ERIES JOURNAL, VOLUME 7, ISSUE 3-4

CONTENT

THE WORK-STUDY DILEMMA OF CZECH UNDERGADUATES Jakub Fischer, Hana Lipovská	45
THE SERVICES QUALITY LEVEL ASSESSMENT AT THE TECHNICAL UNIVERSITY USING THE SERVQUAL METHOD Renata Stasiak-Betlejewska, Michael Kaye, Marilyn Dyason, Katarina Stachová, Hana Urbancová	53
ANALYSIS OF EXAM RESULTS OF THE SUBJECT 'APPLIED MATHEMATICS FOR IT' Helena Borožová, Jan Rydval	59
COMPARISON OF RESEARCH ENGAGEMENT OF PHD STUDENTS AT VARIOUS STUDY PROGRAMS AT CULS PRAGUE: AN INTRODUCTORY STUDY Martin Flégl, Hana Vostrá Vydrová, Ivana Tichá	66
AN ANALYSIS OF THE STUDY PLAN OF THE PROFESSIONALLY ORIENTED BACHELOR STUDY FIELD OF MULTIMEDIA IN ECONOMIC PRACTISE Zdeněk Vondra, Kristýna Vltavská	74
ENGLISH FOR SPECIFIC PURPOSES E-LEARNING EXPERIMENTAL RESEARCH Lenka Kučírková, Petr Kučera, Hana Vostrá Vydrová	80
TEACHING TACIT KNOWLEDGE: CAN ARTIFICIAL INTELIGENCE HELP? Václav Švec, Josef Pavlíček, Ivana Tichá	87
SOCIAL RESPONSIBILITY OF HIGHER EDUCATIONAL INSTITUTIONS – THE COMPARISON OF THE VIEW OF STUDENTS AND POTENTIAL STUDENTS Lucie Kvasničková Stanislavská, Roman Kvasnička, Kateřina Kuralová, Klára Margarisová	95

Web pages: http://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 editor: doc. Ing. Milan Houška, 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 22438 2355.

© Czech University of Life Sciences Prague, Czech Republic, 2014

URNA 2



JOURNAL ON EFFICIENCY AND RESPONSIBILITY IN EDUCATION AND SCIENCE

VOLUME 7







ISSUE 3-4

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

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

EDITORIAL BOARD

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:

- the EBSCO database;
- the Directory of Open Access Journals.

Editor-in-Chief

prof. RNDr. Jaroslav Havlíček, CSc., Czech University of Life Sciences Prague, Czech Republic

Executive Editors

Ing . Igor Krejčí, Ph.D., Czech University of Life Sciences Prague, Czech Republic Ing. Martin Flégl, Ph.D., Business School, University La Salle, Mexico

Editorial Board Members

dr. Peter M. Bednar, University of Portsmouth, United Kingdom doc. Ing. Peter Fandel, CSc., Slovak University of Agriculture in Nitra, Slovak Republic doc. Ing. Jana Hančlová, CSc., Technical University of Ostrava, Czech Republic Joan Harvey, PhD. Newcastle University, United Kindgdom doc. Ing. Milan Houška, Ph.D., Czech University of Life Sciences Prague, Czech Republic dr. Irem Kizilaslan, Dokuz Eylul University, Turkey doc. PhDr. Luděk Kolman, CSc., Czech University of Life Sciences Prague, Czech Republic prof. RNDr. Jindřich Klůfa, CSc., University of Economics, Prague, Czech Republic dr. Ricardo Lozano, Yeditepe University Istanbul, Turkey doc. Ing. Stanislava Mildeová, CSc., University of Economics, Prague, Czech Republic prof. RNDr. Eva Milková, Ph.D., University of Hradec Králové, Czech Republic prof. Ing. Zdeněk Molnár, CSc., Czech Technical University in Prague, Czech Republic prof. RNDr. Jarmila Novotná, CSc., Charles University, Czech Republic dr. Moufida Sadok, Higher Institute of Technological Studies in Communications, Tunisia prof. PhDr. RNDr. Antonín Slabý, CSc., University of Hradec Králové, Czech Republic prof. Ing. Milan Slavík, CSc., Institute of Education and Communication of the CULS Prague doc. Ing. Tomáš Šubrt, Ph.D., Czech University of Life Sciences Prague, Czech Republic prof. Ing. Milan Turčáni, CSc. Constantine the Philosopher University in Nitra, Slovakia doc. RNDr. Eva Vaněčková, CSc., University of South Bohemia, Czech Republic dr. Christine Welch, University of Portsmouth Business School, United Kingdom doc. Ing. Roman Zuzák, Ph.D., University of the Applied Psychology, Terezín, Czech Republic

Technical Editors

Ing. Jan Bartoška, Ph.D., Czech University of Life Sciences Prague, Czech Republic Ing. Roman Kvasnička, Ph.D., Czech University of Life Sciences Prague, Czech Republic Ing. Jiří Fejfar, Ph.D., Czech University of Life Sciences Prague, Czech Republic

Editorial Office

ERIES Journal, Czech University of Life Sciences Prague, CZ 165 21 Prague 6 - Suchdol, Czech Republic, email: editor@eriesjournal.com, tel: +420 22438 2355

Registration number: MK ČR E 21414

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 Copyright 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 Englishspeaking 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.

- 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 guote material that has appeared in another publication.

EDITORIAL

Journal on Efficiency and Responsibility in Education and Science (ERIES Journal) has gone through a very exciting and difficult year 2014.

Firstly, at the beginning of the year we published the first printed issue in the ERIES Journal history. Since Volume 7 and Issue 1 the ERIES Journal is published both in online and printed version.

Secondly, the ERIES Journal was not indexed in the list of reviewed non-impacted periodicals published in the Czech Republic for the year 2014. However, thanks to the effort of all Editors, Members of Editorial Board and Technical editors, the ERIES Journal can successfully finish the year 2014 with this special issue 3-4. We are also grateful to all reviewers who found the time to review all submitted manuscripts and patiently expressed their suggestions and recommendations.

Last but not least, we are pleased to announce that the Research, Development and Innovation Council (RVVI) at its 299th meeting on November 28, 2014 approved an updated the list of reviewed non-impacted periodicals published in the Czech Republic. As a result, the ERIES Journal is again indexed in the list of reviewed journals by the RVVI.

In this last issue of the year 2014 we have variety of articles from the University of Economics in Prague; Czestochowa University of Technology in Poland, University La Salle in Mexico City, and Czech University of Life Sciences Prague. As in the previous issue, we are glad that the ERIES Journal constantly attracts researcher, academics and authors from diverse institutions and countries.

Jakub Fischer and Hana Lipovská analyse the work-study dilemma of Czech students. These authors examine the impact of the work and study workload according to the students' expectations towards labour market chances. The authors found that Czech full-time students spent almost one full-time employment studying and working in one workweek. Moreover, the authors found considerable differences between men and women's work experience during their studies.

Collective of authors lead by Renata Stasiak-Betlejewska focus on services quality level in higher education, more precisely at the technical university. The authors used SERVQUAL methodology for this analysis, followed by a survey among 3000 students of technical universities and 200 high school graduates. The findings show the biggest differences in expectations related to parking availability and opening hours of students offices. In addition, students have doubts about the skills and knowledge of the teaching staff. The third article in this issue, from Helena Brožová and Jan Rydval, evaluates students' exam results in the subject Applied Mathematics for IT, which is taught at the Czech University of Life Sciences Prague. The authors analyse exam results from the last 13 years and for both regular and distance form of studies. The purpose of the analysis is to find out the reasons of low students' results. To support this analysis, the authors also analyse the content and structure of the exam tests. As a result, the exam test has appropriate content and difficulty. Therefore, the low exam results are related to students' knowledge and preparations.

Martin Flégl, Hana Vostrá Vydrová and Ivana Tichá compare research engagement of PhD students at various study programmes at Czech University of Life Sciences Prague. The authors disseminated online questionnaire among 1093 PhD students. At the end, their analysis consists of 187 respondents from both full-time and part-time PhD students. The analysis covers areas such as allocation of time to doctoral studies, allocation time to research, involvement in research projects and satisfaction with doctoral studies. The authors found, among others, that there is no significant difference in time allocation to research and PhD students are dissatisfied with their research outputs.

Kristýna Vltavská and Zden*ě*k Vondra focus on the study field of Multimedia in Economic Practise, which has been taught at the University of Economics in Prague since 2011. Due to the first graduates of this study field, the authors analyse if the study field has the right structure of subjects, i.e. if all the subjects are relevant for students. This analysis is made according to a comparison of students' and creators' point of views. As a conclusion, there are different views on the relevance of the theoretical subjects. These findings will lead to a revision of subjects' contents towards the next reaccreditation.

The article of Lenka Kučírková, Petr Kučera and Hana Vostrá Vydrová deals with ESP e-learning experimental research. This research was conducted in the lessons of Business English. The research sample is represented by 107 students enrolled in this subject. The authors divided the students randomly into the experimental and controlled groups. As a result, the students from experimental group are statistically better in listening comprehension. Moreover, all analysed students have positive attitude to e-learning.

The authors Václav Švec, Josef Pavlíček and Ivana Tichá examine students' ability to use tacit knowledge. For this purpose, the authors conduct an experiment to test whether students are able to transfer and use tacit knowledge. The students obtained this tacit knowledge in the basic course of Strategic Management. The authors chose to play a board game Power Grid for the experiment evaluation. Results show low students' ability to use tacit knowledge. According to the results, the authors propose a possibility of using a business game as a teaching tool of specific tacit knowledge.

The last article of this special issue, from collective of authors lead by Lucie Kvasničková Stanislavská, deals with the issue of social responsibility in higher education. The authors use qualitative data from two focus groups: current higher education students and potential higher education students. The answers from both focus groups are then compared. The authors find students' willingness to participate in social responsibility activities. However, potential students are dissatisfied with the current way of getting information from universities.

We hope that all our readers will find this last issue of the year 2014 interesting, and we also hope that the ERIES Journal will contribute to the field of efficiency and responsibility in education as it has contributed so far. With the end of the year 2014 we would like to thank to all the authors and reviewers who contributed in increasing the ERIES Journal quality.

We wish you the best to the year 2015.

Sincerely,

prof. RNDr. Jaroslav Havlíček, CSc. Editor-in-Chief

THE WORK-STUDY DILEMMA OF CZECH UNDERGADUATES

Jakub Fischer, Hana Lipovská University of Economics, Prague

Highlights

- Family background does not influence the study workload or the working activity of students
- Self-studying contributes to the future wage twice more than studying at school or working
- · Hard-working students and students with in-branch experience are optimistic about labour prospects

Abstract

This paper describes a theory of adaptive eLearning, a tool that enables an individualised instruction. First The aim of this paper is to analyse the work-study dilemma of Czech students. We examine the impact of the work and study workload on the student's expectations for their future labour market chances. For the future formal evaluation of Czech students' workload, it is necessary to take into account if the students' jobs are closely connected to their field of study, which make up the important part of their education. We used a unique dataset based on the survey EUROSTUDENT V to test this challenging question. We have found that Czech full-time students spent almost one full-time employment studying and working in one workweek. It was proven, that students who study very hard as well as students with in-branch experience are optimistic about their future labour prospects. Business-minded students especially prefer working hours to studying at school or at home. We did not discover the importance of family background to their workload with the exception of the labour-market perspectives. Furthermore we found considerable differences between men and women's work experience during their studies. Finally, according to the solution of the work-study dilemma model, we proved that while working hours are substitutes for hours spent at school, the role of self-study is irreplaceable.

Keywords

EUROSTUDENT V, ECTS, work-study dilemma model, study workload

Fischer J. and Lipovská H. (2014) "The Work-study Dilemma of Czech Undergraduates", *Journal on Efficiency and Responsibility in Education and Science, Vol. 7, No. 3-4*, pp. 45-52, online ISSN 1803-1617, printed ISSN 1803-1617, doi: 10.7160/eriesj.2014.070301.

Introduction

One of the most crucial questions of recent tertiary education in the Czech Republic is the balance between traditional formal education at universities and students' working activities during term-time. The so called work-study dilemma (Barett, 2000) exerts pressure both on universities, which are forced to change curricula in favour of e-learning, and on the undergraduates, who feel the need to have enrolled at least a part-time job while studying.

The trade-off between the amount of time spent studying and time spent working is a challenging problem that must be worked out by every university, every class teacher and every student. The crucial question is whether the "work experience myth" is built on sand or solid rock. While there is medially grateful evidence on the employer's preferences of experienced graduates, a lot of companies actually prefer graduates who are not burdened by non-relevant work habits (compare Doležalová, 2014a).

Dadgar (2012) maintains that according to Becker's Human Capital Theory, it is optimal for individuals to get a job after completing formal education to make the investment into individual human capital fully beneficial. Scott-Clayton (2012), on the contrary, stresses the concavity of human capital productivity which leads to marginal returns from the work experience. From this point of view, a student's job during termtime can improve their soft skills, career networking and secure references (ibidem).

In short, the study-work rate challenges economic theory: if

Human Capital Theory connected with Garry Becker's research (Becker, 1962) proves to be right, then a student's study workload should be very high and their work experience should create just a marginal part of their university years. Nevertheless, if higher education was just a necessary, but not sufficient condition in terms of job market signalling (Spence, 1973), then we should call for Czech students to work more.

However, the work-study dilemma is a more complex problem that should be studied even from other points of view. As the result of a university surplus and a shortage of students, several universities accept students without entrance exams (Alina and Volek, 2014). Such measures might diminish not only the quality of freshmen, but even the study workload of students.

Our former analysis dealt with intergenerational transmission suggesting that a student's family background highly influences their non-formal lifelong learning (Fischer and Lipovská, 2013). In accordance with Denny (2011), it was mentioned that the role of information and knowledge is less appreciated in blue-collar households than in white-collar households. Therefore, it is important to analyse this question once again in terms of the formal tertiary education.

Czech media (perhaps attracted by the legendary autobiography of modern heroes such as Steve Jobs and Bill Gates) ask whether business-minded youths really need to enrol in university (Hníková, 2014). The difference between future employers and employees might be detected even in the solution of their work – study dilemma.

Full research paper

Article type

Article history Received: December 8, 2014

Received in revised form: December 20, 2014 Accepted: December 28, 2014 Available on-line: December 31, 2014 Although tertiary education at Czech public universities is free of charge, it does not mean it is completely without expenses. The cost of living (as well as opportunity costs) forces full-time students to work, at least partly. It is demanding to analyse the relationship between the reason for the student's work and their study workload.

The aim of this paper is to present the work – study dilemma as solved by the Czech students, using data from the survey EUROSTUDENT V¹. The rest of the paper is organized as follows. We introduce the data and the statistical methods we used. We then present the results of our analysis. Firstly, the study workload from the perspective of study field, reasons for work, students' attitude towards business and university entrance requirements is discussed. Secondly, we analyse the relationship between study field and current job in terms of gender, chances on the labour market and wages. Than we focus on family background and study workload. Finally, the workstudy dilemma model is researched.

Materials and Methods

Our research is based on high quality and unique data from the survey EUROSTUDENT V, which was conducted in 2013 over all Czech public and 29 private universities. The questionnaire was sent to 95 177 undergraduate full-time and part-time students, with the response rate below 7%. After removal of uncompleted or insufficient questionnaires, our dataset consists of 4 664 respondents (Fischer and Vltavská, 2013). The great deal of questions from the survey EUROSTUDENT V used a type of the 5-point or 6-point Likert scale.

For the purpose of our analysis the optimal week study workload was computed. The Bologna Declaration of 1999 (Ministry of Education, Youth and Sports, 1999) supports the European Credit Transfer and Accumulation System (ECTS). It has been suggested that one term should consist of 30 ECTS on average, with 1 ECTS being from 25 to 30 lessons (1 lesson = 45 minutes). Based on the schedules of 11 Czech universities², the 20 week term³ is standard. One ECTS is considered to be 26 lessons (see Mazouch and Fischer, 2011). The average weekly study workload in hour is computed as:

study workload =
$$\frac{lessons \times TOTAL \ ECTS \times \frac{45}{60}}{weeks} = \frac{26 \times 30 \times \frac{45}{60}}{20} = 29.25 \sim 29 \ hours.$$

The study workload is then divided into 5 categories. The first category covers the workload that is lower than half of the optimal week study workload. The second one stays for more than half of the optimal hours. In the third category, there are students whose studies during the workweek are exactly the optimal workload. The forth category includes students who study longer than 29.5 hours but less than 40 hours. Finally, the last category contains students whose study workweek is longer than the standard Czech labour workweek.

study workload [hours]	intensity
(0, 14.5>	very low
(14.5, 29>	low
(29, 29.5>	enough
(29.5, 40>	high
(40, 146>	verv high

Tab. 1: The study workload intensity in five categories

Variable *wage*, as a proxy for wages which can be expected by students of different programmes on the Czech labour market, was taken from the report based on the REFLEX 2010 survey (Koucký and Bartušek, 2012). As the dataset for the recent labour market situation was not available at the time of writing, the *wage* variable from 2010 was considered mainly as the relative one. Using the average wage on the Czech labour market in the 4th quarter of 2010 (25 803 CZK, CZSO, 2011), we create the new dummy variable acquiring a value of 1 for the above-average wage and value of 0 for the below-average wage.

The dummy variable *exam* reflected whether the respondents had to pass entrance exams, including aptitude tests or General Record Examination (GRM) or if they had enrolled either without any requirements or were accepted due to their former study results.

The original dataset was narrowed down to a subset of 3 852 respondents – full-time students – who answered the questions on their study workload.

The study workload, as a share of the total workload is computed as

study workload share =
$$\frac{h_{sh} + h_{ss}}{h_{sh} + h_{ss} + h_w}$$
 (1)

where h_{sh} is the amount of hours spent on self-study during the work-week, h_{ss} is the weekly amount of hours of formal education at school and h_w stands for time spent weekly by working in paid job.

We have used standard statistical methods as the analysis of variance and non-parametric tests (Budíková et al., 2010). For the nominal and ordinal data, correspondence analysis was used (Řezanková et al., 2009).

Work-study dilemma model (WSDM)

To solve the work-study dilemma, the following model was derived. Suppose that tertiary education consists of two interconnected effects, which are revealed due to the labour market.

This is based on the equation of wage and marginal product of labour w = MLP. The first effect is the "diploma effect" as the result of Spence's job market signalling theory. According to this effect, the worker receives higher wage because of the wage premium – the wage differential σ between the average wage of a lower-educated worker w_L and higher-educated worker w_H :

$$\delta = w_H - w_L \tag{2}$$

Based on the average-wage data published by the Czech Ministry of Labour and Social Affairs (table 2) it is obvious, that whole differential is not the result of pure diploma effect as the average revenue of one bachelor's study hour is disproportionate to the average revenue of one master's study hour.

¹ This survey was lead in the Czech Republic within the project IPn KREDO CZ.1.07/4.1.00/33.0005.

² Charles University in Prague; University of J. E. Purkyně, Ústí nad Labem; Prague University of Economics, Prague; Czech Technical University in Prague; Masaryk University; Czech University of Life Sciences; University of South Bohemia in České Budějovice; University of West Bohemia in Plzeň; Institut of Chemical Technology in Prague and Technical University in Liberec. These schools create 77% of our dataset.

³ Including the examination period.

	average wage [CZK]	wage differential [CZK]	study workload [hours]	average revenue [CZK]
upper secondary	23 319	-	-	-
bachelor's degree	27 199	3 880	3 510	1.105
master's degree	37 215	10 016	5 850	2.375

Tab. 2: Average revenue from one hour of compulsory study according to the degree. Source: Czech Ministry of Labour and Social Affairs

To get the total differential, we must include the second effect. The second effect is the marginal revenue from the additional hour spent on studying ρ_s and the marginal revenue from the additional hour of paid work ρ_w . This marginal revenue is measured purely in terms of human capital, it is not connected to the financial income, so $w \neq \rho$.

We assume that the hour of study h_s is to a certain extent a substitute for the hour of work h_w . If this hypothesis was valid, than we could expect the relationship to be as follows:

$$\rho_{w} = k_{\rho s}, \ k \neq 0 \tag{3}$$

with k being the constant.

For the purposes of our analysis, it is appropriate to split the total amount of hours spent on studying h_s into the time spent on attending formal courses at school and time devoted to self-study:

$$h_{S} = h_{ss} + h_{sh}.$$

The challenging problem is how to estimate corresponding coefficients ρ_{ss} , ρ_{sh} and ρ_{w} . The equity (3) can be modified in the following way:

$$\rho_{w} = k_{h} \rho_{sh}, \ k \neq 0 \tag{3.1}$$

and

$$\rho_{w} = k_{s} \rho_{s}, \ k \neq 0 \tag{3.1}$$

It is obvious that none of the undergraduates know the exact relationship between the work and study, but they assume that future employers require either sufficient work experience or excellent academic results. Every rational student is then optimizing within their time budget line the work-study ratio according to their personal abilities, preferences, knowledge and expectation. Following the philosophy of Hayek (1945), we assume that from the individual choices of appropriate bundle $[h_{sh}, h_w]$ the optimal relationship between ρ_{sh} and ρ_w can be computed. If h_{ss} is approximately common for all students of a certain subject with (reflecting the "diploma effect"), than we can estimate the coefficient using the ordinary least square model without intercept:

$$\delta = \rho_{ss}h_{ss} + \rho_{sh}h_{sh} + \rho_{w}h_{w} + \varepsilon \tag{4}$$

The corresponding estimators are then r_{ss} , r_{sh} and r_{w} . The relationships between these coefficients are tested by the Fisher F-test (Heij et al., 2004).

Results

This section is divided into four chapters. Firstly we deal with the study workload in light of the field of study, reasons for work, university entrance requirements and students' attitude towards running their own business. Secondly, we analyse the wage perspectives according to the students' self-evaluation of their labour market chances, their work experience and gender. In the third part, we discuss the relationship between students' family background and their study as well as the job workload. Last but not least, we present the results of our work-study dilemma model.

Study workload

Field of study

Part-time students should be able to study approximately 11 hours more than full-time students during weekends to fulfil the optimal study workload of 29 hours per week. Full time students spent 37 hours during the workweek studying and working in paid jobs and part-time students study and work a total of 49 hours during workweek. T-test for independent samples confirms that a significant difference between the study intensity of full-time students and part-time students exists.

Figure 1 clearly shows that the full-time students of Healthcare sciences and Pharmacy accomplish nearly the whole optimal workload during the workweek; on the other hand students of Law and Economics should spend approximately 8 - 10 hours studying during weekends. The narrowest difference between the weekend overload of full-time and part-time students is in Art, and the widest in Natural sciences.



Fig. 1: How many hours should full-time and part-time students study during weekends to fulfil the optimal 29-hours-quota? Categorisation according to field of study.

The correspondence map (fig. 2) visualizes the relationship between study workload during the workweek and the field of study (because the 2nd dimension explains 90% of the whole inertia, we can focus just on the horizontal relationship). While the highest workload is connected with full-time Healthcare and Pharmacy study programmes (more than 40 hours per week), students of Law, Economics, other Humanities and Social sciences spend less than 14.5 hours studying during the workweek.



Fig. 2: Association between workweek study intensity and field of study

Full-time students who are studying hard during the workweek

consider their chances on the Czech labour market as very good, students who studied exactly the optimal 29-29.5 hours consider their chances being fair (fig. 3).





Students, whose job is very closely connected to their field of study, spend in the workweek just a little time studying. On the other hand, if the intensity of studying is very high (more than 40 hours workweek), there is not a close relationship between their job and field of study. In this case, the term job is a clear substitute for formal education.

Other important factor is the satisfaction with the university. Students, who claim they would enrol in the same school again, study 29 hours a workweek in comparison to 27 hours for students who would never chose their school again. Moreover, satisfied students find their labour-market chances significantly better – on the scale from 1 (very good chances) to 5 (very poor chances) they evaluate their chances as 2.3, which is 0.6 point better than unsatisfied students.

Reasons for work

Two subsets were separated from the set of working full-time students: (i) students who work only to earn for a living, but not to gain work experience and (ii) students who work only to gain work experience but do not need to earn for a living. We find evidence, that the "must-work" students not only work 8 hours longer than students working to get experience, but they even study 6 hours longer. This might show, that the work is for students a kind of substitute for education.

Students who work just to get more work experience also find their labour-market chances significantly better than students working for money. Their jobs are also much closer to the field of their study than jobs of students who work to earn for a living (fig. 4).



Fig. 4: The job-study relation in light of the prevailing reason to work

Full-time students could even evaluate whether they

are primarily the students who work just in their freetime, or if they see themselves specifically as workers who study as an extra activity. Full time students, who describe themselves as mostly students, study 11 hours a workweek longer and work 23 hours a week less than full-time students who consider themselves to be workers who study (see tab. 3).

	study workload	work workload
student with other activites	28	8
work and study in free time	17	31

 Tab. 3: Study and work workload according to the self-evaluation of full-time students

Entrance exams and the study workload

According to the analysis of variance results, there is a significant impact caused by university entrance requirements. Students who did not need to take the entrance exams study significantly more than students, who passed the exams, aptitude or GRM tests. The difference is almost 2 hours a week (31.1 hour vs. 28.7 hour), which is 1.6 ECTS per term.



Fig. 5: College admission and study workload

Business-minded students

The amount of students who plan to start a business after graduation, was in our dataset very low (40 respondents only). Nevertheless, the analysis of variance shows a significant gap between the workweek study workload of "future employees" (30 hours) and "future employers" (22 hours). This difference is even more pronounced in terms of the whole term – it creates 5.5 ECTS credits. The "missing hours" are clearly the result of a higher job workload for business-minded students. They work 12 hours a week longer than other students (22 hours in comparison to 10 hours). Surprisingly, both groups of students have the same expectations for their future labour market prospects.



Fig. 6: Study workload of business-minded and non-business minded students

Field of study and the labour market

There exists a moderate relationship between the wage level (typical for the study programme) and the chances students consider to have on the Czech labour market (Cramer V=0.20). Students of programmes with significantly higher wages evaluate their chances on the Czech labour market as very good or good. Students who evaluate their labour-market chances as fair or poor can expect lower wages. However, there is not a statistically significant difference between the expected wages of full-time students who consider their chances on the Czech labour market as very poor and those who are unable to rate their chances (fig. 7).

Full-time students, who do not have a paid job during semester time, study during the workweek significantly more (31.5 hours) than students who work (25.5 hours).

Full-time students are more confident in terms of getting a job in the national labour market if their recent work is related to the content of their study programme (fig. 8). Students, whose job is not closely related to their study, evaluate their labour market chances as fair or poor or they are unable to rate them at all.



Fig. 7: Students evaluation of the Czech labour market chances and the average wage they can expected

Gender

There exists a significant relationship between the sex of students and relationship of their job to the content of their study programme. Male students tend to work during their studies more often in the field of their study than women (Cramer V =

0.19). While 44% of working male students work in a job very closely or closely related to their study, 40% of female-students work in a branch that has nothing in common with their study field. In total, 67% of female students study in a programme in which graduates have a below-average wage. On the contrary, 59% of male students major in a field, for which is typical an above-average wage.



Fig. 8: Labour market chances in light of the job-study relation

Family background

According to the results of analysis of variance, family background does not influence the study workload or the working activity of students. Students with at least one whitecollar parent do not study more than students with both bluecollar parents. On the other hand, students from white-collar families evaluate their chances on the labour market better than students from blue-collar families.



Fig. 9: Ranking the labour-market chances according to their family background (white-collar vs. blue collar parents)

Very similar results can be achieved when we focus on the initial education of students' parents. Children with both parents with tertiary education devote the same effort to work and study as children from families where both parents reached just primary or lower secondary education. Nevertheless, children of tertiary educated parents are much more optimistic in terms of their labour-market chances.



Fig. 10: Ranking the labour-market chances according to their family background (low-educated vs. high-educated)

Work-study dilemma model

Using the equation (1) we computed the share of full-time students' study workload on their total working time (time devoted to paid work, studying at school and self-studying). It is clear from fig. 11 that more than half of full-time students really study full time (80% - 100% of their total working time). Full-time students spent 38 hours on average weekly working or studying. Students with a higher share of study time work considerably less and self-study 7-times more than the "hard-workers" from the 1st quintile. However, the total working activities (including studying) of students from the 1th quintile are 8 hours longer than the activities of students from the 5th quintile.



Fig. 11: Quintile histogram of full-time students' study workload as a share of their total workload



Fig. 12: Structure of full-time students' workload

The solution to the WSDM (4) using the Newey-West estimator is

$$l = 0.065h_{ab} + 0.037h_{ac} + 0.036h_{ab}$$

with the coefficient of determination⁴ being $R^2 = 0.86$. Fisher F-test confirmed the solutions of equity (3.1) and (3.2) which is $k_h = 1.75$ and $k_s = 1$. It means that 100 hours of self-studying contributes to the future wage twice more than 100 hours of studying at school or 100 hours of work.

Discussion

If we consider standard full-time employment in the Czech Republic to be 40 hours, then full-time students study and work is almost at full-time employment level. On the other hand, part-time students need to spend 15 hours per weekend studying to fulfil the 29 hour quota, which is equivalent to a full-time job 7 days a week. This great time burden might be the main cause of part-time students' weaker study workload.

The differences in study workload in specific fields are in line with the greater number of compulsory lectures in Healthcare and Pharmacy in comparison with Law or Economics. This is in accordance with Ryška and Zelenka (2011) who analysed the total amount of hours spent weekly (including the examination period and weekends) on studying. In this research, both medical students and students of technical sciences devoted to their studies more than average time (more than 34 hours) and students of Economics and Law studied the below the average.

According to the Alina and Volek (2014), there is a relationship between the form of college admission and the success of students in key compulsory subjects taught in the very first term. Students who needed to pass an entrance exam did significantly better than students who enrolled without any examination. On the contrary, our results suggest that students who enrolled without exams worked harder. Three different explanations might be suggested for this: (i) Students who enrolled without exams might have a lower initial level of human capital as they possibly did not manage to pass the entrance exams at other schools. Those students need to work harder to catch up with the required human capital level. (ii) Students enrolled without exams are students with excellent secondary-school results. Rubešová (2009) mentions that such students tend to be more successful even at university. They might study harder not because of the catch-up effect, but because of their positive attitude towards studying. (iii) Students enrolled without exams are mainly students of Technical sciences (67% of students in technical colleges did not need to pass an exam) or Agriculture sciences, Forestry and Veterinary medicine (43% of students without entrance exams). However, those students' study workload was (together with students of medicine) the highest found (see fig. 1). Bearing those three points in mind, the higher study workload of students who did not need to pass entrance exams is perfectly clear.

For the future of the Czech national economy, it is threatening that, according to the survey, business-minded students count for just a small part of Czech undergraduates. One of likely explanations for this might be that the survey data is biased, as the business-minded students are perhaps not motivated enough to fill in a survey questionnaire. On the other hand, it is clear that students who want to run business find the marginal revenue from one additional lesson of study lower than from one additional hour of paid work. This is in line with Scott-Clayton's suggestion (2012).

⁴ It is important to note, that the coefficient of determination does not have a great unformational value in the OLS model without intercept.

The job-study relationship among male and female students could be a latent factor that models wider wage differences between men and women. Moreover, female students more often study programs in which graduates have significantly lower wages. While, in our dataset, the typical female branch is Education (the field with the highest rate of below-average wages), females create only 28% of law students (with law being one of the best-paid fields). This is in line with Chalupová and Borůvková (2012) who remark that for Czech male students' the three key factors in choosing their profession are career security, prestige and profitability.

Similarly as Šimková, Švarcová (2014) we have tested the importance of family background on students' lives. According their findings, students from low social classes work more often than students from higher classes, however, this is inconsistent with our results. The main reason might be that while their evaluation of family background was based on the students' self-assessment (a subjective evaluation), we used an objective evaluation - parental level of education and type of job. There is a clear impact of the family background on the labour-market perspectives. Children from white-collar and better educated families are more optimistic, possibly because of their parents' higher social capital (including a better social network). This is consistent with the results of several surveys led by particular Czech universities (e.g.: Masaryk University or Mendel University). According those results, the role of parents in finding the first job is irreplaceable. They found that from 10% to 23% jobs are found only thanks to the social network of the family (Diatelová, 2014, Mendelu 2010).

Our findings on work-study dilemma model are rather unexpected. While one hour of work is a substitute for an hour of formal studying at school, one hour of self-study is much more beneficial than both the formal education and working experience. Based on those results, the proclaimed importance of working experience is overrated. These findings are consistent with the requirements of employers (tab. 4) who actually do not expect work experience from graduate students.

	secondary	tertiary	quaternary
graduate	1,1 %	8,2 %	8,8 %
experienced worker	9,4 %	87,0 %	86,1 %

Tab. 4: Requirements of employers on graduates and experienced workers (Source: Doležalová 2013, Doležalová and Vojtěch 2013 and Doležalová 2014a, 2014b)

Conclusion

In this paper, the measurement of students' workweek workload is based on the optimal quota of 29 hours which students should spend studying at school and at home. There are great differences in the amount of study among the fields covered. The number of study hours depends also on the student's participation in the labour market.

We have discovered that wage differences during the working career might have their roots in undergraduates' activities. Women tend to enrol in study programs for which below-average wages are typical. Furthermore, they lose the opportunity to enhance their work experience when they work on jobs that have nothing on common with their field of study.

This paper is a further contribution to the discussion on the need for closer links between formal education and work experience. It is obvious that students who work in the field of their study consider one hour of work to be a substitute for one hour of formal studying, and are more optimistic in terms of their future career. Nevertheless, the rule of self-study cannot be ignored in the time management of the individual student. This should be taken into account when computing the compulsory ECTS for the Czech universities.

Acknowledgements

This work was supported by project No. IGS F4/9/2013 "Quantification of the Impacts of Educational Policy in the Last Decade in the Light of the Census Results" funded by the University of Economics, Prague and project No. MUNI/A/0811/2013 "The Economic Policy in the EU and the Czech Republic" funded by Masaryk University.

References

Alina, J. and Volek, T. (2014) 'Impacts of cancellation the entrance examinations on courses economics' *Proceedings of the* 11th International Conference on Efficiency and Responsibility in Education (ERIE 2014), Prague, pp. 11–18.

Barrett, S. (2000) 'The work/study dilemma: A pilot survey'. *International Education Journal*, vol. 1, no. 1, pp. 127 – 137.

Becker, G.S. (1962) 'Investment in Human Capital: A Theoretical Analysis', *The Journal of Political Economy*, vol. 70, no. 5, pp. 9-49.

Budíková, M. et al. (2010) *Průvodce základními statistickými metodami [Guide to basic statistical methods]*, Prague: Grada Publishing, a.s.

Chalupová, M. and Borůvková, J. (2012) 'Research on willingness to study nursing, education and social work among senior male students in Vysocina region'. *Journal on Efficiency and Responsibility in Education and Science*, vol. 5, no. 2, pp. 63-77.

CZSO [online]. Available:http://www.czso.cz/csu/csu.nsf/ informace/cpmz030911.doc [9 March 2013]

Dadgar, M. (2012) 'The Academic Consequences of Employment for Students Enrolled in Community College', *CCRC Working paper*, no. 46.

Denny, K. (2011) 'Do Teachers' Children Do Better at School?', *Regional and Sectoral Economic Studies*, vol. 11, no. 3, pp. 119 – 134.

Diaetlová, I. (2014) 'Absolventi a práce? Spokojenost' [Graduates and work? Satisfaction], *Atrium, no. 3, pp. 3.*

Doležalová, G. (2013) 'Postoje zaměstnavatelů k zaměstnávání absolventů škol (Zpráva ze šetření zaměstnavatelů v technických odvětvích)' [Attitudes of Employers to Employ Graduates (Report on survey of employers in the technical sector)], Prague: NÚV

Doležalová, G. and Vojtěch, J. (2013) 'Potřeby zaměstnavatelů a připravenost absolventů škol – šetření v sekundárním sektoru' [Needs of employers and readiness of graduates – secondary sector survey], Prague: NÚV

Doležalová, G. (2014a) 'Potřeby zaměstnavatelů a připravenost absolventů škol – šetření v terciárním sektoru' [Needs of employers and readiness of graduates – tertiary sector survey], Prague: NÚV

Doležalová, G. (2014b) 'Potřeby zaměstnavatelů a připravenost absolventů škol – šetření v kvartérním sektoru' [Needs of employers and readiness of graduates – quarternary sector survey], Prague: NÚV Fischer, J. and Lipovská, H. (2013) 'Building human capital: the impact of parents' initial educational level and lifelong learning on their children'. *Journal on Efficiency and Responsibility in Education and Science*, vol. 6, no. 4, pp. 218 - 231.

Fischer, J. and Lipovská, H. (2014) 'The path to the labour market: Czech students, their study workload and work experiences.' *Proceedings of the 11th International Conference on Efficiency and Responsibility in Education (ERIE 2014),* Prague, pp. 118 – 124.

Fischer, J. and Vltavská, K. (2013). EUROSTUDENT V: 'Základní výsledky šetření postojů životních podmínek studentů vysokých škol v České republice.' [EUROSTUDENT V: basic results of the survey among students at the Czech HELs] Prague.

Available:http://kredo.reformy-msmt.cz/viewdownload/1-ipnkredo/14-eurostudent-v-zakladni-vy-sledky-setreni-postojuzivotnich-podminek-studentu-vysoky-ch-skol-v-ceskerepublice

Hayek, F. A. (1945). 'The Use of Knowledge in Society'. *American Economic Review*, vol. 35, no. 4, pp. 519 – 530.

Heij, C. et al. (2004). *Econometric Methods with Applications in Business and Economics*, New York: Oxford University Press.

Hníková, E. (2014). 'Je vzdělání k ničemu?' [Is Education Useless?] Ekonom: Týdeník Hospodářských novin. Praha: Economia, a.s, vol. 58, no. 25.

Koucký, J. and Bartušek, A. (2012). 'Funkce a profily veřejných vysokých škol v ČR 2012' [Function and profiles of public universities in the Czech Republic] Prague: Charles University.

Mendelu (2010). 'Průzkum uplatnění absolventů Mendelovy univerzity v Brně' [Survey on the employability of graduates of the Mendel University in Brno] Brno: Mendel University.

Ministry of Education, Youth and Sports (1999) *Bologna Declaration,* Available: http://bologna.msmt.cz/bolona-1999/ bolonska-deklarace

Mazouch, P. and Fischer, J. (2011) Lidský kapitál – měření, souvislosti, prognózy [Human capital – measuring, context, prognosis] Prague: C. H. Beck.

MPSV [online]. Available: http://www.mpsv.cz/ISPVchara.php [30 June 2014]

Rubešová, J. (2009) 'Souvisí úspěšnost studia na vysoké škole se středoškolským prospěchem?' [Is the success at college connected to the results from the secondary school?], *Pedagogická orientace*, vol. 19, no. 3, pp. 89 – 103.

Ryška, R. and Zelenka, M. (2011) 'Absolventi vysokých škol: hodnocení vzdělání, uplatnění na trhu práce, kompetence' [College Graduates: Assessment of education, labour market enforcement, competence], Prague: SVP, Charles University

Řezanková, H. (2009) *Shluková analýza dat [Cluster data analysis]* Prague: Professional Publishing.

Scott-Clayton, J. (2012) 'What explains trends in labor supply among U.S. undergraduates?', *National Tax Journal*, vol. 65, no. 1, pp. 181–210.

Šimková, M. and Švarcová, P. (2014) 'Undergraduate Students From Families With Low Social Standing', *Proceedings of the* 11th International Conference on Efficiency and Responsibility in Education (ERIE 2014), Prague, pp. 720 – 727.

Spence, M. (1973) 'Job Market Signaling', *The Quarterly Journal of Economics*, vol. 87, no. 3, pp. 355 – 374.

THE SERVICES QUALITY LEVEL ASSESSMENT AT THE TECHNICAL UNIVERSITY USING THE SERVQUAL METHOD

Renata Stasiak-Betlejewska¹, Michael Kaye², Marilyn Dyason³, Katarina Stachová⁴, Hana Urbancová⁵

¹Czestochowa University of Technology Faculty of Management, ²University of Portsmouth, ³Quality Partnership Solutions Limited, ⁴School of Economics and Management in Public Administration, ⁵Czech University of Life Sciences Prague

Highlights

• The article refers the results on the technical university service quality analysis

Abstract

Contemporary universities services quality level concerns mainly the education efficiency evaluation that results from the learning outcomes realization and innovative features of the teaching programs that differs universities offers. Technical universities' attention is focused on ministerial requirements fulfillment which are strictly concentrated on the obtaining of students' skills expected by the employers' market. Analysis of the university services quality ignores common expectations of students and candidates for students related to the technical or functional quality such as university facilities and administrative workers empathy.

The aim of this study is to identify the expectations of both students and candidates for studies at technical universities. This allows identifying a level of the university services quality and areas that needs improvement in terms of not only the educational services but also technical university facilities. Results show significant importance of the all examined service quality aspects in the context of candidates expectations and students' perception. Research findings also support the university development within the scientific research process assistance.

Article type

Full research paper

Article history

Received: December 8, 2014 Received in revised form: December 20, 2014 Accepted: December 28, 2014 Available on-line: December 31, 2014

Keywords

Expectations, perception, SERVQUAL, service quality, university services

Stasiak-Betlejewska, R. et al. (2014) "The Services Quality Level Assement at the Technical University Using the Srvqual Method", Journal on Efficiency and Responsibility in Education and Science, Vol. 7, No. 3-4, pp. 53-58, online ISSN 1803-1617, printed ISSN 1803-1617, doi: 10.7160/eriesj.2014.070302.

Introduction

Education is one of the key factors, which is the subject of the service quality assessment of contemporary universities. It is a key mission component of each university, what underlines the main component of the university evaluation.

Nowadays, many assessments and rankings of higher education institutions (HEI) and their faculties are published by wide range of agencies and organizations. Due to the higher education globalization, the focus has shifted to worldwide rankings and assessments. University leaders believe that good rankings help to maintain and build institutional position and reputation, students and postgraduates exploit rankings to make a university choice (Furková, 2013).

A very popular and important supporting decision tool seems to be evaluation of HEI. The HEI assessments and rankings provided by wide range of agencies and organizations are based on different ranking systems; different indicators or metrics are used to measure higher education activities.

There are several institutions that measure higher education services quality level with applying of different indicators or metrics. In Poland the agency, which deals with evaluation of the higher education institutions activity results, is the State Accreditation Commission. In Czech Republic, the quality of higher education is fostered by the Accreditation Commission (Urbancová, Urbanec, 2013, Stacho, Urbancová, Stachová, 2013). In Slovak Republic, there are two agencies dealing with assessment and ranking of HEI: Accreditation Commission and Academic Ranking and Rating Agency (Furková, 2013).

The quality of education services at universities is traditionally evaluated by study results of students or their graduates. Important information for graduates is the percentage of employment on appropriate positions. The results of students can be measured not only by the examination grades but also by subjective satisfaction of students (Vostrá Vydrová, Jindrová, Dömeová, 2012).

Identification of the university services quality needs to verify different definitions and concepts of service quality from the literature. A general definition of the service quality is "the totality of features and characteristics of a service that bears on its ability to satisfy stated or implied needs" (Johnson and Winchell, 1988). Service quality is important to all organizations as it is "regarded as a driver of corporate marketing and financial performance" (Buttle 1996:8). Service quality has been also put forward as a critical determinant of competitiveness (Lewis, 1989) and a source of lasting competitive advantage through service differentiation (Moore, 1987).

LeBlanc and Nguyen (1988: 7-18) have suggested that corporate image, internal organization, physical support of the service producing system, staff-customer interaction, and degree of customers' satisfaction all contribute to service quality. Further, Edvardsson et al. (1989) presented four aspects of quality that affect customers' perceptions: technical quality (skills of service personnel and the design of the service system), integrative quality (the ease with which different portions of the service delivery system work together), functional quality (to include all aspects of the manner in which the service is delivered to the customer, to include style, environment and availability), outcome quality (whether or not actual service product meets both service standards or specifications and customer needs/ expectations) (Robinson, 1999).

The education services performance in the form of skills and competences gained by students at technical universities results from the tangible and intangible assets. Furthermore, the learning process effectiveness can be influenced by many factors. Students' personalities and qualities can be one of them (Kostolányová, Šarmanová, Takács, 2011, Urbancová, 2012).

However, the technical universities services quality is related to both education and research activity. In the result the university services quality improvement may arise from the different sources related to students' expectations on service quality determinants such as: university facilities, technical conditions (buildings, premises and equipment appropriate for the learning process), teachers and administrative workers competencies, workers empathy, reliability of the offered services, assurance, availability and comfort (Urbancová, 2010).

The aim of the study is to identify students' expectations related to all technical university services and verifying valuable service quality factors that need improvement through identification of the university services quality level. The research model is based on the SERVQUAL method. Research findings are compared with the research findings obtained in the survey conducted among the candidates for technical universities studies (at chosen vocational schools), whose expectations show the other factors improving the university service quality level.

Materials and Methods

Service organizations, which care about quality of services, should recognize the clients' requirements and measure their satisfaction. Results are useful in the process of the organization performance improvement towards a more complete fulfillment of the clients' expectations in the context of the service value analysis. Customers' feedback allows identifying the strengths and weaknesses of the organization (Urbancová, 2012).

Many service quality models have been proposed (Moore, 1987; Heywood-Farmer, 1988; Beddowes, 1988; Nash, 1988; Philip and Hazlett, 1997; Robledo, 2001). The most enduringly popular, widely cited and best researched method of assessing service quality is SERVQUAL (Asubonteng, 1996; Waugh, 2002) developed by Parasuraman et al. (1985, 1988). SERVQUAL method is focused on identifying perceived quality, which is a customer's judgment about the excellence of a service (Zeithaml, 1987).

SERVQUAL methodology is tried and tested methodology primarily within the commercial sector (Kaye, Dyason, 2013). Brysland and Curry (2001) concluded that the literature clearly supported the use of SERVQUAL in the public sector. SERVQUAL has been used successfully in higher education sector research, although these have been limited to Library Services (Broady-Preston and Preston, 1999), undergraduate academic teaching (Hill, 1995) and administration (Galloway, 1998).

SERVQUAL methodology presents the differences (gaps) related to some different levels of expectation and perceptions result from the clients' and the organization point of view (Fig. 1).



Figure 1: SERVQUAL methodology model (Kaye and Dyason, 2013)

The first gap is created by a difference between the expectation of clients (students) and the perception of these expectations from the service providers' point of view (university and university campus). The source of this difference may be the lack of reliable knowledge about students' expectations resulting from the shortcomings of marketing research, errors in applying of the research results and shortcomings in communicating with students. Improper perception of expectations may be the result of too extensive organizational structure of universities, often resulting in the separation of the senior management workers from the complete set of information on the students' expectations and, consequently taking improper decisions.

The second gap creates a difference between the perception of students' expectations for the service organization and the specification of university services quality. The reason for this gap may be a lack of belief management's ability to meet students' expectations, and the lack of adequate supporting service process in the appropriate research and technical equipment, facilities and adequate procedures. The discrepancies between quality of service specification, and its performance is, according to the authors' model, the third gap. The source of this discrepancy may be such factors as: lack of clarity and conflict roles performed by workers, low-skilled staff, poor technology, and poor selection of employees working in a team, and improper supervision of process control services. Fourth gap results from the difference between the service provision and the process of external communication with the students. In practice, there is often a disproportion between service sellers' promises, implementation of services and fulfillment of promises made earlier by service provider (technical university). All differences, discussed consequently, form a key gap between the expected service and the received service, which determines the university service quality perceived by students. It could be argued that the foundation for the realization of a satisfactory service is the student's precise knowledge of his/her expectations and skillful processing of these expectations on the aims and objectives of a service organization.

The fifth gap in the SERVQUAL methodology model consists in measuring the customer's satisfaction as a numerical value. The concept is implemented on the basis of surveys concerning desirable features that should characterize the perfect service and the customer's satisfaction degree. This method allows determining the difference between the expected and the resulting quality for the studied population of consumers. The method is based on the five dimensions of service quality, which determine the client's perception of the organization: the material dimension, reliability, willingness to cooperate, assurance and empathy. In order to establish the service quality level, there should be established the difference between client's expectations regarding service level and the client's perception of the service provided by a particular organization.

Condition of the student's satisfaction is a subjective feeling that is identified individually by every human's experience and emotion. It reflects the feeling of satisfaction with unfulfilled expectations of a student as a result of the acquisition of a particular service. I should be emphasized that the perception of student's satisfaction is closely associated with the experience of his/her positive impressions. Students' (clients') satisfaction is a reflection of the extent to which the overall product offered by the organization meets a set of students' requirements.

In this context, the service quality function is expressed as the function of students' perceptions (P) and the future students' expectations with regard to all technical university services (E):

$$\mathbf{Q=f}\left(\mathbf{P-E}\right) \tag{1}$$

Students' expectations and their perception level in relation to services offered by technical university were analyzed by statements including five service quality criteria (dimensions of the clients'/students' expectations and their perceptions):

- Tangibles. Appearance of physical facilities, equipment, personnel and communication materials.
- Reliability. Ability to perform the promised service dependably and accurately.
- Responsiveness. Willingness to help clients/students and provide prompt service.
- Assurance. Knowledge and courtesy of employees and their ability to convey trust and confidence.
- Empathy. Caring, individualized attention the organization provided to clients/students.

The whole basis and the value of the SERVQUAL methodology lays in the relevance of the statements. The questions are normally derived from the conversation with students. The value of the mentioned research method is in developing the statements interactively with the sample population. The statements chosen for the research study (Table 1) result from the analysis of all service quality aspects that considers technical university services in all aspects affecting students' perceptions and expectations of candidates for studies (technical quality, integrative quality, functional quality, outcome quality) in relation to students' and teachers' expectations, feelings and experiences that were identified in the process of the pilot survey (as a part of presented study).

The survey includes statements based on the following attributes of the technical university services such as: university indoor, equipment, dormitory conditions, courtesy and the staff, ability to provide the desired services in a reliable, accurate and consistent way, image, or reputation of an institution providing education services. Some of these features are called "hard service elements" (e.g. equipment) that are easily affected by objectification and thus allows setting acceptable standards for students. Evaluation of the service implementation process is the more difficult the more it is personified. In this situation, the

qualitative characteristics of services are not assessed primarily through the prism of these "hard elements" but characteristics are assessed by elements such as: individual feelings, sensations, moods, emotions and experience. The service quality assessment performed by the service provider (university) can be different than the evaluation of the same services performed by client (student).

	THE SURVEY STATEMENTS INVESTIGATING THE QUALITY LEV	EL	OF	SEF	VIC	ES					
	PROVIDED BY CHOSEN TECHNICAL UNIVERSITY										
1.	Recruitment process at the university is efficient and well-organized.	1	2	3	4	5	6	7			
2.	Staff recruiting candidates for the university is polite in relation to the prospective student.	1	2	3	4	5	6	7			
3.	Parking availability.	1	2	3	4	5	6	7			
4.	External appearance of the university buildings and offices.	1	2	3	4	5	6	7			
5.	Internal appearance of the university buildings and offices.	1	2	3	4	5	6	7			
6.	Marking indoor enables efficient movement inside and outside the university buildings.	1	2	3	4	5	6	7			
7.	University lecturers have appropriate knowledge and skills.	1	2	3	4	5	6	7			
8.	The university has modern equipment for research and well-equipped laboratories.	1	2	3	4	5	6	7			
9.	University staff cares about the cleanliness and safety.	1	2	3	4	5	6	7			
	The meals served in the cafeteria and students canteen are appropriate										
10.	(portion size, temperature, taste).	1	2	3	4	5	6	7			
11.	Price of external services available on the campus (cafeteria, bookstores, photo-copying) is adequate for their quality.	1	2	3	4	5	6	7			
12.	Opening hours of students offices are convenient for the students.	1	2	3	4	5	6	7			
13.	Teaching staff in relation to students is friendly and attentive.	1	2	3	4	5	6	7			
14.	A student can always rely on help from the teachers.	1	2	3	4	5	6	7			
15.	Price of tuition is adequate to acquired skills.	1	2	3	4	5	6	7			
16.	Exams dates are convenient for students.	1	2	3	4	5	6	7			
17.	Extramural classes schedule are convenient for students.	1	2	3	4	5	6	7			

Table 1: Statements characterizing the technical university services quality for students included in the survey

There was applied the scale of Likert (1 - 7) to rate the service quality level in relation to respondents' expectations and performance by asking students with using the set of questions on attributes that reflect mentioned quality dimensions (Table 1) (Parasuraman, Zeithaml, Berry, 1988).

Respondents/students of technical university were asked to assess the importance degree in terms of the university service quality, and then to identify which factor has met their expectations as a result of the technical university services. The seven point scale (scale of Likert) was applied, where the number 1 (in the case of a survey of students' expectations) - indicates not very important factor and 7 - a very important factor. However, in the case of survey, the number 1 means a very low factor assessment carried out by the service provider (university), and 7 - very high rating of a given factor.

The seven point scale allows identifying the most (1) and the least (7) importance degree considered as the most important results of the study which are significant in the research final conclusion. There were also the average importance levels (2 - 6), that were identified as the second important study results, because of the service quality level improvement.

Scope of the survey group consists of 3000 students of technical universities (65% of men and 35% of women) and 200 high school graduates (40% of men and 60% of women) who want to study at a technical university. The selection of respondents to the study group had a random and accidental character (survey group was gathered on the University Open Day at chosen technical universities). The response percentage was 80% of the survey group.

Results and Discussion

Research results in Table 2 show results that correspond to the fifth difference described in the SERVQUAL methodology model.

Analysis of research results (Table 2) show that students' expectations (ideas) on particular areas affecting the technical university services quality are not fully met in relation to candidates' expectations (in 85%) as to present and future students (result Q = P - E). The biggest difference between the average value of the expected and experienced service can be seen on issues relating to the parking availability (-5.25) and opening hours of students offices (-2.65). The other great difference identified between the students' expectations and their experience concerns a doubt about the skills and knowledge of the teaching staff (-2.35).

The significant gap was identified also in the dimension of the price of tuition that is not adequate to acquired skills (-1.9). In the case of questions concerning the purity and safety, the assessment of the facts made by the students don't exceed expectations of future students' ideas (-1.6).

Expectations of the future students' group (candidates for studies) have been exceed in terms of the canteen meals quality (0.2) and the meal price (0.75).

Statement's number in the survey questionnaire	The survey part investigating perceived service quality level by the current students of technical university (P)	The survey part investigating expected service quality level by the future students of technical university (E)	Quality level $(Q = P - E)$
1	5.4	6.2	-0.8
2	5.3	6.55	-1.25
3	1.5	6.75	-5.25
4	5.3	5.7	-0.4
5	5.6	6.65	-1.05
6	5.3	6.7	-1.4
7	4.65	7.0	-2.35
8	6.1	6.6	-0.5
9	5.35	6.95	-1.6
10	6.55	6.35	0.2
11	6.45	5.7	0.75
12	4.15	6.8	-2.65
13	5.35	7.0	-1.65
14	5.75	7.0	-1.24
15	5.1	7.0	-1.9
16	5.9	6.4	-0.5
17	5.1	6.65	-1.55

 Table 2: Average quality level values on the expectations of candidates for technical university and the service quality level perceived by current technical university students

Expectations of the future students have been outperformed with regard to the external appearance of the universities' buildings (-0.4) and the internal appearance (-1.05), which are related to the marking indoor enables efficient movement inside and outside the universities' buildings. Research findings on this part of the study have shown that students' expectations exceed their perception level (-1.4). Expectations were not met also with regard to organization of the recruitment process at universities (-0.8) and treatment of the candidates for study in the recruitment process (-1.25). Expectations have not been met also in terms of the modern research and laboratory equipment that should be aimed at students' qualifications improvement (-0.5). The important service quality area that was low rated (the exam terms: -1.65) doesn't meet students' expectations (-1.55).

One of the most important elements of the research findings analysis is detailed examination of the candidates' opinions with regard to services offered by technical university (Fig. 2).



Figure 2: The technical university service quality level (E) expected by future students of technical university (candidates)

Research findings presented in Figure 2 show that in the opinion of candidates for studies at technical university the most important elements taken into consideration during the decision process on the university choice concern the university lecturers' knowledge and skills and teachers' empathy (the readiness to provide assistance to students). The least important factors that affect on the candidates choice are associated with external appearance of the university buildings and the price of external services available on the campus. It means that the great role in the candidates' choice of the university belongs to knowledge offered by the every single technical university.

Opinions of current students (Fig. 3) are useful in the process of comparison of candidates' expectations and students experience. This comparison is used in the identification of the services areas which need improvement. Results of the current students survey confirm partly candidates' expectations concerning technical infrastructure as the element of well – equipped laboratories. This element is supportive element in the process of a knowledge transfer, what also result in the students' skills improvement and teachers' scientific research process realization. Obtained research findings show also that, in the contrast to candidates' opinions, the most important elements of good university services are associated with technical infrastructure of the university related to the external services (bookstores, cafeteria, photocopying, and parking).



Figure 3: The technical university service quality level (P) perceived by current students of technical university

The underlying question to be addressed in the presented research results is also if the given results of the survey contribute the other gaps (1-4) mentioned in SERVQUAL model (Fig. 1)?

The first answer on the question related to the chosen research methodology (SERVQUAL) and the gap chosen to analyze is the identification of the correlation between gap 1 (difference between customers' expectations and management's perception of customer expectations) and the research result on the analyzed gap 5. In the analyzed survey case, the candidates' opinions gave some guidelines on the areas that should be well prepared in accordance to future students' needs. It is also an information source that should be compared with the students' opinions in the final stage of the service quality level assessment.

Managers and teachers of technical universities consider, in the learning outcomes analysis, what is the crucial element in the university services that create appropriate (expected by the ministry and the employers market) graduates skills and knowledge. The answer can be obtained by the fifth gap research survey results analyzed in the context of service quality specification delivered by ministry of higher education and common employers.

Current students' opinions can be used in the process of the comparison of service delivery process results and service quality specification (gap 3) what is supported by fourth gap concerning external communication with students.

Analysis of the all gaps in the context of obtained research results in SERVQUAL analysis helps with the identification of the weak and strength aspects of the technical university activity with regard to students, future candidates, ministry requirements and employers as well.

Conclusion

The main conclusion of the research results analysis concerns identifying factors that play the great role in the university education process improvement within the service process. In order to receive the appropriate level of the service quality, taking into account the students' satisfaction, the process of creating university services quality should be properly managed. An important function of the university services management, which is the basis for the service quality improvement, is the evaluation and the control, what can be supported by methodology presented in the article. The specificity of tuition services at technical universities, indeed, and other intangible services, is the difficulty of defining clear service quality, and hence determining a clear methodology for its evaluation. SERVQUAL method, as the answer for the university services quality level evaluation, takes into consideration all aspects of the technical university services and actions related to the ministerial requirements.

The majority of the universities are focused on the opinions of current students and graduates in the process of the service quality assessment. It can be very useful source of information in the service process improvement, but it can give only the answer to the one aspect of the services quality level evaluation since the crucial aspect of the SERVQUAL methodology is comparison of future students' expectations and students' experiences. An important determinant of the quality of teaching services is undoubtedly satisfied students whose experiences are compared to their expectations. SERVQUAL method is an useful tool of expectations and perception measurement.

The one of the most important issues mentioned in the survey, that was low-rated, is technical infrastructure of the technical university that supports realization of the teaching process and ensures students with skill and qualifications. The well-equipped laboratories can be a source of both students' and teachers' skills development and can result in the university research progress. Results of technical infrastructure evaluation compared with results of the education process evaluation, what was done by students, can result in the identifying direction of the research and education processes improvement.

Acknowledgements

This work is related to the scientific program of the "Improving quality of processes, products and services" BW 615/201/07 supported by Polish Ministry of Science and Higher Education.

References

Asubonteng, P., McCleary, K.J. and Swan, J.E. (1996), "SERVQUAL revisited; a critical review of service quality", *The Journal of Service Marketing*, Vol. 10 No. 6, pp. 62-81.

Beddowes, P., Gulliford, S., Knight, M. and Saunders, I. (1988), Service Success! Who Is Getting There?, *Operations Management Association*, University of Nottingham, Nottingham.

Broady-Preston, J. and Preston, H. (1999), "Demonstrating quality in academic libraries", *New Library World*, Vol. 100 No. 3, pp. 124-9.

Brysland, A. and Curry, A. (2001) 'Service improvements in public services using SERVQUAL', *Managing Service Quality*, Vol. 11, No. 6, pp. 389-401.

Buttle, F. (1996) 'SERVQUAL: review, critique, research agenda', *European Journal of Marketing*, Vol. 30, No. 1, pp. 8-32.

LeBlanc, G. and Nguyen, N. (1988) 'Customers' Perceptions of Service Quality in Financial Institutions', *International Journal* of Bank Marketing, Vol., 6 No. 4, pp. 7-18.

Edvardsson, B., Gustavsson, B.O. and Riddle, D.J. (1989) 'An Expanded Model of the Service Encounter with Emphasis on Cultural Context', *Research Report 89;4*, CTF, Services Research Centre, University of Karlstad, Sweden.

Furková, A. (2013) 'Alternative approaches to efficiency evaluation of higher education institutions', *Journal on Efficiency and Responsibility in Education and Science*, Vol. 6, Issue 3, pp. 167-178. ISSN: 1803-1617. http://dx.http://doi: 10.7160/eriesj.2013.060304.

Galloway, L. (1998), "Quality perceptions of internal and external customers: a case study in educational administration", *The TQM Magazine*, Vol. 10 No. 1, pp. 10-26.

Heywood-Farmer, J. (1988), "A conceptual model of service quality", *International Journal of Operations & Production Management*, Vol. 6 No. 3, pp. 5-9.

Hill, F.M. (1995), "Managing service quality in higher education; the role of the student as primary consumer", *Quality Assurance in Education*, Vol. 3 No. 3, pp. 10-21.

Johnson, R.H. and Winchell, W.O. (1988), "Educating for quality", *Quality Progress*, Vol. 2, September, pp. 48-50.

Kostolányová, K. Šarmanová, J. Takács, O., (2011), "Adaptation of teaching process based on a student's individual learning needs", *Journal on Efficiency and Responsibility in Education and Science*, Vol. 4, No. 1, pp. 3-17, ISSN 1803-1617

Kaye, M. and Dyason, M. (2013) 'Delivering "more for less" in the public sector: a criminal justice system case study', *Proceeding of 14 International Symposium on Quality, Quality against recession, Rovinj,* pp. 571-581. ISBN 978-953-57036-3-1.

Lewis, B.R. (1989), "Quality in the service sector – a review", *International Journal of Bank Marketing*, Vol. 7 No. 5, pp. 4-12.

Moore, C.D. (1987), "Outclass the competition with service distinction", *Mortgage Banking*, Vol. 47 No. 11.

Nash, C.A. (1988), "A question of service: action pack", *Business Management Programme*, Hotel and Catering Industry Training Board, National Consumer Council, London.

Parasuraman, A., Zeithaml, V.A. and Berry, L.L. (1985), "A conceptual model of service quality and its implications for future research", *Journal of Marketing*, Vol. 49, Fall, pp. 41-50.

Parasuraman, A., Zeithaml, V.A. and Berry, L.L. (1988), "SERVQUAL: a multiple-item scale for measuring consumer perceptions of service quality", *Journal of Retailing*, Vol. 64 No. 1, pp. 12-40.

Philip, G. and Hazlett, S. (1997), "The measurement of service quality: a new 'P-C-P' attributes model", *International Journal of Quality & Reliability Management*, Vol. 14 Nos 2/3, pp. 260-86.

Robledo, M.A. (2001), "Measuring and managing service quality: integrating customer expectations", *Managing Service Quality*, Vol. 11 No. 1, pp. 22-31.

Stacho, Z., Urbancová, H., Stachová, K. (2013), "Organisational Arrangement of Human Resources Management in Organisations Operating in Slovakia and Czech Republic", *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, Vol. 6, No 62, ISSN 1211-8516.

Urbancová, H., (2012), "Conditions and Principles for Knowledge Continuity Ensuring in Organizations", *Scientia Agriculturae Bohemica*, Vol. 43 (4), pp. 166 – 172, ISSN 1211-3174.

Urbancová, H., Urbanec, J., (2013), "Learning methods in the Czech and Slovak organizations" [In:] *Efficiency and Responsibility in Education*, 10th International Conference, pp. 618-625. ISBN 978-80-213-2378-0.

Urbancová, H., (2010), Role of ICT in area of Knowledge Management. [In:] *Efficiency and Responsibility in Education*, 7th International Conference, 2010, pp.244-252. ISBN 978-80-213-2084-0.

Vostrá Vydrová, H., Jindrová, A., Dömeová, L., (2012), 'Evaluation of results in chosen subjects and analysis of the motivation of distance students', *Journal on Efficiency and Responsibility in Education and Science*, Vol. 5, Issue 1, pp. 36 – 37. ISSN: 1803-1617, http://dx.http://doi: 10.7160/eriesj.2012.050104

Waugh, R.F. (2002), "Academic perceptions of administrative quality at universities", *Journal of Educational Administration*, Vol. 40 No. 2, pp. 172-88.

Zeithaml, V. (1987), "Defining and Relating Price, Perceived Quality and Perceived Value", *Marketing Services Institute Report* No. 87-101, Marketing Services Institute, Cambridge, MA.

ANALYSIS OF EXAM RESULTS OF THE SUBJECT 'APPLIED **MATHEMATICS FOR IT'**

Helena Borožová, Jan Rydval

Czech University of Life Sciences Prague

Highlights

- The exam results of "Applied Mathematics for Informatics" from the last 13 years are analysed
- The reliability, difficulty, and discrimination power of the tests are analysed
- Students' frame influences their examination results

Abstract

In this paper the exam results of the subject "Applied Mathematics for Informatics" (formerly Methods of Operation Research) from the last 13 years have been analysed. The exam has two parts: written test and oral exam. The grades of the students of the subject have been low for a long time. We would like to know if the low grades are due to the quality of the tests or due to a reducing number of hours of contact teaching. Another reason of low grades can be due to the mathematical character of the subject and to the unpopularity of such kind of subjects. Based on the bad results, students have also initiated a change in the scoring system.

This article builds on our paper at the conference ERIE 2013. The main goals of this paper are to find out if the grades have had the tendency to decline during the years and to evaluate the validity, reliability, difficulty, and discrimination power of the tests.

Keywords

Framing effect, difficulty index, discrimination index, reliability of the tests, validity of the test, students' grades

Brožová H. and Rydval J. (2014) "Analysis of Exam Results of the Subject 'Applied Mathematics for IT'", Journal on Efficiency and Responsibility in Education and Science, Vol. 7, No. 3-4, pp. 59-65, online ISSN 1803-1617, printed ISSN 1803-1617, doi: 10.7160/eriesj.2014.070303.

Introduction

Each subject has its own preferences and expectations that create its own view (frame). As Tversky and Kahneman (1981) mentioned the framing effect is made up of these frames. They also pointed out that framing effect influence the way in which the information is interpreted. Individual decisions are influenced by the presented information and by the problems formulation (Druckman, 2001). Therefore, the framing effect can be defined as a set of preferences and expectations of involved subjects belonging to a particular decision-making problem. Specific frames can also be defined for the teachers' and students' point of views (Rydval and Brožová, 2011). These frames can negatively affect passing the information in the education process. Rydval and Brožová (2011) also mentioned that the usual student's frame aims to succeed in examinations with the least effort. This influences students' results significantly.

Examination, testing, test scoring and grading are very important parts of a pedagogical work. The purpose of these activities is to assess student's knowledge related to a subject. Student's grade for a course is generally based on a scoring on the final exam and the oral examination. It is necessary to have a suitable quality and validity of tests and a good objective scoring system to ensure consistence of the students grading.

Basic statistical analysis of test results is a method typically used in many study information systems or e-learning systems. On the other hand, these tools give only summary results, as frequency of the grades, average of the grades and number of attempts. However, more detailed analysis has to be done by teachers themselves. Kaspříková (2011, 2012a, 2012b) did such

analysis for instance for mathematics course at University of Economics in Prague and Jarkovská et al. (2012) for distance programs at Czech University of Life Sciences Prague (CULS Prague).

Jacobs (1991), Miller (2012) and Wells and Wollack (2003) analysed following other characteristics of the tests:

- Test validity test should be suitable for the objective testing of the students from the three points of view:
 - Content validity test should be able to assess 0 student's knowledge of the subject.
 - Criterion validity test should be able to measure student's knowledge.
 - Predictive validity test should be able to predict, 0 for example, student's knowledge during the oral exam.
- Test reliability test should be reliable and consistent and should not be subjected to random errors.
- Test difficulty test should not discourage students from further learning; it should be neither too difficult nor too easy.
- Test discrimination power test should show a difference between skilled and unskilled students, the skilled students should answer test questions well.

The aim of this paper is to analyse the basic characteristics of the exam test in the subject of Applied Mathematics for Informatics (AMI), earlier Methods of Operation Research (MOR). This analysis is performed because the students consider the test as

Article type

Full research paper

Article history

Received: November 25, 2014 Received in revised form: December 11, 2014 Accepted: December 17, 2014 Available on-line: December 31, 2014 very difficult and due to the students' grades that have been too low.

This article follows the contribution of Brožová and Rydval (2013) in which the results of the subject "Applied Mathematics for Informatics" from the years 2009/10, 2010/11 and 2011/12 were analysed. The exam results of the last 13 years are analysed and also the impact of changes to the scoring system is evaluated.

The main questions which would have to be answered are:

- Have the results had the tendency to decline in the last 13 years?
- Has the test been very difficult?
- Which scoring system is more suitable?

Material and Methods

Content and structure of the exam tests

The subject Applied Mathematics for Informatics (AMI) is in the curriculum as a specialization of Informatics in regular and distance study programs at the Faculty of Economics and Management, Czech University of Life Sciences Prague. In the last 13 years the test results of these subjects have not reached the satisfactory level from the teachers' perspective, because majority of students (more than 70% since the year 2008/09) reached only grade 3 - good or didn't pass the exam. Therefore, in this research, the exam tests used in these subjects are analysed and their characteristics are discussed.

The main subject topics are covered by the lectures and seminars, definitions and steps of algorithms are highlighted during the teaching. During the last lecture the brief recapitulation of the subject content is made. Moreover, the structure of the test is described along with the scoring and grading system. The exam has two parts, written test and oral exam.

In total, more than 30 variants of the test exist, and they differ in selected topics and numerical input. These variants were used during the last 13 years with only small changes, which were always done according to the actual content of subject.

The test is scored and the total possible score is 100 points. The minimum amount of points necessary for the oral examination is 50 points. The grading system uses three grades: 60 - 73 points is a good grade, 74 - 86 points is a very good grade and 87 - 100 points is an excellent grade.

During the oral examination students have to confirm their knowledge related to the subject. Nevertheless, students can increase their score, i.e. improve their grade.

The test is divided into 3 parts. The first part consists of three theoretical questions, the second part includes two small examples and, finally, the third part consists of a large practical example. The questions and examples of the tests follow all the topics of the subject.

- Three theoretical questions these short questions have a form of a brief question that requires a written answer not longer than a few sentences or a paragraph. For example the students have to describe or explain the basic definitions, the steps of algorithms or calculations or the simple principle. Maximum score of each question is 10 points.
- Two small examples these questions have a form of computational questions, which have to be solved by more or less simple calculations and the results have to be interpreted. Maximum score of each example used to be 15 points. The scoring was changed last year and,

nowadays, maximum score of each example is 20 points.

 Practical example (essay) – this part of the test has a form of a case-study / scenario question, which is used to prove that students can understand and integrate key concepts of the course, apply theory to a practical context, and demonstrate the ability to analyse and evaluate obtained results. Depending on the problem description of the small practical problem the students have to select and create a suitable model, solve it, and interpret the results. Maximum score used to be 40 points. The scoring was changed last year and, nowadays, maximal score is 30 points.

To analyse the exam results we use the data from Student information system from the last 13 years from 2000/2001 to 2012/2013; we collected data such as number of students, their grades and number of attempts.

For the detailed analysis of exam tests, the scores of test items, the total test scores and the final grading have been collected from the last four years, regardless of the number of attempts. Together we have 325 tests from the year 2009/10, 265 tests from the year 2010/11, 193 tests from the year 2011/12, and 292 tests from the year 2012/13.

Methods used for analysis of the tests

The high quality exam tests help to evaluate the student's knowledge and motivate the students to learn. In this research, we use the following methods for analysis of the test quality (Jacobs, 1991; Miller, 2012; Wells and Wollack, 2003):

- Difficulty Index of the tests,
- Discrimination Index of the tests,
- Reliability of the tests.

The analysis of the tests is supplemented by an overview of the exam results. The following parameters are calculated:

- Average grade,
- Average number of exam attempts,
- Success rate.

Difficulty Index

Difficulty index (P) of the test questions is one of the most useful and the most frequently reported analyses. It is a measure of a proportion of examinees who answered the question correctly; for this reason this index is frequently called as P-value:

$$P = \frac{S_{\text{sum}}}{S_{\text{max}}} \tag{1}$$

where S_{sum} is a total number of obtained scores of all students;

 S_{max} is a maximum possible amount of score.

Difficulty index can range between 0.0 and 1.0. The higher value indicates that a greater proportion of examinees responded to the question correctly, or in the other words the higher the value the easier the question is. The index of difficulty of a suitable question lies in the closed interval [20%, 80%] (Škoda et al., 2006).

Discrimination Index

Discrimination index (ULI - Upper-Lower Index) is a measure we use to distinguish between good and bad students (the students are ranked according to their scores).

$$ULI = \frac{N_U - N_L}{0.5N} \tag{2}$$

where N_U is the number of good students, students from better group who answered the question properly;

 N_L is the number of bad students, students from worse groups who answered the questions properly;

N is the total number of students

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

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

Difficulty (P-value)	[20%, 30%]	[30%, 70%]	[70%, 80%]
Discrimination (ULI)	≥ 0.15	≥ 0.25	≥ 0.15

Table 1 Recommended values of difficulty and discrimination indices

Reliability of the tests

Measure of reliability can be calculated using the method for measurement of the internal consistency (Cronbach, 2004; Škaloudová, 2012). Reliability in this way shows if all test items' content is homogeneous, if these items measure the same knowledge with the similar score. The Cronbach's alpha evaluates the test items using multi-scale scoring for reliability calculating

$$\alpha = \frac{k}{k-1} \left(1 - \frac{\sum_{i=1}^{k} s_i^2}{s^2} \right)$$
(3)

where s_i^2 is the variance of the *i*-th test items score;

 s^2 is the variance of the test score and

k is number of test items.

The value of the α coefficient of reliability varies from 0.0 (no consistency) to 1.0 (perfect consistency). The coefficient α is only a lower bound of the reliability, so the real reliability is often much underestimated. Obviously, a larger coefficient is better (Cronbach, 2004; Revelle and Zinbarg, 2009).

Cronbach's alpha	Internal consistency
[0.9, 1]	Excellent
[0.8, 0.9]	Good
[0.7, 0.8]	Acceptable
[0.6, 0.7]	Questionable
[0.5, 0.6]	Poor
[0,0.5]	Unacceptable

Table 2 Meaning of values of Cronbach's alpha

It is acceptable for subject's exams to have lower reliabilities because the grades are based on several measurements – at least on written test and oral examination, and also each student can take the exam three times in the worst case (Wells and Wollack, 2003; Jacobs, 1991).

Exam results analysis

Average grade – average students' grade is calculated only for results of the students who passed the exam, it means for grades 1 - excellent, 2 - very good and 3 - good, as a sum of a collection of grades divided by the number of successful students.

Average number of attempts – average number of attempts is calculated as a sum of all used exam terms divided by a number of studying students.

Success rate – Success rate is calculated as a ratio of number of the successful students and number of all students.

Results

As it was mentioned above the main questions which need to be answered are:

- Have the results had the tendency to decline in the last 13 years?
- Has the test been very difficult?
- Which scoring system is more suitable?

Analysis of the exam results

Data about the exam of the subject Applied Mathematics for IT as the number of students, their grades and the number of the exam attempts were collected from the Student information system from the year 2000/2001 to 2012/2013. For the main characteristics of students' results see Figure 1, Figure 2, Figure 3 and Appendix for a Table 3.

It is possible to say that average grades for group of regular students were slightly increasing so the grades show the tendency to be worse. In accordance with this fact, the success rate was decreasing and the number of attempts was increasing. This is demonstrated by the logarithmic trend lines. Logarithmic trend was selected, because the analysed values have upper or lower bound. Coefficient of determination is greater than 0.6. Year 2011/2012 was the year in which the old subject and the new subject were taught together and the students of the old subject had to study very hard, because repetition of the old subject was no longer possible. This is the reason for partial improvement of the results. Development of the distance students' results is different, because these students have different reasons for their education. These students need a university education for their jobs and so they are forced to study.





Figure 1 Development of average grade, 2000/01 to 2012/13 (source: own calculation)



Figure 2 Development of success rate, 2000/01 to 2012/13 (source: own calculation)

Figure 3 Development of average number of attempts, 2000/01 to 2012/13 (source: own calculation)

Analysis of the tests quality

Data of the tests scoring were collected from the year 2009/10 to 2012/13. The tests are scored from 0 to 100 points. The frequency of the number of the points is calculated for the unequal intervals (Figure 4 and see Appendix for Table 4), because at least 50 points are necessary for the oral exam and from 60 to 73 points is necessary for 3 - good, 73 to 86 for the grade 2 - very good and 87 to 100 for the higher grade 1 – excellent. It is surprising that about 50% of the tests are scored less than 50 and more, about 30% of the tests are scored less than 30. Students with such test did not pass the exam, so it is possible to suppose that many students come to the exam to try it and to find out what the exam tests are like. That reason students also explain during the oral examination. However this strategy means that they lose one exam attempt. This faithfully corresponds with the usual student's frame which is to succeed in examinations with the least effort.

Discrimination index (ULI) and the Difficulty index (P-value) of the tests were calculated for the whole test and also for each item of the test (see Appendix for a Table 5).

The column '*P-values ALL*' contains the Difficulty index for all tests in the group. Difficulty index in the column '*P-values* >50' was calculated for the group of tests with the whole score higher

than 50 points. The answer scored at least with 60% of points is considered as a correct answer.



Figure 4 Frequency of the number of the test points (source: own calculation)

Cronbach's alpha was calculated for the whole test and also for questions and examples of the test (see Appendix for a Table 5). The column '*Cronbach's alpha ALL*' contains the Reliability index for all tests in the group. The Reliability index in the column '*Cronbach's alpha Second half*' was calculated for the second half of the tests in the exam session.

Difficulty index values are between 0.35 and 0.56 for all tests from different years. This index is higher for the group of the tests scored more than 50 points (between 0.44 and 1.00). This can be explained by the fact that the students were better

prepared for the resits. Difficulty index calculated for all tests has a satisfying value; therefore the tests have good levels of difficulty (Figure 5 and Figure 6).



Figure 5 Difficulty index for all tests in the group (source: own calculation)



Figure 6 Difficulty index for tests with a whole score higher than 50 points (source: own calculation)

Values of the Discrimination index of all tests are greater than 0.5, so the tests distinguish well between good and bad students. The Discrimination index of the theoretical questions is the lowest, it seems, that the students seek to know practical application of studied method and not the theoretical background (Figure 7).



Figure 7 Discrimination index of the tests (source: own calculation)

The Cronbach's alpha of the whole tests lies in all cases within the interval [0.5, 0.659]. It is not a high reliability because the reliable tests have the Cronbach's alpha near to 1.0. However, because the students have to make the resits, if they do not pass the exam, the conditions are different; the students learn more during the second or the third attempt and, therefore, reliability values of the second half of the tests in the exam session are better (Figure 8 and Figure 9).







Figure 9 Cronbach's alpha of the test from the second half of the exam session (source: own calculation)

In the year 2012/2013 the scoring system was changed, 10 point for the correct answer of theoretical question remained, but the small examples are awarded by 20 point instead of 15 and the practical example by 30 instead of 40 points. The reliability of the test was increasing (Figure 8, Figure 9 and see Appendix for a Table 5) to 0.659 with this new scoring system, so the decision to change the scoring system was good. This value of the Cronbach's alpha is still not satisfactory. Nevertheless, it is necessary to consider a system where students can three times repeat the exam and, therefore, the tests are formulated in 30 variants and also each part of the test is aimed to determine the different types of knowledge - definitions, calculations, and practical applications.

Discussion

The decreasing tendency of the average grades for the group of regular students and the success rate together with the increasing number of exam attempts show the worsening of the exam results. This may be caused due to the mathematical character of the subject and unpopularity of such kind of subjects, the reduction of the number of hours of seminars since 2011 and the students' frame of the least effort.

Nowadays, universities recognise that students are entering higher education system with a poor mathematical preparation and lower level of basic mathematical skills (Gallimore and Steward, 2014; Grossman, 2001). Therefore, the lack of sufficient mathematical knowledge can affect students' achievements on Operations Research courses. In addition, Jordan et al. (1997) report that 77% of instructors view the mathematical background of students or fear from mathematics as a principal source of teaching and learning problems.

Teaching students a mathematically-oriented course with insufficient mathematics backgrounds has predictable results: frustrated instructors, frustrated students, and poor teaching ratings. Operations research and computer science use tools of mathematics to solve and analyse problems. Students who lack a lucid appreciation for mathematics are limited in their ability to understand and explore the Operations Research and Computer Science interface (Hardin et al, 2012).

The difficulty of the tests were increasing (P-value was decreasing) although the same tests were used repeatedly from the year 2000 (Figure 5, Figure 6 and see Appendix for a Table 5). This fact can also be caused by the reduction of the number of hours of the seminars; formerly each topic has been planned for a 90-minute long lecture and a 90-minute long seminar. However, from the academic year 2011/2012 only 45 minute long seminars are planned.

The worsening tendency of the test results may not be caused only by the reduction of hours of the seminars, but could partially correspond with the traditional students' effort to go through a learning process using the path of least resistance. This traditional student's decision frame means the student is satisfied with the least result and adjusts study effort only for passing an exam. Not always the students realise that the path of least resistance is not the most satisfactory for the future. Such students' frame is confirmed by several time-used studies in engineering education, which show that students use less time studying than was allocated in the curricula (Kollari et al., 2008).

Conclusion

Analyses of 13 years series of the grades of both regular and distance students show a slight increase in the difficulty of the tests and, therefore, together with the students' frame of the least effort the grades have had the tendency to decline. However, in the last four years this trend has been slowing or stopping (Brožová and Rydval, 2013).

Very disturbing is the very high number of the tests with less than 50 points, this fact apparently shows that students use the first exam term to only become familiar with a form of the test and the exam. However, the information about the form of the test is provided during the last lecture and, therefore, students waste their exam terms.

Analysis of the scoring system shows that the new scoring system 10-10-10-20-20-30 is preferable, because the results are not so dependent on a practical example. Test reliability increased, but the value is not satisfactory, which is primarily due to a possibility of the two resits and also due to the small number of the test items. Test reliability (Cronbach's alpha is greater than 0.5 for whole tests) can be considered satisfying because we include also resit tests and each test consists of only 6 items.

The tests have appropriate difficulty (P-values are between 0.4 and 0.5 for whole tests). For students it is the hardest to answer the theoretical questions. So we have to pay more attention to the careful construction of the test questions. We have to phrase each question clearly so students know exactly what they are asked for. The discrimination power of the tests is high (ULI values are greater than 0.5 for whole tests) which means that the test structure and used questions are suitable.

Acknowledgement

The paper is supported by the Internal Grant Agency of the University of Life Sciences Prague – project IGA PEF 20121032.

References

Brožová, H. and Rydval, J. (2013) 'Analysis of the exam test quality', *Proceedings of the 10th International Conference on Efficiency and Responsibility in Education*, Prague, pp. 120–127.

Cronbach, L. J. (2004) 'My Current Thoughts on Coefficient Alpha and Successor Procedures', *Educational and Psychological Measurement*, vol. 64, no. 3, pp. 391-418. http://dx.doi.org/10.1177/0013164404266386.

Druckman, J. N. (2001) 'Evaluating framing effects', *Journal of Economic Psychology*, vol. 22, no. 1, pp. 91-101. http://dx.doi. org/10.1016/S0167-4870(00)00032-5

Gallimore, M., Stewart, J. (2014) 'Increasing the impact of mathematics support on aiding student transition in higher education', *Teaching Mathematics and Its Applications*, vol. 33, no. 2, pp. 98-109, http://dx.doi.org/10.1093/teamat/hru008

Grossman, T.G.A. (2001) 'Causes of the Decline of the Business School Management Science Course', *INFORMS Transactions on Education*, vol. 1, no. 2, pp. 51-61. http://dx.doi.org/10.1287/ ited.1.2.51

Hardin, J.R., Holder, A. Beck, J. Ch., Furman, K., Hanna, A., Rader, D. and Rego, C. (2012) 'Recommendations for an Undergraduate Curriculum at the Interface of Operations Research and Computer Science', *INFORMS Transactions on Education* vol. 12, no. 3, pp. 117-123, http://dx.doi.org/10.1287/ ited.1110.0080.

Jacobs, L., C. (1991) *Test Reliability*, [online], Available: http://www.indiana.edu/~best/test_reliability.shtml [3 Aug 2013].

Jarkovská, M., Kučera, P., Vostrá Vydrová, H. and Varvažovská P. (2012) 'Analysis of Students' Results in Distance-studies centres'. *Journal on Efficiency and Responsibility in Education and Science*, vol. 5, no. 2, pp. 78-91. http://dx.doi.org/10.7160/ eriesj.2012.050203.

Jordan, E., Lasdon, L., Lenard, M., Moore, J., Powell, S. and Willemain, T. (1997) 'OR/MS and MBAs', *OR/MS Today*, vol. 24, no. 1, pp. 36-41.

Kaspříková, N. (2011) 'Multivariate Analysis of Examination Papers', *Proceedings of the 8th International Conference on Efficiency and Responsibility in Education*, Prague, pp. 120–127.

Kaspříková, N. (2012a) 'Data analysis of students' performance', *Proceedings of the 9th International Conference on Efficiency and Responsibility in Education*, Prague, pp. 213–218.

Kaspříková, N. (2012b) 'Statistical Evaluation of Examination Tests in Mathematics for Economists, *Journal on Efficiency and Responsibility in Education and Science*, vol. 5, no. 4, pp. 203-211. http://dx.doi.org/ 10.7160/eriesj.2012.050403.

Kolari, S., Savander-Ranne, C. and Viskari E.L. (2008) 'Learning needs time and effort: a time-use study of engineering students', *European Journal of Engineering Education* vol. 33, no. 01, pp. 483-498, http://dx.doi.org/10.1080/03043790802564046.

Miller, I. (2012) *Edukometrie*, [online], Available: http://www. miller.wz.cz/ [13 Sep 2013].

Revelle, W. and Zinbarg, R. E. (2009) 'Coefficients Alpha, Beta, Omega, and the glb: Comments on Sijtsma', *Psychometrika*, vol. 74, no. 1, pp. 145–154. http://dx.doi.org/10.1007/s11336-008-9102-z.

Rydval, J. and Brožová, H. (2011) 'Quantification of Framing effect in education Process using ANP', Proceedings of the 7th International Conference on Efficiency and Responsibility in Education, Prague, pp. 36-45.

Škaloudová, A. (2012) *Měření reliability*, [online], Available: http://userweb.pedf.cuni.cz/~www_kpsp/skalouda/pokrocili/ reliabi.htm [18 May 2012].

Škoda, J., Doulík, P. and Hajerová-Müllerová, L. (2006) Zásady správné tvorby, použití a hodnocení didaktických testů v přípravě budoucích učitelů, [online], Available: http://cvicebnice.ujep.cz/ cvicebnice/FRVS1973F5d [25 May 2012].

Tversky, A. and Kahneman, D. (1981) 'The framing of decisions and the psychology of choice', *Science*, vol. 211, no. 4481, pp. 453-458. http://dx.doi.org/10.1126/science.7455683.

Wells, C. S. and Wollack, J. A. (2003) 'An Instructor's Guide to Understanding Test Reliability', *Testing & Evaluation Services, University of Wisconsin*, [online], Available: http://testing.wisc. edu/Reliability.pdf [8 Mar 2013].

	2000/2001	2001/2002	2002/2003	2003/2004	2004/2005	2005/2006	2006/2007	2007/2008	2008/2009	2009/2010	2010/2011	2011/2012	2012/2013	Summary
Number of Regular students	99	120	117	155	207	204	225	218	214	181	143	105	185	2173
Unrated	8	17	21	31	44	47	75	45	35	29	16	9	28	405
1 - excellent	14	12	19	16	19	9	17	16	7	5	8	5	2	149
2 - very good	28	24	18	33	42	44	20	41	18	22	23	16	22	351
3 - good	37	58	53	59	78	80	80	73	83	62	71	41	59	834
4 - unsufficient	12	9	6	16	24	24	33	43	71	63	25	34	74	434
Number of attempts	140	169	151	197	261	250	249	332	349	313	255	174	317	3157
Average grade	2.29	2.49	2.38	2.40	2.42	2.53	2.54	2.44	2.70	2.64	2.62	2.58	2.69	2.51
Success rate	0.80	0.78	0.77	0.70	0.67	0.65	0.52	0.60	0.50	0.49	0.71	0.59	0.45	0.61
Average number of attempts	1.54	1.64	1.57	1.59	1.60	1.59	1.66	1.92	1.95	2.06	2.01	1.81	2.02	1.79

	2000/2001	2001/2002	2002/2003	2003/2004	2004/2005	2005/2006	2006/2007	2007/2008	2008/2009	2009/2010	2010/2011	2011/2012	2012/2013	Summary
Number of Distance students						57	62	96	90	93	79	65	73	615
Unrated						25	30	37	33	31	34	5	19	214
1 - excellent						4	6	7	4	3	4	4	3	35
2 - very good						8	8	10	5	6	5	7	3	52
3 - good						13	15	26	20	31	17	17	21	160
4 - unsufficient						7	3	16	28	22	19	32	27	154
Number of attempts						52	53	110	117	106	90	105	93	726
Average grade						2.36	2.31	2.44	2.55	2.70	2.50	2.46	2.67	2.51
Success rate						0.44	0.47	0.45	0.32	0.43	0.33	0.43	0.37	0.40
Average number of attempts						1.63	1.66	1.86	2.05	1.71	2.00	1.75	1.72	1.81

Table 3 Exam results from Student information system (source: own calculation)

Points	2009/2010 20			2010/2	010/2011 2011/2012					2012/2013			
	Number	%	Cumulative	Number	%	Cumulative	Number	%	Cumulative	Number	%	Cumulative	
0-29	92	0.283	0.283	65	0.245	0.245	47	0.244	0.244	99	0.339	0.339	
30-49	84	0.258	0.541	53	0.2	0.445	50	0.259	0.503	67	0.229	0.568	
50-59	59	0.182	0.723	41	0.155	0.6	32	0.166	0.669	48	0.164	0.732	
60-73	62	0.191	0.914	67	0.253	0.853	39	0.202	0.871	53	0.182	0.914	
74-86	25	0.077	0.991	30	0.113	0.966	21	0.109	0.98	21	0.072	0.986	
87-100	3	0.009	1	9	0.034	1	4	0.021	1	4	0.014	1	
Sum	325			265			193			292			

Table 4 Frequency of the number of the test points (source: own calculation)

	2009/2010					2010/2011				2011/2012			2012/2013							
	P-v	alue	ULI	Cror a	ibach's Ipha	P-v	alue	ULI	Cror a	ibach's Ipha	P-v	alue	ULI	Cror al	ıbach's lpha	P-va	alue	ULI	Cro	nbach's Ilpha
	All	> 50		All	Second half	All	> 50		All	Second half	All	> 50		All	Second half	All	> 50		All	Second half
Questions	0.389	0.506	0.226	0.586	0.509	0.371	0.664	0.194	0.494	0.514	0.394	0.515	0.267	0.461	0.423	0.358	0.445	0.258	0.549	0.639
Examples	0.448	0.631	0.358	0.448	0.530	0.557	0.998	0.477	0.484	0.503	0.500	0.686	0.422	0.369	0.289	0.450	0.615	0.558	0.547	0.633
Practical example	0.466	0.747	0.710			0.510	0.913	0.667			0.494	0.738	0.615			0.407	0.603	0.582		
Sum of points	0.438	0.640	0.556	0.500	0.566	0.482	0.864	0.803	0.577	0.575	0.466	0.656	0.667	0.512	0.565	0.409	0.560	0.534	0.630	0.659

Table 5 The Difficulty index, Discrimination index and Cronbach's alpha (source: own calculation)

COMPARISON OF RESEARCH ENGAGEMENT OF PHD STUDENTS AT VARIOUS STUDY PROGRAMS AT CULS PRAGUE: AN INTRODUCTORY STUDY

Martin Flégl¹, Hana Vostrá Vydrová², Ivana Tichá²

¹Business School, University La Salle, Mexico, ²Czech University of Life Sciences Prague

Highlights

- Doctoral study programs are assessed with research in focus.
- There is no significant difference in time allocated to research
- Form of study has impact on involvement in research projects
- PhD students at CULS Prague are dissatisfied with their research outputs

Abstract

In an attempt to improve the quality of doctoral studies and the satisfaction of PhD students at the Czech University of Life Sciences Prague (CULS Prague) the authors disseminated online questionnaire among all PhD students in May and June 2014. The questionnaire covered areas related to doctoral study, PhD supervisors, doctoral scholarship, research publications, and last but not least, to satisfaction with the doctoral study. In this article, responses related to research, such as allocation of time to doctoral studies, allocation of time to research, involvement in research projects and satisfaction with research outputs, are analyzed. The authors provide comparison of all above mentioned domains according to faculties as well as form of doctoral studies at CULS Prague.

Keywords

Doctoral studies, evaluation, PhD students, questionnaire, Pearson's test, Cramer's V

Article type

Full research paper

Article history

Received: December 6, 2014 Received in revised form: December 22, 2014 Accepted: December 27, 2014 Available on-line: December 31, 2014

Flégl M. et al. (2014) "Comparison of Research Engagement of PhD Students at Various Study Programs at CULS Prague: An Introductory Study", *Journal on Efficiency and Responsibility in Education and Science, Vol. 7, No. 3-4*, pp. 66-73, online ISSN 1803-1617, printed ISSN 1803-1617, doi: 10.7160/eriesj.2014.070304.

Introduction

The higher education system in the Czech Republic is mainly financed from the budget of Ministry of Education, Youth and Sport (MEYS). The majority of Higher Education Institutions' (HEI) budgets depend on the institutional funding. This institutional funding is mainly influenced by the number of students (at all levels), types of study programs and indicators of quality and performance. Currently, this part covers approximately 80% from the whole MEYS budget (MEYS, 2014). Moreover, 22.5% out of these 80% are influenced by quality and performance indicators. Quality is, among others, influenced by HEIs' research results. In the Czech Republic, research results are measured based on a scheme developed by Research, Development and Innovation Council (RVVI, 2013).

Consequently, the importance of high profile research results has risen substantially. Moreover, due to a decrease of MEYS budget the competition for state funding in Czech higher educational system has increased. HEIs' performance has become an issue and comparative analyses have been recently published. For example, Vltavská and Fischer (2013) evaluated the labor productivity of HEIs' employees according to the teaching and research productivity. Furthermore, Flégl and Vltavská (2013) presented the efficiency analysis of the Faculties of Economics using Data Envelopment Analysis and production function analysis. Dlouhý (2012) proposed a model for funding allocation among HEI's departments based on publication productivity. Most recently, Jablonský (2014) presented a performance analysis of Czech scientists with respect to their publication activities. Jablonský also discussed the potential of bibliometric indicators as a tool for department, faculties or HEIs evaluations. In general, the authors use mathematical

Printed ISSN: 2336-2375

modeling for performance analysis in higher education, mainly benchmarking analysis. These benchmarking analyses use either nonparametric approaches based on Data envelopment analysis - DEA (Johnes, 2006; Korhonen, Tainio and Wallenius, 2001) or parametric approaches based on Stochastic Frontier Approach -SFA (Furková, 2013; McMillan and Chan, 2006; Stevens, 2005)

As a result of increased competitions, many HEIs introduced internal stimulation schemes to enhance quality as well as quantity of research output of both PhD students and academic staff. In addition to the stimulation scheme the Faculty of Economics and Management (FEM), Czech University of Life Sciences Prague (CULS) launched Project for Innovation of the doctoral study program (IDSP) in March 2012 (Flégl, Tichá and Stanislavská Kvasničková, 2013) in order to deal with long term dissatisfaction of research performance. The project includes several parts (activities), such as Methodological workshops for PhD students and PhD supervisors. All project parts focus on improvement of research performance, mainly on PhD students and partly on PhD supervisors. PhD students at FEM have had lower level of research results in comparison with the other faculties at CULS Prague (Flégl, Tichá and Stanislavská Kvasničková, 2013).

The main cause of generally lower level of research results of FEM PhD students is related to inactivity of substantial proportion of PhD students. As Flegl and Vostra Vydrova (2014) pointed out a huge percentage of PhD students (in some cases more than 60%) at CULS Prague had produced zero research results during the period 2007-2011. There is a number of various reasons behind low performance of PhD students. The influence of PhD supervisors on research results of PhD students is one of important reasons (Barnes and Austin, 2009). Pinheiro, Melkers and Youtie (2014) observed that coauthoring with the supervisor is a significant source of publications. Moreover, coauthoring and mentoring have positive impact for future research performance (Hilmer and Hilmer, 2009; Kyvik and Smeby, 1994). Besides the student-supervisor relationship, it is important to analyze other potential causes of lower level of research performance, such as allocation of time to doctoral studies or involvement in research projects.

The objective of the article is to provide an overview of PhD students' performance with regard to differences among faculties and form of studies (full-time and part-time). This overview includes areas related to a time allocation to doctoral studies, time spent on research, involvement in research projects and satisfaction with research outputs. Univariate and multivariate statistical analysis of categorical data is used to process data.

The next parts of the article are divided as follows: the following part specifies the analyzed data and describes statistical methods used for the data processing. The main part of the article focuses on the findings obtained through questionnaire and on the detailed description of responses. Discussion of findings and brief comments conclude the article.

Materials and Methods

Data specification

Czech University of Life Sciences Prague provided in total 18 doctoral study programs in 29 PhD specializations at its faculties¹ in the year 2014 (CULS, 2014). In these study programs, in total 1093 PhD students were enrolled. In April 2014, the authors prepared online questionnaire for the evaluation of PhD studies at CULS. The questionnaire covers six main areas: questions related to students' introduction, questions related to doctoral study, questions related to PhD supervisor, questions related to doctoral scholarship, questions related to research publications, and questions related to satisfaction with the doctoral study. This article, however, focuses only on questions related to research activity. As several PhD study programs are taught in foreign language (mainly English) the questionnaire was prepared in both Czech and English version. The questionnaire contains of open-ended and closed questions, as well as a combination of both types. The main purpose of the questionnaire was to find out reasons of satisfactions and dissatisfactions with current doctoral studies at CULS Prague.

The questionnaire was disseminated among all PhD students in May and June 2014. The dissemination was supported by an official email sent to all PhD students. The authors also sent a reminder to this survey 2 weeks after the first dissemination. In total, 187 PhD students (representing 17.11%) have expressed their opinions about PhD studies at CULS Prague. Out of those 187 responses, 72 PhD students were males and 115 were females (Table 1).

Gei		
Male	Female	Total
71	113	184
1	2	3
72	115	187
38.50%	61.50%	
	Ger Male 71 1 72 38.50%	Gender Male Female 71 113 1 2 72 115 38.50% 61.50%

Table 1: Number of responses by gender and residency (source: own calculation)

In addition, the respondents can be divided into two basic groups according to their residency, i.e. Czech & Slovak residents and foreigners. Only 3 responses from foreign PhD students were returned. From this reason, responses from foreign residents are excluded from the analysis. The majority of the PhD students (61.41%) stated their permanent residence is in Prague and in Central Bohemia region (Table 2). This distribution is influenced by the location of CULS in Prague. PhD students with the permanent residence outside of the Czech Republic represent only 2.72% of respondents.

Table 3 summarizes the distribution of the respondents regarding their age. The majority of the PhD students are in the group 26-30 years old (72.28%). Considering that the majority of master students in the Czech Republic graduate around the age 26 and the length of doctoral studies at CULS Prague are 3 years in general, so this age distribution reflects well the conditions. Interesting finding is that 5.43% (10 out of 187 responses) of PhD students are older than 41 years old. Doctoral studies are not a matter only of a younger generation, but CULS Prague is also able to attract older students usually for part-time studies.

Region	Czech & Slovak residents	Share
City of Prague	64	34.78%
Central Bohemia region	49	26.63%
South Bohemian region	7	3.80%
The Pilsen region	4	2.17%
Karlovy Vary region	3	1.63%
The Ústí region	13	7.07%
Liberec region	7	3.80%
Hradec Králové region	7	3.80%
The Pardubice region	7	3.80%
Vysočina region	9	4.89%
Southern Moravia region	2	1.09%
The Olomouc region	1	0.54%
Moravian-Silesian region	5	2.72%
Zlín region	1	0.54%
outside the Czech Republic	5	2.72%
Total	184	100.00%

 Table 2: Regions of permanent residence (source: own calculation)

¹ Faculty of Economics and Management (FEM), Faculty of Agrobiology, Food and Natural Resources (FAFNR), Faculty of Engineering (FE), Faculty of Environmental Sciences (FES), Faculty of Forestry and Wood Sciences (FFWS), and Faculty of Tropical AgriSciences (FTAS).

Age groups	Czech & Slovak residents	Share
0-25	14	7.61%
26-30	133	72.28%
31-35	20	10.87%
36-40	7	3.80%
41 and over	10	5.43%
Total	184	100.00%

Table 3: Age of the respondents (source: own calculation)

Most of the respondents (88.59%) study full-time programs and only 11.41% of respondents are enrolled in part-time programs. Table 5 shows the distribution of received responses sorted by faculties at CULS Prague. The distribution corresponds with the size of the faculties, so the most responses are from FAFNR (28.80%), FES (23.37%) and FEM (19.57%). Whereas the smallest faculty FTAS represents only 8.15% from all the responses.

Desideren	Form of	f the study	
Residency	Full-time	Part-time	Total
Czech & Slovak residents	163	21	184
Share	88.59%	11.41%	100.00%

Table 4: Form of the doctoral studies (source: own calculation)

	Number of responses	Share
FAFNR	53	28.80%
FFWS	22	11.96%
FTAS	15	8.15%
FES	43	23.37%
FEM	36	19.57%
FE	15	8.15%
Total	184	100.00%

 Table 5: Number of responses according to faculty (source: own calculation)

Statistics

We use tools of univariate and multivariate statistical analysis of categorical data. The analysis of individual variable values is based on a frequency distribution and calculation of descriptive characteristics. The principles of dependencies of two variables are described on the basis of a contingency table. Chi-square test is chosen to test hypotheses about the independence of two variables. In case of a failure to comply with the basic test requirements, which is linked to the expected frequencies, we logically merge selected answers. Using the chi-square test we test the compliance of observed and expected frequencies. To calculate the test criterion we can use Person's chisquare statistics (Chambers and Skinner, 2003). In addition Cramer's V was applied to measure the strength of the proven dependencies.

The significance level $\alpha = 0.05$ was set for testing statistical hypotheses. Statistical software SPSS 2.2 was used for a practical application of statistical tools.

Results

Following detailed description of achieved results is structured according to areas related to research of PhD students at CULS Prague (time allocated to doctoral studies, time allocated to research, involvement in research projects, research outputs and satisfaction with research outputs). In following subsections discussion and detailed explanation of achieved results is provided.

How many hours per week PhD students spend at CULS Prague as a part of their doctoral studies?

This subsection focuses on the amount of time PhD students spend at faculty as a part of their doctoral studies. This analyzes tries to find out differences either between faculties of CULS Prague or between different form of studies (full-time and parttime studies). Therefore, the following hypothesis is tested:

 H_0 : There is no statistically significant dependence between number of hours PhD students spend at a faculty and the faculty.

Table 6 summarizes both numbers of hours per faculty and calculated statistical characteristics. As a result, H_0 is rejected (p = 0.0000), so there is a statistically significant dependence between PhD students and number of hours they spend at a faculty as a part of their doctoral studies. A significant difference between PhD students from FAFNR and the rest of the university, regarding the time they spend at faculty, can be observed from Table 6. Most of the PhD students (57.4%) at FAFNR spend 30 and more hours at the faculty per week. This is significantly much more compared to the other faculties, where the average is only around 9.73 hours. On the other hand, 55.81% of PhD students from FES spend mostly between 0 to 9 hours at the faculty as a part of their doctoral studies. Similar results can be observed for PhD students from FFWS. In addition, Cramer's V implies to a moderately strong dependence (0.3199).

		Nun	nber of				
Faculty	0-9 10-19		20-29 30-39		40 and more	Statistics	
FAFNR	9	4	9	13	18	Pearson's test	75.3314
FFWS	11	5	4	0	2	p-value	0.0000
FTAS	4	3	3	5	0	Cramer's V	0.3199
FES	24	7	9	2	1		
FEM	9	15	8	3	1		
FE	1	4	6	2	2		
Total	58	38	39	25	24		

 Table 6: Number of hours PhD students spend at faculty according to faculty (source: own calculation)

As the second part of this area, following hypothesis is tested:

H_0 : There is no statistically significant dependence between PhD students of the full-time and part-time form of study according to number of hours they spend at a faculty.

Table 7 summarizes numbers of hours PhD students of fulltime and part-time form of study spend at a faculty as a part of their doctoral studies. Logically, students of full-time form of study spend significantly more hours at their faculties (this is an expected result). Considering the calculated statistical characteristics, H_0 is rejected (p = 0.0011), so there is a statistically significant dependence between PhD students of different form of study and number of hours they spend at a faculty. Moreover, Cramer's V implies to a moderately strong dependence (0.3154).

Type of		Nur	nber of				
study	0-9	10-19 20-29 30-		30-39	40 and Statistics more		ics
Full-time	43	36	37	23	24	Pearson's test	18.3018
Part-time	15	2	2	2	0	p-value	0.0011
Total	58	38	39	25	24	Cramer's V	0.3154

 Table 7: Number of hours PhD students spend at faculty according to form of study (source: own calculation)

Do PhD students allocate all their working time to their doctoral studies only?

This following subsection tries to find out the proportion of working time allocated to doctoral studies and to work elsewhere (outside a department). Firstly, the differences in responses between faculties of CULS Prague are analyzed. The following hypothesis is tested:

H_0 : There is no statistically significant dependence between PhD students' time allocated to studies and faculties.

In this case, PhD students could answer simply either yes or no. Table 8 summarizes responses from PhD students according to their faculties. In addition, calculated statistical characteristics are also included. H_0 is rejected (p = 0.0034), because there is a statistically significant dependence between time allocated to doctoral studies and faculties. Majority of respondents divide their time between doctoral studies and a work outside their department. As in the previous subsection, PhD students at FAFNR represent difference as they allocate their time more often to doctoral studies only. This result is in alignment with the numbers of hours these PhD students spend at their faculty (Table 6).

On the other side, it can be observed that almost all respondents from FE (except one PhD student representing 7.14% from all respondents from FE) devote their time also to other work outside their department. Similarly, only 22.22% PhD students from FFWS, 22.85% PhD students from FES and 24.14% PhD students from FEM allocate their time only to their doctoral studies. It represents approximately each 4th or 5th PhD student focuses only on the doctoral study. Similarly as for the previous testing, Cramer's V implies to a moderately strong dependence (0.3099).

Faculty	Yes	No	Statistics	
FAFNR	25	28	Pearson's test	17.6759
FFWS	4	18	p-value	0.0034
FTAS	4	11	Cramer's V	0.3099
FES	8	35		
FEM	7	29		
FE	1	14		
Total	49	135		

 Table 8: Devotion of working time only to doctoral studies according to faculty (source: own calculation)

 H_0 : There is no statistically significant dependence between PhD students of the full-time and part-time form of study and time allocated to doctoral studies.

Table 9 summarizes responses and calculated statistical characteristics according to form of study and time allocated to doctoral studies. As expected, H_0 is rejected (p = 0.0160), so there is a statistically significant dependence between form of study and time allocated to doctoral studies. All PhD students

from part-time study forms are supposed to work outside their departments. The one PhD students of part-time study form who stated an allocation of time fully to doctoral studies can represent maternity leave. This, however, cannot be verified from received responses. Cramer's V implies weak dependence (0.1748) among responses.

Type of study	Yes	No	Statistics	
Full-time	48	115	Pearson's test	5.8022
Part-time	1	20	p-value	0.0160
Total	49	135	Cramer's V	0.1748

 Table 9: Devotion of working time only to doctoral studies according to form of study (source: own calculation)

Approximately how many hours per week PhD students spend with their doctoral research?

 H_0 . There is no statistically significant dependence between number of hours PhD students allocate to research and the faculty.

Students' responses and calculated statistical characteristics are summarized in Table 10. In this case and contrary to the previous results, H_0 is not rejected (p = 0.0844), as there is no statistically significant dependence between time allocated to research and faculties to which PhD students belong. Moreover, Cramer's V implies to a weak dependence among responses (0.1991). At all faculties, PhD student allocate, in most of the cases, approximately 10 - 19 hours per week to their research. FAFNR is not an exception this time and PhD students from this faculty allocate similar proportion of their time to research as, for example, PhD students from FES.

Considering the previous testing (total number of hours spent at faculty in Table 6) many PhD students from FAFNR spend almost half of their time with other activities then research (teaching, administrative work, etc.). This comment is based on the huge changes in time categories comparing Table 6 and Table 10.

Responses of PhD students from FEM indicate that they allocate most of their time to research (there are no significant changes in time categories comparing Table 6 and Table 10). Small inconsistency in responses from PhD students from FES can be observed. In Table 6 there are 24 PhD students that spend approximately 0 - 9 hours per week as a part of their doctoral studies. However, only 11 PhD students allocate 0 - 9 hours to research (Table 10). These PhD students either miscalculated their time allocation or they allocate to research some time beyond their doctoral studies. Few similar inconsistencies in responses from the other faculties can also be observed.

		Nu	imber of					
Faculty	0-9 10-19		20-29	30-39	40 and more	Statistics		
FAFNR	7	18	15	8	5	Pearson's test	29.1739	
FFWS	8	8	4	2	0	p-value	0.0844	
FTAS	4	4	7	0	0	Cramer's V	0.1991	
FES	11	15	10	6	1			
FEM	13	16	5	2	0			
FE	3	9	2	0	1			
Total	46	70	43	18	7			

Table 10: Number of hours allocated to research by PhD students according to faculty (source: own calculation)

 H_0 : There is no statistically significant dependence between PhD students of full-time and part-time form of study and time allocated to research.

Table 11 summarizes numbers of hours PhD students of both full-time and part-time forms of study allocate to their research as a part of their doctoral studies. Considering the calculated statistical characteristics, H_0 is not rejected (p = 0.0751), so there is no statistically significant dependence between form of study and number of hours allocated to research. Possible explanation is that, even though PhD students in part-time programs spend significantly less hours at a faculty (Table 7), it is due to a lower teaching involvement. Research is not affected and students in both forms of studies allocate approximately the same amount of time to research.

Type of		Nu	nber of					
study	0-9	10-19	20-29 30-39		40 and more	Statistics		
Full-time	36	65	38	18	6	Pearson's test	8.4919	
Part-time	10	5	5	0	1	p-value	0.0751	
Total	46	70	43	18	7	Cramer's V	0.2148	

 Table 11: Number of hours allocated to research by PhD students according to form of study (source: own calculation)

Are PhD students involved as principal researchers in research projects?

Following two subsections analyze involvement of PhD students in research projects. The questionnaire includes questions related to different types of research projects, such as: university internal grant agency (IGA); university-wide internal agency (CIGA); external projects (such as ESF funds); and external research projects (such as Czech Science Foundation – GACR). However, due to a not sufficient amount of responses, following analysis considers involvement of PhD students only as a principal or associate researcher in general. This subsection focuses on principal researcher. Therefore, the following hypothesis is tested:

 H_0 : There is no statistically significant dependence between involvement of PhD students as principal researchers in research projects and the faculty.

Table 12 summarizes responses from PhD students and statistical characteristics. In this case, H_0 is rejected (p = 0.0145), because there is a statistically significant dependence between responses and particular faculty. Cramer's V implies to a weak dependence (0.2777). As a result significant differences between faculties can be observed. For example, a majority of PhD students at FES (69.77%) and FE (66.67%) responded that they are involved in research projects as principal researchers. In addition, 50% of PhD students at FFWS declared their involvement as principal researchers in research projects. On the other side, at FTAS only 20% PhD students are involved in research projects as principal researchers at FTAS can be related to a lower allocation of time only to doctoral studies (Table 8) and vice versa.

Faculty	Yes	No	Statistics	
FAFNR	24	29	Pearson's test	14.1898
FFWS	11	11	p-value	0.0145
FTAS	3	12	Cramer's V	0.2777
FES	30	13		
FEM	17	19		
FE	10	5		
Total	95	89		

 Table 12: Involvement in research projects as principal researcher according to faculty (source: own calculation)

 H_0 : There is no statistically significant dependence between PhD students of full-time and part-time form of study and involvement as principal researchers in research projects.

Similar result is obtained when involvement in research projects is analyzed comparing different form of studies. Again H_0 is rejected (p = 0.0067), so there is a statistically significant dependence between responses and form of study (Table 13). As expected, PhD students from full-time form of study are mainly involved as principal researchers (55.21%), whereas part-time PhD students are involved only in 23.81% of cases. Managing research projects require nearly full-time involvement, so fulltime form of study is more appropriate. Cramer's V implies weak dependence (0.1960) among responses.

Type of study	Yes	No	Statistics	
Full-time	90	73	Pearson's test	7.3471
Part-time	5	16	p-value	0.0067
Total	95	89	Cramer's V	0.1960

 Table 13: Involvement in research projects as principal researcher according to type of study (source: own calculation)

Are PhD students involved as associate researchers in research projects?

Similarly, PhD students' involvement in research projects in the role of associate researchers can be analyzed. Following hypothesis is tested:

 H_0 : There is no statistically significant dependence between involvement of PhD students as associate researchers in research projects and the faculty.

Table 14 summarizes responses from PhD students and statistical characteristics. In this case, and contrary to the previous subsection, H_0 is not rejected (p = 0.4108), and there is no statistically significant dependence between responses and particular faculty. Therefore, most of the PhD students from all faculties are involved in research projects as associate researchers. In almost all the cases more than 50% of PhD students stated their involvement as associate researches.

Faculty	Yes	No	Statistics	
FAFNR	30	23	Pearson's test	5.0421
FFWS	13	9	p-value	0.4108
FTAS	10	5	Cramer's V	0.1655
FES	21	22		
FEM	20	16		
FE	12	3		
Total	106	78		

 Table 14: Involvement in research projects as associate researcher according to faculty (source: own calculation)

 H_0 : There is no statistically significant dependence between PhD students of full-time and part-time form of study and involvement as associate researchers in research projects.

Analysis of involvement in research projects as associate researcher comparing different form of studies, allows rejecting $H_0 (p = 0.042)$, thus there is a statistically significant dependence between responses and form of study (Table 15). PhD students from full-time form of study are mainly involved as associate researchers (61.34%) in research projects. On the other hand, PhD students from part-time form of study are involved only in 28.57% of cases. Involvement of part-time PhD students does not depend on a position in research projects. Involvement of these PhD students is low in both cases, i.e. as principal and associate researchers. Cramer's V implies weak dependence (0.2064) among responses.

Type of study	Yes	No	Statistics	
Full-time	100	63	Pearson's test	8.1846
Part-time	6	15	p-value	0.0042
Total	106	78	Cramer's V	0.2064

 Table 15: Involvement in research projects as associate researcher according to form of study (source: own calculation)

How many research outputs PhD students publish?

The last part of the analysis is related to research outputs published by PhD students at their faculties. The authors compare research outputs according to the official RIV categories (RVVI, 2013)². In addition, the authors decided to compare only categories of research outputs and not number of research outputs due to a different number of responses between faculties. However, this analysis can still provide sufficient information about research orientation at particular faculty. Following hypothesis is tested:

 H_0 : There is no statistically significant dependence between categories of research outputs and faculties.

Table 16 summarizes both numbers of research outputs sorted by categories and calculated statistical characteristics. As a result, H_0 is rejected (p = 0.0380), thus there is a statistically significant dependence between research output categories and faculties. Differences can be observed between FAFNR, FFWS, FTAS, FES and the rest of CULS Prague, whose PhD students have a lot of research outputs in Jimp and Jneimp categories. More precisely, PhD students at FAFNR publish in Jimp category in 22.73% of cases, at FFWS (31.43%), FTAS (22.22%), and FES (20.29%). On the other hand, PhD students at FEM and FE publish fewer outputs in Jimp category (FEM only 5.8% and FE 8.11%), and publish more in Jneimp, Jrec and D category. Comparison of distribution of research outputs as a whole for CULS Prague reveals, that the distribution is equal between all categories (except proceeding category). Cramer's V implies to a moderately strong dependence (0.3020).

Faculty	Ca	tegories	of rese	earch	outputs	. Statistics		
1 acuity	Jimp	Jneimp	Jrec	D	proceeding	- Statie	51105	
FAFNR	20	11	17	10	30	Pearson's test	32.5050	
FFWS	11	9	2	1	12	p-value	0.0380	
FTAS	6	3	2	6	10	Cramer's V	0.3020	
FES	14	12	14	6	23			
FEM	4	12	14	13	26			
FE	3	10	7	7	10			
Total	58	57	56	43	111			

 Table 16: Categories of research outputs according to faculty (source: own calculation)

Difference in research outputs categories regarding form of study is also tested based on following hypothesis:

H_0 : There is no statistically significant dependence between categories of research outputs and form of study.

Contrary to the previous result, H_0 is not rejected (p = 0.7180), thus there is no statistically significant dependence between research output categories and form of study (Table 17). So even though PhD students of part-time form of study spend significantly less time at faculty (Table 7) and they are less involved in research projects (Table 13 and Table 15), there is no statistically significant difference in research output categories. Different results, however, provides an analysis of total number of publications.

Type of	Cate	egories c	of res	h outputs	Statistics	
study	Jimp	Jneimp	Jrec	D	proceeding	- Statistics
Full-time	50	51	48	35	99	Pearson's test 2.0960
Part-time	8	6	8	8	12	p-value 0.7180
Total	58	57	56	43	111	Cramer's V 0.0800

 Table 17: Categories of research outputs according to form of study (source: own calculation)

Are PhD students satisfied with the number and categories of their published research outputs?

The last subsection of the results is focused on the level of satisfaction of PhD students with their research outputs. The questionnaire contained of following possible answers; *definitely not, not very, I do not know, quite satisfied,* and *completely satisfied.* The authors decided to merge categories (to *satisfied, not satisfied,* and *I do not know*) due to fewer number of responses. Moreover, "I do not know" category was eliminated from the statistical analyses, because in total only 11 responses were obtained and zero responses at FFWS and FE (Table 18). Finally, following hypothesis is tested:

 H_0 : There is no statistically significant dependence between satisfaction with research outputs and faculties.

Table 18 summarizes calculated statistical characteristics. As a result, H_0 is not rejected (p = 0.5548), thus there is no statistically significant dependence between satisfaction with research output and faculties. Surprisingly, most of the PhD students across the faculties are not satisfied with their research outputs (neither categories nor number of published outputs). The average dissatisfaction at CULS Prague reaches a level of 70%! Students at FE represent an exception, when their dissatisfaction is only 53.33%. If responses from FE are excluded, then the dissatisfaction average increases up to 74%.

² Article published in a periodical in the Web of Science (Jimp), article published in a periodical registered either in SCOPUS or ERIH (Jneimp), article in a reviewed Czech periodical, which is not registered in WoS, SCOPUS, or ERIH (Jrec), article in proceedings registered in Thomson Reuters (D), and article in proceedings not registered in Thomson Reuters (proceeding).

The reason of high dissatisfaction at FEM can be explained with a low number of research outputs in Jimp category (Table 16). That is in contrary to PhD students from FE who have even fewer Jimp outputs than FEM. However, PhD students at FE are the most satisfied from CULS Prague. Dissatisfaction of PhD students at FAFNR, FFWS, FTAS and FES is quite surprising regarding number of research outputs in Jimp and Jneimp categories. However, dissatisfaction with published research outputs can lie somewhere else. We only make assumption according to the analyzed results in this article. Therefore, further analysis is necessary for finding complex reasons.

Faculty	Satisfied	Not satisfied	Do not know	Statistics	
FAFNR	16	33	4	Pearson's test	3.9628
FFWS	4	11	0	p-value	0.5548
FTAS	11	29	3	Cramer's V	0.1513
FES	4	16	2		
FEM	8	26	2		
FE	7	8	0		
Total	50	123	11		

 Table 18: Satisfaction of PhD students with their research outputs according to faculty (source: own calculation)

Differences in satisfaction regarding form of study are tested with following hypothesis:

 H_0 : There is no statistically significant dependence between satisfaction with research outputs and form of study.

In this case, H_0 is not rejected (p = 0.6327), so there is no statistically significant dependence between satisfaction with research output and form of study. Dissatisfaction of full-time PhD students is 71.7%, while part-time PhD students reach 66.7%. In both cases the results correspond with average dissatisfaction between faculties.

Faculty	Yes	No	Do not know	Statistics	
Full-time	43	109	11	Pearson's test	0.2284
Part-time	7	14	0	p-value	0.6327
Total	50	123	11	Cramer's V	-

 Table 19: Satisfaction of PhD students with their research outputs according to form of study (source: own calculation)

Discussion

Responses from PhD students show significant differences in many areas. First of all, the form of study has significant impact on research results of PhD students. Students of parttime form of study spend significantly less time at a faculty. These students divide their time between the time at a faculty and the time outside the faculty. However, the time outside a faculty does not influence the proportion of time allocated to research. PhD students of both full-time and part-time forms spend approximately the same amount of time with research. Therefore, the difference in time allocation to a faculty is most likely linked to other duties at a department. Full-time PhD students probably teach more classes per week and PhD students of part-time form of study are primarily hired for research.

On the other hand, part-time form of study negatively affects involvement in research projects. Therefore, if CULS Prague is to improve its research results, full-time PhD students should be in focus. It is, however, not enough. There should be a tighter connection between supervisor and PhD student. As Barnes and Austin (2009) pointed out, the influence of PhD supervisors plays important role in research results of PhD students. In addition, Pinheiro, Melkers and Youtie (2014) observed that co-authoring with a supervisor is a significant source of publications. Moreover, this co-authoring and mentoring have positive impacts for future research performance. Therefore, proper supervising could lead to diminishing zero research results of PhD students, as Flegl and Vostra Vydrova (2014) observed.

This improvement must go along with a proper PhD students' education. As Lee and Kamler (2008) pointed out, learning how to write and speak in discipline-specific way, how to frame research questions, and how to effectively collaborate are important in science fields. This learning should be provided on a faculty or department basis. This requires PhD students willing to take research-related courses. This can be facilitated by learners-friendly environment at department as well as faculty level.

Secondly, the authors observed significant differences among faculties in many aspects. Obviously, each faculty requires different workload. PhD students at FAFNR spend significantly more time at the faculty (30 and more hours). Moreover, PhD students at FAFNR publish a lot of articles in Jimp and Jneimp categories (similarly as PhD students at FES). This result corresponds with the findings of Flégl, Tichá and Stanislavská Kvasničková (2013). In their study, four PhD specializations from FAFNR and FES reached the highest research performance among all PhD specializations at CULS Prague. This implies the close link between time spent at faculty and research performance.

The last but not least, PhD students at some faculties allocate their time mostly to research. For example, some PhD students at FEM expressed their time allocation to doctoral studies at the same level as time allocation to research. So why FEM does not reach the same level of research outputs as FAFNR or FES? Firstly, there might be possible influence of hardly comparable research fields (social sciences versus natural sciences). Secondly, different teaching workload might also affect the level of research experience³. More in depth analysis confirming causes of differences is needed in order to design and implement schemes enhancing the level of research performance.

Conclusion

The authors provide analysis of research activity at CULS Prague with focus on doctoral studies. The analysis is a response to an increasing pressure for higher profile research results. The analysis covers areas related to a time allocation to doctoral studies, time allocated to research, involvement in research projects and satisfaction with research outputs. All these areas are analyzed with regard to differences among faculties and forms of doctoral studies at CULS Prague.

The authors found many differences among faculties. For example, 57.4% of PhD students at FAFNR spend significantly more time (30 and more hours) at their faculty in comparison with the other PhD students. The average at CULS Prague is only around 10 hours. In addition, PhD students at FAFNR allocate their time more often to only doctoral studies. Therefore, PhD students from other faculties divide more often their time between doctoral studies and other activities outside their faculties. On the other side, any significant differences between

³ Other reasons should be taken in an account, such as low scholarship, department's environment etc. But the influence of these factors is not the main objective of this article.

time allocations to research were found. At all faculties, PhD students allocate approximately 10 - 19 hours per week to their research.

In most of the cases, significant differences between full-time and part-time PhD students were found. For example, parttime PhD students spend significantly less time at their faculty. Furthermore, these PhD students do not allocate their time only to doctoral studies. Part-time form of study negatively influences involvement in research projects. This negative influence has an impact in both types of involvement, i.e. as a principal and as an associate researcher. Form of study does not have a direct impact on categories of research outputs. Thus, both full-time and part-time PhD students publish similar categories. This analysis did not cover the issue of amount of published results.

The last significant area of this analysis is related to a satisfaction with research outputs. Even though differences can be observed among faculties and form of studies in other analyzed areas, all PhD students are dissatisfied with their research results. The average dissatisfaction at CULS Prague reaches a level of 70%! Students at FE expressed the lowest level of dissatisfaction (53.33%). Moreover, this dissatisfaction was expressed by full-time and part-time PhD students similarly.

The disseminated questionnaire covers more areas, but not all could be included in this analysis. Therefore, the future research will analyze other areas such as cooperation with PhD supervisors, satisfaction with doctoral studies or the issue of appropriate remuneration of PhD students. The authors would like to find out the reasons of most of the dissatisfactions. Moreover, the authors would also like to find out the reasons behind better research results of PhD students at some faculties.

References

Barnes, B. J. and Austin, A. E. (2009) 'The role of doctoral advisors: A look at advising from the advisor's perspective', *Innovative Higher Education*, vol. 33, no. 5, pp. 297-315. http://dx.doi.org/10.1007/s10755-008-9084-x.

Chambers, R. L. and Skinner, C. J. (2003) *Analysis of survey data*, Wiley http://dx.doi.org/10.1002/0470867205

CULS (2014) *Science & Research – Doctoral studies*, [online],. Available: http://www.czu.cz/en/?r=6142, [1 Dec 2014].

Dlouhý, M. (2012) 'Efficiency and resource allocation within a hierarchical organization', *Proceedings of 30th International Conference Mathematical Methods in Economics*, Karviná: School of Business Administration, Silesian University, pp. 112-116.

Flégl, M., Tichá, I. and Stanislavská Kvasničková, L. (2013) 'Innovation of doctoral studies at the FEM CULS Prague', *Journal on Efficiency and Responsibility in Education and Science*, vol. 6, no. 4, pp. 265-280. http://dx.doi.org/10.7160/ eriesj.2013.060405

Flégl, M. and Vltavská, K. (2013) 'Efficiency at Faculties of Economics in the Czech Public Higher Education Institutions: Two Different Approaches', *International Education Studies*, vol. 6, no. 10, pp. 1-12. http://dx.doi.org/10.5539/ies.v6n10p1

Flegl, M. and Vostra Vydrova, H. (2014) 'Is Pareto's 80-20 rule applicable in research? A case of CULS Prague', *Proceedings of 11th International Conference on Efficiency and Responsibility in Education (Erie 2014)*, Prague: Faculty of Economics and Management, Czech University of Life Sciences Prague, pp. 125-131.

Furková, A. (2013) 'Alternative approaches to efficiency evaluation of higher eduation institutions', *Journal on Efficiency and Responsibility in Education and Science*, vol. 6, no. 3, pp. 167-178. http://dx.doi.org/10.7160/eriesj.2013.060304

Hilmer, M. J. and Hilmer, Ch. E. (2009) 'Fishes, ponds, and productivity: Student-advisor matching and early career publishing success for economics PhDs', *Economic Inquiry*, vol. 47, no. 2, pp. 290-303. http://dx.doi.org/10.1111/j.1465-7295.2007.00108.x

Jablonský, J. (2014) 'Bibliometric indicators and their comparison on the set of Czech scientists', *Proceedings of 11th International Conference on Efficiency and Responsibility in Education (Erie 2014)*, Prague: Faculty of Economics and Management, Czech University of Life Sciences Prague, pp. 255-261.

Johnes, J. (2006) 'Data envelopment analysis and its application to the measurement of efficiency in higher education', *Economics of Education Review*, vol. 25, pp. 273-288. http:// dx.doi.org/10.1016/j.econedurev.2005.02.005

Korhonen, P., Tainio, R. and Wallenius, J. (2001) 'Value efficiency analysis of academic research', *European Journal of Operational Research*, vol. 130, no. 1, pp. 121-132. http://dx.doi.org/10.1016/S0377-2217(00)00050-3

Kyvik, S. and Smeby, J.-Ch. (1994) 'Teaching and research. The relationship between the supervision of graduate students and faculty research performance', *Higher Education*, vol. 28, no. 2, pp. 227-239.

McMillan, M. L. and Chan, W. H. (2006) 'University efficiency: a comparison and consolidation of results from stochastic and non-stochastic methods', *Education Economics*, vol. 14, no. 1, pp. 1-30. http://dx.doi.org/10.1080/09645290500481857

MEYS (2014) Rozpis rozpočtu vysokých škol na rok 2014 (in Czech, Schedule of funding for higher education institutions for the year 2014), [online], Available: http://www.msmt.cz/vzdelavani/vysoke-skolstvi/rozpis-rozpoctu-vysokych-skol-na-rok-2014 [28 Nov 2014].

Pinheiro, D., Melkers, J. and Youtie, J. (2014) 'Learning to play the game: Student publishing as an indicator of future scholarly success', *Technological Forecasting and Social Change*, vol. 81, pp. 56-66. http://dx.doi.org/10.1016/j.techfore.2012.09.008

RVVI (2013) Methodology of Evaluation of Research Organizations and Evaluation of Finished Programmes (valid for years 2013 – 2015), [online], Available: http://www.vyzkum. cz/FrontClanek.aspx?idsekce=695512 [25 Nov 2014].

Stevens, P. A. (2005) 'A stochastic frontier analysis of English and Welsh universities', *Education Economics*, vol. 13, no. 4, pp. 355-374. http://dx.doi.org/10.1080/09645290500251581

Vltavská, K. and Fischer, J. (2013) 'Is It Possible to Estimate Labour Productivity in the Czech Higher Education?', *Journal on Efficiency and Responsibility in Education and Science*, vol. 6, no. 1, pp. 34-45. http://dx.doi.org/10.7160/eriesj.2013.060104

AN ANALYSIS OF THE STUDY PLAN OF THE PROFESSIONALLY ORIENTED BACHELOR STUDY FIELD OF MULTIMEDIA IN ECONOMIC PRACTISE

Zdeněk Vondra, Kristýna Vltavská

University of Economics, Prague

Highlights

• If a course is popular by its contents students find the course more relevant to prospective jobs

Abstract

This paper focuses on the study field of Multimedia in Economic Practise which has been taught at the University of Economics in Prague since 2011. This study field has its first graduates which is the reason for a re-examination of the profile of graduates according to the structure of subjects in the study plan. This paper describes evolution of the study field, its content, main idea and structure of its students. It presents two main groups of occupations for graduates with dependence on requirements for student's additional independent activities beyond the study. The analytical part shows five examples of comparison of the course relevance according to the opinion of students and academic staff. The conclusions from the survey will enable academic staff of the study field to the reconsider the future development of the study field.

Keywords

Economic practice, education, multimedia, students' opinions

Article type

Full research paper

Article history Received: December 1, 2014 Received in revised form: December 28, 2014 Accepted: December 29, 2014 Available on-line: December 31, 2015

Vondra Z. and Vltavská K. (2014) "An Analysis of the Study Plan of the Professionally Oriented Bachelor Study Field of Multimedia in Economic Practice", *Journal on Efficiency and Responsibility in Education and Science, Vol. 7, No. 3-4*, pp. 74-79, online ISSN 1803-1617, printed ISSN 1803-1617, doi: 10.7160/eriesj.2014.070305.

Introduction

The bachelor study field of Multimedia in Economic Practice was being prepared at the Faculty of Informatics and Statistics at the University of Economics in Prague after 2009 and it was accredited in the summer of 2011. In September 2011, first students were admitted to the study. A significant part of students graduated in June 2014 as the first graduates of this field ever. The study field is accredited within the study program of Applied Informatics. This establishment is based on the principle that the creation of multimedia is perceived as the creation of communication tools. It means encoding of information, messages and knowledge. This theoretical approach is applied and used as a basic tool for the explanation of the principles. The principles used in teaching of Multimedia in Economic Practice are based on theory of multimedia learning (Mayer, 2009, Mayer and Moreno, 2003), theory of communication (Craig, 1997, Rothwell, 2009) including dual coding theory (Paivio, 1986) and multimedia practical description (Vaughan, 2008).

The moment just after graduating of the first full run of the study field is an opportunity for a review and verification of reaching the goals and expectations of the study field creators¹ (author is one of creators and member of academic staff of this study field) and teachers focused on future students' occupation.

In this paper, we verify whether Multimedia in Economic Practice effectively meets their professional status. It means whether a student is ready for entering into practice immediately after the bachelor level of study. This verification process should answer the question what knowledge and skills are actually missing in the program and which are unnecessary. Areas of knowledge and skills that students should acquire and operate are reflected in the construction of the study plan, which was

¹ The verification of the fulfilling the expectation on the level of individual subject was discussed in Krejčí et. al. (2011).

carefully compiled in relation to the current requirements of practice and expert advices. Therefore, we verify whether the actual setting fits the vision of future knowledge and skills of graduates. This knowledge and skills should be completed for the selected occupation profiles that the creators of the study field set as the goal at the beginning of the formulation. At first, we surveyed university data and thereafter we prepared a survey among students asking for their opinion of the courses, their future occupation and relevant practice. Based on the results we can analyse which courses in the study field are more and less useful or completely useless for a future student's occupation. Moreover, we investigate whether students are motivated to continue their studies at any of the similar or different master study programs. This paper follows and elaborates the findings of Vondra and Vltavská (2014).

Motivation to form the study field

The motivation for the development of the study field was based on public demand among university students, secondary school graduates and employers. This trend relates to digitalization and subsequent availability of multimedia resources to a wide range of users. Herewith, multimedia, which used to represent a closed area of a narrow group of professionals equipped with financially demanding resources, opened towards participation of a wider group including semi-professionals and amateurs. They now face a substantially lower barrier to their use or input into the production of multimedia communications.

The requirements of employers came especially from the field of advertising agencies and companies operating television or radio broadcasts. Their demand has defined the need for new specialists able to work and understand various different types of multimedia tools at the same time. In context with savings and production efficiency, the overlap is a competitive advantage and enables flexibility of both the worker and the organization that employs them. This fact was confirmed by associate teachers of journalism at the Faculty of Social Sciences, Charles University who observed the trend that a reporter due to attempts on saving is forced to operate both the camera and video production and post-production process.

Study plan and profile of the graduate

Multimedia in Economic Practice teaches information especially in the areas of analysis, conception, design and processing of multimedia content for the realization of functional communication. The study field is based on soft systems methodology and theories of information, communication, knowledge, and multimedia learning. It hereby defines procedures for effective multimedia production. From the point of view of specific implementation multimedia is further taught according to practices of each sub-area (typography and word processing, graphics, photographs, video, sound, animation).

Graduates are able to analyse the communication objectives of the company and to propose appropriate usage of multimedia (VŠE, 2011). That means creatively design, implement, or provide various multimedia tools for the specific needs of corporate communication. Graduates are be able to implement these tools either on their own or competently choose an outsourced company and judge the suitability and quality of the selected solution afterwards. This general description is explained by the overview of the study plan and a list of professions, which aspire to their working life.

Expected occupation of a graduate

A graduate can find employment in management and administration. If a graduate tends deeply to one of the specific multimedia disciplines they have a chance to become a professional in the field with knowledge overlapping to other related areas. In practice, the graduate and their work will be more flexible and independent from the structure of the organization or subcontractors. We revised the list of examples of positions from the profile of graduates (VŠE, 2011) and we divided the list in two groups depending on how much personal effort beyond studies is required.

Occupations performance, which does not require student's additional independent activities beyond the study:

- Account Executive, Account Manager (project manager at an advertising agency)
- Marketer, buyer, project manager or PR client-side communication expert
- Strategic / media planner for communication campaigns
- Project manager, executive producer, production manager in advertising, production and post-production companies
- Production manager ensuring realization of multimedia work, runner director
- Creative, art director, creative director, idea maker (creator and creative concepts processor)
- Processor of internal corporate multimedia (photo and video documentation, creating simple graphics)
- Webmaster

Occupations performance, which requires student's personal interest and work beyond the study:

- 2D / 3D graphics maker (creator and processor of graphic design, visualization)
- 2D / 3D graphics animator (creator processor and graphic

jingles for video, animated commercials or basic visual effects)

- Typesetting of documents, printed or outdoor advertising (processor of text, graphics and photos)
- Graphics and typesetting maker for the digital environment (banners, websites, social networks)
- Reporting, product or advertising photographer
- Digital video production maker or assistant, occupant in television or movie companies
- Web designer, director and evaluator of websites
- Audio production and post-production company or advertising or recording studios occupant
- Multimedia journalist in the service of the company or other organization (internet portal, government, local cable TV)
- Coder and programmer of the website or user interface programs and applications (requires completion of education in programming)

Materials and Methods

The aim of the survey was the examination of the meaningfulness and structure of courses taught in relation to the prospective profession of graduates, their previous experience and success in their studies. We acquired 71 answers from the survey from which 51% represents male students and 49% represents female students. 59% of students involved in the survey already had some work experiences in the jobs related to the studies.

As we mentioned in previous chapter graduates can be employed in different types of occupation related to the multimedia. We distinguished these occupations into 11 groups according to the content of the future job:

- 1. MARK Account Executive, Account Manager; Marketer, buyer, project manager or PR client-side communication expert
- STRAT Strategic/media planner for communication campaigns; Project manager, executive producer, production manager in advertising, production and postproduction companies
- 3. CREAT Creative, art director, creative director, idea maker
- 4. PROD Production manager ensuring realization of multimedia work, runner director
- 5. INHOUSE Processor of internal corporate multimedia
- 6. ANIM 2D / 3D graphics maker, 2D / 3D graphics animator
- 7. GRP Typesetting of documents, printed or outdoor advertising; Graphics and typesetting maker for the digital environment
- 8. PHOTO Reporting, product or advertising photographer; Multimedia journalist in the service of the company or other organization
- 9. VIDEO Digital video production maker or assistant, occupant in television or movie companies
- 10. SOUND Audio production and post-production company or advertising or recording studios occupant
- 11. WEB Webmaster; Web designer, director and evaluator of websites; Coder and programmer of the website or user interface programs and applications

For the purpose of this paper we chose 5 different future occupations from these groups which represented different work positions and different opinions of the students. Results are based

on the comparison of the students' and academic staffs' opinions of the relevance of subjects contained in the study plan. The questionnaire contains questions about the students' opinions of the relevance of all obligatory subjects from the study plan. As one of the authors is the creator of the study field and member of academic staff, his opinion on the relevance of the subjects for different occupation groups was used (see Appendix to find the relevance of subject of 11 occupational groups as rated by academic staff). We state 5 as the most relevant and 1 as irrelevant. Figures 1 to 5 contain mean values for each subject.

Results and Discussion

The first group (Fig. 1) describes the most wanted job among students. However, not everyone can do that. This occupation is based on very deep professional and personal skills. One can see that the opinion on subjects relevance of academic staff of the study field copy the opinion of students. Only exceptions represent subjects Cultural Politics, Local and Regional Culture and History of Art and Modes of Aesthetic Experience. As these two courses are very descriptive and students are mostly creative, they do not consider subjects as relevant. Conventional students' approach is that they want to create (learn by doing), rather than to passively learn (in terms of declarative knowledge gaining).

In the case of Cultural Politics, Local and Regional Culture, creators of study field and teacher of the course concluded that this course is not perfectly suitable for the study field. Its function was to establish the point of view on media including the regional and cultural aspects. The malfunction occurred because of its strong focusing on material cultural heritage and its animation. It did not come as essential information for multimedia creation. A discussion had started about superseding it by course Local and regional sociology, which reflects the human behaviour in connection with geography more.

In the case of the course History of Art and Modes of Aesthetic Experience, academic staff of the study field found that students' perspective of creational processes in past should work as the essential best practices. We can admit that this kind of course may be unpopular because of its descriptive style of historical content and because of implemented philosophy part about working of aesthetics but unpopularity does not mean irrelevancy.



Fig. 1: Creative, art director, creative director, idea maker (creator and creative concepts processor)

Source: Vondra, Vltavská (2014)

Note: FIN – Corporate Finance, ACC – Accounting, LAW – Law, RIGHTS - Copyright and Industrial Property Rights, MNG – Management, MAR – Marketing, MAC – Marketing Communications, ECO – Economics, MATH – Mathematics for Economists, STA – Statistics, PUBLIC SECTOR - Public Sector and Financing in Area of Multimedia, MULTI - Introduction to Multimedia

Theory, HISTORY - History of Art and Modes of Aesthetic Experience, CULTURE - Cultural Politics, Local and Regional Culture, SEMIO - Multimedia Semiotics, VEC GRAPH - Basics and Applications of Vector Graph, TYPO -Computer Typography and Typesetting, 3D GRAPH - Applications of 3D Graphics, BASIS DIGI - Basics of Digital Photography and Editing Bitmap, DIGI PHOTO - Digital Photography and Bitmap Editing, BASIS AUDIO -Basics of Audiovisual Communication, AUDIO - Audiovisual Communication, POST-PRODUCTION - Audiovisual Post-production, SOUNDS - Sound and Multimedia, WEB - Web Design and User Interfaces, SKILLS - Presentation Skills, MNG OF MULTI - Management of Multimedia Projects, PROCESS -Communication and Creative Processes



Fig. 2: Project manager, executive producer, production manager in advertising, production and post-production companies

Figure 2 shows that there is lesser agreement between students and academic staff about the relevance of the subjects included in the study plan. The disagreement lies mainly in creative subjects where academic staffs' requirements contain only the knowledge about instruments without deeper creative knowledge. The explanation could be found in the overall popularity of creative courses which evokes the feel of relevance among the students. Economic and theoretical oriented courses are undervalued by students.

However, Figure 2 also shows the same understanding of the necessity of the subjects by students and academic staff. The lower relevance level corresponds with the lesser popularity of theoretical subjects among students. Great paradox, but a reaffirmation of the impact of the level of complexity of the conceptual issues, represents course Multimedia Semiotics. There is a completely opposite assessment. This course examines the processes of perception and interpretation. The intention was to provide academic staff a tool for deeper knowledge assessment for evaluating the submitted work creative professions. This course stands at the border of Master's and Bachelor's degree and requires concentration and understanding, which in the context of the study field discourage students. The output of the findings from the Figure 2 presents the necessity of a more rigorous explanation of the importance of theoretical courses within the context of the study field. On the other hand, theoretically oriented courses should be reviewed in terms of their contribution, whether they actually fulfil their function.

Figure 3 describes the agreement of students' and academic staffs' opinions with some significant deviations. Very interesting agreement or higher relevance according to students was found among the economical courses (excluding Mathematics). However, Mathematics represents a crucial element in 3D graphics. Its low rating can be caused by the amount of theory taught and the difficulty of the subject since the success of study of this course is around 70% (in comparison with high level of success of creative subjects - 85% to 98%). Theoretical courses again show the same trend of proving less relevance

for the students. Professional practical courses - the courses that teach the specific issues – gained interesting evaluation. These courses only scored 4/5. In contrast, the other courses which are complementary for the profession have nearly the same relevance, including Sound and Multimedia, which is practically unusable for static graphics. Students clearly perceive the overlap of this group of profession which indicates their desire and interest in the multidisciplinary principle of the study field. Courses such as Presentation Skills and Management of Multimedia Projects seem to be very relevant, even though their meaning may be used more in professions that are in contact with customers and the market. The explanation is again in the interest of students in practical courses.



Fig. 3: 2D / 3D graphics maker (creator and processor of graphic design, visualization)

Due to the similarity of the results, Figure 4 and Figure 5 are discussed at once. In terms of economic courses there is agreement between students and academic staff. The founding about other areas follow the same pattern as the previous examples. For theoretical courses there are less relevance ratings from students, but values copy mutual ratio among academic staff. For practical courses follow the trend of balancing relevance across the multimedia fields without the detailed reflection of a specific profession. In Figure 4 it is worth mentioning again highlighted the relevance of course Sound and Multimedia by students in the context of the creation of digital photos. In case of Figure 5 it is a designation of Basics and Applications of Vector Graphics and Computer Typography and Typesetting.



Fig. 4: Reporting, product or advertising photographer



Fig. 5: Digital video production maker or assistant, occupant in television or movie companies

Kučera et al. (2012) and Kučera et al. (2013) investigated how the changes in accreditation of the subject of Mathematical Methods in Economics II influenced the results of students' success in the first and in the second year after these changes. Krejčí et al. (2011) focused on the description of the students' opinions on the changes in the subject of Mathematical Methods in Economics using system dynamics. The authors used questionnaire to find out students' opinions on the possibility to integrate the system dynamics into the study. On the other hand, this paper surveyed opinions of student on the whole concept of the study field of Multimedia in Economic Practise. Members of academic staff wanted to create a study field which fulfils not only the requirements of prospective employers. This survey served as a source of information for academic staff whether students understood the importance of the content of each part of the study field in accordance to their future job.

Results of the survey show that the profile of a graduate (VŠE, 2011) requires a modification. In particular, an alteration of the structure of courses which fulfil the profile is necessary. Results of the survey demonstrated that better students' knowledgeableness of the core of less popular courses needs to be ensured. The generally relevant courses should implement the intersections with various areas into other courses. Students ought to understand the courses' importance, usefulness and see their interconnection. Creators of the study field want to increase the intensity of the analytical subjects (e.g. Statistics, Demography). As we already mentioned, the substitutions of some courses are important. Students pointed out that the course of Cultural Politics, Local and Regional Culture is irrelevant to their study field. Since the creators have no arguments for retaining this course in the study plan (VŠE, 2011) this subject will be replaced by the course of Local and Regional Sociology in the new accreditation. Moreover, courses focusing on the language skills and work with text materials will be added to the study plan (e.g. Creative writing 2.0). The final important finding represents the students' willingness to combine different multimedia fields. This is confirmed by the trend of assigning tasks, which expect the students to draw not only from a narrow specialized field but from various areas of multimedia simultaneously (e.g. in the course of Sound and Multimedia the visual part of the task, which relates to and develops the sound record, has to be submitted as well).

Conclusion

Every creator of the study field wants to design the study plan that fulfils the requirements of future employers of the graduates and in the same way that accomplishes the expectation of students. As the first graduates of the Multimedia in Economic Practise study field will look for jobs according their knowledge academic staff of the study field wanted to find out if their study plan was built in relevance to the students and their expectations.

The analysis of the relevance of the courses in context of the future jobs of the graduates of professionally oriented study field Multimedia in Economic Practise shows several repeated situations which presents the input for the conceptual changes of the courses. There exist different views on the relevance of the theoretical courses. Students evaluate them as less relevant in comparison with the opinion of academic staff. This leads to the revision of courses' content and integration to the study plan (e.g. course Introduction to Multimedia Theory was renovated for the academic year 2014/2015 according to the founding from the survey).

From the results of the survey within students of the study field we found out that (in general) if a course is popular by its contents students find the course more relevant to their prospective professions without connection to occupation requirements for skills and knowledge. On the contrary, if a course is not very popular among students they marked it as irrelevant. Course focused on culture studies provided by Department of Arts Management was found irrelevant by students. After the discussion with its teacher we decided to remove this course from the study plan in next accreditation. Conceptual oriented courses are hard to get for students as they are used to learn practical skills. It is necessary to bring conceptual courses close to the practice.

Academic staff of the Multimedia in Economic Practise study field plan to prepare this survey again at the end of the academic year 2014/2015. At that time there will be not only new graduates but the first graduates will have finished their first year at work. Through the contact between academic staff and graduates we will be able to verify what type of occupation they work at and what their opinions on the relevance of the subjects are after one year in practise.

Acknowledgements

This article is supported by Institutional Support for Long Period and Conceptual Development of Research and Science at Faculty of Informatics and Statistics, University of Economics, Prague.

References

Craig, R. T. (1997) 'Communication theory as a Field', *Communication Theory*, vol. 9, no. 2, pp. 119-161. http://dx.doi. org/10.1111/j.1468-2885.1999.tb00355.x.

Krejčí, I., Kvasnička, R., Dömeová, L. (2011) 'Introducing System Dynamics at CULS Prague', *Journal on Efficiency and Responsibility in Education and Science*, Vol. 4, No. 4, pp. 187-196.

Kučera, P., Kvasnička R., Krejčí, I. (2012) 'Impact of the contact teaching reduction on study results in the course of Mathematical methods in economics II', *Proceedings of the 9th International Conference on Efficiency and Responsibility in Education (ERIE 2012)*, Prague, pp. 287-293.

Kučera, P., Kvasnička, R., Vostrá Vydrová, H. (2013) 'Study results development in mathematical methods in economics in two years from accreditation', *Proceedings of the 10th International Conference on Efficiency and Responsibility in Education (ERIE 2013)*, Prague, pp. 341-346.

Mayer, R.E., Moreno, R. (2003) 'Nine ways to reduce cognitive load in multimedia learning', *Educational Psychologist*, vol. 38, no. 1, pp. 43-52. http://dx.doi.org/10.1207/S15326985EP3801_6. Mayer, R. E. (2009) *Multimedia learning. 2nd ed.* Cambridge: Cambridge University Press.

Paivio, A. (1986). *Mental representations: a dual coding approach*. Oxford, England: Oxford University Press.

Rothwell, J. D. (2009) *In the company of others: an introduction to communication*. New York: Oxford University Press.

University of Economics in Prague (VŠE), (2011) *Profile of a graduate* (in Czech only), Praha. [Online], Available: http://gml. vse.cz/zajemci-o-studium/profil-absolventa/. [3 May 2014].

Vaughan, T. (2008) *Multimedia: making it work. 7th ed.* New York: McGraw-Hill.

Vondra, Z., Vltavská, K. (2014) 'Revision of Course Settings in Multimedia in Economic Practice Study Field', *Proceedings* of the 11th International Conference on Efficiency and Responsibility in Education (ERIE 2014), Prague, pp. 898-904.

Appendix

Table 1: Study plan and the relevance of subjects towards 11 groups of occupation by academic staff

Subject/group of occupation	1 - MARK	2 – STRAT	3 – CREAT	4 – PROD	5 - INHOUSE	6 - ANIM	7 – GRP	8 – PHOTO	9 - VIDEO	10 - SOUND	11 – WEB
Corporate Finance	4	5	1	4	3	1	1	1	1	1	1
Accounting	3	4	1	5	2	1	1	1	2	2	1
Law	4	3	1	4	4	1	1	3	2	2	4
Copyright and Industrial Property Rights	5	4	4	4	5	4	4	5	5	5	5
Management	5	5	3	5	3	2	2	2	4	4	4
Marketing	5	5	4	5	3	3	3	3	3	3	3
Marketing Communications	5	5	5	5	4	4	4	4	4	4	5
Economics	3	4	1	5	3	1	1	1	2	2	2
Mathematics for Economists	3	5	1	4	2	4	3	2	3	3	4
Statistics	4	4	1	4	2	1	2	2	3	3	5
Public Sector and Financing in area od Multimedia	5	4	1	5	2	1	1	3	2	2	3
Introduction to Multimedia Theory	5	5	5	4	5	5	5	5	5	5	5
History of Art and Modes of Aesthetic Experience	2	3	5	2	4	5	5	5	5	5	5
Cultural Politics, Local and Regional Culture	2	4	4	3	4	3	2	3	4	4	4
Multimedia Semiotics	2	4	5	3	4	5	5	5	5	5	5
Basics and Applications of Vector Graph	2	2	4	2	4	5	5	4	3	1	4
Computer Typography and Typesetting	2	2	4	2	4	5	5	3	3	1	5
Applications of 3D Graphics	2	2	4	2	3	5	4	4	4	1	3
Basics of Digital Photography and Editing Bitmap	2	2	4	2	5	5	5	5	5	1	3
Digital Photography and Bitmap Editing	2	2	4	2	4	3	5	5	5	1	3
Basics of Audiovisual Communication	2	2	4	2	5	4	3	4	5	4	3
Audiovisual Communication	2	2	4	2	4	3	2	4	5	4	3
Audiovisual Post-production	2	2	4	2	3	4	2	2	5	5	2
Sound and Multimedia	2	2	4	2	4	1	1	1	5	5	3
Web Design and User Interfaces	2	2	4	2	3	4	4	4	2	2	5
Presentation Skills	5	5	5	5	4	2	2	2	3	2	3
Management of Multimedia Projects	5	5	4	5	4	2	3	3	5	5	4
Communication and Creative Processes	5	5	5	4	4	3	3	3	4	3	5

Note: 5 = the most relevant, 1 = irrelevant

ENGLISH FOR SPECIFIC PURPOSES E-LEARNING EXPERIMENTAL RESEARCH

Lenka Kučírková, Petr Kučera, Hana Vostrá Vydrová

Czech University of Life Sciences Prague

Highlights

• English for specific purposes e-learning experimental research

Abstract

The paper deals with English for Specific Purposes (ESP) e-learning experimental research conducted in the lessons of Business English in winter term of academic year 2012/13 at the Czech University of Life Sciences (CULS) in Prague. Online study support for Business English is a 14 module course in the Moodle Learning Management System (LMS) which is used for study purposes on the B1 level of the Common European Framework of References for Languages. The research sample is represented by 107 students enrolled into the optional subject of Business English. These students enrolled into the lessons individually on the basis of their specialist schedules and it was not possible to influence how many of them would be enrolled into the subject of Business English and into what days of Business English lessons. The students were divided randomly into the experimental and control groups. At the beginning of the course the students wrote the pre-test and at the end the post-test. The students of the experimental group were statistically significantly better in listening comprehension, they had exactly the same results in translation and writing as the control group, and very slightly worse results in vocabulary and reading comprehension than the control group, but not statistically significant. Nevertheless, the total results in post-tests were equal, there were not any statistically significant differences. We also analysed students' questionnaires in which students expressed their opinions on e-learning effectiveness. The findings in the questionnaires proved that the students had positive attitude to e-learning.

Keywords

Moodle, e-learning, experimental research, pre-test, post-test, questionnaire analysis

Kučírková L., Kučera P. and Vostrá Vydrová H. (2014) "English for Specific Puproses e-Learning Experimental Research", *Journal on Efficiency and Responsibility in Education and Science, Vol. 7, No. 3-4*, pp. 80-86, online ISSN 1803-1617, printed ISSN 1803-1617, doi: 10.7160/eriesj.2014.070306.

Introduction

The paper deals with English for Specific Purposes (ESP) e-learning experimental research conducted in the lessons of Business English in winter term of academic year 2012/13 at CULS. Students were provided with the online study material developed within the grant of the Higher Institution Development Fund of the Czech Republic 2011, no. F5-1836. Online study support for Business English is a 14 module course in the Moodle Learning Management System (LMS) which is the software with an open code and is used for study purposes on the B1 level of the Common European Framework of References for Languages (Kučírková, Vogeltanzová and Jarkovská, 2011). The experiment is based on the treatment (e-learning method) and the measurement (pre-tests and posttests) and the comparison of results of the experimental group taught through e-learning and the control group taught through the face-to-face instruction. Finally, students' questionnaires on the effectiveness of e-learning method were analysed and evaluated.

Literature review

In this literature review, we have concentrated on the topics connected with our research, such as ESP e-learning (online learning), lifelong learning, e-learning within the learning management system, autonomy, interaction and e-learning course effectiveness. Our findings in the field of ESP e-learning are based on bachelor works, diploma works and dissertations, on conference proceedings such as ERIE (Efficiency and Responsibility in Education) in Scopus database, and on

Article type

Full research paper

Article history

Received: September 19, 2014 Received in revised form: December 20, 2014 Accepted: December 29, 2014 Available on-line: December 31, 2014

handbooks of the research in second language teaching and learning.

The topic similar to our research is described in the research paper called Developing ESP e-learning course: How an e-learning course was created for medical university students by Donesch-Jezo and Misztal (2012). It deals with the development of an e-learning course for therapeutic Professional. The content, stages of development and types of interactive exercises are discussed there. The computer-based tasks that are encompassed in the course engage learners in interactive language acquisition. Teacher's role is to supervise the learning process and assess learners' progress.

Another paper by Pouyioutas et al (2007) presents the initial stages of a Leonardo Da Vinci project that is aimed at developing the English Language for Information Technology Specialists. E-Learning module is designed for IT professionals, students and English language tutors in order to bridge the current gap in the English for Specific Purposes (ESP) and IT-related materials, to facilitate the work of teachers, encourage life-long learning and self-study. The paper is based on the analysis of the results of a survey focused on the identification of the requirements, special needs of users of the proposed module. The survey was conducted through a questionnaire given to IT students and through interviews with IT specialists. Based on the analysis of the results, suggestions for the module design are offered.

The following by Byrne (2007) contribution deals with the use of Learning Management Systems (LMS), called Claroline at

the Catholic University of Louvain in Belgium. In the article, the author compares two uses of the Claroline LMS available at Louvain-la-Neuve within the framework of an ESP writing course. The first experiment was conducted from October 2003 to May 2005, and the second one was conducted as from October 2005. Students in Political Science had to make a similar number of written contributions in iCampus, which is the version of the Claroline platform available at UCL. Teacher's feedback (only correction) was limited in the first experiment. During the second experiment, there was the possibility of a teacher annotation (not only correction) of learners' data. The idea was borrowed from Wible et al. (2001), who describe an error annotation system fully integrated into the LMS. The author combined the existing platform with an off-the-shelf annotating tool. In the contribution, the author highlights the advantages and shortcomings of the combined approach, both in terms of proficiency gains and student satisfaction.

The researcher Keller (2007) conducted research on the use of commercial self-study software packages that are available on the Czech software market for upper-intermediate learners of English for his diploma thesis. He tried to find out whether a self-study software can be a viable alternative to class-based education. Keller evaluated the packages in the context of adult learners, whose study of English is a must in the globalised world, and also computer-assisted language learning that was made possible through fast technological development. He conducted the qualitative research with ten students who were endeavouring to reach level B2 as defined in the Common European Framework of Reference for Languages. Respondents were given pre-study questionnaires before the installation of the software and post-study questionnaires after studies. In prestudy questionnaires, the researcher examined the experience with self-study, basic computer skills, motivation for learning English. In post-study questionnaires, he examined their satisfaction with commercial software and their opinions on this type of study. He found out that none had any experience with the language learning software and that they were mostly motivated to learn English for their job, only one person had a real interest in English. The half of participants invested the time required, and most of them missed the presence of a human teacher. They felt out a loss at one point or another, they would prefer dialogue based on interactions, they did not want to learn the method of the programme and showed no inclination to continue with their studies. The author set criteria for software evaluation and came to the conclusion that none of four language learning software packages were qualified for a general recommendation.

The topic of e-learning can be also found in the diploma thesis by Albrecht (2006), in which he examined the situation of e-learning at the Faculty of Arts at Masaryk University in Brno. In the theoretical part, he outlined the concept of e-learning and introduced some of e-learning definitions. We agree with his view that there is a huge dynamism in this field and that it is difficult to encompass and state all opinions and definitions. Then he concentrates on advantages and disadvantages of e-learning in more detailed way and stresses that an important fact is what contribution e-learning has for the sphere of education, and that it is important to build on its strengths and eliminate weaknesses. In the theoretical part, he points out the functions of students and teachers (tutors) in the environment of online teaching, technological background of online courses and procedures when creating study supports as well. At the end of the theoretical part, he outlines problems of evaluation of e-learning courses. It was a good contribution to the whole framework of the e-learning concept. In the empirical part, he

analyses e-learning at Masaryk University, particularly three courses in the learning management system Moodle. One of them concerns the English language (not specified if general or ESP) in Interpreting, but this e-course is the combination of e-learning and full-time studies. He finds out that there are no 100% e-learning courses at the university. The objective of this analysis was the identification of distinctive elements of these courses and revealing possible mistakes. The outcome of the analysis is a recommendation and advice for creators of e-courses. This part with advice was inspiring for us when creating our e-learning course.

Another diploma work that examines e-learning concerns the teacher in e-learning (Vančová, 2007). The author first of all analyses the role of a teacher in general, and then that of the teacher of foreign languages, which is based on the study of relevant specialist literature. The author comes to the conclusion that in contemporary teaching, the liberal role of a teacher over the authoritative one prevails. Then she concentrates on the role of a teacher in e-learning. She states various definitions of e-learning, advantages and disadvantages of e-learning for various types of students and various types of courses and determines the role of a teacher in e-learning (tutor) which in many ways corresponds to the classical role of a teacher in the classroom but which requires skills specific for educational process through e-learning. In the next part, the author compares three different types of study material - classical textbook, selfstudy textbook and on-line course. The author analyses and evaluates textbooks and the on-line material from the point of view of the aim, structure and content, presents the main differences and similarities, and determines the role of a teacher in each study material. The detailed analysis is completed with a table with the survey of skills and language means that can be developed within the studies from mentioned teaching materials. Then the author explores the pedagogical research conducted by means of questionnaires distributed to teachers, in which she examined the views of teachers on their role in the teaching process, and to students who expressed their views on the lessons run by teachers and those supported by means of computers. The author was not successful in addressing more students who studied through e-learning, and that is why she had to address the students of English who did not have to have the experience with e-learning. This fact probably also influenced the result of her research when most students think that the lessons run by a teacher are the most proper way of studying and that the future of e-learning is only complementary.

The diploma thesis on e-learning and its practical use at primary schools in the Czech Republic and EU countries by Hronová (2011) concerns the e-learning awareness of pupils at primary schools and their parents. In the theoretical part, the author concentrates on the notion of e-learning, history, advantages and disadvantages, on learning management systems (LMS), in particular on Moodle, on e-course, Internet, web pages and forms of teaching in e-learning. In empirical part, she first describes research examination by means of questionnaires, analyses data, interprets results from questionnaires and comes to the conclusion that confirms the hypotheses. In next two parts, she describes the attitude of the EU and the CR to e-learning and documents of state information policy. Finally, she tries to suggest the system of e-learning usage at primary schools for pupils and parents.

The main objective of the experimental research was to find out if there existed statistically significant differences between the results of students studying Business English through e-learning (online learning) and those who are taught through the face-toface instruction. Furthermore, we wanted to find out opinions of students on the e-learning method effectiveness in general and in single skills.

Materials and Methods

The population is represented by all students of the CULS within the bachelor studies for whom the English language is compulsory within these studies. The research sample is represented by those students who enrolled into the optional subject of Business English.

Online study support for Business English is in the form of a 12-module course in the learning management system (LMS) Moodle with the following topics, see Kučírková, Vogeltanzová and Jarkovská (2011):

- Business and its basic terms
- Business letter: layout, content, style
- Business Organizations
- Company profile
- Macroeconomics, microeconomics
- Enquiries, replies, orders
- Personnel management
- Curriculum vitae, letter of application, job contract
- Marketing
- Email
- Accounting and finance
 - Invoicing, quotation, payment

Single thematic units are of the following structure with respect to the principles of e-learning teaching:

- a) Lead-in
- b) Key words and definitions
- c) Specialist material reading/audio-visual
- d) Various activities
- e) Resources

We worked with natural groups that existed prior to the research. Students enrolled into the lessons individually on the basis of their specialist schedules and it was not possible to influence how many of them would be enrolled into the subject of Business English and into what days of Business English lessons. 107 students enrolled into the lessons at the beginning of the term. In the pre-research there was one experimental and one control group. In the study proper there were two experimental groups and two control groups. They were considered as one experimental group and one control group for the purposes of the research because in order to gather enough subjects for the experimental research, it is possible to pool the results of more classes (Seliger and Shohamy 1990:149, Pelikán, 2007: 54). At the beginning of the course the students wrote the pretest and at the end the post-test. We observed 49 students in the experimental group and 45 students in the control group. The students were divided into these groups randomly.

Methodology of Processing

The treatment, i.e. the e-learning course in the Moodle learning management system, is a controlled and intentional exposure of groups to a language teaching method, specially constructed for the experiment (Seliger and Shohamy, 1990: 136 - 137). The treatment is the independent variable in the research, the measurement, i.e. the test results, is the dependent variable. The

In both tests (pre-test, post-test) we tested vocabulary, comprehension of reading, comprehension of listening, writing and translation. Each of the tests was evaluated through Moodle in percentage, only writing was evaluated by a teacher herself and the points were recounted into percentage. We adapted

post-tests.

in percentage, only writing was evaluated by a teacher herself and the points were recounted into percentage. We adapted existing standardized tests as pre-tests. Post-tests, comprising specialist terminology, were developed by a teacher on the basis of her experience and in the form of standardized tests. The listening post-test was adapted from the existing standardized test. All tests were consulted with two other teachers of Business English and verified in a pilot study. Both groups wrote pre-tests at the beginning of the lessons in winter term of the academic year 2012/2013 in order to find out the level of input skills of single students, and post-tests after completing the course of Business English at the end of the winter term, in which we tried to find out the level of skills with the focus on business and economic terminology. Results of pre-tests and post-tests were processed into tables and assessed by means of statistical methods with the help of a colleague from the Department of Statistics at Faculty of Economics and Management at CULS.

measurement refers to how the effects of the treatment will be

evaluated or observed (Seliger and Shohamy, 1990: 137). It is

represented by language tests in our research, i. e. pre-tests and

To test the statistical hypotheses, non-parametrical tests were chosen owing to the character of input data, particularly, Mann-Whitney and Wilcoxon pair tests. In case of dependent samples (pre-tests and post-tests with the same group), Wilcoxon pair test was used. On the contrary, Mann-Whitney test is primarily determined to test independent samples - pre-tests and post-tests with different groups (Sharpe, De Veaux and Velleman, 2010). Tests were carried out on the significance level $\alpha = 0.05$. Statistical programme Statistica 10 was used for the calculation.

We compared the results in the pre-test and post-test separately within the control group and separately within the experimental group so that we could find out whether there are statistically important differences in single skills and whether the students improved or worsened within their groups. Then we compared and analysed the results in pre-tests and post-tests of single skills between the control and the experimental group in order to find out if the e-learning method could be efficient and whether there are statistically significant differences in the results of both groups. We also analysed students' questionnaires in which students expressed their opinions on e-learning effectiveness.

Results

Comparison of the results within single groups

Control Group

The results of the pre-test and the post-test within the control group are presented as follows:

Vocabulary pre-test and post-test: p-value is 0.000339 – lower than the level of significance. There is statistically significant difference between the pre-test and the post-test. Students improved quite a lot in the knowledge of specialist vocabulary.

Reading pre-test and post-test: p-value is 0.000049. Students showed great improvement in reading comprehension. There is

a statistically significant difference between the pre-test and the post-test.

Translation pre-test and post-test: p-value is 0.016384 – lower than the level of significance. There is statistically significant difference in the pre-test and the post-test. Students improved a little.

Writing pre-test and post-test: p-value is lower than 0.05 - 0.019239 there are statistically significant differences in writing. Students improved but not very much.

As far as **total results** are concerned, students improved a lot. P-value is 0. 000000, thus the difference between the pre-test and the post-test is statistically significant.

Experimental Group

The results of the pre-test and the post-test within the experimental group are presented as follows:

Listening pre-test and post-test: p-value is 0,000000 – lower than the level of significance. There exists statistically significant difference between the pre-test and the post-test. In listening comprehension, students improved very much.

Vocabulary pre-test and post-test: p-value is 0.019960 - lower than the significance level. There is a statistically significant difference between the pre-test and the post-test. Students improved in the knowledge of vocabulary a little.

Reading pre-test and post-test: p-value is 0.000015, so the difference between the pre-test and the post-test is statistically significant. Students improved in reading comprehension a lot.

Translation pre-test and post-test: p-value is 0.025111 – lower than the level of significance. There is statistically significant difference between the pre-test and the post-test in translation. Students improved a little.

Writing pre-test and post-test: p-value is 0.031994 –lower than the level of significance, it means that there is statistically significant difference between the pre-test and the post-test and students improved in writing a little.

Total results in the pre-test and the post-test: p-value is 0.000000, so there is statistically significant difference between total results in the pre-test and the post-test. In general, students improved very significantly.

Shrilla	Experin	nental group	Control group			
SKIIIS	<i>p</i> -value	Improvement	<i>p</i> -value	Improvement		
Reading	0.000015	A lot	0.000049	Great		
Listening	0.000000	A lot	0.000002	A lot		
Writing	0.031994	A little	0.019239	A little		
Translation	0.025111	A little	0.016384	A little		
Vocabulary	0.019960	A little	0.000339	Quite a lot		
Total results	0.000000	A lot	0.000000	A lot		

Table 1: Results of testing differences between the pre-test and the post-test for the experimental group and the control group

As Table 1 shows, all *p*-values in tests are lower than the chosen level of significance 0.05 and therefore differences between observed skills of Business English at the beginning and at the end of the term are statistically significant both in the experimental group and in the control group.

Comparison of the results between the control and the experimental group

For the evaluation, non-parametrical analogy of a two-sample t-test was used. In pre-tests there were not any statistically significant differences in single skills. They have nearly equal results. Also in total there were not any statistically significant differences.

Listening pre-tests: From the comparison of the results in listening pre-tests it follows that there is not any statistically significant difference between the groups – p-value is 0.086470, even though students of the experimental group were a little better.

Vocabulary pre-tests: As far as the vocabulary pre-test is concerned experimental group is a little better than the control group. P-value is 0.446861, so there is not any statistically significant difference between both groups in their results.

Reading pre-tests: From the statistical point of view, there is not any statistically significant difference between groups: p-value 0.221575 is higher than the level of significance. The results of the groups are equal.

Translation pre-tests: In translation, the results are nearly equal. P-value is 0.882666, so there is not a statistically significant difference in pre-test results of the two groups.

Writing pre-tests: In writing results, p-value is 0.879680, so there is not any statistically significant difference between both groups. The results in writing of the groups are equal.

Listening post-tests: P-value is 0.043689, thus lower than the significance level. There are statistically significant differences in listening comprehension between groups. The experimental group is better than the control group.

Vocabulary post-tests: The results of both groups are nearly equal. From the statistical analysis it is shown that there is not a statistically significant difference between groups, p-value is 0.338342.

Reading post-tests: P-value is 0.131053, thus there is not a statistically significant difference between both groups. The results of both groups are nearly equal. Reading through e-learning method can be nearly as efficient as reading through face-to-face method.

Translation post-tests: P-value is higher than the significance level -0.791082, so there are not any statistically significant differences between groups. Results in both groups are equal.

Writing post-tests: There are not any statistically significant differences in the results of groups. P-value is 0.906610, it means higher than the significance level. The results of both groups are equal.

In the **total results of the pre-test** p-value was 0.716381, so at the beginning of the academic year there were not any statistically significant differences between the groups. Experimental group was a little better but not statistically significantly.

In the **post-test total results**, p-value was 0.823319 – higher than the significance level. There were not any statistically important differences between both groups in the results of post-test at the end of winter term. The total results of both groups in post-tests are equal. E-learning method seems to be of the same efficiency as the face-to-face method. (Kučírková, Kučera, Vostrá Vydrová, 2013)

		Pre-test	Post-test				
Skills	<i>p</i> -value	Comparison EG and CG	<i>p</i> -value	Comparison EG and CG			
Reading	0.221575	EG a little better than CG	0.131053	EG very slightly worse than CG			
Listening	0.086470	EG a little better than CG	0.043689	EG better than CG			
Writing	0.879680	EG equal CG	0.906610	EG equal CG			
Translation	0.882666	EG equal CG	0.791082	EG equal CG			
Vocabulary	0.446861	EG a little better than CG	0.338342	EG very slightly worse than CG			
Total results	0.716381	EG a little better than CG	0.823319	EG equal CG			

Table 2: Results of testing differences between the experimentalgroup (EG) and the control group (CG)for the pre-test and thepost-test

As Table 2 shows, all *p*-values in tests for the pre-test are greater than the chosen level of significance 0.05 and therefore, in pretests there were not statistically significant differences in single skills. The control and the experimental group have nearly equal results. Also in total there were not statistically significant differences.

In post-tests, there was a statistically significant difference between the experimental and the control group only in listening. For other skills, differences between both groups were not statistically significant.

In general, p-values from 0.05 to 0.75 represent a slight difference between EG and CG, p-values bigger than 0.75 signify no difference.

Data analysis and the interpretations of the results of students' questionnaires

The analysis of data is based on statistical calculation. Students of both groups were given questionnaires in which they expressed their views on the appropriateness of the inclusion of e-learning into the lessons of Business English within distance studies and the effectiveness of e-learning as far as the language skills (except for speaking) and language issues (vocabulary) are concerned. 94 questionnaires in the paper form were distributed among students the last lesson in the winter term 2012/2013. We did not have problem with low response rate because we collected all questionnaires personally. The return was 93%. In seven questionnaires, students did not respond to some questions and that is why these questionnaires were excluded from the analysis. Collected data were processed quantitatively.

There were 51 men (58.6%) and 36 women (41.4%) among respondents. As far as fields of studies are concerned, the most highly-represented specified field was the field of study of Business and Administration with 23 students (26.4%). Then it was Economics and Management field of study with 19 students (21.8%). Trade and Business with Technique field of study was represented by 17 students (19.6%). "Another" (not specified field of study) was represented by 28 students (32.2%). 68 respondents (78.2%) were students in their first year of studies, only 7 respondents (8%) were in their second year of studies and 12 respondents (13.8%) were students in their third year of studies. 47 respondents took part in the e-learning course, while 40 did not.

71 respondents (81.6%) think that the inclusion of e-learning into the ESP lessons for distance students is proper, while only three respondents think that it is improper (3.4%), the remaining 13 respondents (15%) did not know.

In other six questions, based on opinions of students, we tried to determine whether or not the development of single skills (with the exception of speaking) and vocabulary by using the e-learning online course can be as effective as the face-toface instruction. Under the same effectiveness it is understood that the results of pre-tests and post-tests of students studying through the e-learning online course and those studying through the face-to-face instruction will be relatively the same, i.e. from the statistical point of view, there will not exist any statistically significant differences in the results between both groups. The frequency of single responses is shown in the following table and figure:

	Yes	Rather yes	Rather not	No	Do not know
Overall effectiveness of e-learning course	6 (6.9%)	38 (43.7%)	31 (35.6%)	11 (12.6%)	1 (1.1%)
Reading with comprehension	11 (12.6%)	34 (39.1%)	31 (35.6%)	10 (11.5%)	1 (1.0%)
Listening with comprehension	22 (25.3%)	38 (43.7%)	15 (17.2%)	9 (10.3%)	3 (3.4%)
Writing	24 (27.6%)	44 (50.6%)	10 (11.5%)	5 (5.7%)	4 (4.6%)
Translation	28 (32.2%)	33 (37.9%)	17 (19.5%)	7 (8.0%)	2 (2.3%)
Vocabulary	36 (41.4%)	24 (27.6%)	17 (19.5%)	4 (4.6%)	6 (6.9%)

Table 3: Frequency of responses





Opinions of students whether or not the effectiveness of the e-learning course and the face-to-face instruction is the same were also evaluated separately for the experimental group (students who took part in the e-learning course) and the control group (students without e-learning course). Results of this analysis are shown in Table 4.

Shilla	Yes or Rather yes		Rather not or No			Do not know			
SKIIIS	EG	CG	Total	EG	CG	Total	EG	CG	Total
Overall effectiveness of e-learning	29	15	44 (50.6%)	17	25	42 (48.2%)	1	0	1 (1.1%)
Reading	29	16	45 (51.7%)	18	23	41 (47.1%)	0	1	1 (1.1%)
Listening	34	26	60 (69.0%)	12	12	24 (27.6%)	1	2	3 (3.4%)
Writing	39	29	68 (78.2%)	8	7	15 (17.2%)	0	4	4 (4.6%)
Translation	35	26	61 (71.1%)	12	12	24 (27.6%)	0	2	2 (2.3%)
Vocabulary	31	29	60 (69.0%)	13	8	21 (24.1%)	3	3	6 (6.9%)

Table 4: Results of the questionnaire analysis for the experimental group (EG), the control group (CG) and for both groups together

As far as the overall effectiveness of the e-learning course is concerned, 44 students (50.6%) think that using the e-learning online course can be as effective as the face-to-face instruction. From this number of students, 29 took part in the e-learning course, 15 of them did not. Six (6.9%) respondents are persuaded on 100% ("Yes"), 38 respondents (43.7%) think "Rather yes". 42 students (48.2%) think that the e-learning course probably cannot be of the same effectiveness as the faceto-face instruction. From this number of students, 17 took part in the e-learning course, 25 did not. One student (1.1%), who took part in the e-learning course, did not express any opinion (do not know). The development of reading in the e-learning course is thought to be the same as through the face-to-face instruction by 45 students (51.7%). 29 of them took part in the e-learning course, 16 did not. 41 students (47.1%) think that the development of the skill through e-learning cannot be of the same effectiveness as through the face-to-face instruction. 18 of them took part in the e-learning course, 23 did not. One student (1.1%), who did not take part in the e-learning course, responded "Do not know". As far as listening is concerned, 60 students (69%) had confidence in the effectiveness of e-learning in comparison with the face-to-face instruction. 34 of them took part in the e-learning course, 26 did not. 24 students (27.5%) think of this issue more negatively – in their opinion the development of listening is not so effective through the e-learning online course as through the face-to-face instruction. Three (3.4%) students (one took part in the e-learning course, two did not) did not have any opinion on this issue. The development of writing through e-learning is thought to be very effective by many students. 68 students (78.2%) think that it can be of the same effectiveness as the face-to-face instruction. 39 respondents took part in the e-learning online course, 29 did not. Only 15 students (17.2%) think that it is not so effective like the face-to-face instruction. Four students (4.6%), who did not take part in the e-learning course, responded "Do not know". Translation learnt through the e-learning online course is thought to be of the same effectiveness as the face-to-face instruction by 61 (70%) students (35 took part in the e-learning online course, 26 did not) and less or not effective by 24 (27.6%) students (12 took part in the course, 12 did not). Two (2.3%) students, who did not take part in the e-learning online course, did not express their opinion. The development of vocabulary through e-learning online course is viewed as to be of the same effectiveness as the face-to-face instruction by 60 (69.0%) students (31 took part in the e-learning course, 29 did not), and not to be of the same effectiveness by 21 (24.1%) students (13 took part in the e-learning course, 8 did not). Six (6.9%) students did not know what to answer. Three of them took part in the e-learning course, 3 did not.

Table 4 shows that in most cases, negative views of the effectiveness of e-learning course showed that those students who expressed their negative view of effectiveness did not take part in the e-learning course. On the contrary, as far as the positive attitude to the e-learning effectiveness is concerned, the number of students who took part in the e-learning online course prevailed.

Discussion

From the point of view of the statistical significance there were not any statistically significant differences between the experimental and the control group. At the end of the term, the total results in post-tests were absolutely equal, there were not any statistically significant differences. The students of experimental group were statistically significantly better in listening comprehension, they had exactly the same results in translation and writing as the control group, and very slightly worse results in vocabulary and reading comprehension than the control group, but not statistically significant. Thus, e-learning method could be considered as an equally efficient method as the face-to-face method. Moreover, it was shown that students using e-learning may achieve in some skills even better results than students taught face-to-face, such as in listening comprehension in case of this study (Kučírková, Kučera and Vostrá Vydrová, 2013).

The findings from the questionnaires of students were also very important as students expressed their views on the effectiveness of the e-learning course and its inclusion for distance studies. The findings in opinions on the development of single skills show students' positive attitude to e-learning. As far as the development of single skills is concerned, more than half of the respondents (52% - 78%) think (in all questions relating to it) "Yes" or "Rather yes", i.e. that the results of pre-tests and posttests of students studying through the e-learning online course and those studying through the face-to-face instruction will be relatively the same. Most of the students who participated in the course evaluated the course positively and think that it could be included within distance studies, even more than a half of those students who did not take part in the course (controlled group) think that it could be included within studies of distance students. Even if there existed statistically significant difference in responses to question connected with the effectiveness of the e-learning method, more than half of students expressed the view that the ESP e-learning course could be of the same effectiveness as the face-to-face instruction.

A similar research on the use of computers in second and foreign language learning in research studies from 1990 to 2000 inclusive was conducted at the University of Texas. The authors (Liu et al, 2010: 24) explored the research evidence with regards to how computer technology can enhance language skills acquisition. They went through 70 research studies using quantitative and/or qualitative methodologies on Computer Use in Second Language Learning, but there were only a few studies on e-learning in English teaching, and none of them was on ESP e-learning. Research provided some evidence on the effectiveness of computer technology in second language learning. Only a few studies focused on listening and speaking, but instead, most of the studies addressed reading and writing skills. Although there has not been convincing evidence on the use of computer technology to improve language skills in all areas, the majority of the studies reviewed indicated enthusiastic responses and positive attitudes toward technology use from the students (Liu et al, 2010).

Conclusion

As of right now, we have not been aware and have not found any research focused exclusively on ESP e-learning experiment comparing the statistically significant differences in results of the control and the experimental group. It can be concluded that the experimental research is original and contributional to the pedagogical and second language research.

E-learning enables the students to adjust learning to their individual needs and time requirements, it is motivating for them. Tests are immediately assessed and the content of the course is possible to be kept up-to-date. However, there are also some disadvantages – some skills such as speaking are more difficult to practise online, problems could include technical

issues, some students are unable to learn individually, they need teacher's directions.

From the practical point of view, the e-learning course is intended to be used for distance students and also for full time students as a support material for the face-to-face instruction or in case of illness, as the results of the experiment showed that there had been statistically significant differences in listening comprehension, specialist vocabulary, in reading comprehension, in translation and in writing in the outcomes of university students learning through the e-learning method (= purely online course) between their pre-test and post-test. It means that students improved in the skills due to the participation in the e-learning course throughout the term.

References

Albrecht, K. (2006) *E-learning na Filozofické fakultě Masarykovy univerzity*, Diploma thesis. Brno: Masaryk University.

Byrne, T. (2007) 'Marrying two existing software packages into an efficient online tutoring tool', *Computer Assisted Language Learning*, vol. 20, no. 5, pp. 459-469

Donesch-Jezo, E. and Misztal, I., (2012) 'Developing ESP e-learning course: How an e-learning course was created for medical university students', *International Journal of Learning*, vol. 18, no. 8, pp. 317-324

Hronová, J. (2011) *E-learning a jeho praktické využití na ZŚ* v Č*R a zemích EU*, Diploma thesis. Brno: Masaryk University.

Keller, M. (2007) Self-study language learning software for upper-intermediate (B2) adult learners of English: Do existing products meet the requirements?, Diploma thesis. Prague: Charles University.

Kučírková, L., Kučera, P. and Vostrá Vydrová, H. (2013) 'Experimental Research in Business English E-learning Course and Face-to-face Course: The Study Proper', *Proceedings of the 10th International Conference on Efficiency and Responsibility in Education (ERIE 2013)*, Prague, pp. 347-354

Kučírková, L., Vogeltanzová, T. and Jarkovská, M. (2011) 'Business English Courses Online Support', *ERIES Journal*, vol. 4, no. 4, pp.197-206

Liu, M. et al (2010) 'A Look at the Research on Computer-Based Technology Use in Second Language Learning': Review of Literature from 1990-2000, http://jabba.edb.utexas.edu/it/ seclangtechrev.pdf (released 10. 8. 2012)

Pelikán, J. (2007) Základy empirického výzkumu pedagogických jevů, Prague: Karolinum,

Pouyioutas, P. et al (2007) 'The EIT e-learning module', *ICE-B* 2007 - Proceedings of the 2nd International Conference on *e-Business*, pp. 353-356

Seliger, H.W. and Shohamy, E. (1990) Second Language Research Methods, Oxford: OUP

Sharpe, N.R., De Veaux, R.D. and Velleman, P.F. (2010) *Business Statistics*, Boston: Addison Wesley

Vančová, S. (2007) *Teacher in E-learning*, Diploma thesis. Prague: Charles University.

Wible, D. et al (2001) 'A Web-based EFL writing environment: Integrating information for learners, teachers, and researchers', *Computers and Education*, vol. 37, no. 3-4, pp. 297-315 Švec V., Pavlíček J. and Tichá I. - ERIES Journal vol. 7 no. 3-4

TEACHING TACIT KNOWLEDGE: CAN ARTIFICIAL INTELIGENCE HELP?

Václav Švec, Josef Pavlíček, Ivana Tichá

Czech University of Life Sciences Prague

Highlights

- To find out the level of knowledge students are able to use in the simulated situation
- To propose teaching tool for specific tacit knowledge training
- To specify basic conditions under which proposed tool can be functional

Abstract

In the paper we first examine students' ability to use tacit knowledge. We conducted the experiment to test whether the students are able to transfer and use tacit knowledge they obtained in the basic course of Strategic management. As tacit knowledge is difficult to transfer to another person we used course design with several experiential techniques to increase the students' abilities in the field of Strategic management. For the evaluation experiment we chose to play a board game "Power Grid", where we tested whether the students were able to use knowledge they had been taught in the basic course. As the result we found out low students' ability to use tacit knowledge. Despite the fact that in the basic course where they obtained the knowledge we used experiential techniques. Used techniques force students to acquire a skill and therefore, they also acquire corresponding understanding that defies articulation i.e. tacit knowledge. According to the result of the experiment, we propose the business game with the artificial intelligence as a teaching tool which can be further discussed as a tool for teaching specific tacit knowledge in the paper.

Article type

Full research paper

Article history

Received: December 10, 2014 Received in revised form: December 21, 2014 Accepted: December 28, 2014 Available on-line: December 31, 2014

Keywords

Tacit knowledge, artificial intelligence, strategic management, experiential learning, neural network

Švec V., Pavlíček J. and Tichá I. (2014) "Teaching Tacit Knowledge: Can Artificial Inteligence Help?", Journal on Efficiency and Responsibility in Education and Science, Vol. 7, No. 3-4, pp. 87-94, online ISSN 1803-1617, printed ISSN 1803-1617, doi: 10.7160/eriesj.2014.070307.

Introduction

Approaches to managers' education

According to Jarosova (2005) there are different approaches to educate future managers which can be divided into two main streams: an academic and an experiential approach. Academic approaches to learning understand learning as a process of learning highly formalized objective scientific knowledge and capability development process of critical review and skills to explain knowledge in practice view (Jarosova, 2005). Experiential approach is represented by the experiential learning. Experiential learning according to Kolb (1984) is learning process whereby knowledge is created through the transformation of experience. Kolb's learning cycle (Kolb, 1984) consists of four stages of learners' progress (active experimentation, concrete experience, observation and reflection, generalisation and abstract conceptualisation). Among adult learning theorists is a general consensus that the experiences which adults have gained during their lives are important part of any learning activity they will join (Huddleston and Unwin, 1997). Hawtrey (2007: 144) sees the experiential learning as 'the incorporation of active, participatory learning opportunities in the course' which is sometimes also called situational learning.

To the discussion about management teaching Mintzberg (2004) adds that university professors overemphasize the science of management while ignoring its art. He contends that even graduated students have inflated views of their competence and ability to be successful. Mintzberg (2004) argues that many essential managerial skills can be learned only from personal

experience and suggests a major change in management education which will allow students to gain more experience.

Experience is the knowledge of a subject or event gained through involvement in or exposure to it (Oxford English Dictionary, 1989). Linkage between experience and knowledge supports Kolb (1984:41) with his definition of learning as 'the process whereby knowledge is created through the transformation of experience'. When we speak about knowledge, we understand the personal level of knowledge. Then we see knowledge as what person knows as well as his/her skill and ability that would determine or help him/her make decisions and take action (Gao, Li, and Nakamori, 2003). Drucker (1989: 242) defines the knowledge as information that 'changes something or somebody either by becoming grounds for action, or by making an individual or an institution capable of different and more effective action'.

Polanyi (1959) divided human knowledge into two categories: explicit knowledge (written and formalized) and tacit knowledge (the action related and unformulated). Gao, Li and Nakamori (2003: 9) expand and explain the characteristics of knowledge in Polanyi's point of view that 'there are two different dimensions in knowledge: one relates to the scientific, logical or objective dimension; another to the subjective dimension'. In the objective dimension the knowledge is like a "thing' or 'object' that can be articulated, captured and stored. The subjective dimension of the knowledge, however, can be fully understood only by person with enough capacities. (Gao, Li, and Nakamori, 2003) This view of tacit knowledge (as subjective dimension of the knowledge) uses Mintzberg (2004) in his statement that university professors overemphasize the science of management while ignoring its art. And Jarosova (2005) adds that for students to know is fundamental but more difficult is to be able to apply knowledge in real managerial situations.

The aim of the paper is to find out the level of explicit and tacit knowledge (taught in the previous course of Strategic Management) which the students are able to use during the model situation (board game playing) and propose the teaching tool which can ensure the transfer of specific tacit knowledge for the usage in the course of Strategic management. The paper extends and elaborates the findings of Svec, Pavlicek and Ticha (2014) and Pavlicek, Svec and Ticha (2014).

Materials and Methods

In the paper we first examine students' ability to use tacit knowledge. We conducted the experiment to test whether the students are able to transfer and use tacit knowledge they obtained in the basic course of Strategic management they completed in the last semester. As tacit knowledge is difficult to transfer to another person we used course design with several experiential techniques to increase the students' abilities in the field of Strategic management. Therefore students are taught within the experiential learning approach with usage of case studies, team work, experiential exercises, active students' presentations and role playing, and active discussions to level up the experience between students.

In engineering and technological fields it is usual to conduct experiments for students so they have opportunity to test and employ the theories and concepts they have learned (Sun, 1998). However, in management areas as in the field of social science such experiments are if not impossible thus difficult to carry out. Keeping this fact in minds we chose for the evaluation experiment to play a board game "Power Grid", which met the criteria of complex situation in managing the company on strategic level. With this tool we tested whether the students were able to use knowledge they had been taught in the basic course.

The game was played with 25 students, 17 women and 8 men, who studied the course Applied Strategic Management in their final year in masters' study. This course follows the course of Strategic Management, where students learn strategic management principles, rules, and techniques with help of real life case studies. Therefore all students playing the game were supposed to have skills coming from the previous course of Strategic Management. Students passed the examination in Strategic Management course with different results. The structure of results is: (i) excellent 4 % of students, (ii) very good 48 % of students, (iii) good 36 %, and (iv) 12 % of students did fail to pass exam. We can see the official study results as structure of knowledge level within the observed group of students. We also measure students' managerial competencies during the course of Strategic Management in six competency sets (Švec, Tichá and Kadeřábková, 2011): (i) Planning and organising (competencies of planning, organizational skills, and delegation), (ii) Impart information (competencies of transfer of information, presentation of opinions, written communication), (iii) In-person competencies (learning by doing, creativity, perspective, self-knowledge), (iv) Decision making (problem solving, quality decision making, early decision, cope with uncertainties, critical thinking), (v) professional competencies (business issues knowledge, specific field competencies), (vi) Team building competencies (co-creation of an effective team,

building relationships with colleagues, dispute settlement, focus on results, issue instructions). Competencies affected in Strategic Management courses taught at FEM CULS Prague were identified and elaborated on basis of competency models of Lombardo and Eichinger (2009), and Stevens and Campion (1994). The structure of competencies of students involved in the experiment is seen in the Fig. 1.



Fig. 1: Competencies structure of students involved in the course of Strategic Management

Game-play

Students were given rules of the game in advance for a week to precisely identify the driving forces, principles, barriers of the game, and to set up goals and their plan. With game rules came the task to study it, so students were not explicitly instructed to work more with the principles of the game as they were tested whether they will prepare themselves more or not and whether they exploit the experience and knowledge gained in previous course of Strategic Management.

In the workshop where experiment took place, before the game playing itself started, the students were given task to write down their main goal and strategy for the game. During the game playing, students were making the notes about their decision making process and its results. After the game playing, they were asked to make an evaluation of each decision they had made. Students were also observed during the game playing.

The Power Grid Game's Phases

The Power Grid game is played over several rounds. Each round of the game has five phases (Fig. 2).



Fig. 2: Power Grid Game's Phases

During the phase 1 players' order is set up. Starting player is always the player with the most cities in his network. Determination of the order of remaining players follows the same rule. Strategic point with the players' order is that if you are the first one, you can pick a power plant from auction, but you buy the resources for your plants as the last one (and vice versa). In the phase 2 each player has the opportunity to buy at most one power plant according to his/her needs, which means to have plants with enough capacity to power all the cities in his/ her network and to decide what kind of resource will the player use (the same as desired power plant needs). In the auction the player can do just two decisions: to pass or to choose the power plant for auction. In the phase 3 players buy resources for their power plants from the resource market. The strategic point here is reverse: player with the smallest number of cities in the net starts. The phase 4 is building and as in the previous phase the last player starts to add cities to his/her network on the map which is essential to win the game. The phase 5 is called bureaucracy and players in this phase - according to detailed rules - earn money, re-supply the resource market, remove and replace power plants from the auction. This phase brings some strategic points for players: (i) Payment – according to number of cities connected to their network players earn amounts of cash known in advance (seen as table in rules). (ii) Re-supplying the resource market - players re-supply the resources used in their power plants and give them back to the game in the amounts according to the game rules, the amounts are also known in advance. (iii) Updating the power plant auction, where each player can see the new offer of power plants before the next run starts. After phase 5 new round of the game begins with the phase 1 again. The whole game ends immediately after phase 4 when at least one player has at least 17 cities connected and fully supplied in his/her network.

The winner is the player who can supply electricity to the most cities in his network with the power plants and resources he/she has. Only if there is a tie, the player with the most remaining money wins.

Used approaches

To find out what lessons from playing board games can be brought back to teaching of Strategic Management course we used combination of above mentioned competencies approach (Lombardo and Eichinger, 2009) and general views on strategy (Mintzberg, 1987).

Strategy and competency of planning

According to Mintzberg (1987) the word strategy has been used implicitly in different ways even if it has traditionally been defined in only one. Explicit recognition of multiple definitions helps people to manoeuvre through this difficult field. Mintzberg (1987) provides five definitions of strategy: Plan, Ploy, Pattern, Position, and Perspective. Strategy as a plan is some sort of consciously intended course of action, a guideline (or set of guidelines) to deal with a situation. By this definition strategies have two essential characteristics: they are made in advance of the actions to which they apply, and they are developed consciously and purposefully. Strategy as a Ploy is a specific manoeuvre intended to outwit an opponent or competitor. Pattern is seen as stream of actions. As strategy is consistency in behaviour, whether or not intended. The definitions of strategy as plan and pattern can be quite independent of one another: plan may go unrealised, while patterns may appear without preconception. Plans are intended strategy, whereas patterns are realised strategy. From this we can distinguish deliberate strategies, where intentions that existed previously were realised, and emergent strategies where patterns developer in the absence of intentions, or despite them. Strategy as Position represents locating an organisation in an environment. Strategy is the mediating force between organisation and context (between internal and external environment). Perspective strategy is not just a chosen position, but the perspective shared by members of an organisation, common thinking or behaviour of employees in specific organisation.

Research questions

In this article we want to find out the level of knowledge which students learned and are able to demonstrate in a "real" situation. We take advantage of continuing teaching the same group of students in two consecutive semesters. The main research question is whether the students are able to use knowledge taught in the previous course of Strategic Management in current course during the model situation substituting the real situation.

Partial research questions follow:

- 1. Are students able to propose for the "real" managerial situation the goals in SMART format?
- 2. Are students able to propose goals which are relevant to the context of the managerial situation they face?
- 3. Are students able to propose the strategy corresponding with the set goals in the managerial situation they face?
- 4. What kind of strategy are students able to propose and follow in the "real" situation?
- 5. Are students able to identify strategic failures correctly?
- 6. Are there any conditions under which we can assure the transfer of previous characteristics of the tacit knowledge on students during Strategic management course?
- 7. Can we propose any tool we can use for such intention?

For presenting teaching tool proposals we use the flow chart technique, where we represent solution model to a given situation using usual symbols.

Results and Discussion

Experiment's results

Based on proposed researched questions we followed six basic criterions: students' knowledge of rules, the ability to invoke the principle of SMART goals setting, the ability to propose goals corresponding to the context of the situation students face, the ability to derive strategy from the goals, type of strategy students used in game, and type of any poor decision they did in the game.

The level of rules knowledge can be deduced from the number of rounds played in the game. As students had the same time slot for the game (90 minutes) and they had to arrange the game in the beginning, the number of rounds played is showing who mastered the game rules and who did not (see graph Rules Knowledge in Fig. 3). Students who mastered the rules (32 %) should be in advantage according to the others who had not paid attention to conditions in which the competition took the place (68 %).



Fig. 3: Students results in observed categories

In the previous course of Strategic Management students were taught to use SMART approach for proposing any strategic goal, which means to set goals: specific, measurable, acceptable, realistic, and reachable in time. The game rules offer such a possibility, even more, the rules itself are giving students the exact wording of goals in SMART form. Despite that fact only 8 % of students were able to fully follow the SMART approach of goals setting, 8 % of students were partially successful with setting the SMART goals, and 84 % of students were just not able to formulate SMART goals (or just to copy them out from the game rules, where the goal is explicitly expressed) - see SMART goals setting in Fig. 3. Setting the goals is not only about being SMART, but goals should correspond with the context in which they are set. In our case this context is represented by game rules and the main goal of the game was to ' ... supply electricity to the most cities in his network with the power plants and resources he has '(Friese, 2004: 7). With this criterion we examined whether the set goals are appropriate and achievable in the game. As it is seen in Fig. 3 - Goals correspond to game - fully corresponding goals had only 8 % of students, rather corresponding goals had 52 % students, and 40 % of students were not able to formulate appropriate goals. In proposing the strategy the setting of goals is followed by strategy formulation. These two steps are tightly linked and proposing strategy have to be based on set goals. Therefore we examined whether students strategies correspond to their goals they set before. In 64 % of cases the strategies were based on goals students set before, although only 24 % of cases did match perfectly – see Fig. 3 – Goals correspond to strategy. The last criterion we examined - strategy setting category - was type of strategy students used. We used two of Mintzbergs' five views on strategy (Mintzberg, Ahlstrand, and Lampel, 1998) plan and pattern, as they fit best to our intention and conditions. Mintzberg et al. (1998) sees plans as intended strategy, whereas patterns sees as realised strategy. From this we can distinguish deliberate strategies, where intentions that existed previously were realised, and emergent strategies where patterns developer in the absence of intentions, or despite them. Students did not

have to improvise with the strategy in 56 % of cases – see the Fig. 3 – Type of strategy – the rest of students (44 %) did not have clear strategy or was not able to perform strategy well and had to adapt to the situation they faced.

During the game playing students noticed their decisions into the forms and after the end of game playing students made after-action-evaluation. The strategic decisions in the game are following: (i) choosing a city to start with, (ii) choosing the power plant to or not to, (iii) choosing to or not to start ploy within the auction system. According to the after-actionevaluations there were 16 students who made no strategic mistake during gameplay, 8 students made 1 strategic mistake and 1 student made 2 strategic mistakes. Results can be seen in Fig. 3 – Bad decisions in gameplay.

Experiment's discussion

Students did fully recall the need of SMART goals only in 8 % of examined cases and only 8 % of students were able to propose the goals fully corresponding to the managerial situation they faced. If students set any goals 24 % of them were able to propose a corresponding strategy. These results are quite negative because of low rates. On the other hand 56 % of students proposed strategy with intended purpose (plan) and 64 % of them did not take a wrong strategic decision during the game.

These results show the dominant inability to use properly the competency of planning, which according to Lombardo and Eichinger (2009) means to accurately scope out the length and difficulty of tasks and projects; to set objectives and goals; to develop schedule; anticipate and adjust for problems and roadblocks; measure performance against goals; and evaluate results. On the other hand students showed the ability to foresee the situation, in major to take a good decision when needed.

As our intention was to find out what can be taken from playing the board game with students to the strategic management teaching, the statistical dependence of six variables on students grades from Strategic management course were calculated. The results we present in Table 1.

Testing dependence between:	Pearson's chi square	P value	α
Level of rules knowledge vs. Grade	0.0188537	0.89079	0.05
SMART goals setting vs. Grade	na	na	na
Goals correspond with the main goal of the game vs. Grade	0.0267094	0.87018	0.05
Strategy correspond to the goals vs. Grade	0.0712251	0.78941	0.05
Type of strategy vs. Grade	0.0509907	0.82135	0.05
Mistakes evaluation vs. Grade	0.3216257	0.57063	0.05

Tab. 1: Dependence between monitored variables and grades

According to statistical test in Table 1 we found out no variable is dependent on the grades. Dependency between setting the SMART goals and students' grades from previous Strategic management course could not be calculated as they did not meet the statistics' conditions. Above mentioned results mean that the grades students gained in previous course did not have any influence on their behaving during the game (in each case is $P > \alpha$). As the grades from previous course represent the recognized level of knowledge which students achieved or demonstrated during the exam (written and oral) and the game we can see as a model of real strategic situation, therefore we can say

students do not use their knowledge of strategic management in situation(s) or in the moment(s) where/when this knowledge should be used.

This result brings further analytical question: "Why do not students use the knowledge they probably have when facing the "real" managerial situation?" The most likely answer is: "They do not possess adequate knowledge. Or enough capacities as mentioned by Gao, Li, and Nakamori, (2003)." The probably explanation is that we predominantly teach them explicit knowledge and we do not focus enough to tacit knowledge despite the fact we use variety of experiential learning tools during the course. This finding is in accordance with Kolb's statement that "simple perception of experience alone is not sufficient for learning". (Kolb, 1984: 42)

From the view of above presented results we agree with Mintzberg (2004) who said that many essential managerial skills can be learned only from personal experience and who also suggested a major change in management education which would allow students to gain more experience. Such a major change might be a change in portfolio of teaching tools which can provide more personal experience for students and thus can increase the tacit knowledge level. Therefore here comes another important question: "How to ensure the transfer of specific tacit knowledge on students during the Strategic management course?"

Teaching tool's proposal

The ability to adapt to the business environment, to choose and follow an appropriate strategy, to critically assess the market situation, to minimize loss or maximize profit - every graduate of management courses should possess the ability to handle. To ensure the transfer of specific tacit knowledge we reflect the experience we had with the above described experiment. As the board business game can be used as tool for the knowledge transfer evaluation, we came up with the idea to use it, in different form, as a teaching tool of specific tacit knowledge. There is a strong support in the literature why to use the games for management teaching. For example Wawer et al (2010) see the individual games as scenarios describing possible market situations, which are very likely to be encountered in the real world. Business games offer an entertaining way to hone these crucial skills in a virtual environment, thus without impacts on the real world. It can be assumed the more realistic the game conditions are, the more realistic the decision making procedure must be applied. And there is also an agreement upon the time on the usefulness of games in teaching management. For example Schrieber (1958) sees the teaching purposes of games used in management teaching as to give the experience in decision-making, to develop a universal method of analytical thinking, to practice interactions between students, and to see the connections, links between issues (to broaden the view to the issue). And from more recent times Salas, Wildman, and Piccolo (2009) see game-based training as ideal technique for management education programs in undergraduate and graduate management programs as it gives students practical skills, which they need when entering the business or corporate world.

Therefore we decided to use the board-game "Power plants" as case study for the proposal of teaching tool enabling the tacit knowledge training.

Conditions for successful tacit knowledge training

We found three basic conditions which must be met for successful tacit knowledge training:

- 1. Specificity of trained tacit knowledge.
- 2. Repeatability/availability of the situation in which training runs.
- 3. Changeability of the training situation's conditions.

Specificity of trained tacit knowledge

The tacit knowledge we see as non-linguistic non-numerical form of knowledge that is highly personal and context specific and deeply rooted in individual experiences, ideas, values, and emotions (Gourlay, 2002). Due to these characteristics of tacit knowledge we have to provide that each student will practice precisely defined process to learn required knowledge. The characteristic "specifity of trained tacit knowledge" is fully compatible with statement of Nonaka and Takeuchi (1995: 69), who say that tacit knowledge 'can be also acquired through "internalization" involving the use of explicit knowledge in the form of documents and similar media, a method they claimed facilitates changing mental models '.

In the case of used board-game "Power plants", we found following examples of processes which can be precisely defined and therefore are suitable for tacit knowledge learning:

- 1. Process of the proposition and usage of goals in SMART format.
- 2. Process of the setting goals relevant to the context of the situation.
- 3. Process of the proposition of strategy corresponding with the set goals in the situation.
- 4. Process of the strategy follows in the "real" situation.
- 5. Process of the strategic failures identification.

Repeatability/availability of the game

The characteristic of repeatability is based on premise of relationship between skill learning and repetition (Poldrack et al, 1999). The more repetitions the students will do the higher probability of knowledge acquisition they have. Along with repeatability comes the availability. To ensure the students will be allowed to repeat the training situation, the training situation has to be widely accessible.

In our case study of the "Power plants" we decided for the online form of the game with the artificial inteligence to ensure the repeatability and availability of the training situation. Online form of the game will ensure the accessibility and artificial intelligence will ensure the possibility to repeat the situation any time without the supervision of any administrator or even teacher.

Therefore we programmed the server which assigns each player a unique identifier and generates a game board setting. The game board is set up at the beginning of each game and remains unchanged until the end of the on-going game epoch. The server also ensures the basic game rules and settings, including:

- Amount and distribution of resources.
- Generation of power stations and random set up of their properties:
- The power plant generation follows the price rule. The "technologically worst" and hence cheapest are the power stations burning the fossil fuels.
- Power plants operating on two different commodities (excluding wind) are always available for purchase.
- The wind power stations require no additional resources for their operation. This type or power plants cannot store resources.

- Game plan set up, and placing a player at a random location on the game board.
- Dynamic game board refreshing.

The random generation of the game board and player's starting location can naturally put a certain player into disadvantageous starting position. This is also desirable from the educational point of view, because in such situation a different set of strategies must be applied. After creating the game world, the solution consequently prompts individual players to make their turns. It ensures the game is played according to the rules, manages the consumption of resources, their availability and prices on the market. It also updates the list of available power stations, and governs the auctions.

Without seeing the actual game adversary, we cannot perceive the facial expressions of our opponents. This naturally highly reduces the space for bluffing, which is currently one of the key disadvantages of such computer game. Our research team considered scanning the facial expression of the individual players. This however goes against the idea of replacing the game adversary with the artificial intelligence. Naturally up to the point when a computer would be capable of efficiently imitating human mimics. This possibility is however on the theoretical level only.

The decision each player makes must be stored in the form of a vector, also called the vector of solution, to the solution database. The winning strategy is consequently presented to the intelligent agent, which uses it for learning. Such empirically gathered data are valuable, because the player can retrospectively follow the strategy utilized in game, and find out the important breakthroughs in the game. This function is priceless from the educational point of view.

The artificial intelligence

The game intelligence is formed by the perceptron neural network with one hidden layer, which adapts itself based on the gathered learning sets from winning strategies. The intention is to make the network capable of replacing a human player, and become fully independent. From the technical point of view, this is a standard artificial intelligence task. Porter (1990), Mitchell et al (2000), Baker, Gedajlovic and Lubatkin (2005) and many other authors describe various strategies companies utilize. Based on these findings a classical optimization algorithm can be designed, but the complex nature of the game mechanisms makes such a solution inappropriate. The behaviour of artificial neural network is highly unpredictable, because of the ability to predict as well as make mistakes. The student should thus feel like playing against a human adversary.

Changeability of the game's conditions

Unfortunately, the state space of conventional managerial games is usually quite limited. When keeping the game in a purely deterministic way, the players can soon get an understanding of the game principles and employ a collection of "hard coded" strategies that work only in the limited game domain. Therefore, the practical relationship with the real world scenarios would be negligible. To overcome this issue, the authors include various elements of chance in their games (rolling a dice, picking a random card, etc.). Certain games also incorporate the elements of bluffing and bidding. This makes the outcomes less predictable and the illusion of the game taking place in the real world much stronger.

The deterministic software utilizes for such tactics only pseudo-random algorithmic mechanisms. Human players are

usually capable to learn how such functions work after several iterations. The intelligent system in comparison, imitates the behaviour of human beings, and acts in a nondeterministic way. Moreover, the game intelligence adjusts its settings based on the varying initializing conditions. It is thus close to impossible for a player to learn anything more than basic game rules. The system behaviour is much closer to the human being behaviour and the illusion of playing against a real player is more realistic.

Following Thompson (2010) we can propose that the game strategy is the key point of the whole solution. It evolves dynamically. The implemented strategies differ according to the resources and the power stations available. While in the classical game scenario, students get the understanding of the available types of power plants, and structure of the game world, the intelligent software solution flexibly generates these values. The "technological development" of the power plants can also have varying pace, be slower or faster, depending on the required situation. Therefore, students are forced to abandon trivial strategies, and modify their plan gradually. When the intelligent agent acts in a human-like way, it can choose the optimal strategy depending on the game round and development. In that case, students would have an ideal educational tool at hand. The aim is to create an artificial solution that will not be differentiable from a human being in a game play.

While in one epoch, it can be beneficial to save money and invest them after several game rounds; in other epochs such a strategy can lead to the loss of important power plants and inevitable defeat. From the game strategy point of view, it may be important to save money and focus on purchasing the power plants, which in turn enables the player to store plenty of resources and thus sell out the game market. This can force the opponents to restructure the portfolio of the power plants owned. Another possible strategy relies on early purchase of the short and thus cheap wiring between cities, without actually supplying them with energy. Such investment into infrastructure means a financial disadvantage for the game adversaries in the later stages of the game. By Becker (2011) we suppose the player can also rely on the 'eager finish', when the last turn means a complete consumption of resources, which would normally affect players' performance in further rounds, but is irrelevant because of the actual victory. This idea is relevant for "Power Plants" game too. Each of these strategies and their combinations lead to various scenarios of bidding and bluffing during the power plant purchasing stage. Such intentional manipulation of game adversaries introduces a real world situation for the students, where the decision making is dependent on the environment (Nemerow, 1996), where the available information influences our reasoning.

To affirm the benefits of artificial intelligence to changeability of trained situation let us see onto very specific part of the game - power plant auction (Fig. 4). This game lap is typical for "clever" human decision. Each player must calculate with a lot of unknown variables. "How will change my adversary's strategy, if I try to buy a better power plant?", "Start auction?", "How much money can I spend?", "Can I bluff and manipulate with them to by Power plant, which I really don't want?"



Thanks to this example it is visible that for realistic behaviour the system must use something more than the randomness as we see in Fig: 4.

Fig. 4: Artificial intelligence decision mechanism implemented for the auction

Figure 4 shows the Artificial intelligence decision mechanism implemented into the power plant auction. The system makes decision via internal strategy. This strategy should be de facto optimal solution for game.

We understand that possible ways of addressing these situations are countless, and each of them represents a feasible study variant, and thus a beneficial educational game.

Becker (2011) has described the impact of business games as a tool of experiential learning. In comparison with their approach, we do not rely on the predesigned set of game strategies, but instead propose a solution capable of learning from the recorded games. By adapting the methods of artificial intelligence, the solution can evolve together with the players and thus better support their professional development similar to Wawer et al (2010), Wolfe (2000) or Hawtrey (2007). This way the game keeps its dynamic character, which is difficult to predict, and players thus must gradually work on their strategy.

Conclusions

Due to our experiment we have found out that even in the course designed with the experiential learning techniques the successful training of tacit knowledge is not always provided. This result is consistent with Mintzberg's (2004) or Jarosova's (2005) findings that it is necessary to improve the ability of students to apply knowledge in the real managerial situations. Mintzberg (2004) predicts a major change in the management education but he does not specify it closer. We see this change as a change in the approach to teaching, as Huddleston and Unwin (1997) described, where the teacher becomes a manager of education and will use different teaching tools which can provide more personal experience for students and thus can increase the tacit knowledge level. Having the experience from conducted experiment we proposed a solution in the form of business game with the artificial intelligence and specified the conditions necessary for the proper functioning of the tool. The business games based on the artificial intelligence solution can be used in the education of students of management courses. The nondeterministic character of the game generated using such an agent can further approximate the real market situation, and thus support the players in acquiring the important managerial skills and insights into the practical work of managers.

References

Baker, T., Gedajlovic, E. and Lubatkin, M. (2005) 'A framework for comparing entrepreneurship processes across nations', *Journal of International Business Studies*, vol. 36, pp. 492–504. http://dx.doi.org/10.1057/palgrave.jibs.8400153

Becker, R.S. (2011) '*Interactive Games for Business Training*' [online] Becker Multimedia, Available: http://itforum.coe.uga. edu/paper123/Interactive_Games_for_Business_Training.pdf [15 Apr 2014].

Friese, F. (2004) '*Power Grid*', Game manual. USA: Rio Grande Games.

Drucker, P.T. (1989) 'The New Realities: In Government and Politics / in Economics and Business / in Society and World View'. New York: Harper & Row.

Gao, F., Li, M. and Nakamori, Y. (2003) 'Critical Systems Thinking as a Way to Manage Knowledge', *Systems Research and Behavioral Science*, vol. 20, no 1., pp. 3-19. http://dx.doi. org/10.1002/sres.512

Gourlay, S. (2002) 'Tacit knowledge, tacit knowing, or behaving?' *3rd European Organizational Knowledge, Learning and Capabilities Conference*. Athens, pp. 86-105.

Hawtrey, K. (2007) 'Using Experiential Learning Techniques', *Journal of Economic Education*, vol. 38, no. 2, pp. 143-152. http://dx.doi.org/10.3200/JECE.38.2.143-152

Huddleston, P. and Unwin, L. (1997) '*Teaching and learning in further education, diversity and change*', London: Routledge.

Jarosova, E. (2005) 'Trénink sociálních a manažerských dovedností: metodický průvodce', Praha: Management Press.

Kolb, D.A. (1984) 'Experiential learning: experience as the source of learning and development', New Jersey: Prentice Hall.

Lombardo, M.M. and Eichinger, R.W. (2009) 'For Your Improvement: A Guide for Development and Coaching For Learners, Managers, Mentors, and Feedback Givers', USA: Lominger International: A Korn/Ferry Company.

Mintzberg, H. (1987) 'The Strategy Concept I: Five Ps For Strategy', *California Management Review*, vol. 30, no. 1, pp. 11-24. http://dx.doi.org/10.2307/41165263

Mintzberg, H., Ahlstrand, B., and Lampel, J. (1998) 'Strategy Safari: A Guided Tour Through the Wilds of Strategic Management'. New York: Prentice Hall.

Mintzberg, H. (2004) '*Managers not MBA*', San Francisco: Berrett-Koehler Publishers.

Mitchell, R.K., Smith B., Seawright, K. W. and Morse, E. A. (2000) 'Cross-cultural cognitions and the venture creation decision', *Academy of Management Journal*, vol. 43, no.5, pp. 974–993. http://dx.doi.org/10.2307/1556422

Nemerow, L.G. (1996) 'Do classroom games improve motivation and learning?', *Teaching and Change*, vol. 3, no. 4, pp. 356–366.

Nonaka, I. and Takeuchi, H. (1995) '*The Knowledge-Creating Company*'. New York: Oxford University Press.

Simpson, J., and Weiner, E. (1989) 'Oxford English Dictionary'. United Kingdom: Oxford University Press.

Pavlicek, J., Svec, V. and Ticha, I. (2014). 'Business Games Powered by Artificial Intelligence in Education', *Efficiency and Responsibility in Education 2014*, pp. 179-185.

Polanyi, M. (1959) 'The Study of Man'. Chicago: Chicago Press.

Poldrack, R.A., Selco, S.L., Fiel, J.E. and Cohen, N. J. (1999) 'The relationship between skill learning and repetition priming: Experimental and computational analyses'. *Journal of Experimental Psychology: Learning, Memory, and Cogn*ition, vol. 25, no. 1, pp. 208-235. http://psycnet.apa.org/doi/10.1037/0278-7393.25.1.208

Porter, M.E. (1990) '*The Competitive Advantage of Nations*', The Free Press: New York.

Salas, E., Wildman, J.L., and Piccolo, R.F. (2009) 'Using Sumilation-Based Training to Enhance Management Education', *Academy of Management Learning & Education*, vol. 8, no. 4, pp. 559-573.

Schrieber, A.N. (1958) 'The Theory and Application of the Management Game Approach to Teaching Business Policy', *The Journal of the Academy of Management*, vol. 1, no. 2, pp 51-57. http://dx.doi.org/10.2307/254492

Stevens, M. A., and Campion, M. J. (1994) 'The knowledge, skill, and ability requirements for teamwork: Implications for human resource management', *Journal of Management*, vol. 20, pp 503–530.

Svec, V., Pavlicek, J. and Ticha, I. (2014). 'Playing Board Game: Lessons (not only) for Strategic Management', *Efficiency and Responsibility in Education 2014*, pp. 805-812.

Sun, H. (1998) 'A game for the education and training of production/operations management', *Education* + *Training*, vol. 40, no 9, pp. 411. http://dx.doi.org/10.1108/00400919810247212

Thompson, A. (2010) '*The Business Strategy Game*', computer software: GLO-BUS Software, Inc.

Wawer, M., Milosz, M., Muryjas, P. and Rzemieniak, M. (2010) 'Business Simulation Games in Forming of Students' Entrepreneurship', *International Journal of Euro-Mediterranean Studies*, vol. 3, no.1, pp. 49-71.

Wolfe, J. (2000) 'The Global Business Game: A Simulation in Strategic Management and International Business', Boston: South-Western college Publishing.

SOCIAL RESPONSIBILITY OF HIGHER EDUCATIONAL INSTITUTIONS – THE COMPARISON OF THE VIEW OF STUDENTS AND POTENTIAL STUDENTS

Lucie Kvasničková Stanislavská, Roman Kvasnička, Kateřina Kuralová, Klára Margarisová

Czech University of Life Sciences Prague

Highlights

- The article summarises the attitudes and expectations of two important stakeholder groups in a HEI with reference to social responsibility of HEI in the Czech Republic
- The conducted comparison is supported by empirical data

Abstract

Higher educational institutions (HEIs) in the Czech Republic seek to get quality and talented students. For the perception of HEI as quality institutions, it is essential that they behave in a socially responsible manner. Corporate social responsibility (CSR) is one of the useful tools to positively affect society and develop relationships with stakeholders. Current and future students are important stakeholders for HEIs. Through the method of focus groups the article chases up the knowledge and relationship to problems of social responsibility of universities between two important groups of interest - contemporary and potential students – and students' requirements on universities.

Keywords

Corporate social responsibility, higher education, stakeholders, focus groups, students, potential students

Article type

Full research paper

Article history

Received: September 19, 2014 Received in revised form: December 20, 2014 Accepted: December 29, 2014 Available on-line: December 31, 2014

Kvasničková Stanislavská, L. et al. (2014) "Social Responsibility of Higher Educational Institutions - the Comparison of the View of Students and Potential Students", *Journal on Efficiency and Responsibility in Education and Science, Vol. 7, No. 3-4*, pp. 95-99, online ISSN 1803-1617, printed ISSN 1803-1617, doi: 10.7160/eriesj.2014.070308.

Introduction

Corporate social responsibility (CSR) has become an important part of firms' operations over the past decade. Social Responsibility has become an increasingly important concept both within the European Union and globally, and it has become part of the debate about competitiveness and sustainability in the globalization context (Vasilescu et al., 2010). Many organizations have increased their investments in CSR either voluntarily as part of their strategy and vision or as a result of pressure from activist shareholders. Many organizations also publish annual CSR reports that provide detailed information about their CSR activities and achievements or devote large sections of their annual reports to a description of their CSR activities (Deng, Kang and Low, 2013). In the European Union, the promotion of CSR also reflects the necessity to defend common values and increase the sense of solidarity and cohesion. Enterprises of all sizes, in cooperation with their stakeholders, can help by means of CSR to reconcile economic, social and environmental ambitions (Vasilescu et al, 2010).

Current definitions

'CSR is a continuous and long-term process guided by organisational and personal values. It is concerned with people (as stakeholders), the environment and organisational policies, and is influenced by political concerns. Adoption of CSR is often associated with monetary gain or profit for the initiator' (Isa, 2012: 335). 'Baron (2007) supported that corporate social responsibility has become an important part in the business strategy of a growing number of companies worldwide, since the performance of a business organization is affected by their strategies in the market, as well as non-market environments' (In Mustafa, Othman and Perumal, 2012: 898).

Stakeholders in Corporate Social Responsibility

Stakeholders play a key role in corporate social responsibility (Bearle and Means, 2002; Costa and Menichini, 2013; Murray and Vogel, 1997). According to Freeman's theory a stakeholder is anyone susceptible to be impacted by the goals of an enterprise and anyone that could be impacted by their realisation (Freeman 2010). The stakeholder theory is based on the necessity of producing outcomes, which can optimise the advantages for important stakeholders, without favouring only one stakeholder (Jones, 1999). The main point in the concept of corporate social responsibility is to understand the expectations of those, who can influence an organisation, and are influenced by an organisation (Steinerová, Václavíková and Mervart, 2008). Trnková (2004) states that the application of CSR principles is a process of building trust in target groups functioning within the organisation. An organisation becomes trusted, when it systematically tries to cooperate with stakeholders. Falck and Helbich (2007) assume that CSR can be applied in a strategic way for satisfying the requirements of each stakeholder. The management of an enterprise can use CSR as a normative instrument for making plans that will satisfy the shareholders, as well as stakeholders.

Costa and Menichini (2013) mention the negative impact that a lack of social responsibility of any given organisation has on stakeholders. Organisations that present themselves as socially responsible, yet are found not to be responsible by some stakeholders, can be severely damaged. Melé (2008) even claims that if the social responsibility of a company is understood in a broader sense, then the stakeholder theory can be considered as a theory of social responsibility, because it proposes a normative framework with reference to accountability.

Social responsibility of higher educational institutions

The economic, political and social changes that took place over the past decades have had an impact also on the European higher education institutions, which have undergone an ample reform process meant to meet the new challenges they are facing. Globalisation, the knowledge society, innovation, the development of technologies, a growing emphasis on the market forces are among the key factors, which influence the universities' mission, organisation and profile, the mode of operation and delivery of higher education (Vasilescu et al., 2010). HEI increasingly need professional management structures, similar to corporate type organisations. A highly competitive market requires HEI to develop competences and skills that were previously not required. Specifically, this refers to resources management and management of the relations to students, or in matters of university branding (Michael, 2004). The mission of any HEI has been expanded beyond the framework of teaching and research. Nowadays, it includes service to the community in which the HEI is situated, partnership with surrounding communities and other stakeholders (Jongbloed, Enders and Salerno, 2008). Research shows that currently the important stakeholders are students, who are actually studying at a given HEI and potential students (Alves, Mainardes and Raposo, 2010; Chapleo and Simms, 2010; Kantanen, 2007).

The article follows and extends Kvasničková et al, (2014), the goal of which was to identify the attitude of contemporary university students to the problems of social responsibility of universities in the Czech Republic. This goal is extended by the identification of the attitude of potential university students to the mentioned problems.

Materials and Methods

The attitudes and expectations of students will be determined by the focus group method, recommended for this purpose by Mainardes, Alves and Raposo (2010). The focus group method is a useful and effective tool for determining collective opinions, values and faiths (Jayasekara 2012). Huston and Hobson (2008) describe the focus group method as a structured and planned group discussion designed in such a way as to gain a rational idea about a defined area of interest. The discussion should take place in pleasant and convivial surrounding.

Krueger and Casey (2000: 6-7), who have described the method in detail, mention its main aspects as follows:

- There should be 4 to 12 members in a focus group
- The main characteristic of the focus group is its homogeneity, with reference to the goal of the given study. It is the basic prerequisite for the functioning of a focus group. It ensures that the participants have the same mind-set from the very start of the discussion.
- Collecting qualitative data the goal of the focus group is to collect data, with reference to the requirements of the researcher. By comparing the outcomes one can come to the desired conclusions, e.g. reaching a consensus, getting recommendation, or a choice of relevant decisions.

The discussion is prepared and led by the researcher. All the questions are formulated purposefully in logical sequences. The design of the questions is crucial for the research outcomes. Questions are classified from general to specific. The most relevant questions appear at the end of the research.

Veisová (2009) classifies typical questions raised during focus group discussions as follows:

- Opening questions that lead to the identification of common characteristics of participants.
- Introductory questions focused on the research theme, i.e. questions that define the issue that will be at the centre of discussions. Transitional questions that lead the conversation to the key issues.
- Key questions, crucial for the entire study.
- Final questions which close the discussion.

The structure of the focus group discussions outcomes refers to the type of questions (Veisová, 2009).

Specific types of questions are mentioned in Tab 1.

Typical Questions	Specific types of questions
Identification	Identification of respondent (name
questions	of HEI, year of studies)
Introductory	Awareness of the concept of social responsibility of HEI
questions	Awareness of socially responsible activities of the HEI
Key questions	Ways of acquiring information
	Attitude to issues related to social responsibility of the HEI
	Requirements and expectations with reference to the HEI
Final questions	Conclusion and amendments

Tab. 1: Structure of scenarios implemented during group discussions with focus group 'Current Students'

The main advantages of this method can be summarised as follows: the focus group is a quite inexpensive (Veisová, 2009) and fast method for collecting qualitative data (Huston and Hobson, 2008). A properly set up group can stimulate thought exchange amongst participants, ensuring that nothing will be omitted (Klein, Tellefsen and Herskovitz, 2007). Group interaction helps participants in developing and focusing their thoughts (Freeman, 2000).

For identifying the attitudes and requirements of current HEI students the above mentioned focus group method was used. The group discussions with HEI students had eight participants – five females and three males. There were group discussions held with potential university students studying their last year at secondary schools. Eight respondents participated in these discussions – for men and four women. At the time all respondents were decided to apply for a university in the following months.

The division of students according to their HEI is indicated in Tab 2. The division of potential university students of their type of the secondary schools indicated in Tab. 3.

Name of HEI	Number	
	of respondents	
Czech University of Life Sciences Prague	2	
Jan Evangelista Purkyně University in Ústí nad Labem	2	
University of Economics, Prague	2	
Technical University of Liberec	1	
Masaryk University	1	

Tab. 2: Respondents according to HEI

Type of secondary school	Number of respondents
High school	5
Grammar school	3

Tab. 3: Respondents according to type of secondary school

Tab 4. indicates students according to the year of studies at HEI.

Year of study	Number of respondents
1.	1
2.	2
3.	2
4.	2
5.	1

Tab. 4: Respondents according to the year of studies at HEI

Results

Awareness of the issue of social responsibility

The initial question in the group discussion focused on identifying awareness of the issue of social responsibility, in general as well as with reference to HEI. The majority of respondents from contemporary students did not know the term. Some respondents of current students admitted that, *'the term is familiar to me, however, I do not know what it really means'*. When requested to define to some extent what the term meant, they usually assumed that *'it had something to do with charity'*. No one from the potential students knew the term.

The concept of social responsibility had thus to be explained. The EU definition as published in the Green Book - Promoting a European framework for corporate social responsibility (2001: 6) was cited: 'Corporate social responsibility is essentially a concept whereby companies decide voluntarily to interactions with stakeholders'. Social responsibility was also discussed in a broader context.

Another part of the discussion addressed the possibility of applying the concept of social responsibility in the conditions of Czech HEI. All respondents agreed that the concept can be applied at HEI and that HEI in the Czech Republic should act as socially responsible organizations. Even the majority of respondents from the group of potential students expressed the opinion that universities should also be social responsible. The participants stated that they would welcome these activities: 'It will make an impression on me, if I know that the school helps somehow', 'I would like it', 'I would appreciate it'.

Once the concept has been clarified, students could easily discern socially responsible activities in their HEI. Most often they thought of sports and cultural activities offered to employees and students (e.g. 'ball dances', 'concerts', 'festivals', 'sports facilities'), sporting events for the public (e.g. 'we offer the sporting grounds of the Department of Physical Education for use by the public') as well as ecologically minded activities (e.g. 'we separate waste'). The most frequent socially responsible activities that the secondary school students could recall were also cultural and sport events for students and the public: 'I know about festivals at universities'. The students also noticed ecological activities of universities: 'During open day I saw that many universities sort waste'.

Information channels

Ways in which students get information about socially responsible activities at their HEI, have also been investigated.

The most often cited information channel were posters in the campuses. Students also mentioned that the teachers informed them during their classes.

Students thought that they have enough information about the abovementioned activities of social responsibility ('*I think that information is available when someone is looking for it and he can find it*') and they don't need to obtain information in another way.

All secondary school students, who took part in the group discussions, considered gaining information from universities as insufficient. They found out about socially responsible activities, which they knew, from their friends ('I've never found anything about it on university websites', 'I think that these activities aren't promoted in the media at all'). In general the last year students evaluate the university websites negatively ('there is information only about the fields of study, I've never found, what I've been looking for', 'the websites didn't help me a lot', 'it is difficult to orientate in the websites and I've never found what I've looked for '). Except for the information about socially responsible activities, that most students would be interested in (there was only one student, who did not show interest in this problems – 'my main interest at the moment is the GCSE exam'), the students lacked information about entrance examinations ('I was searching how many points do I need, I was interested in subjects in particular fields of study, I want to decide according to *it'*). The students appreciate open days of individual universities, where the majority of them took part in ('the best way is, when also the students are present, I'm interested in their experience with the university'). They suggest to extend the potential of open days by handing out leaflets with detailed information ('I thoroughly studied everything that was for nothing', 'I would welcome, however I didn't get any'). The students would next appreciate delegations of university representatives at their secondary schools, especially when also the university students would participate ('it is more trustworthy', it will influence me a lot when choosing a university').

Involvement of students in socially responsible activities at HEI

Controversies arose around this issue. One section of current students was willing to take part in socially responsible activities of the HEI in their free time, provided it *'had a meaning' and provided they found the project 'beneficial'*. Another section refused to take part, with explanations ranging from 'I have enough of my own work', or 'I prefer to work and make money'. If a socially beneficial project would be implemented as a part of their curricula, all respondents replied that they would take part.

Secondary school students' attitude to socially responsible activities was more definite. In case that they are accepted to a university, the majority of students would not refuse to join in a socially responsible activity. Most frequently they would welcome if the activity is connected with their study ('so that I can later write it in my CV', 'I will participate if it is connected with my study'). A small part represented by women will be ready to take in the activities even if they are not connected with their study ('if it is meaningful, it doesn't have to have something to do with my study', 'I wouldn't mind to sacrifice my own free time').

Requirements of students

Key issue addressed during group discussion. Students would require more facilities, such as reading rooms, access to internet, a user friendly IT system, etc. They would also want more cooperation between HEI and the industry, more specialists involved in teaching, the possibility to have internships at companies, possibility to write one's thesis while doing an internship, etc. Students would of course require adequate housing and meals to be provided. Thirty-six student requirements have been generated from our survey. The requirements were divided into six groups:

- Students' technical and administrative requirements,
- Cooperation between HEI and the industry,
- Triple Bottom Line Activities,
- Welfare requirements,
- Possibilities for language skills improvement,
- Free time activities for students

The requirements of potential students are current to those of contemporary students. However they put greater emphasis on an easier way of getting information from universities (open days, clear websites, helpful attitude of the staff, who come into contact with university applicants, etc.) and opportunities for foreign language improvement such as high level of language subjects, the possibility to study abroad and cooperation with foreign universities. There were thirty-five requirements identified in this group. The requirements were divided to seven groups:

- Technical facilities and open communication,
- Cooperation between HEI and the industry,
- Triple Bottom Line Activities,
- Welfare requirements,
- Possibilities for language skills improvement,
- Free time activities for students
- Admission Process through SCIO tests (National Comparative Exams)

Discussion

Interaction between HEI and their stakeholders is a relatively new concept within academia, however it has been increasingly acknowledged by HEI Boards as well as by academics specialised in the area of HEI management (Alves, Mainardes and Raposo, 2010).

Despite the growing interest in the issue of universities stakeholder the current research are focus only on the first step in analysing universities stakeholders - to the identification of relevant interest groups. Brown (1999) in his article identifies the most important stakeholders: students, government, employers - teaching staff. Moreover, Brown highlights the relationships between an HEI and these stakeholders as a 'survival route for this type of institutions'.

The concept of social responsibility is widespread in the commercial sector. However the research findings indicate that majority of respondents are not familiar with the concept of CSR. For current and potential students concept of CSR represents activities as concert, festivals etc.

The research focusing on the next step in the analysis of stakeholders, i.e. identifying the requirements of important stakeholders for HEIs, is missing. This kind of research is missing despite the fact that the satisfaction of students is crucial for HEIs. To identify the requirements of the stakeholders is important for the modern HEI, in accordance of Wiliams (2002). He sets that the students' feedback is necessary for HEI. His study findings confirmed the importance of measuring student satisfaction as a relevant HEI management tool. According to

our findings the HIES should complete and make more clear their websites. So the potential students can find necessary information.

However the researches in this area are primary focused on the customers' perceptions of CSR concept in companies (Trapero, Lozada and García, 2010). Other studies are focused on the question: how big influence the stakeholders have on CSR activities at corporations (Park,Chidlow and Choi, 2014). But the identification of stakeholders' requirements are missing in these studies. This article presents an extended view of social responsibility associated primarily with the requirements of HEI's stakeholders.

Conclusion

The article summarises the attitudes and expectations of two important stakeholder groups in a HEI with reference to social responsibility of HEI in the Czech Republic. The group discussions indicates that today's students and potential students do not have enough theoretical knowledge of the concept of corporate social responsibility. Their understanding of the concept is limited, and takes only sports and social events into consideration. A section of understands the concept to be related to ecological activities of their HEI. As to personal involvement of students in socially responsible activities, the study has shown some incongruity. Some students would be willing to get involved during their free time in socially responsible activities, provided such activity would be considered as meaningful by them. Compared to this, potential students are willing to take part in the socially responsible activities.

Students considered current dissemination of information about the social responsibility of HEI as satisfactory in case of active involvement. Passive involvement comes through posters and flyers, or through information shared by the teacher during a course. Secondary school students express their dissatisfaction with the way of communication in this field. In general potential students are dissatisfied with the way of getting information from universities. They often consider university websites as unclear. They would appreciate a more active approach to getting information from universities, e.g. by the delegations of university representatives at secondary schools.

At the end of the focus group sessions the requirement of students with reference to social responsibility of the HEI, were analysed. On the basis of respondent's answers a list of relevant requirements of students on the HEI was drawn. This list will be used in subsequent quantitative research. The requirements will be tested using the 5 point Lickert' Chart. In a survey, using factor analysis, various factors will be identified and evaluated with reference to benefits generated for each stakeholder.

References

Alves, H., Maninardes E.W. and Raposo, M. (2010) 'A Relationship Approach to Higher Education Institution Stakeholder Management', *Tertiary Education and Management*, vol. 16, no. 3, pp. 159-181, http://dx.doi.org/10.1080/13583883 .2010.497314

Baron, D. (2007) 'Corporate social responsibility and social entrepreneurship', *Journal of economics and Management Strategy*, vol. 16, no. 3 pp. 683-717, http://dx.doi.org/10.1111/j.1530-9134.2007.00154.x

Bearle, A. and Means, G. (2002) *The Modern Corporation and Private Property*. 4. print. New Brunsvick: Transaction Publishers, 2002.

Brown, S. (1999) A systemic perspective on higher education in the United Kingdom. *Systems Research and Behavioral Science*, vol. 16, no. 2, pp. 157–169

Chapleo, C. and Simms, C. (2010) 'Stakeholder analysis in higher education', *Perspectives: Policy and Practice in Higher Education*, vol. 14, vo 1, pp. 12-20, http://dx.doi. org/10.1080/13603100903458034

Costa, R. and Menichini, T. (2013) 'A multidimensional approach for CSR assessment: The importance of the stakeholder perception', *Expert Systems with Applications*, vol. 40, no. 1, pp. 150-161, http://dx.doi.org/10.1016/j.eswa.2012.07.028

Deng, X., Kang, J. and Low, B.S. (2013) 'Corporate social responsibility and stakeholder value maximization: Evidence from mergers', *Journal of Financial Economics*, vol. 110, no. 1, pp. 87-109. http://dx.doi.org/10.1016/j.jfineco.2013.04.014

European Communities (2001) Green Paper Green Paper -Promoting a European framework for 358 ERIE 2014 corporate social responsibility. [Online], Available: http://eur-lex.europa. eu/legalcontent/EN/TXT/?uri=CELEX:52001DC0366 [10 May 2014]

Falck, O. and Helbich, S. (2007) 'Corporate social responsibility: Doing well by doing good', *Business Horizons*', vol. 50, no. 3, pp. 247–254. http://dx.doi.org/10.1016/j.bushor.2006.12.002

Freeman, E. (2010) *Strategic Management: A Stakeholder Approach*. Cambridge: Cambridge University Press.

Huston, S.A. and Hobson, E.H. (2008) 'Using focus groups to inform pharmacy research'. *Research in Social and Administrative Pharmacy*, vol. 4, no. 3, pp. 186-205, http://dx.doi.org/10.1016/j.sapharm.2007.09.001.

Isa, S., M. (2012) 'Corporate Social Responsibility: What Can We Learn From Stakeholder'. *Procedia – Social and Behavioral Sciences*, vol. 65, pp. 327-337, http://dx.doi.org/10.1016/j. sbspro.2012.11.130

Jayasekara, R., S. (2012) 'Focus groups in nursing research: Methodological perspectives', *Nurs Outlook*, vol. 60, no. 6. pp. 411-416, http://dx.doi.org/10.1016/j.outlook.2012.02.001

Jones, M. T. (1999) 'The Institutional Determinants of Social Responsibility', *Journal of Business Ethics*, vol. 20, no. 2, pp. 163-179. http:// dx.doi.org/10.1023/A:1005871021412

Jongbloed, B., Enders, J. and Salerno, C. (2008) 'Higher education and its communities: Interconnections, interdependencies and research agenda', *Higher Education*, vol. 56, no. 3, pp. 303-324, http://dx.doi.org/10.1007/s10734-008-9128-2

Kantanen, H. (2007) 'Community Relationships and the Practice of Public Relationships in Higher Education', Tertiary Education and Management, vol. 13, no. 1, pp. 47-59, http://dx.doi.org/ 10.1080/13583880601151254

Klein, E.E., Tellefsen, T. and Herskovitz, P.J. (2007) 'The use of group support systems in focus groups: Information technology meets qualitative research', *Computers in Human Behavior*, vol. 23, no. 5, pp. 2113–2132. http://dx.doi.org/10.1016/j. chb.2006.02.007

Krueger, R.A. and Casey, M.A. (2000) *Focus Groups: A practical Guide for Applied Research*, Thousand Oaks, CA: SAGE.

Kvasničková Stanislavská, L., Kvasnička, R., Kuralová, K. and Margarisová, K. (2014) 'Social Responsibility of higher educational institutions – The students' view'. 11th International conference on Efficiency and Responsibility in Education 2014.

Mainardes, E.W., Alves, H. and Raposo, M. (2010) 'An Exploratory Research on the Stakeholders of a University', *Journal of Management and Strategy*. vol. 1, no. 1, http://dx.doi.org/10.5430/jms.v1n1p76

Melé, D. (2008). 'Corporate Social Responsibilities Theories', *The Oxford Handbook of Corporate Social Responsibility*. New York: Oxford University Press. http:// dx.doi.org/10.1093/oxfordhb/9780199211593.003.0003

Michael, S.O. (2004) 'In search of universal principles of higher education management and applicability to the Moldavian higher education system'. *The International Journal of Educational Management*, vol. 18, no. 2, pp. 118–137. http://dx.doi.org/10.1108/09513540410522252

Murray, K.B. and Vogel, C.M. (1997) Using a Hierarchy-of-Effects Approach to Gauge the Effectiveness of Corporate Social Responsibility to Generate Goodwill Toward Firm: Financial versus Nonfinancial Impacts. *Journal of Business Research*. vol. 38, no. 2, pp. 141-159. http://dx.doi.org/10.1016/ S0148-2963(96)00061-6

Mustafa, S.A., Othman, A.R. and Perumal, S. (2012) 'Corporate Social Responsibility and Company Performance in the Malaysian Context', *Procedia - Social and Behavioral Sciences*, vol. 65, pp. 897-905. http://dx.doi.org/10.1016/j. sbspro.2012.11.217

Park, B.I., Chidlow, A. and Choi, J. (2014) 'Corporate social responsibility: Stakeholders influence on MNEs' activities', *International Business Review*, vol. 23, no. 5, pp. 966-980 http://dx.doi. org/10.1016/j.ibusrev.2014.02.008

Steinerová, M., Václavíková, A. and Mervart, R. (2008) Společenská odpovědnost firem, průvodce nejen pro malé a střední podnik. Praha: Business Leaders Forum,

Trapero, F.G.A., Lozada, V.C.M. and García, J.G. (2010) 'Consumers and their buying decision making based on price and information about corporate social responsibility (CSR). Case study: Undergraduate students from a private university in Mexico', *Estudios Gerenciales*. 2010, vol. 26, no. 117, pp. 103-118. http://dx.doi.org/ 10.1016/S0123-5923(10)70136-4

Trnková, J. (2004) *Společenská odpovědnost firem – kompletní průvodce tématem a závěry z průzkumu v ČR*, Praha: Business Leaders Forum.

Vasilescu, R., Barna, C., Epure, M. and Baicu, C. (2010) 'Developing university social responsibility: A model for the challenges of the new civil society', *Procedia Social and Behavioral Science*, vol. 2, no. 2, pp. 4177-4182, http://dx.doi. org/10.1016/j.sbspro.2010.03.660

Veisová, E. (2009). Možnosti a dusledky kombinace metod v sociologickém výzkumu se zretelem na metody focus groups a internetového výzkumu. Prague: PhD Thesis. Institute of Sociological Studies, Faculty of Social Sciences, Charles University, Prague.

Williams, J. (2002) The student satisfaction approach: Student feedback and its potential role in quality assessment and enhancement. Paper presented at the *24th EAIR Forum*, Prague, Czech Republic.

EFFICIENCY AND RESPONSIBILITY IN EDUCATION (ERIE) 2015

Conference Efficiency and Responsibility in Education 2015 is an international conference that is organized by the Faculty of Economics and Management, Czech University of Life Sciences Prague on June 4 - 5, 2015.

Conference topics

- Theory and Methodology of Pedagogy and Education
- Information and Knowledge in Lifelong Education and Training
- ICT in Education
- Applications, Practice and Experience
- Responsibility in Education, Ethical issues

All papers are submitted to a double-blind peer review process before publication. Based on reviewers' recommendation, the papers will be published in the conference proceedings.

The previous conference proceedings are listed on the Thomson Reuters ISI Index to Social Sciences & Humanities Proceedings (ISSHP) and the Thomson Reuters ISI Index to Social Sciences & Humanities Proceedings (ISSHP/ISI Proceedings).

Deadline for full paper submission is March 2, 2015.

Programme Committee

- Head: Jaroslav Havlíček, Czech University of Life Sciences Prague, Czech Republic
- Members:
 - o Peter M. Bednar, University of Portsmouth, United Kingdom
 - o Peter Fandel, Slovak University in Nitra, Slovakia
 - o Jana Hančlová, Czech Society for Operations Research, Czech Republic
 - o Irem Kizilaslan, Dokuz Eylul University, Turkey
 - o Piet Kommers, University of Twente, Netherlands
 - o Eva Milková, University of Hradec Králové, Czech Republic
 - o William O'Brien, Worcester State University, United States
 - o Karel Sladký, Academy of Sciences of the Czech Republic, Czech Republic
 - o Milan Turčáni, Constantine the Philosopher University in Nitra, Slovakia

Editors

- Igor Krejčí, Department of Systems Engineering, CULS Prague
- Martin Flégl, Department of Systems Engineering, CULS Prague
- Milan Houška, Department of Systems Engineering, CULS Prague

Conference co-editors

- Irena Benesova Department of Economics, CULS Prague
- Helena Brozova Department of Systems Engineering, CULS Prague
- Jiri Brozek Department of Information Engineering, CULS Prague
- Ludmila Domeova Department of Systems Engineering, CULS Prague
- Martina Fejfarova Department of Management, CULS Prague
- Tomas Hlavsa Department of Statistics, CULS Prague
- Martina Houskova Berankova Department of Systems Engineering, CULS Prague
- Jakub Husak Department of Humanities, CULS Prague
- Martina Kuncova Department of Economic Studies, College of Polytechnics Jihlava
- Pavel Michalek Department of Psychology, CULS Prague
- Lucie Severova Department of Economic Theories, CULS Prague
- Petra Sanova Department of Trade and Accounting, CULS Prague
- Pavel Simek Department of Information Technologies, CULS Prague
- Hana Urbancova Department of Management, CULS Prague
- Josef Pavlíček Department of Information Engineering, CULS Prague
- Kristyna Vltavska Department of Economic Statistics, University of Economics, Prague

Complete information regarding to this conference is available at the conference website http://erie.pef.czu.cz or you can contact us via the email address erie@pef.czu.cz.

Conference Fee

- Full conference fee: 140 EUR or 3800 CZK
- Reduced conference fee (for regular PhD students): 80 EUR or 2200 CZK

Conference deadlines

- 6th January, 2015 1st call for papers
- 2nd February, 2015 2nd call for papers
- 2nd March, 2015 Deadline for full paper submission
- 13th April, 2015 Results of review process
- 1st May, 2015 Deadline for final version submission
- 10th May, 2015 Notification of paper acceptance
- 18th May, 2015 Deadline for conference fee payment