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Aims and Scope

The Journal on Efficiency and Responsibility in Education and Science aims to publish perspectives of authors dealing with issues of efficiency and/or responsibility in education and related scientific disciplines. The focus is on topics such as:

- theory and methodology of pedagogy and education;
- theory and methodology of science;
- human resources and human relations management;
- knowledge management and knowledge engineering;
- systems engineering and information engineering;
- quantitative methods.

The journal accepts quantitative, qualitative and experience-based full research papers, short communications or review studies. Applications and case studies introducing and describing impacts of new theoretical approaches in real conditions of practical case are also accepted.

All papers passed a double-blind peer review process.

ICT CHALLENGES IN THE 21ST CENTURY BUSINESS ENGLISH UNIVERSITY CLASSROOM

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Abstract

Given the nature of the study, the objectives of this paper are to demonstrate practical approach to using ICT tools in teaching Business English to university-level students. By offering specific examples for efficient integration of selected technologies within undergraduate classroom the study concentrates on practical and yet motivated solutions to many issues faced by the university teachers and students within the teaching-learning process. The study explores the importance of establishing an authentic business context via the invaluable help of ICT tools. This authentic context facilitates smooth acquisition of language proficiency and multitude of other skills for students' future career use. Based on actual classroom teaching/research, this study demonstrates that meaningful use of ICT tools allows the 21st century Business English teachers and students to keep pace with the ever-changing business world.

Key Words

Authentic business context, business career, Business English, ICT, IWB, task-based learning, teaching-learning process

Introduction

Information and communication technology (ICT) has become a fundamental part of most organisations and businesses, an inseparable part of our everyday lives and many of our activities. Specific research into this sector, namely within Eastern (Central) Europe was carried out early on by Piet Kommers (2000), who recorded his findings in an article entitled "Information and Communication Technology (ICT) for Education: Research and Development for the Educational Integration of Technology in Eastern European Countries" (2000). This research was seminal as it brought to the forefront the need of integrating, via ICT, this portion of Europe into the whole of the continent for eventual social integration.

Since 2000, the infiltration of ICT into the sphere of the quotidian has only increased. Drowned in explosive amounts of information and new technology developments, the impact of such ICT tools on the teaching-learning process is enormous, bringing unprecedented perspectives and opportunities into the classroom. New technologies have the potential to support education across the curriculum and provide opportunities for effective communication between teachers and students in ways that before were not possible.

However, this potential may not necessarily be easily realised as Dawes (2001: 61) has underlined. The development of ICT at universities and its effective implementation into the process of education is an ever dynamic process, modifying and challenging the roles of both the student and teacher. Students' characteristics alter according to society's expectations, whilst education objectives are tailored to fit the more exacting requirements of inter-country integration, and thus, the overall process of education must also be modified accordingly.

This being stated, it is evident that ICT has been penetrating the teaching processes at universities, without consideration of any technophobic proclamations. Since the focus must be directed at new methods of teaching and/or implication of technologies into the teaching process, new competencies of teachers are also required and innovative technology integration processes must be defined, since inappropriate implementation of ICT may worsen educational - and ultimately societal - results

According to Anderson, J. (2009: 3), thinking about ICT means considering all the uses of digital technology that already exist to help individuals, business and organisations access and utilize information. The ICT abbreviation encompasses computers of all types (desktops, laptops, notebooks, iPods, and servers), as well as videos, CDs and DVDs, radio and television, printers, data projectors, interactive whiteboards, satellites, fibre optics, Wi-Fi, modems and routers, and a myriad of other network equipment and software that enables electronic mail, short message service programs, and video-conferencing telephone calls. ICT also embraces other accessories, such as mobile phones, digital imaging and sensing, global positioning devices, and a range of other tools. Finally, the term ICT covers a family of transmission technologies for voice-over-Internet protocol (e.g. Skype) together with technologies for computer-mediated social interaction and networking (e.g. Facebook, Twitter, MySpace, LinkedIn).

Transforming ICT into the educational domain, Barad (2009: 1) claims that the extensive use of web 2.0 and Internet components such as blogs, e-groups, e-dictionaries, e-encyclopaedia, webcasting, cyber cafés and mobiles could also be used by students to interact among themselves, as well as with the teacher. Language teachers should consider the extensive collaboration opportunities using word processing packages,

spreadsheets, search engines, and presentation software as basic elements within the teaching-learning process. Some of these tools are already integrated in e-learning, which has been described in great detail in a number of papers and which is especially beneficial in distance-learning and mixed forms of studies. Notable information can be found for example at Liaw's E-learning and the Development of Intercultural Competence (2006) or Business English Courses Online Support (Kučírková, Vogeltanzová, Jarkovská: 2011). The implementation of some of the above-stated tools and applications in language teaching and in the process of staying up-to-date is an increasingly demanding task for teachers, whose places of employment must provide new computer-enhanced language learning environments that will enable learners to pool their knowledge in effective ways (Barad, 2009: 47).

There are a number of different types of e-learning resources especially designed for Business English teachers and learners. Some ICT tools, such as on-line presentations, on-line videos, company web pages, other Internet sources, interactive CD ROMs and CDs (which usually accompany the course books) are already frequently used in Business English classes. Useful links can easily be found on-line at: www.besig.org, www.bized.ac.uk, www.bbc.co.uk, in addition to many others. Additional web-based language learning resources comprise pronunciation guides, e-dictionaries, e-encyclopaedias, etc. However it is worth noting that all of them must be consistently checked for their credibility, up-to-date aspects and overall attractiveness to learners (Sampath & Zalipour, 2009: 3). Even the latest examples of books, CD ROMs and CDs are oftentimes at least one year old, whereas credible examples from the Internet usually deal with up-to-the-minute issues. Barad (2009: 49) reminds teachers that they should not only be up-to-date, but sometimes even up-

to-the moment, given that the business environment changes increasingly quickly as Jeskanen-Sundström (2003) validated with his research. Generally, students are certainly interested in more than lifeless definitions of business terms; they want to experience the genuine business world. This encourages an authentic context within the lesson and, taking into account the business market of today in terms of worldwide expectations, it is almost impossible to establish an authentic business context without ICT tools.

Given the nature of this study, the objectives of this paper are to provide certain practical reasons for using ICT with the groups of Business English students, as well as sufficient reasons for larger, suitable integration of ICT tools into university-level classrooms. This paper does not aim to encompass the use of all potential ICT tools in the classroom, but instead focuses on selected communication technologies which can be used in the everyday contact of teachers/learners and mutually among learners; this, in turn, can partially fill the gap between the potential of technology and the trends still current in traditional classroom practices. Notably, the selected technologies are set in an entirely authentic business context within the classroom. By offering this type of an example-based framework, this paper concentrates on a practical and yet motivated solution to the multi-faceted issues faced by the university teachers who decide to implement ICT into their lessons. Various sources are used/suggested, as appropriate to intermediate university students, to encourage teachers to implement ICT into their teaching methods, in spite of the many internal and external barriers.

The methodology used to formulate this paper comprises a scholarly assessment of several methods used to deliver authentic business contexts for the students, thereby helping

them enhance the complete scope of their language skills (speaking, reading, writing, and listening) within the university context. This is followed by a description of their implementation in practice. Having established the observation research processes and explained the organization of the classes, a cohesive integration of new language skills and other external language measures are offered. All of the described procedures have been tested in the classroom, as evidenced by the number of students, genders, ages, professional goals, etc. Subsequently, this paper provides a methodological discussion of the strengths and limitations of ICT implementation into teaching Business English, including those faced by both the teacher, as well as the student, before offering various solutions to specific classroom situations. Special attention is given to the presentation of effective strategies and practical approaches to establishing authentic business contexts for the learners. Finally, the scholarly results are summarised with a reflection on the importance of sensitive ICT integration into Business English classes, considering the barriers which are likewise discussed.

Material and Methods

This paper reviews the practices of integrating ICT into Business English lessons for undergraduates who have little or no experience within the professional business world. (Their prior experience to taking this course may have consisted of an internship for a term, etc.) The term 'Business English' is used to cover English taught as a second language to a range of full-time and distance-learning students who intend to work in the business sector. According to Thornbury (2006: 26), "Business English is distinguished from general English by its more specialised vocabulary and its more narrowly defined field (e.g. banking, trade, and manufacturing). Teaching Business English

involves coaching learners in such business skills as speaking on the phone, giving presentations, conducting meetings and negotiations, etc."

This paper focuses on several teaching methods which incorporate the above-stated widely-used ICT tools into Business English lessons. The research concentrated on the enhancement of the students' speaking/communication and writing skills. Via several exercises and projects, students experienced video-recorded presentations, video-recorded brainstorming session and on-line stock market demo-trading. Improving their competence in writing skills, the lessons emphasized acquiring conceptual, linguistic, morphological and syntactical knowledge concerning special documents, such as CVs, emails, memos, reports, etc. Students compiled 'real time' written documents and collective reports. Most of the activities were smoothly and flexibly presented with the support of an interactive whiteboard (IWB) and special attention was given to the creation of a real business context for the teaching-learning process. The specific aims of this Business English course, as further explained below, were to improve the students' abilities in communicating in English within a wide range of business situations and enlarge their knowledge of the business world. Students' familiarity with essential business vocabulary and grammar was built up, based on resource materials from the actual business market, using topics of high interest to everyone involved.

The methods and subsequent results analysed below were tested over the course of four full-length university semesters at the University of Finance and Administration in Prague, Czech Republic. Class sizes varied from 10 to 15 students, included both genders (however the majority were male - 75 %) and covered an age range of 19 – 30 year olds. The total number

of students was 120. The courses were aimed at both full-time and distance-learning students. Most of the students were native speakers of Czech; however some of them came from multinational backgrounds (including Russian, Ukrainian, Kazakh and Vietnamese families). The Business English course in which use of ICT was incorporated was a required course for the B.A. degree majors in Company Management and Finance, Marketing and Communication, Banking, Insurance, Public Administration, Public Finance, and Applied Informatics. Thus, it was clear that the students' career focus would strongly benefit from these especially-developed lessons of Business English and their motivation was consequently solid.

Moreover, in order to validate the improved student motivation, a survey was taken before the start of the course and at the end. Answers were given in multiple choice format, where appropriate, and in written sentences elsewhere.

Video-recorded presentations and brainstorming sessions

The following two samples of extensive use of ICT have been designed to extensively practice all of the language skills within authentic business contexts. The first project asked the students to prepare interesting presentations comparing two companies from the same industry (e.g. McDonald's and KFC, Apple and Microsoft, IBM and HP, Société Générale and Erste, Allianz and AXA, etc.). The actual web pages of selected companies were presented. Use of IWB supported such Internet presentation efficiently. Fundamental web page items were saved in an appropriate format (to be used on the IWB). Thus, essential vocabulary could be highlighted, whilst synonyms and opposites, delivered by the students themselves, could be written directly into the presentation during the lessons. This active participation in the dynamic lesson made for considerable student enthusiasm. Many business topics were discussed and related vocabulary was practiced (company establishment, objectives, missions, organisation charts, brands, product portfolios, logos, business development, branches, employees, marketing mix, advertising methods, mergers and acquisitions, credit and debt, investment banking and commercial banking, issues affecting public versus private companies, business strategies, and other business-related plans). The presentations required both reading and researching of on-line documents prior to a required class delivery of the research (5-7 minutes in length). The presentations were video recorded, the aim of which was to preserve the learner's performance for analysis and correction of both language and presentation skills. In the first instance, the students had to overcome any initial feelings of embarrassment or self-consciousness. Such challenges unambiguously contributed to the authentic business context, as business students would certainly face similar situations in their future careers. Once the confidence of the students was reinforced, the method provided "excellent feedback about language performance and competence" as Lonergan also experienced (1984: 113). Later, the recordings were reviewed and commented on by both the teacher and the students themselves.

In the second video-recorded project, the students were asked to run a brainstorming session on reducing company costs in the upcoming year. Students were given substantial data on the companies from their publically-available annual reports which was further simplified and adjusted by the teacher to fit the students' knowledge of business vocabulary. However, the simplification was kept in perspective as a means of leaving enough challenging material for them in terms of vocabulary

increase. Students were requested to diagnose problem areas and contribute any spontaneous suggestions and ideas during the session. The brainstorming session was also recorded on video. The exercise focused on spur-of-the-moment, natural communication: speaking/debate skills, expressing agreement and disagreement, talking about varying points of view, reporting what others say, talking about meanings/nuances, drawing conclusions, giving reasons and offering explanations, phrases of interruption, language of comparison, language of cause and effect (Lustigová, 2011: 25).

Both video recorded activities were implemented into the teaching plan twice, once at the beginning and once at the end of the academic year. Since the recordings were preserved for analysis and correction, significant improvements were observed by comparing both versions. The video material also provided a model for business language use, with several key structures subsequently highlighted via language analysis. Both the comparison and the analysis were carried out by the teacher after the first and second implementation. The presentation skills, in and of themselves, were likewise commented on by the students, making the evaluation process an integral part of the language teaching-learning process within the class itself. The most obvious features of feedback concerned pronunciation, choice of lexis and errors of syntax. This business-oriented project also brought the opportunity to practice grammar, vocabulary, use of appropriate register, synonyms, fluency of speech and accuracy, etc. Students consolidated their language skills, practiced speaking, developed a tactful approach to opinion expression and enjoyed the process along the way. The ongoing discussion of the approaches and language structures contributed invaluably to the practice of speaking / communication skills for eventual frequent use in the students'

business careers. It was observed that if the process was to be worthwhile, the following principles needed to be maintained: the aim defined and strictly adhered to, the feedback immediate; and the evaluation selective, yet sympathetic. According to Lonergan (1984: 116), selectivity and sympathy implies that comments should only be focused on things which merit attention and should be made in a friendly, constructive manner. The learners indeed had the opportunity of seeing what was filmed as soon as possible and there was enough time devoted to feedback, otherwise this major learning component would never have been fully accessed.

'Real time' written documents

Effective utilisation of ICT was chosen as the medium for practising writing skills. Teaching modern forms of communication from 'real time' letters, instead of elaborating on artificial letters covering imaginary topics, once again reinforced the authentic business context. Email was used as the medium to send CVs, motivation / covering letters, memos and business letters. Emails were sent directly from the classroom to the actual companies. Two similar projects were applied for practising Business English writing skills.

The first project focused on the recruitment and selection process. Students were encouraged to search through English servers to look for actual advertisements of part-time students jobs which interested them. The main websites which were used are the following: http://www.jobsite.co.uk/, http://www.monster.com, and http://engineers-international.com. Oftentimes the websites presented many tips for preparing a resume, applying for a job, writing application letters and preparing for job interviews. Many samples of the said documents were also posted. The advertisements and additional material gained from the web

sites were presented via IWB in the classroom, followed up by lexical and syntactical analysis. Special attention was given to the choice of proper register.

Afterwards, students were then asked to draft their own CVs and covering letters, keeping in mind the actual positions for which they were applying. Naturally, several sample fictive CVs and covering letters were provided for them as reference tools. Such settings established a genuine environment and the students were exceedingly motivated to deliver documents which corresponded to the actual situation. The students' drafts were projected via IWB in the classroom, whilst major lexical and grammatical insufficiencies were discussed and corrected. These drafts provided enough material for further practice of vocabulary and grammar structures. At the end of the day, covering emails were drafted collectively and sent to the actual recruitment companies with the help of a GPRS connection to the Internet. Any replies received were discussed in the classroom. The delivered texts were used during the lessons to practise the structuring of a business letter and the type of language used. Typical vocabulary and grammar structures were learned and repeatedly practised using this method. Such actual communication between the students and the companies allowed the students to thoroughly understand the topic, ask the relevant questions of the company and of the teacher, as well as acquire the accompanying essential skills in a much more efficient manner, rather than simply reading letters printed in textbooks. The following would be a typical advertisement chosen by the students:

Telesales - Ringwood - Full & Part Time

About the Job

Telesales Advisor
No experience required

Full time hours will be 12.30 - 8.30 Monday to Friday + one weekend day every other week
Part time hours are flexible but must be a minimum of 15 hours per week ideally covering the hours of 9.30am - 12.30pm 3 days per week plus either a Saturday (9.00am - 5.00pm) or Sunday (10.00am - 4.00pm)

Duties will include new business sales, research and data entry, £6.50 per hour plus bonus.

Bond Williams Professional Recruitment is an equal opportunity employer and operates as an Employment Business and Recruitment Agency

(Retrieved on March 21, 2012 at http://jobview.monster.co.uk/Telesales-Ringwood-Full-Part-Time-Job-Ringwood-South-East-Southern-UK-108023317.aspx).

The latter project centred on claims or requests sent to genuine e-stores abroad. The majority of the students had had prior experience with international e-stores and were thus asked to think about 'actual' problems, inquiries or complaints that they might had encountered. Students mentioned the problems related to customs and processing fees and after-sale service of electronic items, among others. The topics were discussed in the classroom setting, thereby training business vocabulary substantially. The students then drafted their complaints in email and SMS formats during the lessons and all of them were sent directly to the authorised departments of the actual companies. The drafting of replies was carried out in small group format so that the students could help one another improve and function as a second layer of mutual control, after the teacher's primary checking role. Again, mostly auto-replies were received, however, some of the problems were indeed solved and it was a moment of great satisfaction. The

communication with the companies generated enough written material to be discussed and analysed within the lessons with the support of IWB.

Webquest - collective report writing using Google Docs

Students were assigned the task of writing a collective report on customer satisfaction in the field of mobile telephone providers. The educational task was assigned in a form of webquest, carried out by means of the Internet. As Thornbury (2006: 244) states, "the aim of a webquest is to focus on processing information rather than simply copying it, and thereby to encourage analytic thinking and synthesise information." All of these are skills which will be required of the students as they progress into the work world.

Substantial time was devoted by the teacher to instructing the students, prior to accomplishing the given task, how to write short, simple reports and the style and language appropriate to them. Again, IWB became a vital tool for practising and viewing the examples of actual reports, enabling active work with the document. The sample documents were read collectively, which lead towards better comprehension of report concepts and helped for the acquisition and understanding of essential vocabulary and grammar structures. It also allowed for those students who were less comfortable with the writing process to acclimatize to the task at a more personal pace, further developing cognitive reading skills. Later all the students were given the main source of data at http://www.czso.cz/csu/redakce.nsf/i/mobilni_telefonni_sit. This authentic business context used up-to-date data which was saved in word processing format for the students to comment on at a later time. For the purpose of collective report writing, the documents were shared by selected students and the teacher via Google Docs

(an on-line service provided free of charge by Google: http://www.google.com/google-d-s/tour5.html [Košťálková, Králová, Lorenc, 2010: 51]). This enabled fast cooperation in 'real time' by sharing the documents on-line. The documents could be edited from any computer or smart phone with an Internet connection. At the same time, the students contributed to mobile providers' research data by adding more actual information which they downloaded from different websites, cross-checking for accuracy. Students were assigned different roles – report administrator, report owner, etc. These roles could be changed during the entire process. After generating enough data, the students were asked to elaborate their collective report on customer satisfaction in the field of mobile telephone providers. The teacher's role was not limited to monitoring overall, but instead also concentrated on commenting on the students' work throughout the process and in this manner supported the students' development. It was noted that the students acted responsibly and accepted the team project aspect, fulfilling their inseparable roles within the team. Moreover, Google Docs enabled efficient cooperation, without any necessity of sending emails with attachments back and forth. Current versions of the students' presentations were projected on the IWB in the classroom, permitting the related speaking / communication / discussion skills to be practised. 100% of the students were engaged in the project. Generally, the students were enthusiastic and offered insightful and appropriate comments. They also enjoyed being able to add their input in 'real time'. Besides the many language learning benefits, this project utilized the same practice as in many companies, in this manner also enhancing the authentic quality of the task and offering an opportunity for the students to gain additional soft skills, imperative for their future business careers.

On-line stock market demo trading

One of the most exhilarating parts of teaching Business English for both the teacher and the students is the portion devoted to share capital, securities, trading on the stock market, derivatives, etc. Firstly, the method of term definition and explanation was employed to allow all the students to launch from the same platform of understanding. To accomplish this, the students were required to read a great deal in home preparation. Eventually, an authentic business context was created as the students and teacher registered with the website of an on-line stock market demo trading which simulates trading securities. The site http://www.xtb.co.uk/ was used with great success. This demo version was free of charge and soon the students grew in their enthusiasm about trading on a regular basis. As the trading progressed, the students were sent reports about their standing on the market by the demo-trading provider. A common spreadsheet was elaborated in Google Docs and all the results, both gains and losses, were continually listed there. Students were required to access the spreadsheet whenever they received new data from the website. The students' profits and losses were openly discussed in the classroom, founding a friendly atmosphere of competition. Enough teaching material was likewise generated to provoke realistic debates on the reasons for the profits and losses, optional solutions, future strategies and the interpretation of graphs based on the actual data of individual students. Students gained adequate vocabulary related to the above-stated issues, whilst practising the reading of figures, and ultimately, their skills of describing financial trends improved enormously. Discussions were often held in groups. For efficient discussions, small groups of 2-3 turned out to be ideal, requiring even the quiet students to contribute to the dialogue process. The group members were either assigned by the teacher or the students determined the groups by themselves. For such activities, the groups were systematically rearranged "so that the students could cooperate with dissimilar people, learn to test their own opinions on a variety of people and be open to different ideas", as outlined in (Lustigova, 2011: 21).

Results

This paper has demonstrated the applied methods and strategies of creating a genuine business context for intermediate students of Business English with the help of ICT. The above-described and documented scholarly work confirms that ICT provides a powerful environment of learning tools, in turn encouraging the students themselves to be interested and actively involved in the teaching-learning process. Implementing ICT in Business English classes is relatively straightforward as business students are quite receptive to technologies. Overall, the results of meaningfully merging ICT into the classroom produced students who were noticeably more confident and capable of supporting their own language-based success, as well as a classroom where learning was made tangible. By using ICT tools which focused particularly on language use, Business English was able to be exploited in the classroom to both the challenge and the interest of the learner and teacher simultaneously. As the students developed communicative competence in Business English, the teacher directly benefited from a more interactive classroom atmosphere and new perspectives were shared by all.

Using ICT tools, such as IWB projection, aided the students' sensory perception: they could listen, read and see the material at the same time. Since there are various types of learners (auditory, visual, kinaesthetic, etc.), the teacher could more appropriately address the various needs of the diverse learners

with the help of ICT (Barad, 2009: 55). Students using all of these three senses at the same time tended to increase their proficiency without difficulty. Important in terms of classroom fluidity, the specific projects described above in the Material and Methods section could be used only with a lower number of students in a class (up to 15). Any attempt to assign such projects to larger groups proved unwieldy in terms of classroom time, teacher guidance and student/teacher feedback.

By and large, the students improved their proficiency in understanding professional texts, compiling their own reports, writing business letters/covering letters/emails and developing CVs of excellent standard, all of which could be used in their future careers with small adjustments. Taking into account the four language skills, the students manifestly improved their speaking, writing, reading and listening skills, as was evidenced within the classroom and enhanced performance in written homework, oral consultation sessions, exams throughout the year (for example, vocabulary tests, and other oral and written activities during the semester also demonstrated a sufficient increase of gained knowledge) and year-end exams. The students equally benefited by improving their critical thinking skills, in addition to gaining multiple soft skills for future career benefit.

Furthermore, the ICT tools contributed to the enormous motivation of the students. 100% of the students participated in most of the activities, which was not always true when regular homework from their textbooks was assigned. As the course continued, some students also took it upon themselves to specifically request using certain tools or a repetition of projects which they had enjoyed. This correspondingly encouraged some students to apply similar practices, even outside the classroom (e.g. sharing documents, on-going on-line stock market demo trading, etc.).

In order to validate the improved student motivation, two surveys were taken, one before the start of the course and one at the end. The survey was meant as an indicator of original motivation versus end-course progress and included the following questions, among others:

- What motivated you to take this course?
- If any, what is your previous experience with ICT?
- Do you feel that your career will be influenced by ICT? Why – why not?
- Evaluate to date the positive influence of ICT use during the lessons on your career prospects.
- Evaluate to date any potential negative influences of ICT on your career prospects and Business English lessons.
- How do you think that ICT use can be further developed in the lessons to help students?

Students were given sufficient time to respond to the question and were encouraged to ask for help from the teacher in expressing themselves, in case of any difficulties. Answers were given in multiple choice format, where appropriate, and in written sentences elsewhere. Several examples of answers furnish evidence of initial- versus post- student motivation (for the purposes of this paper, only a few selected answers written in sentences are listed):

- 'I took this course because of course requirement and because it was recommended by another student from last year.'

- 'This course seemed more interesting than a normal business English course, we can use computers and I am handy with technology.'
- 'I did not have much experience with ICT. The school I come from did not have the money to purchase the tools, so I was not sure if I would enjoy this method or even understand what I should do. However, I enjoyed every moment of the course and I believe it helped me a lot to be better prepared.'
- 'After this course, I believe that ICT will influence my career – maybe for the good and bad. But at least, I feel better prepared.'
- 'It is difficult to stay updated; however, the business lessons helped a lot.
- 'I see that ICT is going to be a big influence for me, but I hope that I am able to keep a personal approach to the consulting cases.'
- 'It is hard to know how technology will develop. It seems that it is often used just because it exists, not because it is actually helpful. Nevertheless, I within this actual course I found very exiting to solve the real business problems within the real company context. And the used technologies were really necessary for the task we were assigned.'

In addition to the survey results quoted above, attendance over the term of the course improved dramatically. Given that the answer to the first question listed above for course motivation was primarily 'course requirement', the enhanced attendance from an initial 70% to 98% was understood as direct proof of student interest in the subject matter, teacher presentation/ use of ICT tools and student motivation towards future career prospects.

It was observed that if the process of implementing ICT into the classroom is to be beneficial for both the teacher and the students, then there are several principles that should be maintained:

- the activity's pedagogical aim must be defined and strictly adhered to
- once the activity's aim is defined, it is key to determine if ICT makes a significant difference or not in the learning process (if ICT is not determined to be valuable, then either another pedagogical aim should be established or ICT should be used at another time, i.e. nothing forced)
- acclimation time – some students are more geared towards technology than others – the teacher himself/herself needs to have patience accordingly – for those students who are gifted in technology, additional tasks (within the project itself) can be assigned on an on-going basis
- the feedback for the students should be immediate
- enough time must be allocated to feedback, otherwise the educational results deteriorate
- the evaluation of the students' work should be selective and sympathetic
- the teacher must be well-prepared and confident in using the ICT tools (i.e. ICT tools should be tested in advance of the lessons)
- the teacher must be convinced himself/herself of the importance of using ICT in the classroom as Bingimlas (2009: 242) argues – only once the teacher is convinced, will the students themselves also begin to see the corresponding value

Ultimately, the classroom research for the course under discussion proved that the teacher's role changed pointedly in such projects, as Anderson comments (2010: 15). He argued that the teacher must be keen to fulfil multiple roles at the same time – that of learning facilitator, collaborator, coach, and co-learner. Concurrently, the learners were given more options and responsibilities for their own learning. They became active participants in the teaching-learning process, learning to collaborate with others. It was observed that "in the classes where ICT was routinely used, students were likely to participate in virtual excursions and be active researchers", as claimed in Anderson (2010: 16).

Discussion

Strengths of ICT promotion in Teaching Business English

The use of ICT in the classroom is no longer a choice; today it has become a necessity. This is especially true in teaching Business English students. They are acutely attuned to new approaches and generally interested in learning to manage certain technologies to their own future success. ICT enables an entirely authentic business context to be constituted early on within the lessons, thus simulating the actual environment of business companies which students will join in the very near future. According to Bingimlas (2009: 236), "traditional educational environments do not seem to be suitable for preparing learners to function or be productive in the workplaces of today's society". The classroom-based research for this paper proved that wisely used technologies have a measurably positive impact on the improvement of students' language skills, various soft skills and on the delivery of objectives required by the curricula.

Thus, it was proved that receptivity of students to chosen ICT tools were more than satisfactory.

As stated in Barad (2009: 48), "business students are much more receptive in using technologies. This receptivity of commerce and management students helps the teacher to go beyond the horizon in experimenting with innovative practices in the classroom." The above-described research for the course under discussion experimented with video-recorded presentations and brainstorming sessions, 'real time' business letters, collective report writing, and online stock market trading. All these activities provoked attention, motivation and the ultimate active participation of the Business English students and prepared them for actual workplaces at business companies.

Lewis (2009: 54) claims that the great advantage of using online tools in the classroom is their accessibility, possibility of language level choice and the appropriateness of the tasks according to the focus, experience and age of students. Within the research, these components were thoroughly considered by the teacher when the tasks were set and assigned. In several cases, it proved to be important to verify the accessibility of online sources before the lesson. Functioning and suitably selected on-line tools supported the establishment of genuine business contexts. If authentic background materials and documents were to be used (in collective report writing, presentations and brainstorming sessions), some of their parts had to be adjusted by the teacher and used in an off-line mode to better correspond to the students' current knowledge of the subject matter and their language proficiency. This necessitated a certain amount of extra preparation time outside of the classroom.

Using ICT tools in the Business English lessons facilitated task-based learning, as the learners are given opportunities to use the full range of language skills they have at the given

time, according to Lindsay and Knight (2006: 24). The benefits of task-based learning were especially obvious in collective report writing. Within this project, as commented extensively above, listening, reading, writing and speaking skills were engaged. Moreover, the pre-tested teaching methods, which used different technologies, facilitated the acquisition of many important soft skills: presentations, discussions/debates, collaboration and team-work, capability of being sensitive and considerate, constructive criticism, etc.

The research for this study proved that ICT enables a unique mixture of learning styles to enter the Business English language classroom. The teacher is challenged to identify these learning styles and then likewise has the opportunity to choose the best ones to suit the needs of individual learners. This is reinforced in the research of Lewis (2009: 86), "There is a strong correlation between student learning styles and technology option". Within the classroom tested techniques of the course under discussion, the following results were observed:

- logical thinkers benefitted from the on-line polls and surveys
- visual learners enjoyed projects based on the video recording of presentations
- learners with a strongly reflective side found collective report writing, as well as the feedback sessions, stimulating
- social learners liked the compilation of 'real time' emails and other social networking facets of the business projects
- kinaesthetic learners benefited from the IWB-based exercises

According to Lewis (2009: 86), this relationship between learning styles and technology tools can be applied to any specific activity. However, such a selective approach cannot be always chosen as the teacher must work with the entire class, consisting of different types of students. Nevertheless, the different teaching methods based on the learners' needs, as described above, can meet the needs of most of the students, if the individual tasks within the projects are wisely assigned, distinguishing among learning types.

The success of the above-described projects benefited from the supportive use of IWB as a means of media interaction with the students. It was observed that IWB is highly beneficial for reviewing language, saving lessons, modelling presentations, and audio transcripts. It also supported the development of personalised content and the so-called heads-up learning style, as described in Sharma, Barret and Jones (2011: 10). These benefits, as actually tested in the classroom within the course under discussion may be summarized as follows:

- IWB helped to direct all eyes in the same direction towards the screen
- the texts could be seen, especially in writing exercises, allowing for the adjustments to be followed by all the students at the same time
- given the ease of changing what is projected on the IWB, the attention of the students was able to be maintained for lengthy periods of time
- overall, the IWB promoted collective learning and team-work, as students were required to absorb the same information and comment/constructively criticize as a group

It was observed that the IWB should not be overused or integrated into the lesson only as a powerful presentation tool as discussed by Sharma, Barret and Jones (2011: 11). The value of using the IWB remains in its audience mode. Within

this audience mode, the interactive features of IWB brought much better value to the lesson and to the individual learners as the multi-sensory character of the board appealed to various learning styles (visual, audio, physical), as noted by Lewis (2009: 33).

ICT-Integration Challenges and Suggested Solutions for the Business English Classroom

Despite all of the above-mentioned worthwhile results in terms of Business English lessons, a second set of potential challenges is also engaged, as faced by the teacher who decides to implement ICT in the classroom:

- the teacher's thorough preparation
- the teacher's sensitive involvement in the teaching-learning process
- the teacher's potential low competence in ICT use
- the teacher's potential technophobic aspect
- lack of adequate technical support
- lack of adequate funding for ICT tools and/or technical support
- lack of adequately-funded teacher training opportunities for ICT projects
- lack of time for such training (as stated above), given outside time constraints
- the students' limited knowledge
- the students' various language capabilities
- the students' various levels of technology proficiency

To overcome time constraints within the lessons, the teacher must be well-prepared and devote enough time to lesson preparation to feel confident in applying the above-described tasks within the Business English lessons. All the tasks must be tested in advance. The accessibility of the web links must also be verified prior to the lessons. The teacher's competence can be further enhanced by providing sufficient teacher training opportunities for ICT projects where the teachers can gain additional knowledge about ways of integrating ICT for curriculum enhancement. Teacher training can also be complemented with intensive self-study, as well as research from/discussion of other teachers' experiences. It is likewise valuable for the teachers to have access to the necessary technology at home which eases the out-of-classroom preparation process. Furthermore, even though the teacher is enthusiastic about using ICT in his/her lessons, he/she might experience lack of ICT department support at the place of employment. The place where the teacher works should have a proper infrastructure with a constant power supply and high-speed Internet connectivity. Finally, the listed barriers can only be overcome if the place of work makes ICT integration into the education and language-teaching process a priority.

Another barrier of efficient integration of ICT into Business English lessons might be the students' unwillingness to experiment with technology in terms of language learning. This can be solved by partial integration of ICT, in combination with other more traditional classroom practices. For example, within the course under discussion, the large majority of students were geared towards technology prior to their participation in the class; however, approximately 5% needed additional time to acclimate. This was accomplished by assigning (to the entire class) a series of short and specific articles for home preparation on the importance of ICT within the business environment/future career. The level of language within the articles, which complied with the language capabilities of the

students, was equal to that of the on-line texts. If the download text was too complicated, it was first modified by the teacher. Home preparation was followed by in-class discussions over the period of a week, 15 minutes at the start of each lesson. During the discussion sections, the assigned articles were used in an offline mode with IWB support if needed. In terms of a conversation builder with business vocabulary, this preparation process proved crucial. It also allowed the less technology-geared students to ease into the idea of using ICT regularly in the Business English classroom.

If the group discussion session was not flowing as planned, the teacher separated the students into smaller groups or pairs and assigned a specific question to discuss about the article. This proved an easy method for the teacher to diagnose any specific problems faced by the individual students. After an article was analysed as the subject of group discussion, the students were called upon to answer questions in terms of their own capabilities.

In addition to the above-mentioned challenges, Bingimlas (2009: 237-241) defines other barriers to the successful integration of ICT in the teaching and learning environments: lack of teacher confidence and competence, resistance to change and negative attitudes, and lack of accessibility of sources. However, these were not experienced within the course under discussion. Teaching/research in ICT tools integration would not have been possible without sufficient levels of confidence, training, and preparation to improve the desired skills and competencies of the students. The accessibility of standard ICT sources, such as computers, data projectors, and interactive whiteboards are, in large part, well facilitated at universities today. The same

applies for good quality software and fast Internet connections. However, a lack of flexible technical support, as described earlier, was indeed experienced in various cases.

Conclusion

This present study aimed to research selected ICT-driven tasks into the process of teaching Business English via the establishment of an entirely authentic business context (video recording of presentations, elaborating 'real time' written documents, collective report writing in Google Docs and on-line stock market demo trading). As the students felt increasingly motivated by the 'real' environment and the combination of multiple approaches which suited different types of learners (kinaesthetic, visual, logical thinkers, social learners), both the students and the teacher found the teaching-learning process beneficial and highly effective. The study also indicates that insisting on an authentic business context brought substantially increased positive effects, far beyond the simple improvement of the students' language skills. Although these ICT tools were tested within a Business English classroom, with purposeful modification they can be potentially applied in most ESP (English for Specific Purposes) classes.

Since technology has transformed from a choice into a necessity, the considerations of how to implement technology into the classroom should be made with the utmost attention, maintaining the ultimate language learning goal in focus, as Lewis (2009: 89) states. With each use of ICT, there needs to be a defined language component as the target of the session. Furthermore, ICT must be looked at critically and the best tools selected wisely and thoughtfully. Even though there are certain barriers linked with ICT integration into language teaching, the teachers should not be technophobic, but instead continue

experimenting in this unlimited space of freedom, as the benefits of new approaches to the teaching process correspond with the current thinking of young learners.

In the university context, the traditional educational environment and curriculum must keep abreast of the learners' needs for eventual work positions after the university years are finished, as the students need to "function in the workplaces of today's society" (Bingimlas, 2009: 236). Within the context of teaching Business English, the students themselves must become knowledgeable, able to collect and analyse information, communicate and collaborate. All these skills are gained as a side effect of efficient and sensitive integration of astutely chosen ICT tools into the Business English lessons. Along with the many soft skills acquired and the collaborative team spirit established, the students develop their capacities for technology integration into their own lives/careers. As they learn to facilitate clearer thinking within the field of technology integration, the students can likewise more effectively contribute to society.

As educators seek opportunities for research and testing, the options in terms of choice for appropriate teaching materials will only increase (examples include, but are not limited to: systems of modular on-line units, cloud computing and mobile technologies). Other prospects for learning tasks within an ICT-integrated classroom may be the creation of class wiki sites, practising polls and surveys, chats, and using social networks, such as Facebook and Twitter. This final suggestion is supported by research which states that "Students spend up to a quarter of all their time online interacting with Facebook. Educators cannot afford to ignore such a major phenomenon," (Anderson, 2009: 9), but should instead harness the technology for learning purposes. Consequently, however, the students themselves may be termed 'smart learners' and can be polled for ideas of how they would like to see technology used to their own benefit. The fact remains that there are more students than teachers; as a result, the value of manifold perspectives can be coupled with teachers' increased research to increasingly excellent educational standards. Indeed, despite their inherent value, all of these ICT products and methods cannot substitute for genuine moments of learning and comprehension unless they are purposefully incorporated into the task at hand. Information and communication technologies must remain the tools of the teacher to aid students purposefully in being more productive in the teaching-learning process.

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RESEARCH ON WILLINGNESS TO STUDY NURSING, EDUCATION AND SOCIAL WORKS AMONG SENIOR MALE STUDENTS IN VYSOCINA REGION

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Abstract

This paper summarizes the results of the research that centered on the decision-making process of senior male students in the Vysocina Region for a field of study on a higher education institution. The survey was administered to male students in their last year of the high school who were enrolling for the first time. The focus of the research was on the choice factors. The particular aim was to find out whether the male students were considering as their field of study nursing, education and social works; majors that are traditionally dominated by women. Spearman's rank correlation coefficients were used to measure statistical dependence between choice factors and the tendency to choose ‚female profession'.

Key Words

Senior male students, major choice, Vysocina Region, Spearman's rank correlation coefficients

Introduction

Higher education institutions in the Czech Republic are facing increasingly complex challenges, which demand deeper understanding of the sources prospective students use when applying to a college or a university. Currently the Czech system of higher education comprises of twenty–six public universities that offer a wide range of study fields within bachelor, master and doctoral study programmes and two non-university public institutions of higher education which provide bachelor study programmes only. The sector also includes fourty–six private higher education institutions.[1] The number of colleges and universities has rised dramatically. In 2000 the system of higher education in the Czech Republic consisted of twenty–four public and eight private institutions. In the meantime, the demographic curves clearly indicate the stagnation of the size of higher education age groups. Political development seeking rationalisation of the higher education system is leading to managerial and funding challenges for higher education institutions. Overall, these factors intensify the competition and understanding the decision-making process of the prospective students is of extreme importance (Moogan, 2011; Hoyt and Brown, 2003).

The decision what university or college to attend has been characterised as a highly complex process that is subject to multiple influences. Studies in higher education are founded in several disciplines, including economics (e.g. Perna, 2008; Des Jardins et al., 2006; Avery and Hoxby, 2004), public policy (e.g. Dill, 1997) and sociology (e.g. Porter and Umbach, 2006; Menclova and Bastova 2005; Galloti and Mark, 1994).

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[1]   Data from academic year 2011/2012 (September), Source: Ministry of Education, Youth and Sports of the Czech Republic

Understanding how students make decisions regarding the college selection has led to the development of several student behaviour models. One of the most widely used models is Hossler and Gallagher's three-stage model (1987). The first stage is predisposition, in which students develop aspirations for college attendance, in the second stage they search for information about colleges and develop a choice set and as the third stage they choose the particular college.

The model draws simultaneously on the rational approach and the sociological perspective, providing a comprehensive explanation about the final choice (Hossler, Schmit, and Vesper 1999). Other representative combined models were proposed by Jackson (1982), Litten (1982) or Cabrera and La Nasa (2000).

Vrontis, Thrassou, and Melanthiou (2007) built on such contributions and presented a contemporary higher education student-choice model for developed countries. The model consideres both the sequence of the decision steps and various influences. These determinants include: (1) environment (general public policy and influences/media), (2) high school characteristics (e.g. social composition, quality), (3) higher education institutions (characteristics and actions), and (4) individual (customer and personal attributes). Using these models as a background, this study focuses on information search and choice factors.

Information search

Sources of information can be identified as internal - memory or knowledge from previous related experience and external - involves collecting new information from both personal and non-personal sources (Hawkins, Mothersbaugh, Best, 2009). Studies assessing students' information requirements and relevance have found that students tend to rely primarily on

information sources developed by the education institutions (e.g. brochures, leaflets, university websites). Soukalova (2009) made a research in the Czech Republic and found out, that the students when searching for the information about the fields of study at college or university rely the most on internet sources. The same results were shown in a study in Scotland (Briggs and Wilson, 2007). Simoes and Soares' (2010) findings revealed that Portugese students that chose the fields of health studies and sciences relied significantly on the university website as on an information source.

Cultural differences can be found concerning the importance of interpersonal communication. Soukalova's findings (2009) revealed that the second most influential source of information for the Czech students, when deciding about the field of study, is parents and friends (personal recommendations). Parental influences have been found to be among the highest predictors of a student's enrollment in college in the USA (Hossler, Schmit, and Vesper, 1999). In Portugal, according to Simoes and Soares' (2010) research, personal influences (family/current ABC University students) were the most important choice factor for only 8 % of the respondents. Briggs and Wilson (2007) state: *'Decisions are based on a combination of information available, word of mouth, perceptions and institution's reputation. Prospective students seek advice from social networks (e.g. friends/acquaintances, teachers) as well as from the formal sources.'*

A connection between preference for information sources and individual factors can be established. In particular, regarding higher education services, Vrontis, Thrassou, and Melanthiou (2007) identified several determinants of student behaviour, such as academic aptitude, gender and personality. Also, Briggs and Wilson (2007) found evidence of gender and discipline differences for information sources. Dolinsky's (2010) study findings suggested different communication strategies for males for some of the college-related attributes (job placement after graduation and financial aid).

Choice factors

Choosing which higher education institution to apply to is a high perceived risk decision, given its long-term implications on students' lives and careers. The selection is influenced by a broad range of choice factors. Literature does not provide any consensual and comprehensive group of choice factors, although various studies directly or indirectly approach the matter. Choice factors are dependent on the study's context. For example Kallio (1995) reports six categories of factors when selecting a graduate school: characteristics of the academic environment of the institution and its programmes, residency status, financial support, spouse considerations, the social environment of campus life, and work-related concerns.

We highlight the following choice factors according to their relevance to this study: parental influence, gender and economic crises (the influence of media reporting about the matter of and personal experience with unemployment in the family and among friends).

Lackland (2001) had suggested that sex-role reinforcement is the reason for gender differences in the major choice, explaining that women tend to choose disciplines like education or nursing because of their female gender role orientation. Kanter (1993) uses the theory of proportions in the social life to argue that the minority status within an organization reinforces traditional roles and places constraints on women. A relatively few number of women in, for example science and technical fields places high pressure on the few who have chosen those fields, resulting in greater likelihood of departure. Kanter's (1993) theory of

proportions can be used to explain the fact that in the Czech Republic, there is still minimum men who choose nursing as their field of study.

The economic crisis, a relatively new phenomenon of the environment, and its influence on the college or university choice should be taken into account. The most important surveys carried out in the field of higher education in the Czech Republic summarized by Minksova (2010) showed that the economic crisis as a factor influencing the decision-making process of the high school students considering their choice of the future field of study has not yet been deeply researched.

Materials and Methods

The aim of the research (conducted in March 2011) was to determine whether the male students in their last year at high school in the Vysocina Region considered as their field of study nursing, education and social works; majors that are traditionally dominated by women. The other aim was to find out if an economic crisis can be a factor that would make an impact on these students' choice. Whether they consider education, nursing and social works, the fields that are touched less by the economic crisis, and therefore can be considered as newly prospective fields.

Given this purpose, this study attempts to answer the following research questions:

1. What are the factors that influence the choice of the field of study of male students who are in their last year at high school in the Vysocina Region?

2. Is there any correlation between choice factors and the tendency to choose majors such as education, nursing and social works?

3. Do senior male students consider nursing, education and social works as their field of study?

This research followed a quantitative design and was carried out at selected secondary schools in the Vysocina Region in cooperation with the secondary schools´ management following preliminary discussions and their agreement. Due to the research objectives, the so-called non-comprehensive selection was performed, which requires investigation only at a specific sample of units. Only grammar schools, business academies and engineering schools students were included. High schools specialised in education, healthcare and social works were excluded, as their students had already chosen this field of study. After interviews with directors of high schools specialised in agriculture, automotive, graphics, arts and veterinary medicine, their students were not included in research either.

The research sample included 23 private and public schools, all of them located in the Vysocina Region exclusively, which represents 76 % of all the grammar schools, business academies and engineering schools (see Table 1).

Districts	Actual number of the chosen high schools in the district	High schools that agreed to participate in the research	Percentage
Havlickuv Brod	8	4	50%
Jihlava	6	6	100%
Pelhrimov	4	3	75%
Trebic	7	5	71.4%
Zdar nad Sazavou	7	5	83.3%
Total	32	23	76.7%

Table 1: Number of grammar schools, business academies and engineering schools in 2010/11

Source: Department of Statistics of the Vysocina Region and our own data

In 2010/11 the number of prospective respondents, i.e. male students that studied in their last year at a chosen high school (grammar schools, business academies and engineering schools), was 1231. The actual number of respondents was 386, which represents 31%. Students were distributed across the following types of high schools: grammar schools 216 (56%) and business and engineering schools 170 (44%).

The questionnaire consisted of 16 questions and was applied as an on-line survey to male students in their last year at high school in the Vysocina Region enrolling at a university for the first time. Directors of the high schools agreed that students would fill in the questionnaire in their classes. They were sent instructions and a web link.

The questionnaire was developed to identify students' choice factors and influences when applying to higher education institution and the choice of a specific field of study. The question "Evaluate the factors that influenced your decision regarding your future study" aimed at determination of the weight of factors that have played some role in the decision-making of respondents. This question was a matrix type, with a scale between 1 and 4 (1 = major influence, 4 = no influence). Factors that have been selected:

- The field of study currently offers career security
- Job prestige
- The field of study is currently „profitable"
- Distance of the place of study from home
- Financial demands of study
- Easy admission conditions
- My parents recommended this field of study
- My friends decided to study this field

Respondents were also asked to reply whether they considered the profession of:

- Nursery school teacher
- Elementary school teacher
- Secondary school teacher
- Nurse
- Social worker

Possible answers to these questions:

- Yes, I would like this occupation
- Considered, but chose another
- No

Based on these questions, a new ordinal variable was constructed: *„tendency to choose female occupation"*. This variable was created as the sum of values that replaced variants of answers: *Yes, I would like this occupation = 2, Considered, but chose another = 1 a No = 0*. These values were summed up for each respondent creating a variable that quantifies the tendency to choose a female occupation.

This variable varied within the interval from 0 to 7, which means that some respondents chose the answer Yes, I would like this occupation more than once. In these cases, it was a combination of the fields of study that is possible to study simultaneously. Only one student chose all five possibilities, and his answers were excluded from the analysis.

Spearman's rank correlation coefficients were used to measure statistical dependence between choice factors and the tendency to choose ‚female profession', using software STATISTICA 11.1. Spearman's rank correlation coefficient is a non-parametric measure of statistical dependence between two ordinal variables (Zar, 1974). It is based on individuals rank numbers. Individuals are ranked by size according to both observed variables. Each individual is connected with the pair of rank numbers: Q (rank number according to the first variable X) and R (rank number according to the second variable Y). For n observed pairs from the sample we set Spearman's rank correlation coefficient using the rank numbers difference $d_i = Q_i - R_i$ (Zar, 1974):

$$r_S = 1 - \frac{6 . \sum_{i=1}^{n} d_i^2}{n . (n^2 - 1)}$$

In case of rank numbers concordance all values $d_i = 0$, thus $r_s = 1$. In case of rank numbers reverse $r_s = -1$. In other situation of rank numbers discordance Spearman's rank correlation coefficient takes values from interval between these two boundary numbers:

$$-1 \leq r_s \leq 1$$

For the values of r_s near 0 we can consider that rank numbers R and Q are ordered randomly and there does not exist any dependence between variables X and Y.

Next step of Spearman's (rank) correlation coefficient calculation is the significance test of this coefficient. We set null hypothesis: H_0: $r_s = 0$ and if the test p-value exceeds 0.05, variables X and Y are independent with probability at least 95%.

Results

Values for each variable were summed according to the importance that respondents linked to the factor. The factors were then sorted by the importance, from the lowest sum that represents the most significant factor (see Table 2).

The field of study currently offers career security	772
Job prestige	836
The field of study is currently "profitable"	879
Distance of the place of study from home	1,087
Financial demands of study	1,1
Easy admission conditions	1,143
My parents recommended this field of study	1,229
My friends decided to study this field	1,323

Table 2: Factors that influence the student's choice of the field of study sorted by the importance (lower sum means more significant factor)

As there are no continuous numeric variables, Spearman's rank correlation coefficients were used to measure statistical dependence between choice factors and the tendency to choose 'female profession' (see Table 3). Bold coefficients are statistically significant on the significance level 0.05, other correlation coefficients must be considered as zero and variables are uncorrelated.

The field of study currently offers career security	0.065
Job prestige	0.089
The field of study is currently "profitable"	**0.145**
Distance of the place of study from home	−0.045
Financial demands of study	−0.054
Easy admission conditions	0.025
My parents recommended this field of study	0.011
My friends decided to study this field	**0.136**

Table 3: Spearman's rank correlation coefficient between the choice factors and tendency to choose 'female profession'
(Bold coefficients are statistically significant, the significance level 0.05)

Spearman's rank correlation coefficients values sorted in Table 3 demonstrate very weak causality between motives „the field of study is currently profitable" and „my friends decided to study this field" on one side and „tendency to choose female profession" on the other.

Those who tend to choose education, nursing or social works as their future occupation are less affected by the profitability of the job or friends' opinion.

The research further proved that one-fifth of the households included in the survey were affected by unemployment (see Fig. 1). Those not contemplating further study did not answer this question (12 respondents).
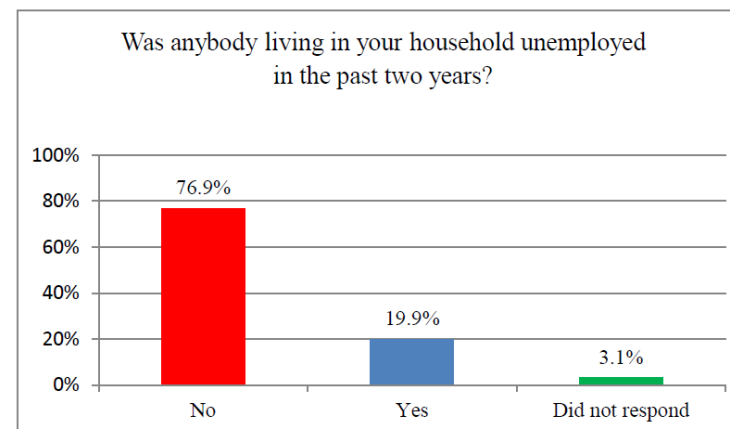
Figure 1: The unemployed in the households of the boys preparing for the graduation exam in 2010/11 over the past two years

The most frequently unemployed member in the households of the future secondary school graduates in the Vysocina Region was mother (46.8% of the 77 respondents who mentioned a household member without any job for the recent two years). As further explained by Fig. 2, father was the unemployed household member in 26 (33.8%) of the cases. A total of 15.6% of the future graduates shared their households with an unemployed brother or sister.
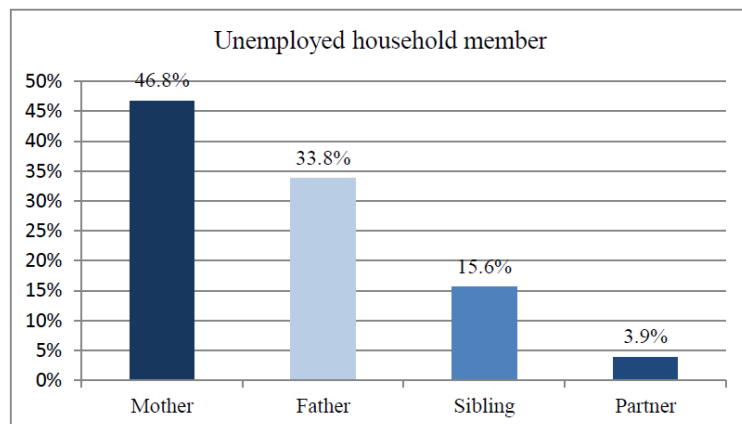
Figure 2: The unemployed in the households of the future graduates over the past two years - specific members

According to the survey, the influence of unemployment in the households of the future graduates was not significant (see Fig. 3). This fact had a major or rather important influence on the decision regarding the future field of study for only 9.1% of the respondents. A total of 81.5% of the males mentioned no or a lesser influence by this factor.
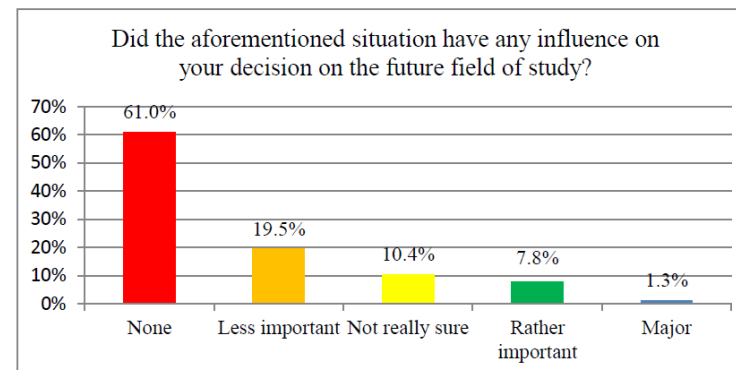
Figure 3: The unemployed in the households of the future graduates over the past two years - influence on the decision on the specific field of study

The future graduates were exposed to a rather intensive news coverage concerning the recession; see Fig. 4. However, only 5.8% of the respondents admitted active searching for this sort of information. Yet, the media influence is substantial - more than 63% of the males took regular notice of events related to economic problems. A mere 6.8% of the respondents did not follow the information at all. A strong interest in economic studies has, thus, been demonstrated.

Figure 4: Following the news coverage of the economic crisis by the future graduates in the Vysocina Region in 2009-2010

As seen in Tab. 4, respondents considered the banking sector as the worst hit by the economic crisis while the supposedly least affected one is the computer technology domain. The monitored areas - social services and health care - were seen on the basis of the information collected from the media as those not seriously impacted by the crisis. Quite surprisingly, the educational system was perceived as bearing above-average consequences of the crisis. It is also of interest that the respondents did not consider any of the offered areas as strongly affected by the crisis. The scale was between 1 and 4 (1 = strong effects of the crisis on the area, 4 = no effects of the crisis on the area).
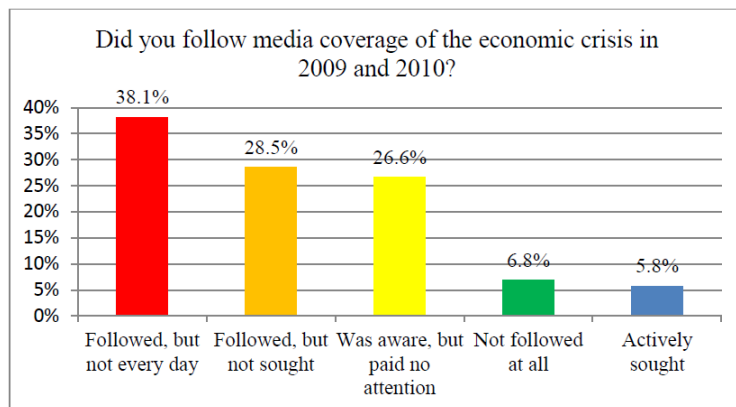
Banking sector	1.72
Insurance	1.98
Services	2.10
Social services	2.11
Health care	2.18
Construction	2.20
Transport	2.26
Heavy industry	2.32
Electrical engineering	2.57
Education	2.69
Mininig	2.70
Computers	2.75

Table 4: Economic area affected by the crisis in the view of the male students preparing for the graduation exam in the Vysocina Region, influenced by media coverage in 2010/11

The reasearch was conducted in March 2011, most of the students had already made their decision on their field of study, some of them chose more than one study programme. The majority (more than 31%) picked economics (business, management or finances). Surprisingly, a high percentage of the male students chose education (slightly over 10%). Nursing and social works were the least popular (see Table 5).

Programmes	Actual number	Percentage
Business, finance and management	121	31.4%
Humanities and arts	81	21%
Technologies	66	17.1%
Education	40	10.4%
Law	35	9%
Natural sciences	28	7.3%
Medicine and pharmacy	27	7%
Other medicine (nursing)	13	3.4%
Social	9	2.3%

Table 5: Choice of the field of study – male students preparing for the graduation exam in the Vysocina Region in 2010/11

The crucial part of the research concerned the interest of future graduates of secondary schools in the Vysocina Region in studying those fields that would prepare them for the occupations of a nursery/elementary/secondary school teacher, nurse or social worker.

A total of 11 males showed an interest in becoming a nursery school teacher, i.e. 2.8% of the total number (see Fig. 5). This population was divided by the type of the secondary school - 8 respondents studied grammar schools and 3 technical secondary schools. However, a direct identification with the given field of study in question no. 2 (Could you tell us which field or fields of future study you have chosen?) was recorded in only 2 respondents. Yet, the general answer „pedagogy" or „education" appeared quite frequently. Almost one-sixth of the population, 15.5% to be exact, considered this career path. Of

these, 36 studied the grammar school, 24 studied a business/engineering secondary school.
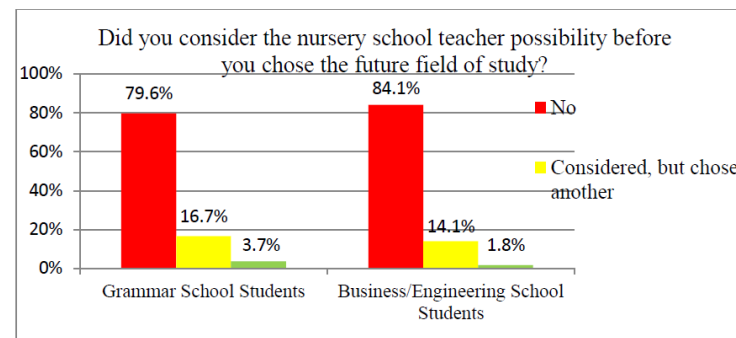
Figure 5: Interest in the nursery school teacher job among the future graduates in the Vysocina Region in 2011

As seen in Fig. 6, 17 boys preparing to take the graduation examination (4.4%) showed an interest in the elementary school teacher profession. The majority of these (15) studied the grammar school, 2 studied a business/engineering secondary school. Once again, there is a high percentage of those who may have considered this option, but finally chose a different career (16.8%). Grammar school students prevail (42), while there were 23 students interested in this profession at business/engineering secondary schools.
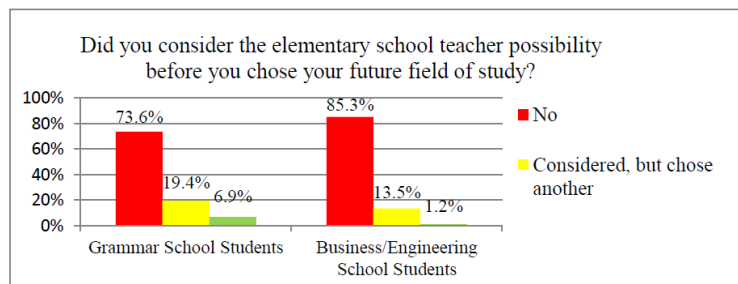
Figure 6: Interest in the elementary school teacher profession among future graduates in the Vysocina Region in 2011

A total of 9% of the respondents mentioned an interest in the job of a secondary school teacher, which is the most positive reaction of all the offered positions within the educational system. There is a majority of grammar school students (31) compared to 4 students interested in this job currently studying at the business/engineering schools. More than 23% of the students contemplated this possibility, but finally opted for another field of study; see Fig. 7. Again, grammar school students prevail (70) over the business/engineering schools (21).
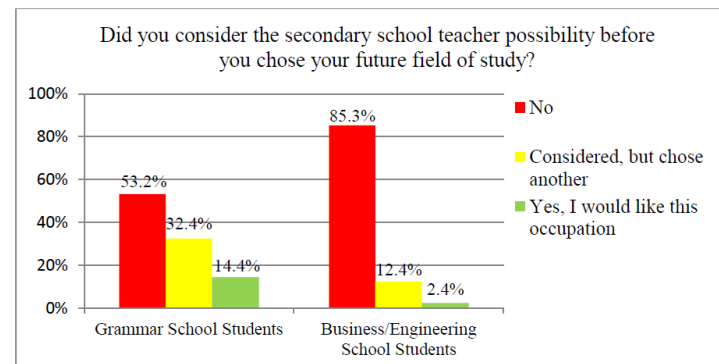
Figure 7: Interest in the secondary school teacher job among future graduates in the Vysocina Region in 2011

Respondents who were to take the graduation exam in the Vysocina Region showed the least interest in the nursing job. As seen in Fig. 8, only 6 males would like to do this job (1.6%), all of them grammar school students. This possibility was considered by 32 boys (8.3%). Grammar school students prevailed (28), while only 4 were from the business/engineering schools (4).

Figure 8: Interest in the nursing job among the future graduates in the Vysocina Region in 2011

A total of 7.3% of respondents would like to work in the social work field (see Fig. 9). Most of them are among grammar school students (21) while students of the business/engineering schools also showed some interest (7). Almost 20% of the males had contemplated this career in the past. Again, grammar school students prevail (50) over the business/engineering school students (24).

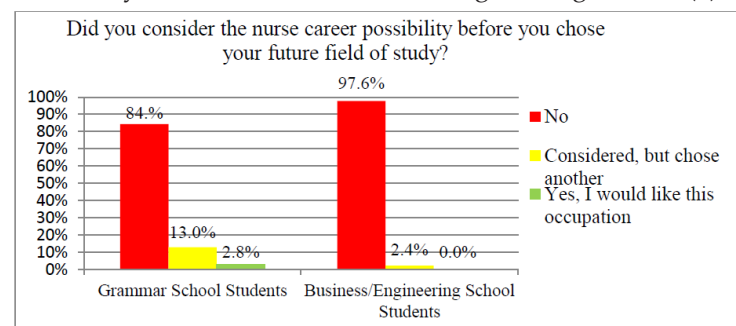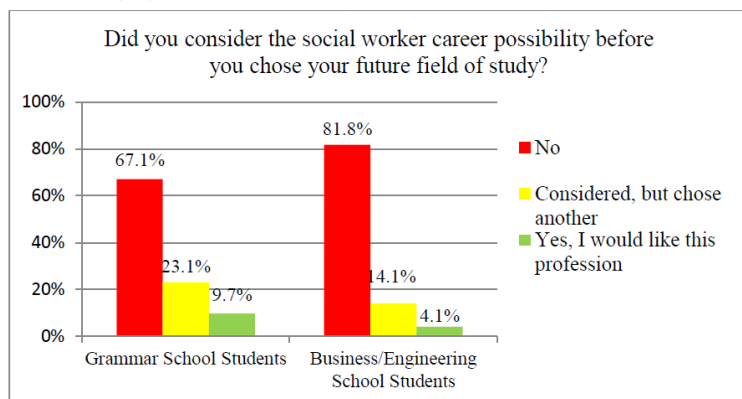**Figure 9: Interest in the social worker job among the future graduates in the Vysocina Region in 2011**

Of the offered specializations, most boys preparing for the graduation examination showed interest in those fields of study that would enable them to work as a secondary school teacher (9.07%). The social worker was the second most frequently chosen option (7.25%). A career of a nurse was the least appealing (1.55%).

Discussion

The objectives of the research were to try to map the views of the secondary school population in the Vysocina Region: to find out about their interest in educational, health care and social careers, and to analyse choice factors. The research proved that future graduates in the Vysocina Region considered the factor of career security to be the most important for their decision on the future field of study. A major role was also played by the prestige of the job they would have after they completed the studies. The „profitability" had a strong influence, too. Unlike Soukalova's findings (2009), future graduates in the Vysocina Region deny that friends or parents have impact on their decision on their choice of the field of study. The respondents had been heavily exposed to information related to the recession. However, only 5.4% of them admitted an active search for this sort of information. Yet, the media influence is remarkable - more than 63% of the future graduates took regular notice of events related to economic problems. A mere 6.5% of the respondents did not follow the information at all. According to the survey, the influence of unemployment in the households of the future graduates was not significant. This fact had a major, or rather important influence on the selection of the future field of study for only 9.2% of the respondents. The further analysis, using Spearman's rank correlation coefficients, proved very weak causality between the motives of "the field of study is currently profitable and "my friends decided to study this field" on one side and "the tendency to choose a female profession" on the other. Those who tend to choose education, nursing or social works as their future occupation are less affected by the profitability of the job or friends' opinion. There was no correlation between the media coverage on the recession and unemployment in the household and the tendency to

choose a 'female' profession. Nevertheless, male students, future graduates, were considering education, nursing or social works as their future occupation, a high percentage of the male students chose education (slightly over 10% in total); nursing and social works were the least popular. For the future research, it would be recommended to use a combined research that would integrate quantitative and qualitative methods. The focus should be on the factors/drivers that repulse male students from choosing nursing or social works as their major education.

Conclusion

A minority of male students, future graduates in the Vysocina Region in 2010/2011, chose education, nursing or social works as their future occupation. A rather important segment of respondents was considering this profession (especially education), but then selected another. The factor of career security plays the most important role in the decision-making process of the male students/future graduates. Prestige of the job they will have after they graduate the studies is of a high importance as well, and the "profitability" of the profession had a strong influence, too. The further analysis, using Spearman's rank correlation coefficients, proved very weak causality between the motives of "the field of study is currently profitable" and "my friends decided to study this field" on one side and "the tendency to choose a female profession" on the other.

Acknowledgements

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ANALYSIS OF STUDENTS' RESULTS IN DISTANCE-STUDIES CENTRES

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Abstract

The present paper focuses on the study results of students of distance-studies centres carried out by the Faculty of Economics and Management at the Czech University of Life Science in Prague. The centres are situated in areas with a generally low concentration of universities and therefore the possibility of university education is relatively low. We observed the students who entered the study field of Public Administration and Regional Development in the academic year 2009/10 and the monitoring lasted first three semesters of their studies. We selected five different courses studied at the centres and subjected them to statistical analyses. The findings show differences in the rigorous nature of the selected courses, students of different age and gender and, last but not least, among individual centres. This information can be useful both for students and studies centres management. For the statistical analysis we used Statistica 9 software.

Key Words

Distance-studies centres, study results, statistical analysis

Introduction

The distance-studies centres of the Faculty of Economics and Management (FEM), Czech University of Life Sciences (CULS) are situated in various places, prevailingly in rural regions of the Czech Republic. These regions have a lower number of university graduates than the Czech average. The lower average education corresponds with higher unemployment and lower salaries. The regional differences are remarkable and the situation has not changed much. Altogether CULS has eight such distance-studies centres.

The reasons for the lower educational level could generally be the worse economic situation, a weaker tradition in higher education as well as others. But recently we can see two very clear problems.

First, young students study at universities in big cities and after their graduation they do not return to the regions. There are no specific measures or motivations to keep them in smaller places. Regional firms and offices rarely offer fellowships and getting a job in a big city is usually easier.

The second reason can be found in the more complicated studies for adults. They have to commute to bigger places and improving their qualification is more expensive as well as time demanding. They often have to study in order to keep their jobs and improve their position.

The regional studies centres offer the possibility to study on lifelong courses as well as getting regular university graduation. The education in these centres is a combination of contact lessons and self-study. The contact lessons are provided in the regions so that the students do not have to travel to Prague. Also the exams and administrative are done in the centres. In fact, the students have to travel to the university in the capital only to pass the state exam.

The only research done found so far, by other authors, concerning the CULS distance-studies centres was a questionnaire survey among the students in these centres focused on demographic structure and differences between male and female students by Dömeová, Vydrová and Jindrová (2010). They found a very weak difference only, significant only in two of the questions. There has also been research done in lifelong education concerning mainly education for adult learners. In promoting lifelong education it is necessary to stress the cooperation between local governments and schools or adult education centres (Stasane, 2007). Rowland and Rubbert (2001) researched the history of adult education in correspondence to particular study modes applied to distance-studies in higher education in the UK. In their article they stress the overuse of the Internet as the teaching aid for distance leaners who often have difficulty coping with the complexity of web pages and they provide recommendations on how to improve the existing information services. Applying information technologies in lifelong education and in distance-studies in particular, is discussed for example in Rodriguezrosello (1993), Bard (1996), and Lloyd, Moore and Kitching (2001). At CULS the use of on-line support in distance-studies centres has been discussed by Houška and Beránková (2010).

However, the rate of successful study in the distance-studies centres is not very high. For instance, of the students that we examined, only 75% students in our observed year progressed to the 2nd year of study in the regular way (i.e. without retaking or interrupting the studies etc.). The objective of the paper is to find out particular problems the students could be encountered what they should concentrate on and what they should be

aware of. This is done by means of statistical analyses of the set of students' study results. At the same time, our findings should present centre administrators and the department staff responsible with invaluable incentives to make the studies easier and help the students improve their study results. During our research we have not intentionally done a survey based on questionnaires. Respondents very often do not pay enough attention to filling in the questionnaire and what is more, it has become obvious that even without a questionnaire significant and important findings can be achieved.

In this paper we extended and deepened our results already observed in Jarkovská, Kučera, Vydrová and Varvažovská (2011) with the results observed in another course. Besides, we focused our analysis on the results of those students who graduated from the individual courses successfully only.

Material and Methods

The Characteristics of Courses Examined

We dealt with students majoring in Public Administration and Regional Development (PARD) who began their studies in the academic year 2009/10. In this year, this study area was available in four distance-studies centres: Klatovy, Litoměřice, Most and Šumperk. In other distance-studies centres either a different or no study area was available. We examined the results obtained from five selected courses, each representing a different type.

The first course, Mathematical Methods in Economics and Management (MMEM), is taught in the winter semester of the first-year of studies. It is indisputably the most difficult subject. Owing to the fact that within PARD there is no course in mathematics as a separate subject, MMEM comprises selected areas in mathematics, in particular the basics of linear algebra and differential calculus of functions containing one variable. This part makes up approximately 35% of the course. The remaining part consists in theoretical basics of mathematical methods applied in economics to systems analysis and optimum management and their simple applications. It definitely concerns the most theoretical subject of the study area and it is relatively remote to its focus.

Another selected course was the Systems Analysis of Product Verticals (SAPV), taught in the summer semester of the first-year of studies. It directly follows MMEM but it is much more practically oriented. The objective of the course is to expand the knowledge of methods and approaches from the point of view of system approaches to various types of problems.

We also observed how students were successful in the studies of foreign languages (FL). The foreign languages are taught as one two-semester course, at the end of which the students take an exam. The languages taught at the distance study centres are English and German. In the examined year the students could choose from English or German at A1 level in all distance-studies centres. In Most they could also take English at the more advanced A2 or B1 level.

The Fundamentals of Regional Development (FRD) is one of the profile courses of this study area. The course objective is practical, i.e. to teach students how to prepare and implement different environment-friendly, socially acceptable and economically beneficial development programmes. The students are introduced to the issues of regional development and its mechanisms, including institutions in the CR and EU. The students receive theoretical knowledge as well as practical skills in respect to problem definition, particular projects preparation and the principles of project implementation. At the end of the course the students sit a written exam. The exam tests their

theoretical knowledge as well as their ability to apply the skills to particular practical questions. This type of final examination, i.e. a written test, is shared by all the courses under observation.

The last course under investigation was the Fundamentals of Statistics (FS). The course objective is to introduce basic statistic concepts and their qualified application in economic routine. The course covers selected methods of descriptive statistics, data research analysis, the elements of probability theory, inductive techniques of estimation theory and statistical hypothesis testing, as well as an introduction to the research of statistical dependencies. Course graduates receive theoretical knowledge of formal statistical approaches applied to the research of social-economic reality. The teachers of particular courses taught in one or two distance-studies centres at the most.

Let us add that at most Czech universities and schools of higher education a four-mark system of evaluation is applied, where 1 (excellent) is the best mark. Then follows 2 (very good) and 3 (good). Mark 4 (failed) means that the student failed an exam.

Statistical Testing

First, we considered a pair of courses. For each pair we assessed the difference between the exam results. This was done by the testing of statistical hypotheses on the results. A statistical hypothesis is a certain presupposition about the characteristics of the distribution of the examined random variable. The testing of a given hypothesis is the procedure by which we would make the decision about the validity or refusal of a null hypothesis on the basis of random choices. Usually, we tested the null hypothesis H_0: $\mu_1 = \mu_2$, i.e. there were no statistically important differences between the two examined samples.

The analysis of variance (ANOVA) enabled us to assess the differences between mean values of not only two samples, but also among three or more. We applied this in order to compare the examination results among different centres, among different courses in each centre, and thus among different teachers for a particular subject. We chose the Kruskal-Wallis one-way variance analysis which is a non-parametrical form of the analysis of variance.

When finding out the dependencies between individual observed subjects it is convenient to use one of the dependence tightness measures. If the observed features assess the sequence, it is convenient to use the Spearman rank-order correlation coefficient which assesses the degree of dependence between the observed features where the distribution of probability is unknown.

We used the attributive risk and odds ratio for the analysis of a specific factor impact on students' results. In particular, we compared a success rate of individual subject exams between male students and female students and between individual pairs of the centres. The attributive risk expresses an absolute effect of the observed factor (e.g. gender). It told us how higher the possibility to pass an exam was within one group (e.g. male students only) in comparison to another group (e.g. female students). It is calculated as follows:

$$AR = \frac{a}{a+b} - \frac{c}{c+d} \tag{1}$$

where a and b is a number of students who passed and failed the exam in the former group, respectively, and where c and d is a number of students who passed and failed the exam in the latter group, respectively.

It is also possible to calculate its relative form which is indicated as AF using the following formula:

$$A F = \frac{\dfrac{a}{a+b} - \dfrac{c}{c+d}}{\dfrac{a}{a+b}} \qquad (2)$$

The odds ratio assesses a chance to pass an exam. It is calculated as follows:

$$OR = \frac{d}{b} \qquad (3)$$

If OR = 1, there is no dependency between the observed variables. OR > 1 means that affiliation with the second group is a risk factor, and vice versa, OR < 1 means that the affiliation with the second group is a protective factor.

The last tool was a categorical data analysis. The basic test for finding out the dependence of two variables was the χ^2 test on mutual (in)dependence in a contingency table. If the value of the χ^2 found was bigger than the critical one, the assessed variables were dependent. Another evaluation method consisted of using the p-value compared with the significance level. If the p-value was less than the required significance level, the event was assessed to be statistically significant. For the contingency table we also computed the Pearson contingency coefficient

$$C_P = \sqrt{\frac{\chi_P^2}{\chi_P^2 + n}} \qquad (4)$$

which took values from the interval $\langle 0; \sqrt{(q-1)/q} \rangle$, where $q = \min \{r, s\}$, where r and s are the numbers of the contingency table rows and columns, respectively. It took the value of 0 in the case of statistical independence. Being given fixed values of n, r, s, the bigger value of C_P we obtained, the stronger the dependence was.

Using categorical data analysis we discovered to what extent the study success depended on the gender and age of the student.

For more information about statistical testing in general see Agresti (2002).

Results and Discussion

The examined set compiled the total of 267 students, from which 95 students were from Klatovy centre, 101 from Litoměřice centre, 32 from Most and 39 from Šumperk. In the academic year 2009/10 245 were first-year students. There were an additional 22 students who started studying earlier, 12 of them took an exam in FS, 11 in FRD, and 1 in FL.

The Comparison of Overall Results of Individual Subjects

First, we found out if and to what extent the results in individual subjects differed. The information is presented in Table 1.

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	MMEM	SAPV	FL	FRD	FS
Total number of students	219	173	195	180	177
Number of successful students	168	147	195	170	173
Number of students who failed	51	26	0	10	4
Successful students (%)	77%	85%	100%	94%	98%
Mean grade of all students	2.429	2.306	1.236	2.500	2.435
Mean grade of successful students	1.952	2.007	1.236	2.412	2.399

Tab. 1: Student results in individual subjects

By far the best results were obtained by the students of FL. Furthermore, according to the mean grade of all students, the students were also relatively successful in SAPV, which was followed by MMEM, then FS with the worst results being obtained in FRD. The students therefore seemed to find FL significantly easier than specialist subjects where there were generally no greater differences in feasibility.

Rather a large number of the students did not pass the exam from theoretical-mathematical subjects MMEM and SAPV at all. Nevertheless, the results of successful students in these subjects were obviously better than in the other observed specialist subjects, FRD and FS. Moreover, their results in MMEM were better than in SAPV. In contrast, there were considerably fewer unsuccessful students failing FRD and FS (weaker students did not proceed to the second year of studies where they would sit these exams). On the other hand, there were also fewer students with excellent or very good marks in FRD and FS.

The Comparison of Results per Individual Student

Then we observed relationships and connections between the results for individual subjects per student. We used Spearman correlation coefficients. The analysis was carried out for two different sets: one for the set of all students and one only for the set of those who passed all exams successfully. There were altogether 101 such successful students. Correlation matrices are presented in Table 2 and 3. The coefficients in italics were statistically insignificant at the significance level of α=0.05.

Subject	MMEM	SAPV	FL	FRD	FS
MMEM	1.000	0.317	0.018	0.011	0.409
SAPV	0.317	1.000	-0.036	-0.015	0.077
FL	1.018	-0.036	1.000	-0.047	-0.064
FRD	0.011	-0.015	-0.047	1.000	0.072
FS	0.409	-0.077	-0.064	0.072	1.000

Tab. 2: Spearman rank-order correlation coefficients

Subject	MMEM	SAPV	FL	FRD	FS
MMEM	1.000	–0.425	0.144	–0.068	0.569
SAPV	–0.425	1.000	–0.081	0.047	0.010
FL	0.144	–0.081	1.000	0.016	–0.053
FRD	–0.068	0.047	0.016	1.000	0.082
FS	0.569	0.010	–0.053	0.082	1.000

Tab. 3: Spearman rank-order correlation coefficients – only successful students

From these matrices it can be derived that, to a certain extent, individual students reached similar results in MMES and FS (i.e. each student was either good or bad in both subjects). The correlation coefficient was more than 0.4 in the set of all students and even 0.57 in the set of only successful students.

This can be explained by the fact that both subjects are based on mathematics and successful students are those with relatively good mathematical minds.

An interesting situation can be observed for the dependence between the results in MMEM and SAPV. In the set of all students the positive correlation coefficient was 0.32 and, on the contrary, the negative coefficient for successful students was –0.425. Both coefficients were of a relatively high value; however, they were not statistically significant at the significance level of α=0.05. For statistical analyses the present set is sufficient enough. Nevertheless, we suppose that for a more extensive statistical set such high coefficients would prove as statistically significant. This means that worse students often fail those subjects or, if they did not pass one, they did not have a good result in the other. In contrast, the students who graduated from both subjects successfully were either good in the former and bad in the latter or the other way around. Those students who had problems with the more theoretically focused MMEM probably concentrated more on thematically closer SAPV and reached better results there. On the other hand, those who had no problem passing MMEM underestimated SAPV. This might mean that although both subjects are thematically close, MMEM is far more theoretically oriented than SAPV and therefore, the former could be more suited for theoretically oriented students whereas the latter to the practically oriented ones. Besides, from the fourth semester the students with very good marks had the possibility to transfer to another form of studies where no school fee was required. Therefore the students with worse results from the first semester which included MMEM might have been more motivated to pass SAPV successfully in the second semester and vice versa.

Other correlation coefficients did not exceed 0.2 in absolute value. This means that there was no other statistically significant dependence between the results of individual students.

The Comparison of Results in Individual Distance-Studies Centres

In the following analysis we endeavour to find out if and to what extent the results of individual subjects differed among individual centres. Thanks to the fact that in almost all centres the courses were conducted by different teachers, we could find out to what extent the teacher's quality and adaptation of various special measures in the centres influenced the students' study results.

We calculated the attributive risk and odds ratio for all subjects within each couple of the centres. In the analysis, even those students who did not endeavour to pass the exam were regarded as those who failed. Moreover, we applied the Kruskal-Wallis test, similarly to the analysis in the previous chapter, to two different sets: one for the set of all students and one for the set of those who passed all exams successfully only. The results are summarised in Tables 4-9. Each table first presents the centre where the students were more successful altogether.

	MMEM	SAPV	FL	FRD	FS
Most - passed	17	20	23	22	24
Most - failed	16	13	10	11	9
Most – successful students (%)	52%	61%	70%	67%	73%
Litoměřice - passed	45	46	71	55	60
Litoměřice - failed	56	55	30	46	41
Litoměřice – successful students (%)	45%	46%	70%	54%	59%
OR for Most	1.32	1.84	0.97	1.67	1.82
OR for Litoměřice	0.76	0.54	1.03	0.60	0.55
AR	7%	15%	-1%	12%	13%
AF for Litoměřice	14%	25%	-1%	18%	18%
AF for Most	16%	33%	-1%	22%	22%
Significant difference for all students	No	No	No	No	No
Significant diff. for successful students	Yes	No	No	No	No

Tab. 4: The comparison of results in Most and Litoměřice

	MMEM	SAPV	FL	FRD	FS
Šumperk - passed	30	13	29	28	30
Šumperk - failed	9	26	10	11	9
Šumperk – successful students (%)	77%	33%	74%	72%	77%
Most - passed	17	20	23	22	24
Most - failed	16	13	10	11	9
Most – successful students (%)	52%	61%	70%	67%	73%
OR for Šumperk	3.14	0.33	1.26	1.27	1.25
OR for Most	0.32	3.08	0.79	0.79	0.80
AR	25%	-27%	5%	5%	4%

AF for Most	33%	-82%	6%	7%	5%
AF for Šumperk	49%	-45%	7%	8%	6%
Significant difference for all students	No	No	No	No	No
Significant diff. for successful students	No	No	No	No	No

Tab. 5: The comparison of results in Šumperk and Most

	MMEM	SAPV	FL	FRD	FS
Klatovy - passed	77	69	73	65	72
Klatovy - failed	8	16	12	20	13
Klatovy – successful students (%)	91%	81%	86%	76%	85%
Most - passed	17	20	23	22	24
Most - failed	16	13	10	11	9
Most – successful students (%)	52%	61%	70%	67%	73%
OR for Klatovy	9.06	2.80	2.64	1.63	2.08
OR for Most	0.11	0.36	0.38	0.62	0.48
AR	39%	21%	16%	10%	12%
AF for Most	43%	25%	19%	13%	14%
AF for Klatovy	76%	34%	23%	15%	16%
Significant difference for all students	No	Yes	No	No	No
Significant diff. for successful students	No	Yes	No	No	No

Tab. 6: The comparison of results in Klatovy and Most

	MMEM	SAPV	FL	FRD	FS
Šumperk - passed	30	13	29	28	30
Šumperk - failed	9	26	10	11	9
Šumperk – successful students (%)	77%	33%	74%	72%	77%
Litoměřice - passed	45	46	71	55	60
Litoměřice - failed	56	55	30	46	41
Litoměřice – successful students (%)	45%	46%	70%	54%	59%
OR for Šumperk	4.15	0.60	1.23	2.13	2.28
OR for Litoměřice	0.24	1.67	0.82	0.47	0.44
AR	32%	-12%	4%	17%	18%
AF for Litoměřice	42%	-37%	5%	24%	23%
AF for Šumperk	73%	-27%	6%	32%	29%
Significant difference for all students	Yes	No	No	No	No
Significant diff. for successful students	Yes	No	No	No	No

Tab. 7: The comparison of results in Šumperk and Litoměřice

	MMEM	SAPV	FL	FRD	FS
Klatovy - passed	77	69	73	65	72
Klatovy - failed	8	16	12	20	13
Klatovy – successful students (%)	91%	81%	86%	76%	85%
Litoměřice - passed	45	46	71	55	60
Litoměřice - failed	56	55	30	46	41
Litoměřice – successful students (%)	45%	46%	70%	54%	59%
OR for Klatovy	11.98	5.16	2.57	2.72	3.78
OR for Litoměřice	0.08	0.19	0.39	0.37	0.26
AR	46%	36%	16%	22%	25%

	MMEM	SAPV	FL	FRD	FS
AF for Litoměřice	51%	44%	18%	29%	30%
AF for Klatovy	103%	78%	22%	40%	43%
Significant difference for all students	Yes	Yes	No	No	No
Significant diff. for successful students	Yes	No	No	No	No

Tab. 8: The comparison of results in Klatovy and Litoměřice

	MMEM	SAPV	FL	FRD	FS
Klatovy - passed	77	69	73	65	72
Klatovy - failed	8	16	12	20	13
Klatovy – successful students (%)	91%	81%	86%	76%	85%
Šumperk - passed	30	13	29	28	30
Šumperk - failed	9	26	10	11	9
Šumperk – successful students (%)	77%	33%	74%	72%	77%
OR for Klatovy	2.89	8.63	2.10	1.28	1.66
OR for Šumperk	0.35	0.12	0.48	0.78	0.60
AR	14%	48%	12%	5%	8%
AF for Šumperk	15%	59%	13%	6%	9%
AF for Klatovy	18%	144%	15%	7%	10%
Significant difference for all students	No	No	No	No	No
Significant diff. for successful students	No	No	No	No	No

Tab. 9: The comparison of results in Klatovy and Šumperk

Results in MMEM turned out to be significantly worse in Litoměřice than in any other centres. This may be caused by the fact that in Litoměřice the teacher was a professional mathematician, a graduate from the Faculty of Mathematics and Physics at Charles University, whose methods of conducting

the course were not as practically oriented as that of other teachers who graduated from CULS. Besides, after consultation with the teachers, we found out that in Klatovy the teacher gave the students the possibility to attend extra lectures in Klatovy. In Šumperk they applied a system in which students successful in this course could officially tutor their colleagues in lower years of studies, which helped the students to pass the exam and continue further in their studies. These were other reasons that could make the MMEM exams for the students of the centre easier.

A significant difference was also revealed for SAPV. The best results were reached in Klatovy, statistically significantly better in comparison to Most and Litoměřice. Most probably, it was thanks to the extra lectures mentioned above. The tables reveal rather bad results in Šumperk, even though the Kruskal-Wallis test did not prove any statistically significant difference. They were probably caused by the SAPV consultation being scheduled at the end of the semester. Tutoring by older students in this case did not help either. However, the unsuccessful students rescheduled the exam to the next year and continued in their studies.

For the other courses no statistically significant difference was found, even though there was a different teacher in each centre. Therefore, we can assume that the personality of the teacher or the organization of the course had no important impact on the subject results.

Interestingly, however, a wide-spread surmise that the centres with a lower number of students reach better results did not testify. On the contrary, probably thanks to good course organization, it was Klatovy centre with a relatively high number of students that reached the best results.

The Comparison of Results of Individual Subjects in Individual Distance-Studies Centres

Let us have a look at how different the results in individual centres were in general. Again we applied the Kruskal-Wallis test for two different sets similarly to our previous analysis. In Table 10 and 11 we also present mean grades in single subjects in particular centres.

	MMEM	SAPV	FL	FRD	FS
Litoměřice	3.14	2.86	1.27	2.65	2.43
Klatovy	1.92	1.76	1.12	2.51	2.54
Most	2.48	2.88	1.14	2.30	2.35
Šumperk	1.71	1.46	1.52	2.34	2.28

Tab. 10: Mean grades in the set of all students

Based on the Kruskal-Wallis test in the set of all students in Litoměřice, the results from FL were statistically significantly better than in all other subjects and, besides, the results from FS were statistically significantly better than those from MMEM.

In Klatovy, the results from FL were again statistically significantly better than from all other subjects. What is more, the results from FS and FRD were statistically significantly worse than the results from MMEM and SAPV.

In Most the only statistically significant difference was observed when comparing the results from FL with other subjects and in Šumperk when comparing FL with FS and FRD only.

	MMEM	SAPV	FL	FRD	FS
Litoměřice	2.26	2.16	1.21	2.53	2.21
Klatovy	1.81	1.57	1.17	2.36	2.34
Most	1.56	2.67	1.11	2.22	2.22
Šumperk	1.63	1.13	1.50	2.13	2.38

Tab. 11: Mean grades in the set of successful students

In the set of successful student in Litoměřice, the Kruskal-Wallis test found out the only statistically significant difference when comparing the results from FL with all other subjects. The same difference was also found in Klatovy; however, here the test revealed that the results from SAPV were statistically significantly better than the results from FS and FRD. In Most the only statistically significant difference was found when comparing the results from FL with FS and SAPV. In Šumperk no statistically significant differences were found.

All in all, if we concentrate on the results of successful students, the following situation seemed to be typical: the results in FL were better in comparison with all other subjects, especially with FS and FRD. This situation occurred in both big centres: Litoměřice and Klatovy. In Most and Šumperk there were only few successful students to consider the situation typical for small centres. However, even there a few interesting facts can be found. In Most the students were surprisingly good in MMEM. When comparing results from FL, and even taking into account all students and not only the successful ones, there were differences between Šumperk and other centres. This study result difference can be best explained by the application of the different testing methods used in Šumperk than in other centres.

The Dependency of Students' Results on Gender

We applied Pearson χ^2 test which did not reveal any significant dependency of students' results on their gender for any of the subjects. There showed to be only certain dependence for FL, the p-value was 0.07, C_p was 5.34 and better results were achieved by female students.

Moreover, we calculated the attributive risk and odds ratio. As seen in Table 12, this analysis did not show any great differences either, not even for FL.

	MMEM	SAPV	FL	FRD	FS
Successful female students	70%	60%	80%	72%	72%
Successful male students	58%	54%	71%	55%	61%
OR for female students	1.65	1.26	1.60	2.13	1.64
OR for male students	0.61	0.79	0.62	0.47	0.61
AR	11%	6%	9%	17%	11%
AF for male students	16%	10%	11%	24%	15%
AF for female students	20%	11%	12%	31%	18%

Tab. 12: The comparison of results for women and men

The Dependency of Study Results on Students' Age

First, let us point out the age structure of the students in general. The oldest student was born on 22nd August, 1954 and the youngest on 22nd August, 1990. The average date of birth was around 11th October, 1977, the median being 26th January, 1978. For better imagination of the age structure, let us also mention the bottom quartile 29th December, 1972 and top quartile 11th June, 1983.

In order to apply Pearson χ^2 test, we divided the students into two groups based on the median, the "old" and "young". At this point a significant dependency for SAPV was revealed (p-value 0.024 and C_p=9.43 for the set including unsuccessful students, and p-value 0.040 and C_p=6.45 for successful students set only) and for FRD (p-value lower than 0.002 and C_p=5.08 for the set including unsuccessful students, and p-value lower than 0.005 and C_p=10.73 for successful students only). Also, the Pearson correlation coefficient values proved rather stronger dependency than during Pearson χ^2 test application for gender; they were significantly higher. In both cases it was the older students who were more successful, with their practical experience being probably reflected in their results. In Figure 1 and 2, the results in SAPV and FRD, dependent on the date of birth of the students, are presented graphically. The horizontal axis shows the date of birth, the vertical axis the mark obtained at the examination.
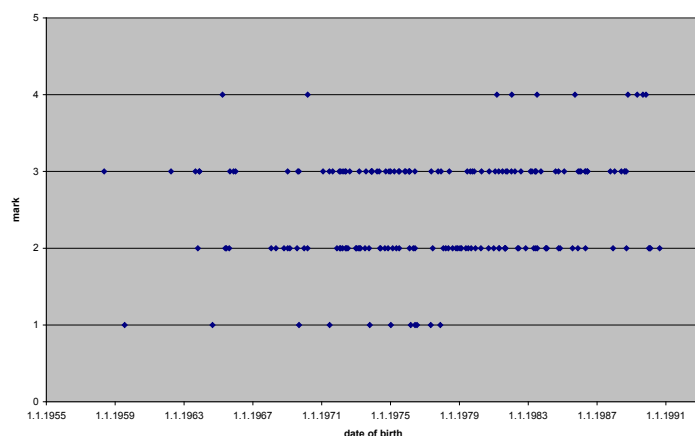
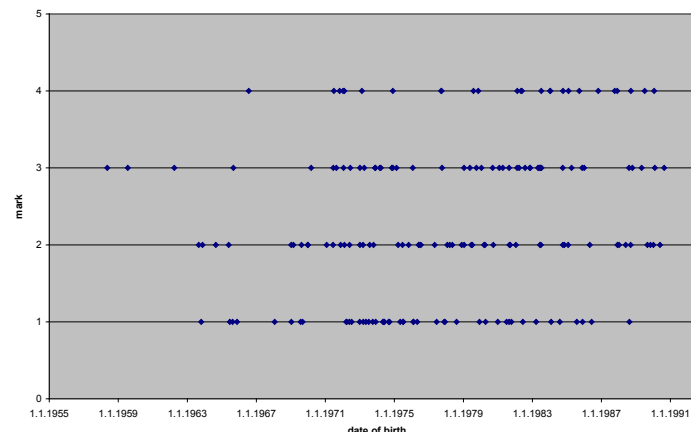

Fig. 1: Results in SAPV

Fig. 2: Results in FRD

For the other courses no statistically significant dependency of study results on the student's age was revealed. It is worth mentioning one p-value of almost 0.15 for the results in MMEM, but only in the set of all students including the unsuccessful, revealing that among the unsuccessful students there were fewer younger than older students. All other p-values oscillated around 0.5 or higher.

Conclusion

The statistical analyses carried out in this article on the results of selected subjects in distance- studies centres have, above everything else, shown what in particular the students should be aware of in their studies, which types of subjects they might find difficult and, last but not least, which study group is endangered the most.

All in all, based on the mean scores of all students, not only the successful ones, the most difficult subject was not MMEM which includes mathematics, generally regarded as student's nightmare. Rather surprisingly and contrary to our expectation, it was FRD which represented profiled specialist subjects. FS also seems to be harder than MMEM. However, the difference among the three subjects was insignificant. Contrastingly, FL turned out to be significantly easier. In respect to a narrow selection of the subjects, no one would surely believe that it is the only easy-to-study subject. Nevertheless, it is definitely an interesting finding that for the students FL does not present any obstacle in their studies of other specialist subjects. However, when interpreting the difficulty of the subjects, we must take into account the fact that the students who did not manage to pass exams from MMEM or SAPV did not continue in their studies and therefore did not even take exams from FRD and FS.

What we may find surprising for FL is the fact that good results were obtained even by older students – despite the conditions for learning foreign languages at secondary schools – with the exception of Russian which, however, was not on the list for the particular year under observation – were much worse than those of younger students. Slightly, though not significantly, better results were achieved by women rather than men. However, the differences in results among individual centres show that the results to a certain extent also depend on the method and manner of testing.

The results in MMEM show that the difficulty of theoretical subjects should not be underestimated. In the centres, it presents the same "obstacle" for all students, and the mean scores depend neither on age nor gender of the student. The greater time distance for the older students from their secondary school studies was probably compensated for by a higher quality of teaching during their school attendance and partially by their life experience.

In SAPV, FS and FRD students show generally similar results as in MMEM. However, in practically oriented subjects of FRD and SAPV it was the older students who achieved significantly better mean scores and did not fail so often, probably thanks to their work experience, while the younger students probably tended to underestimate the subjects because it did not contain much of generally feared theories.

Nevertheless, if we restrict our observation to those students who passed the exams successfully only, then the results in MMEM and SAPV were better than in FRD and FS, moreover, in case of one of the study centres, this difference was statistically significant. This was caused by the fact that the students often dropped out of their studies after the first study year due to MMEM and SAPV. However, if we concentrate only on the results of the successful students in MMEM and SAPV, it is revealed that they are either better in one subject while being worse in the other or vice versa. This may be caused by the different character of those two subjects: MMEM is theoretical while SAPV is practically oriented.

The dependency between the results in other subjects per student was not proved in our analysis.

Our research has shown that the study results and the students' approach to the difficulty of individual subjects attitude can be also influenced by the centres themselves as well as by the university. It did not prove successful to conduct the course with a too theoretically oriented teacher, because it leads both to worse mean scores and to a more frequent failing the exam. In contrast, the students welcomed the possibility to be tutored by their former successful colleagues-students, or

graduates provided by the centre. The first-year students might also benefit from extra optional consultations in order to pass the exam in difficult theoretical subjects. On the contrary, the impact of the centre size (the number of students) on the results did not prove.

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AN ATTEMPT ON NEW SYSTEMATIZATION OF WORK MOTIVATION THEORIES

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Abstract

The paper deals with a semiotic analysis of work motivation theories developed in the second half of the twentieth century. These theories stem from different theoretical backgrounds, varying in ideas as well as in their impact to work motivation reality. For a student approaching this field it might seem to provide an overwhelming situation in an area of study filled with contradictory theories. The method used in this study is similar to one historians use when analysing development in a human society - semiotic analysis. Based on the historical analysis, an analysis of ideas and clusters of meanings follows. Authors assume that personal experience might determine individual motivation factors. It is quite clear, that on the biological level the processes of motivation should be the same in all humans. However, stimuli or conditions under which the processes of motivation are commenced might be caused by the personal experience of the individuals concerned. Authors believe that the above mentioned analysis of clusters of meaning could help us to better systemize the wide range of work motivation theories and make it more evident for all students of the field.

Highlights

- New concept of systematization of the wide range of work motivation theories
- Semiotic analysis used as a conceptual tool
- Personal experience potentially determining individual motivation factors taken into account

Key Words

Work motivation, theories, semiotic analysis, systematization

Introduction

The development of work motivation theories in the second half of the twentieth century is a phenomenon which deserves study in its own right. It appears to be a succession of meanings and ideas, sometimes supporting and sometimes opposing one another. This might be a regular part of the development of a scientific field of study. The number of theories developed, tested, and generally dismissed afterwards was rather large. If there are too many theories concerning one thing, it might be assumed, there is a lack of understanding of the phenomena studied. Another possible explanation of the number of work motivation theories appearing at that time might stem from the need to study and explain diverse aspects of work motivation. If it would be so, however, one would expect some cooperation or complementarities between different theories. This does not seem to have happened. Every one of the succession of work motivation theories tried to explain the field as a whole and as such was tested, received some support, and in due time was substituted by the next. This problem has already been addressed by other authors (see Locke and Latham 2004). In this paper we propose a perspective which might help in achieving the aims they suggested.

In this paper we advocate the idea that the field of work motivation is really very complex and that the students of it approached the field from different perspectives. These perspectives were derived from, or connected to, ideas and ideals concerning many diverse things which work stands for in human lives. Because of it, the perspectives on human motivation mirrored in the work motivation theories are connected to clusters of ideas. These clusters could be called ideologies, like *man as a machine*, or *protestant ethic*. Consequently, the theories expounding such clusters of ideas used specific sets of meanings. The question is whether an analysis of meanings and ideas employed in the work motivation field could help us to further our understanding of the field. The current authors believe it could.

Method

The method employed in this study is akin to the one a historian uses when she/he tries to analyse development in a human society. Accordingly, the main part of the analysis will stem from following these developments in the field since the early 20th century. Based on the historical analysis, an analysis of ideas and clusters of meaning will follow. Such clusters might be considered as sources of ideologies (e.g. of work and/or work behaviour), where by *ideology* is meant a worldview. The term ideology has many other connotations which might clash with the aims of this paper, so for this reason we prefer to speak here about semiotic analysis. (An alternative would have been to call the clusters of meanings *metaphors*, but an analysis of metaphors would be more complicated.)

Semiotics is commonly understood as a study of signification and communication. To justify the use of the term *semiotics*, and by calling the method employed in this paper a *semiotic analysis*, it is necessary to make a proviso. This proviso is that the term *semiotics* is used here in a rather broad sense, implying that this analysis will deal with the meanings assigned to human behaviours, feelings and thoughts and the ways they are used in interpretations of the same behaviours, feelings and thoughts. The interpretations should be understood as the work motivation theories. For the definition of *semiotics* presented here and semiotics in a broad sense, see e.g. Eco (1976, p. 27).

Theory

A possible way in which historical and semiotic analyses might become intertwined might easily ensue from a brief review of work and motivation theories from the first half of the twentieth century. It all started in the 1911, when Taylor's monograph, *The principles of scientific management*, was published (Myers 2011). Taylor's efforts were probably the first attempt to study work behaviour and jobs. For Taylor, a job was something mechanical, which could be developed to a higher standard by an engineer in a similar way as machines can be improved by experts. This perspective on work was commonly held through the first part of the twentieth century. Even in 1948, Bartlett compared in his paper modifications of work procedures to modifications of a machine (Bartlett 1948). At that time, the results of the Hawthorn studies had become known, and this brought about a change of the paradigm. The new ideas on work and work behaviour received full expression as recently as 1960 in McGregor's *The Human Side of Enterprise* (1960).

McGregor's *theory Y* was widely accepted as a formulation of a humanistic conception of work. For many professionals in the field it stood for a new and morally superior view to the one represented by its opposite, the *theory X*. This wide acceptance and acclaim of the theory Y is significant, especially as careful reading of McGregor's works shows his own views were different. With the theory Y humanism developed in a very important stream of thought concerning work motivation. Shortly afterwards Maslow's theory has arrived, followed by variations on the same theme such as Alderfer's theory (Alderfer 1972). These ideas were overly humanistic, and humanist thinking stays with us to these days as an important asset of psychological empowerment (Ahearne, Mathieu, Rapp 2005). If we understand the meaning of empowerment correctly, it says: give the worker freedom and she/he will be happy and will produce (Mathieu, Gilson, Ruddy 2006).

McClelland's theory (1961) dealt with needs like Maslow's, but in a different way. The *achievement* was for McClelland a self-standing quality which was good for the society (if, perhaps, not always for the individual). The achievement is about striving to achieve something specific. In *goal-setting theory* there seems to be a similar idea – according to Locke (1981), the most important ingredient of motivation induced by a goal was a *commitment* to it. In this theory again, the effort, the striving is an important value by itself and on its own. In both the theories, striving (to achieve or to meet a goal) is understood as a general good. This understanding of what work means in the life of a human being is akin to *protestant ethic* as described by Max Weber (1976) half a century ago.

For several decades Vroom's *expectancy theory* was rather influential. Vroom (1964) understood motivation as a power to act, which resulted from the simultaneous influence of three components called expectancy, instrumentality and valence. Vroom's theory is not machine-like. The assumed operations of the three components resemble rather a physiological process. In the eighteenth century the French philosopher, de la Mettrie (Thomson 1996), published two essays entitled *L'Homme Machine* and *L'Homme Plante*. If we would accept *L'Homme Machine* as a predecessor of the man-as-a-machine concept, then we could take *L'Homme Plante* as a model for Vroom's concept or, perhaps, call Vroom's concept *man-as-a-living-organism*.

Another approach to motivation originated with Adams' *equity theory* (Adams, 1965), from which developed a number of theories dealing with perceived justice at the work-place together with the theories of organizational citizenship (Podsakoff et al. 2000). These theories understand the processes of work motivation as

a result of the social perception and interaction of the worker and her/his co-workers. In this case the conceptual model could be called *man-as-a-social-being* or, in the case of organizational citizenship theories, *work as a social institution*.

Psychological empowerment theory was briefly mentioned above in connection with humanistic ideals. Empowerment theory is based on them, and the same holds for Herzberg's theory as well as for Hackman and Oldham's conception. In empowerment (Chen et al. 2007) the freeing of an employee is typically achieved by job enrichment procedures which were proposed originally by Herzberg. Hackman and Oldham's (1980) idea presupposes that a job will motivate the worker, if it takes on specific qualities. These qualities are those which sustain human worth, dignity and meaningfulness of the activities on the job. It might be argued, though, that in the theories discussed in this paragraph elements of protestant ethic could be identified as well. All of them find job and work as something good in itself, under the condition that the job or the work supports human interests or values.

Results

The discussion of the work motivation theories indicates five clusters of meanings (or ideologies). To analyse these clusters a little further, we could employ definitions of the core concepts of the clusters. That way, the clusters (or ideologies) could be described, as follows:

1. *Man-as-a-machine:* a whole composed of parts; uninfluenced by mind or emotions; automatic; governed by, or in accordance with the principles of mechanics; related to the quantitative relations of force and matter;

2. *Man-as-an-organism:* a whole composed of parts, internally organized and coordinated; having the characteristics of an organism;

3. *Man-as-a-social-being:* involving allies or confederates; relating to human society, the interaction of the individual and the group, or the welfare of human beings as members of society; tending to form cooperative and interdependent relationships with others;

4. *Protestant ethic:* the value is attached to hard work, thrift, and efficiency in one's worldly calling;

5. *Humanistic:* centred on human interests or values; the belief that humans, as individuals, are unique beings and should be recognized and treated as such; a concern with the fullest growth of the individual in the areas of love, fulfilment, self-worth, and autonomy.

The five clusters of meanings (or ideologies) associated with work and activities on a job could be construed in at least two ways. Obviously, we might understand the five clusters as standing for five distinct areas of interest concerning the study of human labour. In such a case it would make sense to ask whether the five clusters cover all the important things in the field of work motivation. Or, perhaps, if some clusters are represented in more or less detail as others. In both cases, asking the questions will help to develop the theory of work motivation and further its utility.

Another view is the ideological one. If we would call the clusters of meanings as *ideologies*, this would lead to questions of a different kind. First of all the term "ideology" is emotionally laden with both positive and negative aspects. On one side it might be understood as just a point of view, and on the other as an opinion which is pushed through to serve someone's interest. Again, in both cases, we could ask why somebody has chosen this and not some other opinion and whether or not it

has served some purpose. Of course, asking these questions might make sense only if there is no unequivocal winner, a theory widely accepted as the only true one. It goes without saying that for many work and organizational psychologists, the theory of psychological empowerment would be a good candidate for this position.

Psychological empowerment developed in recent years is a rather sophisticated concept, supported by considerable research data. Even so, the same has held for practically all the work motivation theories mentioned above. These theories were widely accepted and supported by numbers of empirical studies in their own time. In the next part of the paper we will discuss both the reasons why the same fate might lay ahead for the empowerment theories in future developments of the work motivation theories (Wosnitza et al. 2009) and try to answer these questions.

Discussion and conclusions

Humanism is a nice idea and a very Western one. It seems to be a powerful and recurrent theme in work motivation theories. Part of the problem with humanist ideals stems from their Western origin. Because of it they are culturally determined and so they do not have to represent the preferred values of non-Western countries (Hofstede, Hofstede 2005). The Czech Republic is located in Middle Europe and it is one of the post-communist bloc countries. In the last decade we have conducted two surveys on work motivation (Kolman 2001, Michálek *et al.* 2006) and some results suggest that respondents who are older, less educated and live on the country margins understand performance on the job in a different way than their younger, more educated and living in the central part of the country counterparts. These two kinds of respondents differ mainly in their experience on the job. The younger ones believe that to produce on a job will bring rewards to them. The others do not believe it is so. This finding lets us conclude that to fully grasp what the processes and the content of work motivation are, we have to take into account what *job* and *working* signify to those whose work motivation we try to research.

The use of the word "signify" in this place brings us back to semiotics. A job and working activities might mean very different things to people of diverse cultural origins, of diverse social standing and those who hold different beliefs on what work and/or being on a job stands for in their lives. If the scope of work motivation theory is enlarged accordingly, it would become clear that this field really is very complex. It might be extremely difficult or, perhaps, impossible to build one unified theory which would cover it in all its intricacy. At the same time, new themes are arriving incessantly (Latham and Ernst 2006, Masuda et al. 2012), new points of view which would differ from those we have introduced above. For somebody a job might primarily be a social role. For someone else it might be a way to develop as a human being and for another person just a toil which cannot be avoided. These different viewpoints may lead to different concepts on work motivation.

One of the recommendations Locke and Latham (2004) proposed was to "integrate extant theories by using existing meta-analyses to build a megatheory of work motivation". Semiotic analysis might help in this as a conceptual tool.

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TEACHING ENGINEERING STUDENTS CREATIVITY: A REVIEW OF APPLIED STRATEGIES

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Abstract

Recent studies have emphasized the necessity of educating creative engineers. This paper aims to provide a literature review by answering what strategies can be applied to develop creativity in engineering education. As the literature demonstrates, creativity has been studied by a diversity of perspectives such as psychology, social psychology and sociology. Studies on engineering creativity indicate the importance of problem-solving skills for engineers. For developing creativity, strategies such as using thinking tools, learning by solving problems and building learning environment conductive to creativity have been suggested in engineering education. Problem-Based Learning (PBL) is a strategy of developing creativity. So characteristics of PBL, learning cycle in PBL and methods for enhancing group dynamics in PBL are discussed in this paper. In addition, Aalborg University in Denmark is introduced as an example of PBL strategy.

Key Words

Creativity, engineering education, Problem-Based Learning (PBL), strategy

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Introduction

Creativity is widely acknowledged as vital to engineers. Success of engineers in their profession depends radically on the level and amount of creativity and innovation they exhibit in developing sustainable engineering concepts, components and systems, engineering design and their implementation (Panthalookkaran, 2010). However, to many engineers, creativity is nebulous concept that rests uneasily in the precise quantitative engineering world. Creativity is thought as a subject that cannot be taught; it is almost like a talent of an individual that one possesses or not as the case may be (Thompson and Lordan, 1999). This indicates some efforts are needed from educators who play important roles on making young engineers understanding and mastering creativity more explicitly.

This calls for strategies of developing engineering creativity. However, the literature shows creativity has been studied by diverse perspectives and given a wide range of definition. As discussed by Liu and Schoenwetter (2004), defining creativity is a daunting task, because there are very many published definition of creativity ranging from the very simple to highly complex(Thompson and Lordan, 1999). This brings difficulties to educators in designing or employing strategies of developing creativity. Furthermore, studies on engineering creativity indicate the importance of providing students problem-solving contexts in engineering curriculum. Therefore, this paper aims to review published studies by answering what strategies can be applied to develop creativity in engineering education. The review contributes to an outline of how to teach engineering students creativity and understanding Problem-Based Learning (PBL) as a good example of fostering creative engineers.

Studies of Creativity

Definition and Perspectives of Creativity

Generally, creativity is defined as a judgment of the novelty and usefulness (or value) of something (Amabile, 1996). However, there is a great deal of controversy about the meaning of the word creativity, particularly in a university setting (Toernkvist, 1998). Is creativity a mysterious gift? a unique talent? a trait? an attitude? Is it innate, or can it be learned and taught (Richards, 1998)? According to Sawyer (2006), creativity is not the myth. Creative potential exists among all people. Through deliberate intervention, in the form of training or instruction, individuals can make better use of creativity, enhance their level of creative accomplishment, and thus realize more fully their creative potentials (Treffinger, 1995).

The curiosity of creativity also drives to deepen and broaden the meaning of creativity. For example, Klein and Shragai (2001) suggest creativity is many things; it is a way of looking at the world and a way of opening up avenues to opportunity, adventure, and self-confidence. Meanwhile, diverse perspectives of studying creativity have been explored during the past years. As pointed out by Toernkvist (1998), the literature is enormous and spans a number of disciplines:

1. Psychology has focused on the individual's creativity and tried to identify the cognitive capacities and/or traits of personality that make up a creative person.

2. Social psychology has studied the process of creativity as an interaction within a given context.

3. Sociology (and organization theory) has emphasized creativity as an environmental process and studied efficient communication networks made up of prominent personalities with broad and deep knowledge.

Based on these main perspectives, a multi-level approach to study creativity has been asserted by considering at least three levels of analysis (Borghini, 2005): 1) intrasubjective (individual), 2) intersubjective (group), and 3) collective (organization). This approach helps to understand how in the creative process, individuals (in the context of groups and organizations) contributes to the outcome of a creative product through a sensemaking process. In other words, creativity is not only individual cognitive, but also collaborative or social.

Creativity in Engineering

According to Cropley and Cropley (2000), the nature and role of creativity and innovation has received only modest attention over a long period of time, in engineering education literature. However, more recently, the need for people skilled in helping others use creative problem solving is increasing. This need is evident in both engineering and the practice of pedagogy. As pointed out by Charyton and Merrill (2009), creativity has received greater necessity, rather than an accessory in engineering design.

Accordingly, meaning of engineering creativity has been discussed. For example, Gregory and Monk (1972) suggested that engineering creativity is demonstrated in the satisfaction of human needs by the exploitation of matter or energy or other material resources in a more effective manner. This means that for engineering, there is a tension between the need to produce novelty and the necessity of effectiveness, with the latter likely to be emphasized at the cost of the former (Hoffmann at el,

2005). Cropley and Cropley (2005) refer to creativity possessing this particular property as functional creativity, which means that products designed by engineers typically serve a functional and useful purpose, unlike fine art. The purpose is to create useful products (to perform tasks or to solve problems) (Charyton and Merrill, 2009). As Burghardt (1995) suggests, technology is the manifestation of engineering creativity. The products of engineering creativity are physical objects, complex systems such as a submarine or a business information system, or processes in the sense of a service, technique or method (a manufacturing process, a control process, a logistic service) (Hoffmann et al, 2005).

This is not to say that non-engineering creativity is devoid of purpose. As suggested by Hoffmann et al (2005), creativity in general is essential for progress and growth, which in itself is enough to give all creative efforts purpose. In contrast to "general creativity"—creativity that is not domain specific, the emphasis of engineering creativity is more on capability of problem solving. Engineers not only need to address aesthetics like artists, but also need to solve problems, prevent potential problems, and address utility within the constraints and parameters that are designated (Charyton and Merrill, 2009).

Strategies of Developing Creativity in Engineering Education

According to literature, creativity is an ability that students can achieve by using effective exercises and through a suitable environment (Adams et al, 2008). Furthermore, problems could be the sources of creativity that has been emphasized on teaching creativity to engineers (Liu and Schoenwetter, 2004). Accordingly, as the literature indicates, the strategies of fostering

creative engineers explored have been mainly followed three lines: 1) using thinking tools, 2) building learning environment conductive to creativity, and 3) learning by problem-solving.

Using Thinking Tools

As suggested by Liu and Schoenwetter (2004), instructor begins with direct instruction in using thinking tools, and then incorporates the tools into course contents. Note that students need know how to use the tools specifically and effectively, in order to facilitate the idea generation. The literature shows there are very many publications concerned with creativity thinking tools. For example, in the early 1980s, Geschka (1986) identified 50 and expanded on 23 creativity and ideas generation tools. However, according to Thompson and Lordan (1999), many are variations of core tools and therefore stem from the same basic principles. Here, a review is given of the tools that are most relevance to engineers (Liu and Schoenwetter, 2004; Thompson and Lordan, 1999). The tools include:

- Analogical thinking
- Brainstorming
- Idea checklists
- Mind mapping
- Morphological analysis

Analogical thinking: Researchers in cognitive psychology generally agree that creativity consists of reassembling elements from existing knowledge bases in a novel fashion to produce a new idea. Analogical thinking has been proposed as a basic mechanism underlying creative tasks, in which people transfer information from existing categories (i.e., base domains) and use it in the construction of their new idea (i.e., the target domain) (Dahl and Moreau, 2002). By the use of analogies, an individual or group can often find a new insight and approach to the nature of a problem (Thompson and Lordan, 1999). To implement this technique, students are encouraged to deliberately ask questions like 'What else is like this?' 'What have other done?' 'Where can I find an idea?' and 'What ideas can I modify to fit my problem?'

Brainstorming: As the most frequently used tool to generate new ideas, brainstorming means bouncing ideas out about a subject, no matter how wild or ridiculous they may appear like (Liu and Schoenwetter, 2004). It made a breakthrough in applying the psychology of creativity to the problem-solving activities of the real world and has been recommended as probably being of best use in some combination of individual and group practice (Paulus, 2003). Four basic rules of brainstorming were given: (1) Criticism is ruled out (to uphold the principles of deferred judgment); (2) Freewheeling is welcomed (variety of ideas to stimulate originality); (3) Quantity is wanted (quantity leads to quality); and (4) Combinations and improvements are sought (listen to others' ideas and improve by additional insights or combination of ideas) (Osborn, 1953).

Idea checklists: The thinking tool of idea checklist means making a checklist that will encourage the user to examine various points, areas, and design possibilities of a subject (Liu and Schoenwetter, 2004). It is used extensively in engineering design as a means of evaluation. There are different kinds of check-lists mentioned in literature (Thompson and Lordan, 1999), for example, Osborn proposed a list of nine questions including "magnify?", "modify?", "rearrange?" and "reverse?" etc (Osborn, 1953). Gregory (1979) listed his questions under functional headings: economic, understanding, practice, technological stretching, cross-fertilization, guessing the trend, and new axes of reference. The manipulative verb check-list may

provide words for identifying possible insights or alternative approaches to solving a problem. The list also helps to generate ideas by taking a verb from the list and "checking" the verb against certain aspects of the problem, e.g. how to implement a proposal (Liu Schoenwetter, 2004).

Mind mapping: Whereas brainstorming and checklist are ways to generate ideas; mind mapping serves as a tool for structuring ideas. It was firstly developed by Tony Buzan (1976), a mathematician, psychologist and brain researcher, as a special technique for taking notes as briefly as possible whilst being interesting to the eye. Now it has been turned out to be usable in many different ways other than just simple note taking (Brinkmann, 2003). Mind maps are hierarchically structured and produced. On a large sheet of paper the topic of the mind map is placed in the center and from this point of departure main ideas is linked by drawing branches, which again can be linked with sub-branches to elaborate on the idea (Mento, Martinelli and Jones, 1999). This kind of visual representation of ideas creates an overview of related ideas and helps one to think about a subject in a global, holistic sense and increases mental flexibility.

Morphological analysis: Morphological analysis is well known in engineering design. A problem is divided into functions, or even further subfunctions, that must be performed and alternative ideas generated for each function (or subfunction). Therefore, there are very many possible solutions to the problem created from the number of permutations of the solutions to each function. The difficulty for the designer is to choose the best solution from the large number of option available and, in practice, searches are quickly abandoned once a few acceptable solutions are found (Liu and Schoenwetter, 2004; Jones, 1970).

The above tools reviewed are some examples that facilitator can use in engineering classrooms. Furthermore, some other tools are often mentioned in literature, such as wishful thinking, brainwriting (Thompson and Lordan, 1999), and TRIZ (Baille, 2006). These tools can open up more channels for students to highly-efficient divergent thinking and thus help students to engage in the initial stages of the creative process (Liu and Schoenwetter, 2004). However, according to Baillie (2006), there are no rules to creative thinking—however, the skill of the facilitator is to create the atmosphere that is conductive to idea generation, as well as selecting the most appropriate technique, for the participants, in their context and with their particular problems to solve.

Building learning environment conductive to creativity

The social approaches to creativity have emphasized the shaping roles of environment on creativity (Amabile, 1996; Toernkvist, 1998). The development of creativity is affected by both personal and situational factors (Liu and Schoenwetter, 2004). As suggested by Plucker et al (2004), creativity is the interaction among aptitude, process, and environment by which an individual or group produces a perceptible product that is both novel and useful as defined within a social context. So Mitchell (1998) emphasize that teaching creativity in engineering education means to create a cooperative and safe learning environment so that student share ideas, form theories, explore concepts and work collaboratively in teams.

Accordingly, Kazerounian and Foley (2007) propose a list of ten factors that is called the Maxims of Creativity in Education that constitute an educational environment conductive to fostering creativity in engineering students. The Maxims are: 1) keep an open mind; 2) ambiguity is good; 3) iterative process that

includes idea incubation; 4) reward for creativity; 5) lead by example; 6) learning to fail; 7) encouraging risk; 8) search for multiple answers; 9) internal motivation; and 10) ownership of learning. Similarly, Richards (1998) suggests strategies such as 1) don't be afraid to be different, 2) be open and receptive to new ideas, 3) relax, 4) reflect, and 5) have fun, etc.

Furthermore, Liu and Schoenwetter (2004) emphasize it is the facilitator's responsibility to teach students how to recognize and remove blocks to creativity. As suggested by Kazerounian and Foley (2007), when teachers manipulate the learning environment such that students felt it is more accepting of risky behavior, students' creativity increased. Therefore, Liu and Schoenwetter (2004) summarize some common blocks and solutions of removing the blocks (Table 1).

	Blocks to Creativity	Solutions of Removing Blocks
Fear of the unknown:	Avoiding unclear situations; overweighing the unknown versus the known; and needing to know the future before going forward.	Teaching students efficient means of information gathering skills to clarify the situation.
Fear of failure:	Drawing back; not taking risks; and settling for less in order to avoid possible pain or shame of failing.	To provide students with opportunities of failure with the intent of using these opportunities as teachable moments—times when students are usually most receptive to an explanation of why it did not work.
Reluctance to exert influence:	Fearing of using aggressive or push behavior which may influence others; hesitating to stand up for what one believes; and failing to make oneself heard.	Incorporating stories of inventors who, because of their persistent belief in their innovations, even when faced with opposition provided valuable products.
Frustration avoidance:	Giving up too soon when faced with obstacles, in order to avoid the pain or discomfort that is often associated with change or novel solutions to problems.	Telling stories about great inventors, such as Edison who survived thousands of experimental failures.
Resource myopia:	Failing to see one's own strengths; and depreciating the importance of resources (i.e. people and things) in one's environment.	Role-modeling integration of personal strengths with the resources available.
Custom-bound:	Over-emphasizing traditional approaches or methods; and strongly revering for the past; and tending to conform even when unnecessary.	Providing students with opportunities to brainstorm new ideas based on classic traditions.
Reluctance to play:	Not playing around with material; fearing of seemingly foolish or silly act by experimenting with unusual.	Providing students with 'hands-on' learning experiences, making theories tangible.

Reluctance to let go:	Trying too hard to push through solutions to problems, instead of letting things happen naturally; and distrusting of human capacities.	Providing students opportunities to make things as they with and encouraging them to go ahead.
Impoverished emotional life:	Depreciating the motivational power of emotion; attempting to hold back spontaneous expressions; and neglecting the importance of feelings in achieving commitments.	To provide opportunities of celebrating student achievements. Some engineering schools achieve this through various national and international competitions, rewarding the creative efforts of students.
Over-certainty:	Persisting in non-functional behavior; and failing to check out one's assumptions.	Providing students with opportunities to reflect and evaluate their methods of creative problem solving.

Table1: Blocks to creativity and strategies of removing blocks

Learning by Problem-Solving

Since engineering creativity is characterized as functional creativity, and it emanates from engineering problems, it seems more natural for engineering students to gain creativity through practice of problem-solving (Liu and Schoenwetter, 2004; Cropley and Cropley, 2005). As emphasized by Tan, Teo and Chye (2009), problems are sources of creativity. Problem solving is a process in which the learner selects and uses rules to find a solution in novel way (Treffinger, 1995).

Furthermore, cognitive science and cognitive learning theories play an important role in our understanding of the mechanism of problem solving and the application of creativity in humans (Adam et al, 2008). A problem triggers engagement in terms of emotional motivation and deep thinking. When we are solving

a problem, we engage in an active search for meaningful information, a proactive immersion in the task, a conscious and subconscious investment of time on the task, and a search for meaning and explanation, along with the adoption of goal and future orientations (Figure 1) (Tan et al, 2009).
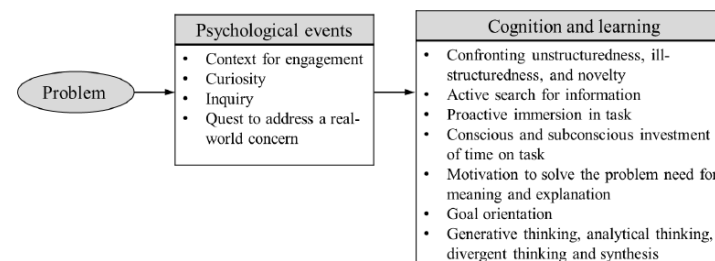

Figure1: Problems lead to cognition and learning

Accordingly, Creative Problem Solving (CPS) approach has been discussed much in literature (Baille, 2006). According to Treffinger (1995), the current CPS framework include three major components (Understanding the problem, Generating ideas, and Planning for Action) and six specific stages (Mess-Finding, Data-Finding, Problem-Finding, and Acceptance-Finding). This framework calls on individuals and groups to invest a substantial degree of thought or reflection, imagination, judgment, and energy in their creative problem solving efforts. Bransford and Stein (1993) suggest an IEDAL cycle for solving problems and they encourage entering this cycle at any point and recycling through the steps as needed. The following steps of the cycle are: 1) Identify problems and opportunities, 2) Define alternative goals, 3) Explore possible strategies, 4) Anticipate and act, and 5) Look and learn. Adams et al (2008) point out a five stage process of teaching problem solving based on work of

Woods (1977) and Polya (1957): 1) Define the problem, 2) Think about it, 3) Plan, 4) Carry out the plan, and 5) Look back.

Moreover, Liu and Schoenwetter (2004) suggest case studies, simulations, role playing or team work in teaching problem solving. They discuss a model made by Treffinger et al (2000), which consists of three hierarchical levels: learning and using basic thinking tools; learning and practicing a systematic process of problem solving; and working with real problems. The use of thinking tools provides a structural methodology for their applications in solving problems. In addition, as a good example of teaching engineering creativity, Problem-Based Learning (PBL) has been discussed much in literature (Awang and Ramly, 2008; Adams and Turner, 2008; Fruchter, 2001), as introduced in the following.

Problem-Based Learning (PBL): A Strategy of Fostering Creative Engineers

PBL and Methods for Creativity in Student Groups

Through learner-centered and constructivist, Problem-Based Learning (PBL) offers a framework for structuring and facilitating learning and group processes based on creative problem solving. The literature demonstrates PBL has been employed in different areas of higher education such as business management (Smith, 2008), medicine (Hendry et al, 2003), and engineering (De Graaff and Kolmos, 2007). In engineering education, PBL has become increasingly accepted due to its principles of integrating knowledge across disciplines and developing expected professional competencies among students by bridging university and society (De Graaff and Kolmos, 2007).

In PBL, student learning centers on a complex problem that does not have a single correct answer. Students work in collaborative groups to identify what they need to learn in order to solve a problem. They engage in self-directed learning and then apply their new knowledge to the problem and reflect on what they learned and the effectiveness of the strategies employed. The teacher acts to facilitate to the learning process rather than to provide knowledge (Hmelo-Silver, 2004). As suggested by Savin-Baden (2000), PBL can offer staff and students the opportunity of learning to 'make sense' for themselves, personally, pedagogically and interactionally. It can also help to realize the value and complexity of it as an approach to learning and the ways in which it can help students to understand and challenge their situations and frameworks by encouraging them to learn with complexity and through ambiguity. Accordingly, PBL scenarios are characterized by the following features (Porath and Jordan, 2009):

- Ill-structured problems. The nature of real-world problem is that they are often without the types of boundaries or structures that define problem solutions. Most problems, in reality, are confounded with other variables and need to be teased out of social, emotional, cultural, and environmental contexts.

- Partial information. When we encounter problem in real life, we often have only partial information available to us at first when we try to find a solution. At times, additional information is found or presented to us during the solution process.

- Questions that belong to students. PBL scenarios are designed to give students the opportunity to become self-directed in their search for solutions, thereby making

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them, rather than the teacher, the persons who develop the questions.

- A real problem with a number of plausible solutions. The ill-structured nature of real problems means that often there is more than one solution. There may be a right answer, but it is also possible that the right answer is mixed in with a number of plausible answers and so further investigation would be required.

- Requirement of cooperative group work. The reality of most problem-solving situations in life is that they are group efforts. We tend to seek out individuals who have information that could be useful to problem solution and usually discuss our findings to solidify our understanding of problems and situations. This natural collaborative problem-solving tendency is captured in the PBL procedure.

The student learning process in PBL may be structured in different ways. One of the most well-known models is the seven-jump method (Segers et al, 2003). Poikela et al (2009) provide a model of PBL learning cycle that also demonstrates tutorial process (Figure 2). In this cycle, the PBL process begins with students working toward a shared understanding of the problem presented to them. They then brainstorm ideas about the content area related to the problem using their existing knowledge and prior experiences. Similar types of ideas are grouped into named categories. The most important and actual problem areas among the named categories are determined. The first tutorial session is then held to decide on the learning tasks to undertake and the goals to achieve. Following the tutorial, students engage in information search and self-study, working both individually and in pairs or in small groups depending on the learning tasks and goals as well as the strategy deemed most appropriate for seeking information. The second tutorial

is the time for applying the new knowledge acquired, to tackle the learning tasks, and to reconstruct the problem in a new way. New and deeper knowledge is synthesized and integrated to provide a basis for deeper learning. Participants clarify and reflect on the whole problem-solving process in the light of the new knowledge. Assessment is part of every single phase of the process. It is necessary to close the tutorial with feedback about students' own learning, their information-seeking behavior, their problem-solving skills, and the group processes so that improvements can be made (Poikela et al, 2009).
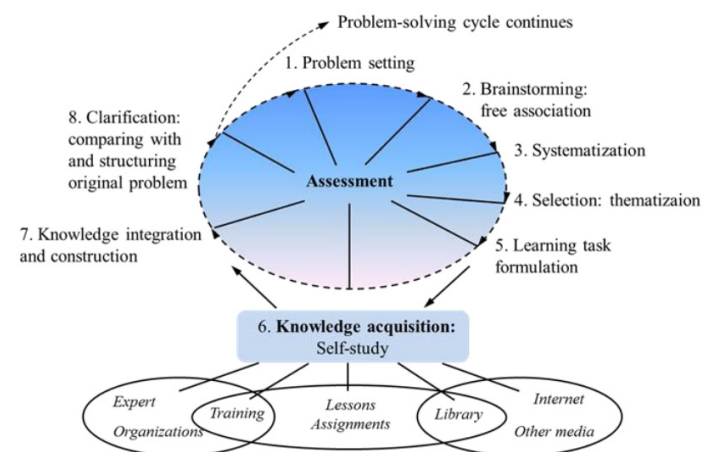

Figure2: Problem-Based Learning cycle

Therefore, the tutor coaches the group by monitoring the group process and helping the students to identify the knowledge that is needed to resolve the problem (Poikela et al, 2009). So "student-centered learning" is the core philosophy of PBL (Dolmans, 2001; Zhang, 2002). The tutors are expert leaners,

able to model good strategies for learning and thinking, rather than experts in the content itself. They are responsible both for moving the students through the various stages of PBL and for monitoring the group process. This monitoring assures that all students are involved and encourages them both to externalize their own thinking and to comment each other's thinking (Hmelo-Silver, 2004). Accordingly, methods for successful collaboration and inspiring creativity in PBL environment have been specially suggested (Gerhardt and Gerhardt, 2009), such as:

- Six Hats Method by Edward de Bono. This technique can enhance diversity of thought by applying different types of thinking to the subject. It can fostering creativity by maintaining a playful (not too critical) attitude as everyone in the group switches from one metaphorical "hat" to another, each representing a different mindset. The six hats comprise the following: White hat is cold, neutral, and objective; while wearing it, you can look at the facts and figures. Red hat represents anger (seeing red), and it signals the times to listen to your intuition and emotions. Black is careful and cautious. Yellow is sunny and positive. Green is full of creative new ideas. Blue is the organizer of thoughts.

- Changing the Environment. By moving outdoors or to a more or less stimulating environment, team productivity may be enhanced or the focus refreshed. Rearranging the furniture in the team meeting room can give the team a fresh perspective. Change the environment and maybe the idea previously set will change as well. It can be very helpful to be in the environment or setting for which one is designing or about which one is learning.

- Handing around Partial Solutions. Try handing around incomplete concepts to get unexpected ideas. The idea behind this is that even if one group member cannot complete the entire cycle, someone else in the group may be able to. This principle is very powerful in collaborative efforts, such as where group work on research publications or even where students work on collaborative papers. The work is completed relay style, passing the baton from runner to runner, and in this way optimal effort can be maintained.

Furthermore, techniques for enhancing group productivity have also been suggested to use in PBL student group meetings (Gerhardt and Gerhardt, 2009). For example, in the first group meeting, the following group-building and meeting-management techniques can be employed:

1. *Introductions* to help group members know each other
2. *Establishment of the agenda*, to which all group members can contribute
3. *Check in/check out*, an exercise held at the beginning and end of the meeting in which group members assess how they feel about the progress of the group and their own expectations
4. *Establishment of group norms*, a discussion of important guidelines and group rules including:

   a) The obligation to dissent, which is the obligation of group members to voice their opinions and concerns even when it means disagreeing with other group members

   b) Use of a peer leadership model, where different "emerging" leaders take turns to lead different phases of the project at hand

c) Use of the standard agenda creation process to ensure that group members know what will be discussed during the group meeting

d) Use of the check-in/check-out process at each meeting to keep the group apprised of individual concerns.

5. Establishment of group meeting schedule for regular meetings, for example, each week during the lunch hour on Tuesday and Thursday.

As mentioned previously, to foster flexible thinking, problems need to be complex, ill-structured, and open-ended; to support intrinsic motivation, they must also be realistic and resonate with the students' experiences (Hmelo-Silver, 2004). So Project-Based Learning has also been applied to engineering education (De Graaff and Kolmos, 2007). According to Steiner and Blicblau (1998), the projects relate basic principles and concepts to real problems and they promote understanding of basic concepts, enabling deep learning, broadening knowledge and encouraging creativity. They stimulate an enjoyable realistic exercise, encompassing time and financial restraints, while learning to perform duties as part of a professional team. However, some researchers point out Project-Based Learning is different from Problem-Based Learning. For example, Savin-Baden (2007) argued that project-based learning is more often seen as a teaching technique in a given area of the curriculum rather than an overall educational strategy such as problem-based learning. However, both Problem-Based Learning and Project-Based Learning would be seen to be synonymous because both are perceive to be student-centered approaches to learning.

Aalborg University in Denmark: An Example of PBL Environment

Aalborg University (AAU) in Denmark has a long tradition for PBL since 1974. The project work model is used in all levels of education at AAU. The traditional Aalborg model is founded on problem-based project work, in which approximately one half of the students' time is spent on project work in teams, whereas the other half is spent on more or less traditional lectures. All project work is made in groups, and the same model is followed from 1st semester until the completion of a masters' degree (10th semester). During the span of the university degree programme, the groups normally become smaller, starting with typically 6-7 students in the 1st year, and reduced to maximum 2-3 students in the final semester (Kolmos et al, 2004).

In each semester, the project and the majority of the courses must relate to the theme of the actual semester. The students are supposed to attend the courses and apply them in their project work, and the output of the courses is assessed along with the project report at the end of the semester. The examination is a joint group examination with individual marks and takes up to six hours. The work with the project report and courses—the theme—covers approximately 80% of the semester, equivalent 24 ECTS (European Credit Transfer System). A full semester is 30 ECTS points. The rest of the semester includes fundamental courses or other compulsory course (study courses) assessed by more traditional examinations (Figure 3) (Kolmos et al, 2004).
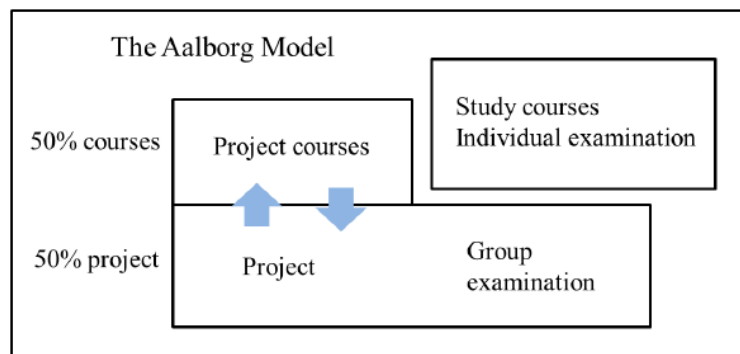
Figure3: The traditional Aalborg PBL model

To ensure a certain education, the project must fulfill some educational demands based on themes for the individual semesters. The specific problems, the groups work with in their project, can either be suggested by themselves, but most likely it is suggested by a scientific staff member, often in co-operation with industry. The students carry out the projects all the way from problem formulation and analysis, through the problem solving, and to the final result which is often an 80-200 pages report and for the engineer students, and most often also a prototype of the (sub-)system they have been working on as well as technical documentation for what they have developed (Larsen and Nielsen, 2011).

The literature demonstrates that AAU has been discussed broadly as an influential PBL model in engineering education (De Graaff and Kolmos, 2007), especially on the project characteristics of solving real-life problems and interdisciplinarity (Nielsen et al, 2008). So the PBL model at AAU has proven to be very popular with the students, who prefer real life engineering problems compared to hypothetical, academic problems and

lectures. This has led to a highly beneficial co-operation with the local industry as a major of master thesises are proposed by companies (Larsen and Nielsen, 2011). Moreover, the recent studies have demonstrated Aalborg University is ranked as the best one of educating engineers in institutions in Denmark (Kolmos and Holgaard, 2010). Due to the success, the UNESCO chair in PBL has been settled at AAU (http://www.ucpbl.net/), aiming to create a global society for researchers and academic staff working with PBL.

Conclusion

It is clearly evident that the ability to solve problems creatively is an essential attribute for an engineer. According to the literature, the development of creativity in engineering education can be enabled through a series of strategies, which include using thinking tools, building a learning environment conductive to creativity, and learning by problem-solving. Problem-Based Learning is a good example of fostering creative engineers since it provides a collaborative knowledge-building and self-directed learning environment, under the core philosophy of "student-centered learning". Due to the potential of developing creativity, PBL has been employed broadly in different areas of higher education and a growing number of institutions, such as Aalborg University in Denmark. However, to apply strategies to developing creativity and high-level thinking skills should not become overburden for both students and teachers. To be effective and attractive, the techniques should be introduced throughout the curriculum and related to interesting topics those engineering students are concerned. Therefore, the key

of developing creativity in engineering education is to help students realize their creative potential, understand what is known about creativity, and increase confidence of being creative engineers in their future careers.

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