	t-test	Wilcoxon	Tukey	t-test	Wilcoxon	Tukey
Successful – Accepted	**0.013**	**0.011**	**0.030**	0.862	0.692	0.984
Successful – Unsuccessful	**0.000**	**0.000**	**0.001**	0.607	0.546	0.854
Accepted – Unsuccessful	*0.080*	*0.087*	0.186	0.630	0.714	0.883
	PF			Overall		
	t-test	Wilcoxon	Tukey	t-test	Wilcoxon	Tukey
Successful – Accepted	0.218	0.225	0.434	**0.021**	**0.014**	**0.047**
Successful – Unsuccessful	0.131	0.144	0.289	**0.000**	**0.000**	**0.003**
Accepted – Unsuccessful	0.552	0.546	0.821	0.108	*0.078*	0.232

Table 5: Military students – Comparison of test for all applicants who successfully passed the entrance exam (Accepted), students successfully finished their studies (Successful), and students who began but did not finish their studies (Unsuccessful); *p*-values of two sample t-test, Wilcoxon test and Tukey multiple comparison; statistically significant differences are emphasized (level α = 0.05 in bold, level α = 0.10 in italics)

Test	Mean			Median		
	Accepted	Successful	Unsuccessful	Accepted	Successful	Unsuccessful
LPT	37.14	39.42	36.03	36	38	36

Table 6: Civilian students – Means and medians of tests results according to the following groups; Accepted (applicants successfully passed the entrance exam), Successful (students successfully finished their studies) and Unsuccessful (students began but did not finish their studies)

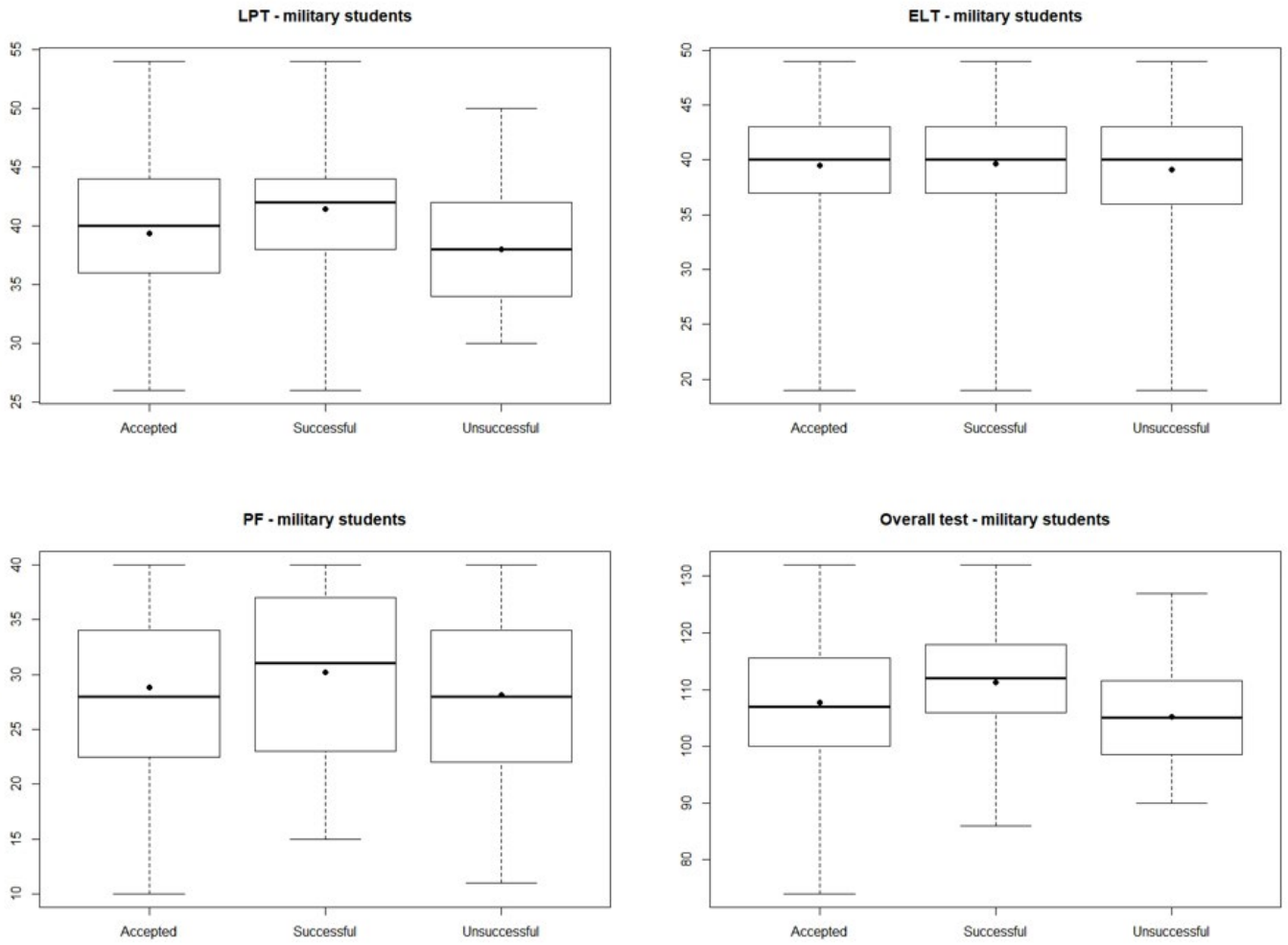

Figure 5: Tests comparison for all military applicants who successfully passed the entrance exam (Accepted), students who successfully finished their studies (Successful) and students who began but did not finish their studies (Unsuccessful); boxplots show the minimum, lower quartile, median, arithmetic mean (points), upper quartile and maximum

Similar methods were applied to data of civilian applicants and students. Civilian applicants were required to pass only the study aptitude test. The number of applicants who successfully passed the entrance exam was 273, the number of students who successfully finished their studies was 59, and the number of unsuccessful students was 63. Table 6 and Table 7 contain results which indicate that one can expect differences in test performance for the groups in question. It can be seen that there is a statistically significant difference between the results obtained in the study aptitude test for students who successfully finished their studies and unsuccessful students. Students who graduated achieved higher scores in the study aptitude test than students who had to terminate their studies.

	LPT		
	t-test	Wilcoxon	Tukey
Successful – Accepted	**0.011**	**0.005**	**0.021**
Successful – Unsuccessful	**0.000**	**0.001**	**0.005**
Accepted – Unsuccessful	*0.081*	0.383	0.375

Table 7: Civilian students – Comparison of test for all applicants who successfully passed the entrance exam (Accepted), students who successfully finished their studies (Successful) and students who began but did not finish their studies (Unsuccessful); *p*-values of two sample t-test, Wilcoxon test and Tukey multiple comparison; statistically significant differences are emphasized (level α = 0.05 in bold, level α = 0.10 in italics)

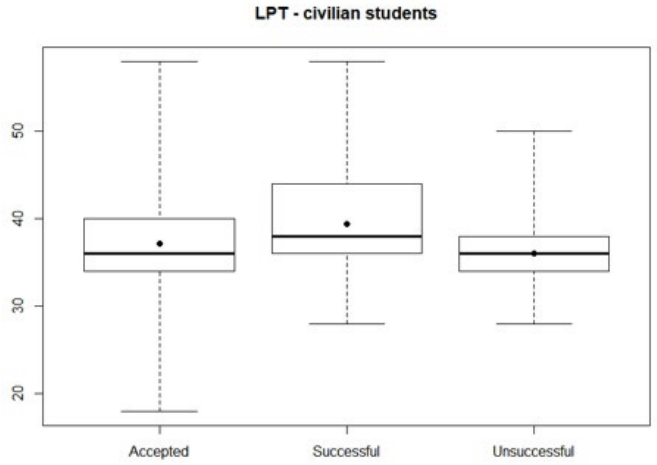

Figure 6: Test comparison for all civilian applicants who successfully passed the entrance exam (Accepted), students who successfully finished their studies (Successful) and students who began but did not finish their studies (Unsuccessful); boxplots show the minimum, lower quartile, median, arithmetic mean (points), upper quartile and maximum

As the last step, we would like to answer the question of whether the results in the entrance exam are somehow linked to overall study success. We focus now on the students who began to study and were able or not to finish their studies at the faculty. Firstly, we start with military students, then run the same procedure with civilian students, and finally put all the students together. The aim is to predict the probability of successful graduation as a function of the entrance exam results. For this purpose, we use logit and probit analysis (Dobson, 2002). The model for the logistic regression is given by the formula:

$$\log\left(\frac{\pi_i}{1-\pi_i}\right) = \beta_0 + \beta_1 x_i\,, \tag{2}$$

then the probability π_i^{logit} is according to formula (3):

$$\pi_i^{logit} = \frac{\exp\{\beta_0 + \beta_1 x_i\}}{1-\exp\{\beta_0 + \beta_1 x_i\}}\,. \tag{3}$$

The model for probit regression is according to formula (4):

$$\Phi^{-1}(\pi_i) = \beta_0 + \beta_1 x_i, \tag{4}$$

the probability π_i^{probit} is according to formula (5):

$$\pi_i^{probit} = \Phi(\beta_0 + \beta_1 x_i), \tag{5}$$

where Φ is the cumulative distribution function of standardized normal distribution $N(0,1)$.

We use a statistical software R (generalized linear model function glm) to get the probability estimates.

Both military and civilian students had to pass the study aptitude test. Before calculation it is reasonable to split the range of possible outcomes into intervals (25–30], (31–35],…, (55–60]. The ratio of successful students was computed for each interval. The results are shown in Table 8 and Figure 7.

Military students

LOGIT	Estimate	Std. Error	*z* value	*p*-value	PROBIT	Estimate	Std. Error	*z* value	*p*-value
β_0	-4.92139	1.48570	-3.313	0.00093	β_0	-3.03332	0.88148	-3.441	0.00058
β_1	0.12642	0.03766	3.357	0.00079	β_1	0.07794	0.02230	3.494	0.00048

Civilian students

LOGIT	Estimate	Std. Error	*z* value	*p*-value	PROBIT	Estimate	Std. Error	z value	*p*-value
β_0	-4.93215	1.48094	-3.330	0.00087	β_0	-3.01491	0.87029	-3.464	0.00053
β_1	0.13177	0.03985	3.307	0.00094	β_1	0.08065	0.02340	3.447	0.00057

All students

LOGIT	Estimate	Std. Error	*z* value	*p*-value	PROBIT	Estimate	Std. Error	z value	*p*-value
β_0	-4.77392	1.02001	-4.680	0.00000	β_0	-2.92726	0.60288	-4.855	0.00000
β_1	0.12502	0.02662	4.696	0.00000	β_1	0.07671	0.01571	4.882	0.00000

Table 8: Logit and probit analysis, estimation results

Using logit analysis according to formula (3), we get for the military students the probability estimates:

$$\hat{\pi}_i^{logit} = \frac{\exp\{-4.921 + 0.126 x_i\}}{1-\exp\{-4.921 + 0.126 x_i\}}.$$

According to formula (5), probit analysis offers the estimates:

$$\hat{\pi}_i^{probit} = \Phi(-3.033 + 0.078 x_i).$$

The estimates for civilian students and for all students can be obtained by the analogy. The links between the result in the Learning Potential Test and the ratio of success are shown in Figure 7. In can be deduced from the computed estimates that there is no difference between logit and probit analysis results; moreover, the estimated models are similar for all three analysed groups.

The entrance exam for the military students also consists, in

addition to LPT, of the language test ELT and PF test. Contrary to the LPT, we were not able to build any model which can describe the link between the test results and study success. It could be concluded that the Learning Potential Test result is a reasonable predictor of study success. According to our findings, a candidate for military study has a greater than 50% probability of successful graduation if he or she has a LPT test score greater than 39, and for a civilian student a score of 37.

Hypothesis H_3 is valid partly only. We can state that hypotheses H_{3b} and H_{3c} are not correct, we were not able to build the logit nor probit regression model which could describe the link between the ELT nor PF entrance test results and the probability of successful completion of studies. It is possible to predict the probability of successful completion of studies according to LPT test only.

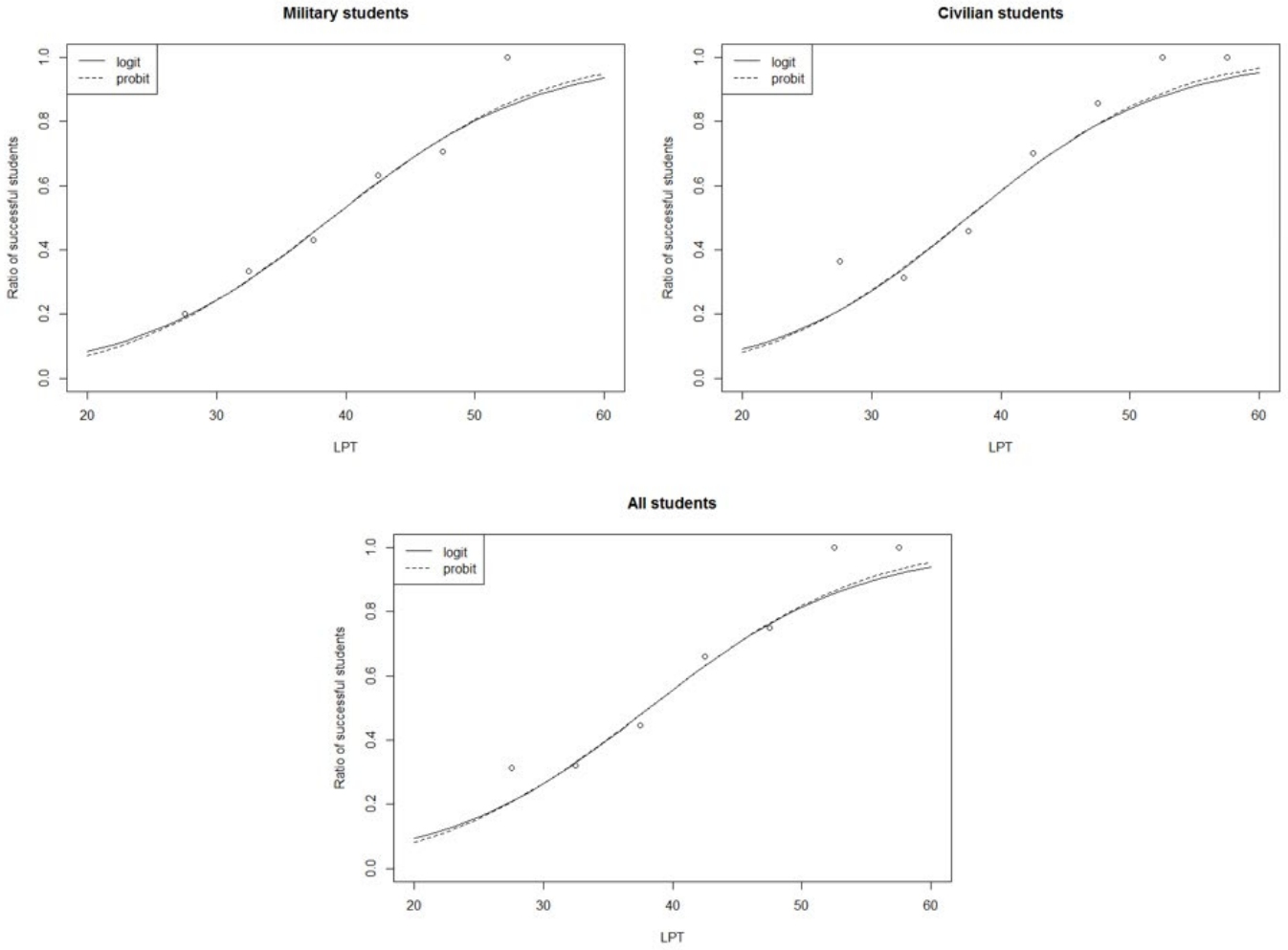

Figure 7: Logit and probit model of the ratio of successful study

DISCUSSION

There is substantial agreement that quality assessment is an effective technology for supporting a change in higher education institutions (Stensaker et al., 2006; Houston, 2010; Hazelkorn, 2011). In theory, quality assessment can provide the impetus for tertiary education/university change. There is no universal unified quality standard model that can be used to assess the quality criteria of tertiary education institutes.

Aboma (2009), in his research, focused on understanding academic success in higher institutions, prior academic achievement measures (preparatory school grade average point, aptitude test scores, and university entrance exam scores) and psychological variables (achievement motivation and academic self-efficacy) to predict first year university students' grade average point. The research outcomes prove that 'students' pre-college academic performances are strong predictors of grade average point at university level'. According to Aboma (2009), the better the pre-college academic performance, the better the study performance in the first grade at the university. Friedman and Mandel (2009) write about student retention and performance in higher education, which is an important issue for educators, students, and a nation facing critical professional labour shortages. In his work, he confirmed the hypothesis that Scholastic Aptitude test and High School Grade Point Average (HSGPA) scores would be positively related to academic performance and student retention.

The research on assessment in higher education gains increased attention abroad as well as at Czech universities, however, no studies in this area have focused on military environment.

The authors started their research in 2010, first concentrating

on entrance exams. In their endeavour to widen understanding regarding factors predicting academic achievement in tertiary education, they compared entrance test results and tried to ascertain whether there is an independent relationship between success in the English Language Test and success in the Learning Potential Test. Their results prove the link between the Learning Potential Test and the English Language Test. If an applicant is good at English, he or she is also good at the Learning Potential Test (Sedlacik, Cechova and Doudova, 2013). They then focused on the item and test analysis of English Language Tests to ensure that entrance tests at the Faculty of Military leadership are reliable and fair. It was found that the established system of test design, moderation, pre-testing, item analysis, and the administration has become a viable and transparent way of selecting university candidates according to their knowledge level (Cechova, Neubauer and Sedlacik, 2014).

In this contribution, the authors decided to publish their statistical findings in order to find the correlation between entrance exams and students´ success at their final exams. They focused on students (military and civilian) who successfully completed the bachelor degree at the Faculty of Military Leadership, University of Defence in Brno, Czech Republic. We can conclude that hypothesis H_1 is valid partly only as there is the correlation between ELT test and study results. Correlation between LPT and PF tests was not significant. Hypothesis H_2 was rejected as there are comparable results between military and civilian students till the half of their studies. Hypothesis H_3 is valid partly only as only the LPT results can help predict the probability of successful completion of studies. Some outcomes were quite surprising and observation the students´ success and especially difficulties helped create conditions for necessary changes in the creation of a new study programme.

No statistically significant correlation was found between the overall result of entrance tests and the results in military students' studies:

1. there was no statistically significant correlation between the LPT test and study results;
2. there was no statistically significant correlation between the PF test and study results;
3. statistically significant correlation was found between the ELT test and the study results (the higher the number of points in the entrance test, the better the marks during the study).

Weak correlation binding the results of the LPT entrance tests to study results was indicated in civilian students' studies. There were significant correlations between the scores for the ELT and study results. Students who received high scores for the ELT in the entrance examination had a clear sense of purpose, and it influenced not only their English study but also their ability to learn special military knowledge, which is directly related to their future, skills required for international training, deployment in missions, and working in NATO structures. Furthermore, students are well informed about a fact that one of their duties during studies at the University of Defence is also to pass examination according to STANAG NATO 6001.

Another interesting issue is the comparison between military and civilian students. It is possible to state that military students' results in the LPT test were better than the results of civilian students, and in the first half of the study the results of soldiers and civilians were comparable. However, in the second part of their study, it is possible to state that civilian students achieve better learning outcomes than military students. The explanation is based on a structure of military study programme. Military students after completing the 2nd semester of their study are enrolled in study modules according to their professional orientation. This guarantees their employment after graduation. Civilian students do not have any guarantee and only the best of them can find employment in the state service. This fact makes them achieve the best results.

The authors then concentrated on comparing the entrance test results of students who successfully finished their studies (Successful students) with those who failed (Unsuccessful students). Both groups, soldiers and civilian students, were compared. As expected, there are significant differences between Successful and Unsuccessful students, however, comparing ELT and PF tests results, no statistically significant differences were found.

When modelling the probability of successfully completing studies at the UoD, it was possible to build a model of logit and probit based only on the results of the LPT test. The parameters of these models are similar for both military and civilian students. Based on these models, it is possible to state that if a military student reaches more than 39 points in a LPT, the probability of successful completion of the study is more than 50%; for civilians, the threshold is equal to 37 points.

CONCLUSION

A number of studies has examined the predictive validity of entrance tests with respect to study results but these studies were predominantly concentrated to the medical area. There is a lack in literature as well as research done with respect to military students and there is no comparable study in this area. At the University of Defence both military and civilian students study, which is not typical for military universities abroad and this fact makes possible to compare their results.

This research has brought interesting results which aid understanding of students' performance during their studies at the UoD, and which forms the basis for the development of new study programmes. The most surprising facts were the correlation between ELT tests and study results or difference between civilian and military students. The Faculty authorities were acquainted with this research results and knowledge of these outcomes was incorporated in the creation of a new study programme. The authors will strive to observe students' study results until completing their master degree and compare it with other programmes to find possible differences.

Another authors' endeavour is observing the students' performance from their first interest in studying at the UoD, from the preparatory course for admission to the UoD to their final state exam. The authors also hope that it will be possible to get outcomes from partnership military institutions to be able to compare universities of similar specialization.

REFERENCES

Aboma, O. (2009) 'Predicting First Year University Students' Academic Success', *Electronic Journal of Research in Educational Psychology,* Vol. 7, No. 3, pp. 1053–1072.

Act no. 111/1998 Coll., on universities § 44 (1998) [online], Available: http://www.msmt.cz/vyzkum-a-vyvoj-2/zakon-c-111-1998-sb-o-vysokych-skolach [20 Jan 2018].

Barnett, R. (2011) 'The marketised university: defending the indefensible', in Molesworth, M., Scullion, R. and Nixon, E. (Eds), *The Marketisation of Higher Education and the Student as Consumer.* Routledge, Oxon, pp. 39–52.

Cech, P., Chromy, J. and Skupinova, S. (2015) 'Company Training of Managers as a Part of the Human Resource Management in the Hotel Industry', in *2nd International Multidisciplinary Scientific Conference on Social Sciences and Arts (SGEM 2015), Psychology and Psychiatry, Sociology and Healthcare, Education,* Vol. II, pp. 189–196.

Cechova, I., Neubauer, J. and Sedlacik, M. (2014) 'Computer-Adaptive Testing: Item Analysis and Statistics for Effective Testing', in *Proceedings of the 13th European Conference on e-Learning ECEL-2014.* Copenhagen, Denmark: Aalborg University Copenhagen, pp. 106–112.

Dobson, A.J. (2002) *An Introduction to Generalized linear models. 2*nd ed. Chapman & Hall/CRC.

Finney, T. Gillespie, R. and Finney, Z. (2010) 'Are students their universities' customers? An exploratory study', *Education + Training*, Vol. 52, No. 4, pp. 276–291. https://doi.org/10.1108/00400911011050954

Friedman, B. and Mandel, G.R. (2009) 'The Prediction of College Student Academic Performance and Retention: Application of Expectancy and Goal Setting Theories', *Journal of College Student Retention Research Theory and Practice*. Vol. 11, No. 2, pp. 227–246. https://doi.org/10.2190/CS.11.2.d

Geiger, M.A. and Cooper A.E. (2010) 'Predicting Academic Performance: The Impact of Expectancy and Needs Theory', *The Journal of Experimental Education*, Vol. 63, No. 3, pp. 251–262. https://doi.org/10.1080/00220973.1995.9943812

Gerritsen-van Leeuwenkamp, K. J., Joosten-ten Brinke D. and Kester L. (2017) 'Assessment quality in tertiary education: An integrative literature review', *Studies in Educational Evaluation*, Vol. 55, pp. 94–116. https://doi.org/10.1016/j.stueduc.2017.08.001

Haapakorpi, A. (2011) 'Quality assurance processes in Finnish universities: Direct and indirect outcomes and organisational conditions', *Quality in Higher Education*, Vol. 17, No. 1, pp. 69–81. https://doi.org/10.1080/13538322.2011.554311

Hazelkorn, E. (2011) *Rankings and the reshaping of higher education. The battle for world-class excellence.* Basingstoke: Palgrave Macmillan. https://doi.org/10.1057/9780230306394

Hinett, K. and Knight, P. (1996) 'Quality and assessment', *Quality Assurance in Education*, Vol. 4, No. 3, pp. 3–10. https://doi.org/10.1108/09684889610125832

Houston, D. (2010) 'Achievements and consequences of two decades of quality assurance in higher education: A personal view from the edge', *Quality in Higher Education*, Vol. 16, No. 2, pp. 177–180. https://doi.org/10.1080/13538322.2010.485730

Kappe, R. and van der Flier, H. (2012) 'Predicting academic success in higher education: what's more important than being smart?', *European Journal of Psychology of Education*, Vol. 27, No. 4, pp. 605–619. https://doi.org/10.1007/s10212-011-0099-9

Knight, J. (2006) *Higher Education Crossing Borders: A Guide to the Implications of the General Agreement on Trade in Services (GATS) for Cross-border Education.* [online], Available: http://oasis.col.org/bitstream/handle/11599/208/GATS.pdf?sequence=1. [12 Jan 2017]

Kurtus, R. (2012) *Tricks for Good Grades: Strategies to Succeed in School.* SfC Publishing Co. Oregon, USA.

Liu, S. (2016) *Quality Assurance and Institutional Transformation, Higher Education in Asia: Quality, Excellence and Governance.* Springer Science+Business Media Singapore.

Malau-Aduli, B.S., Zimitat, C. and Malau-Aduli, A.O. (2011) 'Quality assured assessment processes: Evaluating staff response to change', *Higher Education Management and Policy*, Vol. 23, No. 1, pp. 1–24. https://doi.org/10.1787/hemp-23-5kgglbdlm4zw

Mazouch, P., Ptackova, V., Fischer, J. and Hulik, V. (2018) 'Students Who Have Unsuccessfully Studied in the Past – Analysis of Causes', *Journal on Efficiency and Responsibility in Education and Science*, Vol. 11, No. 3, pp. 66–72. https://doi.org/10.7160/eriesj.2018.110303

McIntosh, J. and Munk, M.D. (2007) 'Scholastic ability vs family background in educational success: evidence from Danish sample survey data', *Journal of Population Economics*, Vol. 20, No. 1, pp. 101–120. https://doi.org/10.1007/s00148-006-0061-3

Mohamadi, Z. (2018) 'Comparative effect of online summative and formative assessment on EFL student writing ability', *Studies in Educational Evaluation*, Vol. 59, pp. 29–40. https://doi.org/10.1016/j.stueduc.2018.02.003

Montgomery, D.C. and Runger, G.C. (2011) *Applied Statistics and Probability for Engineers. 5*th ed. John Wiley & Sons.

Noha, E. (2015) 'The concepts of quality, quality assurance and quality enhancement', *Quality Assurance in Education*, Vol. 23, No. 3, pp. 250–261. https://doi.org/10.1108/QAE-11-2012-0046

Okubo, K., Yamashita, T., Shimada, A. and Ogata, H. (2017) 'A neural network approach for students' performance prediction', in *Proceedings of the Seventh International Learning Analytics & Knowledge Conference*. Canada, pp. 598–599. https://doi.org/10.1145/3027385.3029479

Platt, L., Turocy, P., and Mc Glumphy, B. (2001) 'Preadmission criteria as predictors of academic success in entry-level athletic training and other allied health educational programs', *Journal of Athletic Training*, Vol. 36, No. 2, pp 141–144.

Rigney T.J. (2003) 'Relationship between Admission Grades and Academic Achievement', *The Irish Journal of Management*, pp. 117–138.

Saliger, R. (2017) 'Poznatky z výzkumu organizační kultury Armády České republiky – východisko k inovacím v edukaci leaderů ve vojenském školství', in *Vzdělávání dospělých 2016-východiska a inspirace pro teorii a praxi.* Praha: Česká andragogická společnost, pp. 259–272.

Sapri, M., Kaka, A. and Finch, E. (2009) 'Factors that influence student's level of satisfaction with regards to higher educational facilities services', *Malaysian Journal of Real Estate*, Vol. 4, No. 1, pp. 34–51.

Senge, P.M. (1990) *The Fifth Discipline: The Art and Practice of the Learning Organisation*. Doubleday, New York, NY.

Sedlacik, M., Cechova, I. and Doudova, L. (2013) 'Be born as successful mathematics or language learner: myths, true or

false?', *Journal on Efficiency and Responsibility in Education and Science*, Vol. 6, No 3., pp. 155–166. https://doi.org/10.7160/eriesj.2013.060303

Shahiri, A.M., Husaina, W. and Rashida, N.A. (2015) 'Review on Predicting Student's Performance using Data Mining Techniques', *Procedia Computer Science*, Vol. 72, pp. 414 – 422. https://doi.org/10.1016/j.procs.2015.12.157

European Association for Quality Assurance in Higher Education (2005) *Standards and Guidelines for Quality Assurance in the European Higher Education Area*, [online], Available: http://www.ehea.info/media.ehea.info/file/ENQA/05/3/ENQA-Bergen-Report_579053.pdf [20 May 2018].

Stensaker, B., Langfeldt, L., Harvey, L., Huisman, J. and Westerheijden, D. (2011) 'An in-depth study on the impact of external quality assurance', *Assessment & Evaluation in Higher Education*, Vol. 36, No. 4, pp. 465–478. https://doi.org/10.1080/02602930903432074

Sultan, P. and Wong, H.Y. (2013) 'Antecedents and consequences of service quality in a higher education context: a qualitative research approach', *Quality Assurance in Education*, Vol. 21, No. 1, pp. 70–95. https://doi.org/10.1108/09684881311293070

Tam, M. (2014) 'Outcomes-based approach to quality assessment and curriculum improvement in higher education', *Quality Assurance in Education*, Vol. 22, No. 2, pp. 158–168. https://doi.org/10.1108/QAE-09-2011-0059

UNESCO (1998) *World Declaration on Higher Education for the Twenty-first Century: Vision and Action. Higher Education in the Twenty-First Century: Vision and Action.* [online] http://www.unesco.org/education/educprog/wche/declaration_eng.htm [15 May 2018].

Vroeijenstijn, A.I. (1995) *Improvement and accountability: Navigating between Scylla and Charybdis.* Higher Education Policy Series, 30. London: J. Kingsley Publishers.

Wharrad, H., Chapple, M., and Price, N. (2003). 'Predictors of academic success in bachelor of nursing course'. *Nursing Education Today*, Vol. 23, No. 4, pp. 54–246. https://doi.org/10.1016/S0260-6917(02)00116-8

Winter. J.C.F. De and Dodou, D. (2011). 'Predicting Academic Performance in Engineering Using High School Exam Scores'. *International Journal of Engineering Education*. Vol. 27, No. 6, 1343–1351.

Ullrich, D., Pokorny, V. and Ambrozova, E. (2017) 'Leadership, Situational and Systemic Critical Thinking', in *Vision 2020: Sustainable Economic development, Innovation Management, and Global Growth.* Madrid Spain: International Business Information Management Association (IBIMA), pp. 1323–1332.

EDUCATION AND BUSINESS AS A KEY TOPICS AT THE INSTAGRAM POSTS IN THE AREA OF GAMIFICATION

Ladislav Pilař[1]✉
Pavel Moulis[2]
Jana Pitrová[1]
Petr Bouda[1]
George Gresham[2]
Tereza Balcarová[1]
Stanislav Rojík[1]

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

[2] Davis College of Business, Jacksonville University, USA

✉ pilarl@pef.czu.cz

ABSTRACT

The aim of this paper is to examine the communication content of Instagram social network users, on the basis of the hashtags they use relating to gamification and to define communities within the network in the context of education. The results are based on the analysis of Instagram's worldwide social network. Primary data were collected using script to capture communication on the social network Instagram. The analysis included Instagram photos selected on the basis of hashtag #gamification (17,994 contributions). The results identify that the most commonly associated expressions with hashtags #gamification are hashtags associated with education and business, especially where startup and innovation are concerned. On the basis of an analysis visually isolated communities with an average modularity of 0.506 were identified, which relate to the communication of the gamification on the social network Instagram: 1) Education, 2) Entrepreneurship, 3) Gamification in general, 4) Social and 5) Enjoyment. The benefit of analysis for the education area is to identify the university's links between Education and Entrepreneurship and the Teacher and Trust between education and enjoyment.

KEYWORDS

Business, education, gamification, instagram, social network

HOW TO CITE

Pilař L., Moulis P., Pitrová J., Bouda P., Gresham G., Balcarová T., Rojík S. (2019) 'Education and Business as a key topics at the Instagram posts in the area of Gamification', *Journal on Efficiency and Responsibility in Education and Science*, vol. 12, no. 1, pp. 26-33. http://dx.doi.org/10.7160/eriesj.2019.120103

Article history
Received
November 14, 2018
Received in revised form
March 11, 2019
Accepted
March 11, 2019
Available on-line
March 31, 2019

Highlights

- *Main topics connected to #gamification are hashtags associated with education and business, especially where startup and innovation are concerned.*
- *In Gamification area university's are important area between Education and Entrepreneurship.*
- *Teacher and Trust are important in connection between education and enjoyment.*

INTRODUCTION

Gamification is a relatively new term first used by Nick Pelling in 2002 (Marczewski, 2013) but a sharp increase started in 2010 (Google, 2018). Gamification is a technique that can increase motivation and encourage users, especially in the field of education, which requires teaching and learning activities to be more fun and interesting (Kusuma, Wigati, Suryapranata, 2018).

A deep understanding of social, cultural and environmental issues in context of gamification and education is valuable to analyse people's activities on social networks connected with this topic (Hu, Manikonda, Kambhampati, 2014; Pilař et al., 2016a; Pilař et al., 2017a). Instagram is regarded to be the current fastest-growing social network (Wagner, 2015) and deserves the attention from the research community comparable to that of Twitter and other social media platforms (Naaman, Boase, and Lai 2010; Boyd and Ellison, 2007).

The review of the acadedemic literature on gamification and online social media networks suggests an broad interest in gamification and its use in business, advertising and education (e.g. Jackson and Luchner 2017, Holmes and Gee 2016, Insley and Nunan 2014, Trees 2015, Bittner and Schipper 2014, Dignan, 2011). Gamification can take many forms and the term itself is being used more broadly (Dignan, 2011). Trees (2015) states that gamification means using game mechanics and psychology to manage employees. The author adds that if you want to encourage employees, you will present elements as scores and rewards, provided that people are motivated to progress or win in the context of the game. It is also the idea of impelling the employee to communicate and collaborate using

a fun form. Other authors (Swan, 2012, Sarangi and Shah, 2015) state that gamification has emerged as a standard for the intersection of game elements and „non-game" activities (using elements in a „non-verbal" context). Swan (2012) adds that the general definition of gamification identifies it as a process of connecting game mechanics to processes, programs and platforms that would not traditionally use such concepts. Sarangi and Shah (2015) further add that gamification aids in linking employees to shape corporate identity and reputation. Gamification uses aspects of play, such as challenges, excitement, competition and rewards, and other elements such as the fun or pleasure that comes from interacting to make day-to-day tasks more eye-catching. Chorney (2012) and Paharia (2013) further state that gamification is a technology that uses digital game pieces to motivate people to act in a „non-gaming" environment. Gamification strategies typically include a combination of the above elements (Trees, 2015).

Gamification is driven by the premise that today's omnipresent technologies will converge with informed and active consumers (Prahalad and Ramaswamy, 2004). Holmes and Gee (2016) dealt with the framework for understanding play-based learning and teaching and state that one of the possibilities of gamification is to transform learning into gaming by adopting game elements and structures. Harwood and Garry (2015) empirically examined the gamification approach in online customer engagement and behavior. Their findings suggest that gamification techniques may assist practitioners in developing more robust consumer engagement strategies. Bittner and Schipper (2014) investigated the motivational effects and age differences in the gamification of product advertising. Specifically, they investigated what motivational incentives for game design affect the purchasing intentions of customer. The authors argued that gaming features can be easily used in product advertising. Insley and Nunan (2014) dealt with the role of gamification, the use of game mechanics, in enabling consumer engagement with online retailers. The origin of gamification has been linked to the fact of increased interest amongst consumer motivation researchers when shopping online. Zichermann and Linder (2010) found thatretailers started to improve online customer shopping experience through the process of gamification.

According to Sarangi and Shah (2015), gamification has been successfully used by various organizations such as L'Oreal, Deloitte and Starbucks. Kumar and Raghavendran (2015) also reportedsuccessful gamification in practice by Deloitte. This company demonstrates how to use the principles of gamification in managing relationship with employees and their productivity to change corporate culture and behavior, to discover talent or to promote innovation. Delloite uses its own program called Maverick, where employees compete across departments and deal with various business issues and reward innovative and creative thinking to develop new solutions. On the other hand, the authors also state that gamification does not necessarily have to meet every problem or challenge in the company. In addition, addressing complex and unstructured realities, such as customer problems, violates the structural aspect of the gamification process.

Furthermore, as mentioned Hamari, Koivisto, Sarsa (2014) there is an increasing number of successful startups whose entire service is focused on adding a gamified layer to a core activity (e.g. Codecademy – an online interactive platform that offers free coding classes), or who assist more traditional companies in gamifying their existing services (e.g. CallidusCloud - web sites to measure and influence user behavior using techniques such as gamification).

Social networks, such as Facebook, Twitter and Instagram are used to communicate and share information. People through social networks share not only photos, but also personal experiences, opinions, preferences, activities and feelings are shared among friends. Hashtags are used to mark keywords or topics within a microblog and have proven to be useful for many applications (Efron, 2010) or sentiment analysis (Wang et al., 2011; Pilař et al., 2016b). Other authors claim that hashtag can be described as a technomorpheme: it is a linguistic segment as well as a clickable hyperlink, which allows the creation of a network (Giaxoglou, 2018). On Instagram, hashtags are tags or words prepended with '#' used to indicate the content of the picture. The users are using these hashtags among others to express feelings, emotions and characteristics of shared content (Pilař et al., 2017b). A deeper understanding of Instagram hashtags usage is important because it helps us see the social, cultural and environmental issues surrounding analyzed area from the customers' point of view.

Many studies analysing social networks in terms of gamification havefocused on Facebook, Twitter and Youtube (Sheldon and Bryant, 2016). For a deep understanding of people's activities regarding gamification it is important to analyze Instagram, furthering our insights about (trends) in social, cultural and environmental issues (Hu, Manikonda, Kambhampati, 2014). Instagram, an SNS created in 2010, is relatively new and involves posting photos with the option of using enhancement filters, and nonreciprocal followings of other users (Lup, Trub and Rosenthal 2015).This social media platform is a mobile photo sharing application that greatly increased in popularity since its founding in 2010, with over 500 million active monthly users (Jackson and Luchner, 2017). These authors also confirm that like Facebook, Instagram primarily focuses on photo sharing, image enhancement and nonreciprocal relationships.

The popularity of Instagram's social network is continuously growing, as confirmed by recent studies of internet users, who spend more time on Instagram than on other sites (Duggan, 2015). From a businesses point of view, the important characteristic of social networks isthat it is a free public channel of communication (Caixeta, Nascimento and Abreu; 2016). Unlike other social medias, the most common way how to express user´s feelings on Instagram is to use hashtags.

MATERIALS AND METHODS

Research data were gathered using script for capturing communication on social network Instagram Netlytic (Gruzd, 2016). The script has extracted tags from 17,994 media items that were posted between 25.03.2015 - 21.1.2017. In that period, 17,994 contributions (posts and comments) by 9,154 users were published with this hashtag. These contributions

contained the captured messages on Instagram but also comments to this message that doesn‘t have to contain the “gamification” hashtag. From this reason the gamification hashtag is included in a 15,759 messages. The analysis contains 198,850 unique words. In the first phase of data analysis preparation were removed from the messages other words than hashtags (words begin with #). In the following phase data were input into Gephi 0.9.2. program where by using a module for data importing a network was created. This network contained 15,759 nodes (hashtags) and 562,288 edges (hashtags´ connection) see Figure 1.

The Degree

The degree k_i of a hashtag i is defined as the number of ist neighbors, that is, the number of links incident to hashtag i, where a_{ij} of the adjacency matrix $\boldsymbol{A}$ and $\prod(i)$ the neighborhood of hashtag i.

$$k_i = \sum_{j \acute{o} Ð(i)} a_{ij} \qquad (1)$$

The Average Degree

The average degree of a graph in (2) is a measure of how many edges there are in a set compared with the number of edges in a set (Carrington, Scott, and Wasserman, 2005).

$$k = \frac{2E}{N}, \qquad (2)$$

where E is the number of edges and N is the number of hashtags.

The Graph Density

The graph density in (3) was defined as the number of edges divided by the number of possible edges (Scott, 2000).

$$\boldsymbol{D} = \frac{2(E - N + 1)}{N(N-3)+2} \qquad (3)$$

Modularity

The Modularity (4) was designed to measures the strength of the division of a network within modules (also called groups, clusters, or communities). Networks with high level of modularity have dense connections among the nodes (hashtags) within modules, but sparse connections among nodes (hashtags) in different modules (Knoke and Yang, 2008). In addition, a component analysis was employed. Component analysis represents the number of components (number of hashtag groups) that are created on the basis of the modularity detection algorithm method (Blondel et al., 2008). Fundamentally, this is a method that shows groups of hashtags that are closely related to each other, so that individual groups of related hashtags can be identified using this method.

$$\ddot{A}Q = \left[\frac{\sum_{in} + k_{i,in}}{2m} - \left(\frac{\sum_{tot} + k_i}{2m} \right)^2 \right] - \left[\frac{\Sigma_{in}}{2m} - \left(\frac{\Sigma_{tot}}{2m} \right)^2 - \left(\frac{k_i}{2m} \right)^2 \right] \qquad (4)$$

Σ_{in} is the sum of weighted links inside community, Σ_{tot} sum of weighted links incident to hashtags in community, k_i sum of weighted links incident to hashtag i, k_i, in sum of weighted links going from i to hashtags in community and a m normalizing factor as the sum of weighted links for the whole graph.

Eigenvector centrality

The most widely used SNA measurement technique is centrality. Among these, Eigenvalue Centrality (EVC) is arguably the most successful and common tool employed for detecting influential nodes and neighborhoods of nodes within a social graph. EVC is considered a relative score recursively defined as a function of the number and relative strength of connections among neighbor centralities (Ilyas and Radha, 2011). We have used Eigenvalue Centrality in this study.

$$x_i = \frac{1}{\lambda} \sum_{j=1}^{N} a_{ij} x_j, \qquad (5)$$

where λ is the largest eigenvalue of $\boldsymbol{A}$ and $\boldsymbol{x}$ is the corresponding eigenvector. The i^{th} component of the eigenvector $\boldsymbol{x}$ gives the eigenvector centrality score of the ith in the network (Meyer, 2000).

Visual representation

For the definition of network crowds and their types (visual polarization of individual hashtag groups), Force Atlas 2 was used as a graphical representation method (Smith et al., 2014). For cluster analysis a sample of 15,759 messages was inserted to Gephi 0.9.2, where was created the hashtag interconnection network see Figure 1.

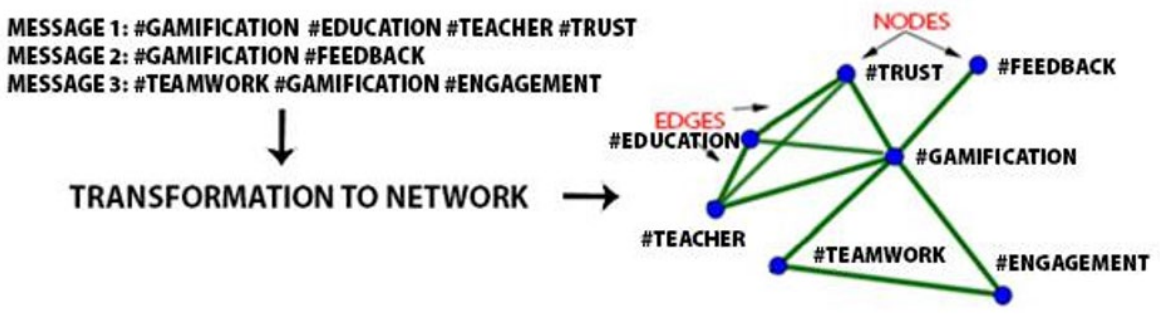

Figure 1: Transformation message to interconnection network (source: own calculation)

RESULTS

As can be seen in Table 1, hashtag #gamification is linked to 15,759 hashtags, which corresponds to the fact that only messages that contain hashtag #gamification are analyzed and so this hashtag is linked to all hashtags based on the transformation to interconnection network.

Based on the value of the degree, it is possible to identify important hashtags in terms of linking to other hashtas. In connection with hashtag #gamification, the following hashtags are listed: #education, #startup, #motivation, #university, #innovation, #business, #marketing, #learning, #design and #inspiration.

Using the value of Weighted Degree, the order is different: #motivation,#business,#university,#entrepreneur,#inspiration, #design, #teacher, #education, #learning, and #startup. Based on the Eigenvector Centrality, the hashtag order is as follows: #motivation, #business, #university, #education, #industry, #inspiration, #design, #startup, #innovation and #teacher.

From this, it can be deduced that there are two large areas that exist in the content of instagram in connection with gamification 1) Education - education, learning, university and 2) Business - startup, business, marketing, innovation, entrepreneurs, innovation.

Order	Hashtag	Degree	Weighted Degree	Eigenvector Centrality
1	#gamification	15,758	1,425.0	1.00000
2	#education	2,703	815.0	0.29221
3	#startup	2,518	689.0	0.26595
4	#motivation	2,508	1,113.0	0.34882
5	#university	2,329	945.0	0.32405
6	#innovation	2,291	657.0	0.25763
7	#business	2,273	1,107.0	0.34027
8	#marketing	2,144	636.0	0.24143
9	#learning	2,041	781.0	0.24850
10	#design	1,813	841.0	0.27159
11	#inspiration	1,674	846.0	0.27219
12	#entrepreneur	1,619	857.0	0.27634
13	#technology	1,557	418.0	0.17710
14	#workshop	1,541	672.0	0.20611
15	#teacher	1,455	824.0	0.25505
16	#training	1,426	385.0	0.16898
17	#work	1,383	622.0	0.22423
18	#creative	1,356	662.0	0.19807
19	#trust	1,292	645.0	0.22893
20	#engagement	1,287	666.0	0.18877

Table 1: Top 20 hashtags sorted by degree (source: own calculation)

ANALYSIS OF INDIVIDUAL HASHTAGS INTER-CONNECTION

When analyzing hashtags, 15,795 hashtags were added to the analysis. Among these hashtags, 562,288 connections were created based on import into the interconnection network.

The basic characteristics of the network are composed of 140 communities. This is due to a large number of hashtags that are used for example only once. The modularity of this network is 0.568, which means that individual hashtags within the community are not as strongly connected to other communities as they are in each community.

To understand the structure of each group, the reduction of individual hashtags was used based on the Average Degree value to 166 - the closest value 1% of the basic set of the Nodes (15,759). Based on hashtag reduction, where hashtags with a grade less than 166 were removed from the analysis, 1,425 hashtags were left with a degree higher than 166. Based on this analysis, 5 strong communities were extracted to explain 100% reduced hashtags, see Figure 2.

Characteristics	Net	Net after reduction*
Nodes (Points)	15,759	1,425
Edges**	562,288	195,993
Average Degree***	71.361	275.078
Graph Density	0.005	0.193
Modularity	0.568	0.506
Number of Communities	140	5

Table 2: The basic networks characteristics (source: own calculation)

Note: * a value of degree higher than 166, ** Connections between hashtags, *** On average, 1 hashtag is connected to another 40 hashtags

After extracting five powerful communities, individual communities can be named based on included hashtags. Due to the size of modularity of 0.506, communities can be considered to be medium polarized and will contain hashtags for one topic, but will be intertwined with other communities (not purely non-profit communities).

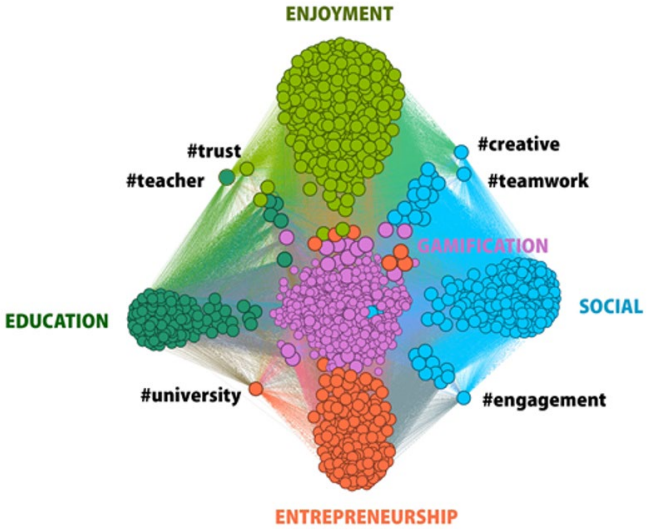

Figure 2: Visual representation of interconnection network based on #gamification at Instagram social network (source: own calculation)

Color	Community	Sample of main hashtags
Dark green	Education	#education #teaching #video #artist #teacher #school #university #students #student #science
Orange	Entrepreneurship	#knowledge #workforce #startups #networking #creativity #entrepreneurship #elearning #entrepreneurs #startup #startuplife #storytelling #feedback #entrepreneurlife #online #meeting #business #company #emprendedor #promotion
Purple	Gamification in general	#gamification #game #fun #play #motivation #instagood #love #entrepreneur #art #learning #design #innovation #marketing #tech #technology #training
Blue	Social	#communication #teamwork #leadership #teambuilding #team #goals #amazing #playing #creative #engagement #challenge #event
Green	Enjoyment	#success #successfulbeautiful #experience #change #skills #reward #friends #winner #win #passion #trust #journey #excited #havingfun

Table 3: Communities (source: own calculation)

DISCUSSION

Based on the analysis, five communities were identified that are relatively well-isolated visually, as can be seen in Figure 2. Based on a visual presentation and modularity value of 0.506, these are not precisely defined groups that do not cross, suggesting the interconnectedness of each community among themselves.

The first community called Education responds to the frequent use of gamification in learning to accelerate the learning curve when it is considered to be a serious approach to the learning process (Harman, Koohang and Paliszkiewicz, 2014), or teaching of gamification to improve business performance (Galan, 2013).

The second crowd of Entrepreneurship responds to the key words associated with business, start-ups, and practical use of business-related keywords, what is also reflected by current studies that confirm the significant use of gamification in business and entrepreneurship (Sarangi and Shah, 2015).

The most general is the third community (Gamification in general), which is generally focused on business, motivation, education and innovation. There are also hashtags from the other four crowds and are often general passwords/keywords. The location of this crowd is at the center, and it is evident that all other communities are intermingled.

The community Social is associated with hashtags #inspiration, #communication, #teamwork, #team identifies communication using gamification in areas associated with teamwork, which is in the line of researches (Marczak et al., 2015; Alhammad and Moreno, 2018) where gamification is used to develop teamwork, leadership and collaboration.

The Enjoyment community is associated with a positive response to gamification. It is basically the feeling that people experience gamification when the growth principle of flow

theory is well set where challenges push their skills (Hamari et al., 2016)
The visual expression clearly outlined the communities Education and Entrepreneurship, which - according to the graphical statement - links the University point. Not only is gaming used in game based learning such as board games, but also virtual environment experiences (Pavlíček et al., 2014; Burguillo, 2010). Universities are also a natural mediator of education and busines. The position of the University in this network is shown in Figure 2. Many universities support entrepreneurship efforts of their students (Fini et al, 2011) Support is not only a background for their own start-up or spin-offs, and the development of expertise and monitoring of new trends in the field, especially through conferences.
Based on the visual interpretation, another five hashtags were identified, including #engagement as a link between Entrepreneurship and Social communities, #creative and #teamwork as a link between Social and Enjoyment and #trust and #teacher as interconnecting elements between Education and Enjoyment communities.
Based on the methods used, it is not possible to create correlations and regressions between individual hashtags and communities, so the impact of these hashtags on individual communities can not be identified. But these hashtags are significant in terms of their positionand linking among communities.
Based on these results, research issues can be defined for further research.
For example, the first link between communities is #engagement. The main objective of gamification is to increase engagement (Villagrasa et al., 2014) so it is possible to ask the folowing research questio: What role does engagement play in the use of gamification in entrepreneurship or education in conjunction with teamwork and leadership?
In the field of #teamwork and #teamwork that connects social and enjoyment communities, a research question can be defined as: How does the teamwork and the creativity affect the enjoyment of gamification in the area of education?
In the #teacher and #trust are area, a research question could be: What is the role of trust in a teacher in the field of enjoyment of education when using gamification?
This research builds on the results of a study focusing on the identification of the most frequent collaborative topics, which has led to the research of gamification in education where the interconnectedness of individual research communities in the field of research and education has been identified (Pilař et al, 2016a). Universities are primarily concerned and interested in gamification‘s education utility. Our research suggests that the subject of gamification is often connected not only with the environment of education and universities, but also with entrepreneurship and start-ups, which leads the authors tosupport further research into the importance of universities in promoting start-ups using gamification.

CONCLUSION

The analysis of the interconnectedness of the individual hashtags involved 15,759 hashtags. A total of 562,288 connections were created between these words. Based on eigenvector centrality values, we can identify the most important hashtags associated with #gamification: #motivation, #business, #university, #education, #industry, #inspiration, #design, #startup, #innovationand#teacher. It is clear that #gamification is tied to two main areas: Education and Business.
The basic characteristic of the network is composed of 140 communities. The modularity value of this network is 0.568, indicating that individual hashtags within the community are linked not only to each other but also to other communities. Net after reduction represents 1,425 nodes, 195,993 degrees, 275 average degrees, 0.193 graph density and modularity 0.506. After the hashtag reduction, five strong communities explaining 100% reduced hashtags have been extracted: Education, Entrepreneurship, Gamification in general, Social and Enjoyment. The most general is the crowd of Gamification, which is universally focused on business, education or innovation. The location of this community is in the center and blends with everyone else.
Education crowd represents concepts related to learning and the school. The Entrepreneurship community responds to key words related to business, start-ups and key words associated with practical business use. Research identified University as a link between Education and Entrepreneurship and Teacher and Trust as a link between education and enjoyment. All these results indicate that the area of gamification is a multidisciplinary issue linking education with the entrepreneurship area, and is also used in areas such as start-up and innovation, which can be considered as an area that is important in teaching and especially in universities. For this reason, gamma should be considered as an additional method of support in teaching management skills.

ACKNOWLEDGEMENTS

This research article was supported by IGA PEF CZU (CULS) 20181022 - Regionální značení potravinářských produků pohledem podnikatelských subjektů, (regional food labelling by business entities´ point of view). Nr. 00002161.

REFERENCES

Alhammad, M. and Moreno, A.M. (2018) ‘Gamification in software engineering education: A systematic mapping’, *Journal of Systems and Software*, Vol. 141, pp. 131-150. https://doi.org/10.1016/j.jss.2018.03.065

Antoniou, I. E. and Tsompa, T. (2008) ‘Statistical analysis of weighted networks’, *Discrete Dynamics in Nature and Society*, Vol. 2008, pp. 1–16. https://doi.org/10.1155/2008/375452

Bittner, J.V. and Schipper, J. (2014) ‘Motivational effects and age

differences of gamification in product advertising', *Journal of Consumer Marketing*, Vol. 31, No. 5, pp. 391-400. http://dx.doi.org/10.1108/JCM-04-2014-0945

Blondel, V., Guillaume, J.L., Lambiotte, R. and Lefebvre, E. (2008) 'Fast Unfolding of Communities in Large Networks', *Journal of Statistical Mechanics Theory and Experiment*, Vol. 2008, No. 10. http://dx.doi.org/10.1088/1742-5468/2008/10/P10008

Boyd, D.M. and Ellison, N.B. (2007) 'Social Network Sites: Definition, History, and Scholarship', *Journal of Computer-Mediated Communication*, Vol. 13, No. 1, pp. 210–23. https://doi.org/10.1111/j.1083-6101.2007.00393.x

Burguillo, J. (2010) 'Using Game-Theory and Competition-based Learning to Stimulate Student Motivation and Performance', *Computers & Education*, Vol. 55, No. 2, pp. 566-575. https://doi.org/10.1016/j.compedu.2010.02.018

Caixeta, C.C., Nascimento, A. Jr. and Abreu, A. M. (2016) 'The Influence of Social Media on Consumer Perception of Brands', *Espacios*, Vol. 37, No. 27, pp. 17.

Carrington, P.J., Scott, J. and Wasserman, S. (2005) *'Models and methods in social network analysis'.* New York: Cambridge University Press.

Chorney, A. I. (2012) 'Taking the game out of gamification', *Dalhousie Journal Of Interdisciplinary Management*, Vol. 8, No.1. pp. 1-14. http://dx.doi.org/10.5931/djim.v8i1.242

Paharia, R. (2013) '*Loyalty 3.0: how big data and gamification are revolutionizing customer and employee engagement'*. New York: McGraw-Hill.

Dignan, A. (2011) *Game Frame: Using Games as a Strategy for Success*. New York: Free Press.

Duggan, M. (2015) *Mobile Messaging and Social Media 2015*, [online], Available: http://www.pewinternet.org/2015/08/19/mobile-messagingand-social-media-2015 /2015-08 -19_social-media-update_09/ [17 Aug 2015].

Efron, M. (2010) 'Hashtag retrieval in a microblogging environment' In *Proceedings of the 33rd international ACM SIGIR conference on Research and development in information retrieval (SIGIR '10)*, New York, USA, pp. 787-788. https://doi.org/10.1145/1835449.1835616

Fini, R., Grimaldi, R., Santoni, S. and Sobrero, M. (2011) 'Complements or substitutes? The role of universities and local context in supporting the creation of academic spin-offs', *Research Policy*, Vol. 40, pp. 1113–1127. https://doi.org/10.1016/j.respol.2011.05.013

Galan, F. (2013) ,Introducing some gamification features in an undergraduate entrepreneurship course', In: *EDULEARN13 Proceedings,* pp. 5432-5437.

*G*iaxoglou, K. (2018) '#JeSuisCharlie? Hashtags as narrative resources in contexts of ecstatic sharing', *Discourse, Context & Media*, vol. 22, pp. 13–20. https://doi.org/10.1016/j.dcm.2017.07.006

Google (2018) *gamification – Google Trends*, [online], Available at: https://www.google.cz/trends/explore?date=all&q=gamification [23 Sep 2018].

Gruzd, A. (2016) *Netlytic: So ware for Automated Text and Social Network Analysis*, [Software], Available: http://netlytic.org/

Hamari, H., Shernoff, D.J., Rowe, E., Coller, B., Asbell-Clarke, J. Edwards, T. (2016) 'Challenging games help students learn: An empirical study on engagement, flow and immersion in game-based learning', *Computers in Human Behavior*, Vol. 54, pp. 170-179, https://doi.org/10.1016/j.chb.2015.07.045

Hamari, J., Koivisto, J. And Sarda, H. (2014) „Does Gamification Work? -- A Literature Review of Empirical Studies on Gamification", *2014 47th Hawaii International Conference on System Sciences*, IEEE, 2014, 2014, pp. 3025-3034. https://doi.org/10.1109/HICSS.2014.377

Harman, K., Koohang, A. and Paliszkiewicz, J. (2014) 'Scholarly interest in gamification: a citation network analysis', *Industrial Management & Data Systems*, Vol. 114, No. 9, pp. 1438 - 1452. http://dx.doi.org/10.1108/IMDS-07-2014-0208

Harwood, T. and Garry, T. (2015) 'An investigation into gamification as a customer engagement experience environment', *Journal of Services Marketing*, Vol. 29, No. 6/7, pp. 533-546. http://dx.doi.org/10.1108/JSM-01-2015-0045

Holmes, J.B. and Gee , E.R. (2016) 'A framework for understanding game-based teaching and learning', *On the Horizon*, Vol. 24, No. 1, pp. 1-16. http://dx.doi.org/10.1108/OTH-11-2015-0069

Hu Y., Manikonda L. and Kambhampati S. (2014) 'What we instagram: A first analysis of instagram photo content and user types', In *Proceedings of the 8th International Conference on Weblogs and Social Media, ICWSM 2014*, pp. 595-598.

Ilyas, M.U. and Radha, H. (2011) 'Identifying Influential Nodes in Online Social Networks Using Principal Component Centrality', In *The 2011 IEEE International Conference on Communications, IEEE*, Kyoto, June 2011, pp. 1-5.

*I*nsley, V. and Nunan, D. (2014) 'Gamification and the online retail experience', *International Journal of Retail & Distribution Management*, Vol. 42, No. 5, pp. 340-351. http://dx.doi.org/10.1108/IJRDM-01-2013-0030

Jackson, C. A. and Luchner, A. F. (2017) 'Self-presentation mediates the relationship between self-criticism and emotional response to Instagram feedback', *Personality and Individual Differences*, Vol. 133, pp.1-6. https://doi.org/10.1016/j.paid.2017.04.052

Knoke, D. and Yang, S. (2008) *Social Network Analysis*, Thousand Oaks: SAGE Publications.

Kumar, H. and Raghavendran, S. (2015) 'Gamification, the finer art: fostering creativity and employee engagement', *Journal of Business Strategy*, Vol. 36, No. 6, pp. 3-12. http://dx.doi.org/10.1108/JBS-10-2014-0119

Kusuma, G.D., Wigati, E.K. and Suryapranata, L.K.P., (2018) 'Analysis of Gamification Models in Education Using MDA Framework', *Procedia Computer Science*, Vol. 135, pp. 385-392. https://doi.org/10.1016/j.procs.2018.08.187

Lup, K. L., Trub, L. and Rosenthal, L. (2015) 'Instagram #Instasad?: Exploring Associations Among Instagram Use, Depressive Symptoms, Negative Social Comparison, and Strangers Followed', *Cyberpsychology, Behavior & Social Networking*, Vol. 18, no. 5, pp. 247-252. https://doi.org/10.1089/cyber.2014.0560

Marczak, S., Filho, F., Singer, L., Treude, Ch., Steffens, F., Redmiles, D. and Ban, A.A. (2015) 'Studying Gamification as a Collaboration Motivator for Virtual Software Teams: Social Issues, Cultural Issues, and Research Methods', In *CSCW '15 Companion*, Vancouver, BC.

Marczewski, A. (2013) *Gamification: A Simple Introduction.*

Meyer, C. D. (2010) *Matrix analysis and applied linear algebra. Philadelphia: Society for Industrial and Applied Mathematics*, Philadelphia: Society for Industrial and Applied Mathematics.

Naaman, M., Boase, J. and Lai, C.-H. (2010) 'Is it really about me?: message content in social awareness streams', In *Proceedings of the 2010 ACM conference on Computer supported cooperative work*, New York, USA, pp. 189-192. https://doi.org/10.1145/1718918.1718953

Pavlíček, J., Švec, V., Tichá, I. and Hanzlík, L. (2014) 'Business Games Powered by Articial Intelligence in Education', in *Proceedings of the 11th International Conference on Efficiency and Responsibility in Education 2014*, Prague, pp. 186–195.

Pilař, L., Rojík, S., Balcarová, T. Poláková, J. (2016a) 'Gamification in Education: Current State', in *Proceedings of the 13th International conference on Efficiency and Responsibility in Education 2016*, Prague, pp. 463-471. https://doi.org/10.13140/RG.2.1.1348.5682

Pilař, L., Balcarová, T. and Rojík, S. (2016b) 'Farmers' Markets: Positive Feelings of Instagram Posts', *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, vol. 64, No. 6, pp. 2095-2100. https://doi.org/10.11118/actaun201664062095

Pilař, L., Rojík, S., Tučková, K., Balcarová, T. and Selby, R. (2017a) "Gamification in Education: social network analysis', in *Proceedings of the 14th International conference on Efficiency and Responsibility in Education 2017*, Prague, pp. 318-324.

Pilař, L., Poláková, J., Gresham, G., Rojík, S. and Tichá, I. (2017b) 'Why people use hashtags when visiting farmers´ markets', In *Agrarian perspectives Proceedings of the 26th International Conference, Prague, Czech Republic*, pp.287-292.

Prahalad, C.K. and Ramaswamy, V. (2004) 'Co-creation experiences: the next practice in value creation', *Journal of Interactive Marketing*, Vol. 18, No. 3, pp. 5-14. https://doi.org/10.1002/dir.20015

Sarangi, S. and Shah, S. (2015) 'Individuals, teams and organizations score with gamification', *Human Resource Management International Digest*, Vol. 23, No. 4, pp. 24-27. http://dx.doi.org/10.1108/HRMID-05-2015-0074

Scott, J. (2000) *Social network analysis: A handbook*, London: SAGE Publications.

Sheldon B. and Bryant K. (2016) 'Instagram: Motives for its use and relationship to narcissism and contextual age', *Computers in Human Behavior*, Vol. 58, pp. 89-97. https://doi.org/10.1016/j.chb.2015.12.059

Smith M.A., Rainie L., Shneiderman B. and Himelboim I. (2014) *Mapping Twitter Topic Networks: From Polarized Crowds to Community*, [Online], Available: http://www.pewinternet.org/2014/02/20/mapping-twitter-topic-networks-from-polarized-crowds-to-community-clusters/ [20 Feb 2014].

Swan, C. (2012) 'Gamification: a new way to shape behavior', *Communication World*, Vol. 29, No. 3, pp. 13-14.

Švec, V. (2014) 'Gamification in marketing communication course: a fictitious products´ promotion at virtual market', in *ICERI2014 Proceedings*, Seville, pp. 5206-5211.

Trees, L. (2015) 'Encouraging millennials to collaborate and learn on the job', *Strategic HR Review*, Vol. 14, No. 4, pp. 118-123. http://dx.doi.org/10.1108/SHR-06-2015-0042

Villagrasa, S., Fonseca, D., Redondo, E. and Duran, J. (2014) 'Teaching case of gamification and visual technologies for education', *Journal of Cases on Information Technology*, Vol. 16, No. 4, pp. 38-57. http://dx.doi.org/10.4018/jcit.2014100104

Wagner, K. (2015) *Instagram is the fastest growing major social network*. [Online]. Available: https://www.recode.net/2015/1/9/11557626/instagram-is-the-fastest-growing-major-social-network [25 Feb 2019].

Wang, X., Wei, F., Liu X., Zhou, M. and Zhang, M. (2011) 'Topic sentiment analysis in twitter: a graph-based hashtag sentiment classification approach', In *Proceedings of the 20th ACM international conference on Information and knowledge management (CIKM '11)*, New York, USA, pp. 1031-1040. https://doi.org/10.1145/2063576.2063726

Zichermann, G. and Linder, J. (2010) *Game Based Marketing: Inspire Customer Loyalty Through Rewards, Challenges, and Contests*, Hoboken: John Wiley & Sons.