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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:

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• theory and methodology of science;

• human resources and human relations management;

• knowledge management and knowledge engineering;

• systems engineering and information engineering;

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All papers passed a double-blind peer review process.

ERIES Journal

A REFLECTION ON UNIVERSITY STUDIES AND FURTHER CAREER DEVELOPMENT OF CHOSEN CULS FACULTIES´ GRADUATES

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Abstract

The article is focused on professional orientation and direction of the careers of graduates of Faculty of Economics and Management (FEM) and Faculty of Agrobiology, Food and Natural Resources (FAFNR) at Czech University of Life Sciences Prague (CULS).

The general information and theoretical part is devoted to the topic of career, its concept and definition, and it deals with chosen determinants of career orientation and career development. The concept of career is considered within the sphere of specialized terminology mainly used in humanities disciplines, it defines subjective and objective career. Moreover, the concepts of life developmental tasks and career maturity are being mapped. The existence of typical stages of development is also discussed, for which there are typical qualitative differences on the level of information, in relation to a given profession and in motivation towards the profession (with regard to the stage that includes university studies). Significant influence of objective and situational factors, which interfere with career orientation and the choice of a profession, is further included. A look at a person's personality with respect to the determinants of career orientation and career development also forms a part of the general information part.

In its first part of the empirical section, the article is focused on the concept and definition of career from the beginning of the 1990s. This includes the views of Czech as well as foreign authors. In the second part, the article tries to present practical consequences of students' career orientation and it deals with processing an estimate whether the observed faculties' graduates remain working in the field related to what they studied within five years from graduation. A part of the study is also formed by a description of the main motives leading to choosing a profession during university studies. The chosen attributes were monitored among a selected group of students, which was formed by graduates of the daily Masters programmes at Czech University of Life Sciences Prague, specifically at Faculty of Economics and Management – Operations and Economics programme and Business and Administration programme, and at the Faculty of Agrobiology, Food and Natural Resources regardless of studied programmes. The students graduated at least a year and maximum five years prior to the conducted research. The data were collected with the help of a survey. The survey included 17 items and was sent out electronically. The respondents marked which facts and to what extent distinctly influenced their professional direction given by the studied programme during their studies at the Czech University of Life Sciences Prague. They also answered an inquiry whether they remain working in the profession that they prepared for during their studies, or (if applicable) the survey tried to find out why their career took a different direction.

Introduction

The working career topic has a long tradition among work and organizational psychology as well as in other psychology and non-psychology disciplines and fields. Career direction, career choice and career development are multilaterally significant issues that are related to an individual, his/her family, to an organization and to society as a whole.

The term "career" (from the French la carriére – profession, course, path) is often used for its content and in various connotations and it has multivalent use. It appears in colloquial language, we see it used in its wider dictionary definition, and it forms a part of specialized terminology used mostly within humanities disciplines that are focused on an individual in relation to the context of work. In specialized terminology, as we come across it in mainly psychological, sociological works, and in publications focused on personnel management, andragogy etc., the term deals with the concept of career as professional advancement in the work place, and its indivisible part is formed by a person's orientation and ambition on the one side and on the other side by the conditions and opportunities created by the organization. We talk about a career in connection with employees' training, their development, with creating opportunities and steering career growth.

Bělohlávek (1994), with reference to Clark's differentiation, distinguishes between an objective career and a subjective career. An objective career is usually presented in structured CVs, which are e.g. worked out when applying for a job. Usually in a chronological order it presents education history, employment, an overview of abilities and skills and work experience gained up to that time. It consists of a summary of individual predispositions, which serve to evaluate the suitability of a candidate for the given position. A career conceived in this form reflects the formal requirements of an organization, which emerge from the organization's system of work positions, and from them arising qualification requirements, career opportunities within the organization (career maps), system of working with people, etc.. It is also subjected to factors given by a broader external environment context such as changes in the labour market, demographic trends, situational limitations and opportunities (Kirovová, 2000).

A subjective career predominantly shows inner reflection of the above given facts and their significance for an individual. It is connected with personal goals and aspirations, with a person's value orientation, attitude, interests, motivational tuning and mainly with his/her self-reflection. "It is related to personal appraisal of success during individual professional development phases" (Štikar and col., 2003, page 119). It reflects the person's own subjective idea of a working life. It is connected with the individual's self-concept, with his/her perception of the world and his/her place in it, with value hierarchy, and with the person's orientation toward life goals and wanted lifestyle. A subjective career is described in terms of an individual's career orientation, subjective career anchors, integration of working life into personal life, and in terms of career development during individual life stages. Sparrow and Hiltrop (according to Kirovová, 2000) consider subjective career - in relation to the changes in the economic and social environment of developed industrial countries, as well as to changes in organizations' structures and in relation to the dynamics of the changes – to be more significant for understanding an individual's career development.

They point out the importance of individual differences, which effect the manner and the level of coping with changes in a dynamic environment of a modern organization. In the

concepts of many distinguished experts focused on career counselling, an important role is played by the life stages, that an individual goes through, on the way a person views his/her career development. In relation to this, as is stated by Vendel (2008), the concepts of **life developmental tasks and career maturity**, which was made popular by Super, caught on in counselling psychology that is focused on career counselling. Super (according to Koščo and col., 1980) defined developmental tasks as a set of expectations, which social environment (society, family etc.) has of an individual, who is going through certain developmental phases. The concept of career maturity expresses the existence of typical developmental stages, for which there are typical qualitative differences on the level of information, in relation to and in motivation towards a given profession. Career maturity – in opposition to immaturity – manifests itself by more comprehensive knowledge regarding the profession, regarding the character of the activities and the demands placed on the person working in the profession. It is connected with having a specific idea regarding the sense of the needed education and the need to obtain necessary skills with respect to future activities related to the profession, and with being aware of the conditions that are necessary in order to succeed in the profession.

In relation to our research's focus, in which the monitored population is formed by "fresh" graduates of Masters programmes that finished their studies a minimum of one year and maximum five years prior to the research, we mainly focused on the last of the three elementary developmental phases that are determined by the level of achieved education (age 6-15 (elementary school), age 15-19 (secondary school), age 19-25 (university studies)). According to developmental psychologists this last phase is on the boarder of early adulthood.

In the early phase of adulthood young people do not fantasize as much as adolescents do. Children's and adolescents' illusions transform into hopes and visions. They are more realistic, more pragmatic, they abandon black and white perception of the world, and they are made stronger by life experiences and by more distinctly manifesting abilities. In this phase of life, personality development occurs on the level of self-concept and in relation to other people. Individualization is directed toward reaching a stable, realistic and acceptably positive identity. Freedom in decision making is linked together with the acceptance of responsibility, self-trust is supplemented with the ability to estimate one's own strength, and the way we behave is corrected by controlling one's emotions. An individually specific way of understanding and accepting roles is connected with the stabilization of an individual's character, values, attitudes and lifestyle (Vágnerová, 2007). Langmeier and Krejčířová (2006) point out that among this age group interests are fully developed, moral values are stable, legal conscience in relation to the surrounding word, nature and other people has already crystallized.

Performing a profession or temporarily performing some work activity brings young adults a specific experience. When specific competencies are put into effect at work it leads to the acceleration of personal development, to the adjustment of one's own self-confidence, to specifying the content and importance of roles in the network of interpersonal relationships. Experiences gained in the work environment lead to the amendment of life goals and plans, they have impact on our idea of further life fulfilment and they amend perspectives that were created up to that point in time. Furthermore, an individual becomes strongly aware of his/her present, although temporary, incorporation into

society's structure and a certain form of lifestyle is stabilized (Farková, 2009).

In the meantime university students see work as a source of necessary financial means and experience. Overall these are temporary contacts, unbinding, they are purposeful for the organizations as well as the students. If these contacts with work experience are connected with future professional orientation, then they give an important insight into future reality, which may have a significant correctional effect on their studies' orientation, possibly on studying as a whole. During the university studies period students verify that they chose the right university studies, the right school and the right programme. Important indicators for them can be study success or lack of it, interest or lack of interest in a group of specialized subjects, anticipation of possible (dis)satisfaction with work on the basis of work experience received during internships and temporary work. It is possible to say that during the first two years of university studies it is being decided whether the student will stay in school with respect to the student evaluating the correctness of his/her previous choice. During the last two years of university studies specialization and future direction is being tuned, but it does not have to be definite. Finishing a university may have several "outcomes", the most frequent are: 1. Identification with the future professional direction and working in the profession; (2) Acceptance of professional direction, but not working in the profession due to the situation on the labour market and other objective reasons; (3) Not accepting the profession's orientation that results from the studied programme and changing orientation to another field of human activity; (4) Acceptance of the profession's moratorium (according to Vágnerová, 2007) in the form of studying at other universities, continuing at a Doctorate's degree programme or applying for study stays at home or abroad.

Super (1980) in his practically oriented articles, Blocher (according to Vendel, 2008) in a worked out overview of relevant studies from the end of last century and in a study worked out in the first decade of the current century (Philips, Christopher-Sisk, Gravio, 2001; Kenny, Bledsoe, 2004; Patton, Creed, 2007 and others), identically refer to a distinct lack of direction and orientation among young people (especially secondary school students, but often also university students) when choosing a career. This mainly has to do with insufficient amount of necessary information that allows for goal-directed professional orientation and choice, and this is connected with indecisiveness and with the delay of making a decision. It further has to do with having only a vague idea regarding the requirements and the demands individual professions have on an individual, with the existence of unrealistic plans that were influenced by important people, information from mass media etc.. For the time being, in addition to that comes insufficient ability to evaluate the situation on the labour market, which is connected with preferences of some groups of professions or with restrictions and limits in other fields. On the whole the given authors agree that such a situation creates space for social pressure and often unqualified influence coming from the family, peers, friends and purposeful influence of mass media.

The given studies and the opinions of their authors thus point to the considerable effect of **objective and situational factors**, which interfere with career orientation and the choice of a profession. Among prominent theoreticians on career choice mainly Super and Holland mention these factors in empirically oriented passages of their publications. Super (1980) determined 4 groups of such factors (loosely worded):

- Family and family background –includes father's and mother's profession, socio-economical status of parents, parents' financial situation, parents' aspiration for their children's occupation, their attitude towards their children's education, mutual relationships within the family etc.;
- Situation in one's own family - status, number of dependent family members, age, state of health, aspiration of life partners etc.;
- Contemporary general situation – current socio-economical status, financial situation, regional membership (town – country), incorporation into subculture, race or religion etc.;
- Current economic state of society – general economic situation in the country, situation on the labour market, changes in the structure of professions in the given stage of the society's development etc.;

Super states that the given conditions occur in various combinations and they influence individual professional development in such a way that they can support it, suppress it, or modify it in a specific way.

Holland (1973) speaks more generally regarding the influence of environmental factors, to which he attributes the same effectiveness as to personal factors when choosing an occupation and for career development. He states that external effects in relation to professional orientation and career choice have the greatest effect in the period of early adolescence and gradually their effect decreases due to the influence of growing career maturity (in the sense of Super's concept).

It is obvious that objective and situational determinants distinctly interfere with career orientation, career choice and further career development. During their positive constellation they can support individual preferences of an individual, they can be in compliance with his/her orientation, wants, and aspirations and goals. However, they can be in sharp contrast and form large barriers against individual direction and effort. From the point of view of counselling activities the given determinants represent contextual factors, which counsellors point out and they encourage the choice of other or supplementary variants of career orientation and the choice of occupation, keeping in mind the potential and the orientation of the individual's personality.

A university that acts responsibly is not only an indifferent component in the student's choice of career. It is further interested in its graduates' career paths, it works with them, organizes events for them, organizes clubs. The university is also interested in finding out whether it fulfils its pedagogical mission and really prepares professionals for working in the field that the students chose. In order to verify the career orientation of Czech University of Life Sciences Prague (CULS) students a scientific project was carried out at the Faculty of Economics and Management (FEM) and Faculty of Agrobiology, Food and Natural Resources (FAFNR) in 2008. The project was performed in the area of career counselling, and it took into consideration the particularities of CULS, student population and conditions that influence their professional focus and subsequent career development. Part of this project, which was organized by the Department of Psychology at FEM CULS, also processed an estimate whether the graduates remain working in a profession that is related to the programme they studied within five years from graduation. The results of this inquiry among a group of selected students are presented in this article.

Material and Methods

The term "career" and its concept is rather broad. Therefore, it is necessary to deal with the definitions of career, with their comparison and to determine common and divers characteristics, with the help of which the term can be defined. We will focus on Czech and some foreign authors in an illustrative rather than an exhaustive manner from the beginning of the 1990s. Růžička (1993, page 10) gives the following definition: "By a professional career or a working career or also by a person's professional path we understand the period, during which the person is incorporated into the work process, which means from the person's entry into his/her first employment relationship (job) until the last employment ends." In his concept a career is defined by a sequence of positions, jobs or professions that an individual holds throughout his/her work life. It is dependent on a person's functioning in an organization and its distinct determinants are personality traits, goals and the orientation of a person on the one side, and opportunities that are created within the organization on the other side. According to Růžička professional career represents a certain advancement of an employee within a business organization, which can be monitored according to objective criteria. In the context of a person's life path a professional career is understood to be an important source for feeling satisfied with one's life. The given concept of the author does not change even in his later works (Růžička, Koš, 1997; Mayerová, Růžička, 2000; Mayerová, Růžička, 2001).

Bělohlávek (1994, page 11) in his treatise dedicated to personal career defines career as: "… a life path, especially then professional path, during which a person gains new experience and fulfils his/her own personal potential." He conceives career as a natural process, and during its course a person fulfils his/her personal potential, is enriched by new experiences and develops his/her personality. The author leans toward objective and subjective differentiation of a career and he leans toward evaluating its success through a set of criteria. This author also uses the same concept in his collected work (Bělohlávek, 1996).

Rymeš (1995, page 155) talks about a professional path as a synonym for a working career and he understands it to be "... a sequence of individual professions, positions_and work roles , which result from person's deliberate decisions, from inevitabilities that are created in the given organization and from sudden opportunities." Professional career has continuous development, which includes rises and falls as well as remaining on the same level, and its course is the result of the company's operation, respectively the organization's and individual's cooperation (as a synthesis or a compromise). The author placed an emphasis on the concept of a professional career as a process of accepting and performing professional positions and roles, the fulfilment of which does not occur without problems and conflicts. In the more recent thematic work on this issue that is a part of a more broadly conceived overview (Štikar and col., 2003), the author leans towards differentiating between objective and subjective careers and he places greater emphasis on a biodromal view of a working career.

Bedrnová, Nový and col. (2007, page 532) give a more generally formulated definition of a person's working career (professional path) as: "… the course of his/her profession from the person's entry into his/her first employment relationship (job) until the last employment ends…." The authors consider working career to be significant phenomena in the context of an individual's whole life. Attention is paid to an individual's need for self-fulfilment, which has an important place especially among

specific forms of career development (move upward, move sideways etc..)

The definition and characterization of a career among foreign authors is very close to the ones we see among domestic authors. That is why we only chose those authors, whose characterization is broader, more complex, and hence incentive for forming our approach towards a career concept.

Clark's career concept (1992) is extensively characterized – by career he understands a continuous professional path in a person's life, which is formed by a sequence of jobs and work activities. Within the framework of a career he differentiates between aspects that are related to the given profession or position and formalized conditions of career advancement, and between aspects that are related to the person him/herself (abilities, experience, his/her orientation and ambition). According to the given author a career can be perceived as a succession of component life stages, or as a continuous working life, which includes il/logicalities or in/continuity in his/her own development.

In Butcher's and Harvey's career concept (1998, page 78) there is an obvious emphasis on the person's own activity, initiative and responsibility for the development of his/her professional path. It rises from the characteristic of a career, which is understood to be "… a process of setting up a personal path in an organization's context …" with emphasis on the development of a wide range of skills, which will allow an individual to take over the initiative in an organization's changing environment (opposed to a passive expectation that the organization will take care of him/her.)

On the basis of theoretical information and in connection with our research plan **H1 hypothesis was formulated**: The extent of representation of individual sources of motivation that influence the choice of profession differs among FAFNR and FEM graduates.

The data was collected with the help of a **survey** that was processed "ad hoc" and adapted for the research's purpose. The survey included 17 items and it was sent out electronically to graduates that completed their studies within 1-5 years prior to the survey. The graduates were addressed by an introductory motivation letter with a direct entry into the survey that was placed on an internet address. Beside basic personal data the respondents marked, which facts and to what extent motivated them during their studies at Czech University of Life Sciences Prague and distinctly influenced their professional orientation given by the studied programme. The final question dealt with whether they remain working in the profession that they prepared for during their studies; if applicable it tried to find out the reason for their career's detour.

The questionnaire contained the following items:

Basic information:

1. Faculty you study (chose)
2. Programme of your study (free answer)
3. Prevail form of your study (chose)
4. Year of your graduation (free answer)
5. What is your highest university degree obtained during your study at our university (chose)
6. Gender FEMALE/MALE
7. Age (chose)

University education:

Which facts motivated you and distinctively influenced your vocational specialization based on programme during your study at CULS? Please, give the answer to all suggested options and qualify their significance. For evaluation use following scale: very distinctively –distinctively- less distinctively – not at all

1. Studied subjects
2. Professors
3. Role model
4. Family
5. Internship during studies
6. Temporary work and other work activities
7. Acquaintances and friends
8. Other influences (please mention which one)

Present time:

Do you work in a profession on which you were prepared during your study at CULS? YES/ NO

If your answer is NO: state purposes of the diversion

The questionnaire was presented in Czech language.

Results

The selected group of students was formed by graduates of daily forms of Master degree studies at Czech University of Life Sciences Prague, at Faculty of Economics and Management - Operations and Economics programme and Business and Administration programme, and at the Faculty of Agrobiology, Food and Natural Resources regardless of the studied programme, and who completed their studies a minimum of one year and not more than five years prior to the survey (Table 1). Data from 224 respondents from the selected group of graduates were received, out of which 154 were FEM graduates and 70 were FAFNR graduates (Table 2). The graduates were addressed electronically. In order for them to fill out the questionnaire a direct link to an internet address was created.

FEM	FAFNR	Total
Absolute number	Absolute number	Absolute number
2376	736	3112

Table 1: Basic group of graduates

FEM			FAFNR			Total		
Absolute number			Absolute number			Absolute number		
Women	Men	Total	Women	Men	Total	Woman	Men	Total
107	47	154	58	12	70	165	59	**224**

Table 2: Selected group of graduates

Items from the Graduate Survey meet H1 hypothesis. The survey tried to find out on a four level scale which facts motivated graduates throughout their studies and had significant influence on their professional orientation given by the studied programme. We present the results in a unified form on the basis of pre-set dichotomic yes/no signs and in the order from the most preferred factors to the least preferred (Table 3 and 4).

Order		FEM	
		Distinctly or very distinctly (%)	Less distinctly or indistinctly (%)
1.	Family	59.5	40.5
2.	Studied subjects	58.4	41.6
3.	Temporary work and other work activities	50.7	49.3
4.	Role model	41.5	58.5
5.	Internship during studies	40.2	59.8
6.	Acquaintances and friends	40.9	59.1
7.	Professors	31.1	68.9
8.	Other influences	0.0	0.0

Table 3: Overview of motives leading to the choice of a profession among FEM graduates

Order		FAFNR	
		Distinctly or very distinctly (%)	Less distinctly or indistinctly (%)
1.	Studied subjects	71.4	28.6
2.	Professors	52.8	47.2
3.	Family	44.3	55.7
4.	Role model	42.8	57.2
5.	Temporary work and other work activities	37.2	62.8
6.	Internship during studies	35.7	64.3
7.	Acquaintances and friends	32.9	67.1
8.	Other influences	0.0	0.0

Table 4: Overview of motives leading to the choice of a profession among FAFNR graduates

Among the motives that most distinctly influenced their choice of profession FEM graduates present family and studied subjects, further on temporary work and other work activities, role model, internship during studies and the influence of acquaintances and friends.

FAFNR graduates put studied subjects as the most distinct motive.

A classical χ^2 test of homogeneity was used in order to analyse the difference in distribution of all monitored variables between both faculties.

A significant difference was found in the influence that professors within CULS had on the professional orientation of the respondents (χ^2 (df = 3) = 12.31; p = 0.006). Professors very distinctly influenced FAFNR graduates rather than FEM graduates.

There are not any differences in the group of other motivational factors between FEM and FAFNR graduate students.

Therefore, we can state that the degree of representation of individual motivational sources that influence the choice of profession among FAFNR and FEM graduates significantly statistically differs within the factor of professors.

In the period between a minimum of one year and maximum five years from graduation 68.2% of FEM graduates and 67.1% of FAFNR graduates work in the profession that they studied (Table 5).

Faculty	Work in the field (%)	Work outside of the field (%)
FEM	68.2	31.8
FAFNR	67.1	32.9

Table 5: Overview of graduates' working in the profession

17.5 % of FEM graduates and 17.1% of FAFNR graduates held a managerial position in the period when the research was done.

2.6% of FEM graduates and 12.8% of FAFNR graduates gave as the reason for change of profession a low number of job opportunities in the given field; 26.2% of FEM graduates and 4.3% of FAFNR graduates were tempted away from performing their studied profession by an interesting offer.

Discussion

The goal of the research aimed toward processing an estimate whether the graduates remain working in positions connected with the programme they studied up to 5 years from completing their studies. The research showed that at both faculties almost seventy percent of graduates within the interval of one to five years still work in the field that they studied. The reason why FEM graduates left their profession is most often due to an interesting offer (this reason is given in more than a quarter of responses), and among FAFNR graduates it is the lack of work opportunities in the given field. Therefore, we can state that FAFNR graduates showed a greater tendency to continue in the chosen field than FEM graduates. The received data correspond with earlier findings that since childhood FAFNR students predominantly manifest the tendency to prefer such interests and professions, which are connected with the subject of their studies. FEM students are less specifically oriented in their interests and subsequently in their choice of a profession.

When comparing both faculties we can state that among FAFNR graduates there are practically as many graduates represented at managerial positions as among FEM graduates.

From the point of view of comparing ambitions from the time of university studies with the actual reality, it is interesting for us to find out the ratio of persons that during the monitored time frame held a managerial position. FEM students, who according to the results of previous research distinctly preferred the choice of a managerial position during their secondary school studies, and who in their first year of undergraduate studies and last year of graduate studies showed the strongest tendency to become leaders, hold this position by approximately 70%. In the group of FAFNR graduates, who in the previous research showed minimum leading ambitions in the area of career

choice, the amount of representation at managerial positions was practically the same as among FEM graduates. We explain this paradox by our belief that graduating from a Master's programme is a formal prerequisite for receiving a managerial role, and many times this is regardless of the studied programme or the university's focus or the fact whether the individual primarily shows managerial ambitions or not.

Conclusion

In further reference to contemporary approaches towards career matters and mainly then career choice, the research set as its goal to work out an estimate whether FEM and FAFNR graduates remain working in the profession that is connected with the programme they studied, and to cover the motives that most distinctly influenced their choice of profession. The results of the conducted research opened new space for determining and providing high-quality university education with regards to the real application of the specific field of study with respect to the graduates' careers.

This field in the future could be extended for effort to affect detailed representation of various professions within the frame of work assertion of graduates FEM and FAFNR or differences in work assertiveness between males and females.

Another interesting direction for future research could be the detailed analysis of the difference in degree of influence the career choice by professors at FEM and FAFNR, which could be an important source of information for superiors of monitored faculties and for teachers to improve the educational process.

References

Bedrnová, E., Nový, I. a kol. (2007) „*Psychologie a sociologie v řízení*", Management Press.

Bělohlávek, F. (1994) „*Osobní kariéra*", Grada.

Bělohlávek, F. (1996) „*Organizační chování*", Rubico.

Butcher, D., Harvey, P. (1998) „*Meta-ability development: a new koncept for career management*", Career Development International, , Vol. 3, No. 2, pp. 75–78.

Clark, F. A. (1992) „ *Strategie for creating management careers*", McGraw-Hill Book Comp.

Cocchiara FK, Kwesiga E, Bell MP, et al. (2010) „*Influences on perceived career success: findings from US graduate business degree alumni*", Career Development International, Vol. 15, No. 1, pp. 39-58.

Farková, M. (2009) „*Dospělost a její variabilita*", Grada Publishing.

Havlová, J. (1996) „*Profesní dráha ve 20. století*", Karolinum.

Holland, J. L. (1973) „*Making vocational choices – a theory of careers*", Prentice-Hall Inc..

Kenny, M. E., Bledsoe, M. (2005) „*Contributions of the relational context to career adaptability among urban adolescents*", Journal of Vocational Behaviour, Vol. 66, No. 2, pp. 257-272.

Kirovová, I. (2000) „*Některé aspekty rozvoje kariéry u studentů VŠB – TU Ostrava*", FF UK.

Koščo, J. (1976) „*Poradenstvo v ekonomickej praxi*" In: Daniel, J., Pikala, J.: „*Psychológia práce*", Bratislava.

Langmeier, J., Krejčířová, D. (2006) „*Vývojová psychologie*", 2. vydání, Grada Publishing.

Mayerová, M., Růžička, J. (2000) „*Moderní personální management*", H&H.

Mayerová, M., Růžička, J. (2001) „*Řízení profesní kariéry*", Západočeská univerzita.

Mukanga D, Namusisi O, Gitta SN, et al. (2010) „*Field Epidemiology Training Programmes in Africa - Where are the Graduates?*", Humana Resources for Health, Vol.8, AN 18.

Patton, W., Creed, P. (2007) „*The relationship between career variables and occupational aspirations and expectations for Australian high school adolescents*", Journal of Career Development, Vol. 34, No. 2, pp. 127-148.

Phillips, S. D., Christopher-Sisk, E. K., Gravino, K. L. (2001) „*Making career decision in a relational kontext*", The Counseling Psychologist, Vol. 29, No. 3, pp. 193-213.

Rothwell A, Jewell S, Hardie M (2009) „*Self-perceived employability: Investigating the responses of post-graduate students*", Journal of Vocational Behavior, Vol. 75, No. 2, pp. 152-161.

Rothwell, A., Herbert, I., & Rothwell, F. (2008) „*Self perceived employability: Construction and initial validation of a scale for university students*", Journal of Vocational Behavior, Vol. 73, No. 1, pp. 1–12.

Růžička, J. a kol. (1993) „*Řízení profesní kariéry zaměstnanců*", VŠE.

Růžička, J., Koš, M. (1997) „*Řízení profesní kariéry*", Psychologie v ekonomické praxi, Vol. 32, No. 3-4, pp. 91-96.

Rymeš, M. (1995) „*Profesionální kariéra absolventů vysokých škol*", Psychologie v ekonomické praxi, Vol. 30, No. 3-4, pp.155-160.

Super, D. E. (1980) „*A life-span, life-space approach to career development*", Journal of Vocational Behavior, Vol.16, pp. 282-298.

Štikar, J., Rymeš, M., Riegel, K., Hoskovec, J. (2003) „*Psychologie ve světě práce*", Karolinum.

Vágnerová, M. (2007) „*Vývojová psychologie II*", Karolinum.

Vendel, Š. (2008) „*Kariérní poradenství*", Grada.

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CONTRIBUTION OF A LINEAR PROGRAMMING VBA MODULE TO STUDENTS PEFORMANCE

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Abstract

This paper deals with the application of freeware modules as a teaching support of Operations Research methods at the Department of Systems Engineering, Czech university of Life Sciences (CULS) Prague. In particular, we concentrated on a linear programming module and measured the impact on student performance. The motivation for this evaluation is based on a current development of a new module that focuses on Traveling Salesman Problem. First, we explain the current situation both worldwide and in the Czech Republic and the CULS Prague. Subsequently, we describe the content of students' exams and statistical methods applied to the evaluation. Finally, we analyze and generalize the obtained results. The students exams have show a positive impact of the modules. Further, our analysis has proven that this impact is statistically significant. The findings motivate us to made new modules for other methods.

Key Words

Education, Linear programming, Traveling Salesman Problem, Paired t-Test, McNemar Test, Pearson Contingency Coefficient, Item Analysis

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Introduction

Throughout the recent years, the members of the Department of Systems Engineering (DSE), Faculty of Economics and Management (FEM), Czech University of Life Sciences (CULS), have developed freeware software for many methods from different branches of the operations research. The majority of these software packages focuses on linear programming, multi criteria analysis, transportation problems and structural analysis (i.e. input output tables) but more of core problems and algorithms of Operations Research have been already compiled into simple computer free programs.

On the market, there is relatively a lot of professional software focusing on such problems and algorithms as What'sBest, LINGO, LINDO, Optimization Toolbox for MATLAB or free Scilab and its optimization and statistical ATOMS etc. Their accessibility and further copying to private student's PCs are often restricted by authors' rights and license cost, which usually exceeds students' possibilities. Another common disadvantage of such software packages is specific user interface that is new for a non-experienced user. The target group of the modules developed at the DSE consists, in the first place, of students in the first or second year of study at the Faculty of Economics and Management, CULS Prague. The main purpose of the modules is just the support of teaching and learning of elementary algorithms in basic courses, not any special software training. Therefore, all the modules are programmed in Visual Basic for Applications (VBA) and use well known user interface of MS Excel.

At universities and other types of schools all over the world, similar VBA modules are often used in the teaching of operations research. This issue is dealt with in a complex way in (Martin 2000). These modules are used most often to discrete event simulations of queues (De Mesquita and Hernandez 2006), (Elizandro and Matson 2005), (Grossman Jr. 1999). An application of VBA modules in the games theory teaching (Nassar 2002) is also interesting. However, we concern in this article particularly with the teaching of linear programming (especially the simplex method) and the Travelling Salesman Problem. We did not succeed in finding any example of using VBA modules in the teaching of these topics. For instance at the University of North Carolina, MATLAB is used for the teaching of the Traveling Salesman Problem and other integer programming tasks (Pataki 2003). On the contrary, VBA modules for linear programming are usually created for the purpose of solving large tasks from practice (LeBlanc and Galbreth 2007).

The situation is also similar at Czech universities. For instance, at the University of Economics there were created VBA modules in MS Excel for the teaching of multiple-criteria decision making (Benešová, Skočdopolová and Kuncová 2010). For linear programming teaching a very thoroughly worked-out teaching system is used at the same university, however, based on the utilisation of MS Access (Lagová and Kalčevová 2006), (Lagová and Kalčevová 2007), (Lagová and Kalčevová 2008). An interesting action was taken at Mendel University in Brno where a module for the critical path method teaching was created using the programme of Macromedia Flash 8 (Zach, Holoubek and Kolman 2010).

All of the above mentioned papers concerning the VBA modules and other software application in teaching mention its impact on the teaching quality. However, we have not managed to find a paper quantifying the impact on student performance as we do below.

Current effort at the DSE is to develop a new module that focuses on the Travelling Salesman Problem. This problem is

commonly taught in different courses of mathematical methods in economics and management. It is also a popular topic of practically oriented bachelor and diploma theses. That is why we assume that this module is missing and its development and further availability would be worthy.

But such assumption can be wrong and, if non-verified, it is not a sufficiently strong reason for software development and especially for its implementation into courses. This is the main aim of this paper – to evaluate the educational impact of already existing and the most used of the software modules LINKOSA – a module for linear programming. The students sat for the same type of the exam on linear model results analysis twice, the first without and the second with the possibility of using the LINKOSA module. We compared achieved results in both cases. We believe that such evaluation can be generalized to other modules and a positive result presents the reason for further development of another module.

In this paper we extend and deepen results observed in (Kučera, Krejčí, Vydrová and Kučírková 2010).

Material and Methods

LINKOSA Module Description

This module provides linear programming model solutions. The input is the model with constraints in the inequality form (slack variables will be added by the module itself). The outputs are arranged into four sheets. The first one contains an optimum solution. It consists of two tables: the first one with the list of optimum values of decision variables, and the second one comprising the values of the right-hand sides and reserves/exceedings for every constraint in the optimum solution (i.e. optimum values of the slack variables). In the second sheet there

is a complete final simplex table in a revised form (i.e. without the columns of basic variables) which is a valuable source for postoptimalization considerations and analyses. The remaining two sheets comprise the survey of base stability intervals (even if they can be determined from a final simplex table), one for right-hand sides and the second for costs. These intervals set the range in which a given parameter can move without changing the optimum base. For more information about the simplex method and its interesting applications see e.g. (Hall and McKinnon 2004), (Tehrani Nejad Moghaddam and Michelot 2009).

Exam for Evaluating the LINKOSA Module Impact

The exam for students that should have shown how LINKOSA is contributional consisted in the following example. An agricultural enterprise should have grown three crops (decision variables x_1, x_2, x_3 express the areas on which they are grown) and there were set the following constraints: disposable area of arable land b_1 in hectares, an upper limitation b_2 of the area for one of the crops (let us denote the corresponding decision variable x_l) also in hectares and a minimum required value b_3 of sales in thousands of Czech crowns. The aim was to maximize the profit z, expressed in hundreds of Czech crowns. The linear model was of the following form:

$$x_1 + x_2 + x_3 \leq b_1$$
$$x_l \leq b_2$$
$$a_{31}x_1 + a_{32}x_2 + a_{33}x_3 \geq b_3$$
$$x_1 \geq 0; \ x_2 \geq 0; \ x_3 \geq 0$$
$$z = c_1 x_1 + c_2 x_2 + c_3 x_3 \rightarrow \max$$

where a_{31}, a_{32}, a_{33} and c_1, c_2, c_3 are the sales from 1 ha in thousands of Czech crowns and the profit from 1 ha in hundreds of Czech crowns for single crops, respectively.

The example was prepared in several numerically mutually different variants. Disposable area b_1 moved in the range from 450 to 1200 ha in single variants and the values were divisible by 50. The upper limitations b_2 were three-digit values again divisible by 50. Required sales b_3 were four-digit values divisible by 100 (from the matter-of-fact view, owing to the fact that they were stated in thousands of Czech crowns, it concerned the millions of Czech crowns). Coefficients a_{31}, a_{32}, a_{33} were one-digit integers and coefficients c_1, c_2, c_3 were at most two-digit integers. In the final simplex table all the values were always integers. Correct answers in every variant of the exam (see below) were either integer values or fractions, but in the worst case thirds. In this way the same numerical difficulty of the calculation of all the variants was ensured in a sufficient degree.

The instruction given to students comprised a brief verbal description and an initial and final table of the model. The form of the initial and final simplex table is shown on an example in table 1.

		53	5	25	0	0	0	−100	
		x_1	x_2	x_3	x_4	x_5	x_6	x_7	
0	x_4	1	1	1	1	0	0	0	450
0	x_5	1	0	0	0	1	0	0	100
−100	x_7	6	1	3	0	0	−1	1	1300
$z_j{-}c_j$		−653	−105	−325	0	0	100	0	−130000

0	x_6	0	2	0	3	3	1	−1	350
53	x_1	1	0	0	0	1	0	0	100
25	x_3	0	1	1	1	−1	0	0	350
$z_j{-}c_j$		0	20	0	25	28	0	100	14050

Table 1: Example of the initial and final table in the exam

Every exam variant consisted of six numeric items that should be fullfilled by the students:

- How much the amount of sales will change in the optimum solution when decreasing arable land (the change of an optimum variable value when changing the value of the right-hand side).
- How much the profit will change in the optimum solution with the same decrease of arable land as in the previous question (the change of an optimum value of the objective function when changing the value of the right-hand side).
- What is the minimum area of arable land for achieving required sales (the limit of the stability interval of the right-hand side).
- On what areas single crops will be grown if there is an increase in the profit with the crop that is not worth growing so that it would be worth growing (entering of non-base variable into the base), i. e. three items.

Statistical Testing

For assessing the difference between the exam solution with or without the usage of SW module, the testing of statitical hypotheses was used. A statistical hypothesis is a certain presupposition about the characteristics of the distribution of an examined random variable. The testing of a given hypothesis

is the procedure by which we make decision about the validity or refusal of a null hypothesis on the basis of random choices.

Owing to the character of input data we chose the paired t-test. It is used in the case of two dependent samples from a two-dimensional normal random variable (X, Y). It evaluates a conclusive non-nullity of a mean difference between pair measurements of values. We want to find out whether a given trial had any influence on a measured object.

A standard error necessary for the calculation of testing statistics is calculated according to the formula:

$$s_{\overline{d}} = \frac{1}{\sqrt{n}} \sqrt{\frac{\sum_i (d_i - \overline{d})^2}{n-1}} \qquad (1.1)$$

where the difference $d_i = x_i - y_i$, and n is a number of pairs.

We usually test a null hypothesis H_0: $\mu_d = 0$. In this case the testing statistics is in the following form:

$$t = \frac{\overline{d}}{s_{\overline{d}}} \qquad (1.2)$$

For more details, advantages and disadvantages, see (Zimmerman 1997).

The strength of the exam results dependence can be found out using a two-dimensional table made by the classification of two dependent variables – the results of the first exam and the results of the second exam. The basic test for finding out the dependence of two dependent samples is the McNemar test on mutual (in)dependence in a contingency table (McNemar 1947). Denoting the table $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$, we are testing whether the numbers b and c differ from each other only within the framework of

random fluctuating. We compare the test statistics χ^2 with a critical value of χ^2 distribution with the degrees of freedom [$(r$-1)(s-1)], where r and s are the numbers of the contingency table rows and columns, respectively. The formula for testing statistic χ^2 is

$$\chi^2 = \frac{(b-c)^2}{b+c} \qquad (1.3)$$

For measuring the dependence strength, i. e. relation among the variables, we can use several coeficients functioning similarly as a correlation coefficient. We can use Pearson contingency coefficient (C_P) (Hendl 2004), which takes values from the interval $\langle 0; \sqrt{(q-1)/q} \rangle$, where q = min {r, s}. For C_p calculation we use the following relation.

$$C_P = \sqrt{\frac{\chi_P^2}{\chi_P^2 + n}} \qquad (1.4)$$

The item analysis is used for exploring the characteristics of single items of the exam. It is suitable for judging the quality of each of its questions. It involves two types of analysis: quantitative (e.g. correlation, burdensomeness, time demand) and qualitative (lucidity, content and format adequacy, etc.). The item is the smallest unit of the exam according to which it is possible to judge a given exam using the item analysis.

In this analysis the following statistical parameters are used in accordance with the classical exam theory.

The facility indicates how easy the question is for a student. In the case of the dichotomic form of the question (correct/wrong answer) this parameter is equal to proportional (or percentage) expression of the correct answers of students. This parameter

can be clearly described by the formula $ease = \dfrac{X_{mean}}{X_{max}}$, where X_{mean} is the average number of points obtained by all the students for a given item and X_{max} is the maximum possible number of points.

The discrimination index (DI) shows how much (to what degree) an item makes a difference between successful and unsuccessful students. With this index it is possible to compare the result of e.g. this item, or the whole exam, and the results of all the other items, or other exams, respectively. In general, we can state that a student with good results will write the exam well, and, on the contrary, a bad student will not succeed. The discrimination index is a rough indicator of the efficiency of each item in a given students' group.

For determining the value of this index, we take one third of all the students with the best results and one third of students with the worst results, and then we find out how these groups of students have solved a given question. In the ideal case the best students should succeed and the worst ones should fail. For each of these two groups we compute the mean value of the proportional expressions of the results of all its members and subtract the mean value of the latter group from the mean value of the former group.

The value of this index ranges in the interval from –1 to +1. Negative values show that the correct answer has been given more often by worse students than by the best students at the corresponding questions.

The discrimination coefficient (DC), from the statistical point of view, is a correlation coefficient between the score for a given item and for the whole exam. It shows how much (to what extent) the results would be different if we differed between clever and less clever students. As in the case of the DI, this index takes values from –1 to +1. Positive values show the difference of the clever students. Negative values indicate items which have been answered wrong by the best students.

The advantage of the DC is that it uses the data of all the results for computing, and not only the results of one third of the best and the worst students as in the case of the DI.

For more information about the item analysis and some of its interesting applications see e.g. (De Champlain 2010) or (Lonn and Teasley 2009).

All statistical calculations we carried out using the STATISTICA 8 software, except for some calculations of the item analysis which we carried out directly in MS-Excel.

Results and Discussion

In the analysed sample with 197 students of the Economics and Management, and Business and Administration fields of study we found out and evaluated the differences between the results of two exams (every student wrote the exam twice, every time a different variant) within the course of Economic and mathematical methods I. For the first time the students wrote the exam before they got acquainted with the LINKOSA module. So they could use only their own knowledge of a particular computation procedure and a scientific calculator. For the second time they knew LINKOSA programme and could use it for the calculation and the analysis of a given problem. In both cases they were given the time limit of 15 minutes for solving the task.

When comparing two dependent samples we can state that they considerably differ in the mean value. The average of points was 0.5 points in the first exam and 2 points in the second

exam, that represents the diference of 1.5 points, see table 2. From the overall number of 197 students, 121 did not get any points and 61 got 0.5 or 1 point in the first exam. There were only three students who reached 3 points. In the second exam, in comparison with the first exam, the situation got better. Only 50 students did not get any points. 66 students reached 3 points and more. (Each exam item represents one point in the student test evaluation.)

Variable	N valid	Mean	Min	Max	Standard deviation
Classical calc.	197	0.467005	0.00	3.000000	0.673990
Module usage	197	2.086294	0.00	6.000000	1.848238

Table 2: Descriptive stastistics

A graphical representation shows the considerable differences between examined groups of exam results, see figure 1. The vertical axis scale indicates how many points a student obtained (how many of items s/he answered correctly). The difference is seen in the value of the average and in the variability of both samples as well.
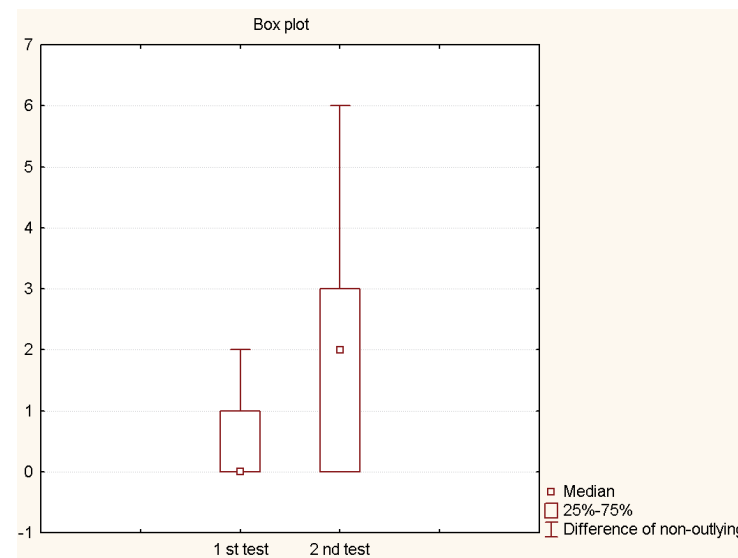

Figure 1: Box plot for comparing the sets of test results (output from STATISTICA 8)

At the beginning of every testing it is necessary to state the hypothesis which we want to test. In this case it was defined in the following way: There is not any statistically important difference between the means of results of the first and the second test. Accepting/rejecting this hypothesis no/a significant impact of the LINKOSA usage would be proven.

In a table form of results there is evaluated statistical importance of differences between the means of dependent samples by means of the paired t-test. The calculated mean difference $\overline{d}$

= −1.619 and standard deviation $s_{\overline{d}}$ = 1.894 correspond to the

value of the test criterion $t = –11.997$. The value p (p=0.000001) is smaller than a given significance level $\alpha = 0.05$, that is why we reject a null hypothesis about a statistical unimportance of the diference between the means of dependent samples. Therefore, the impact of the LINKOSA usage is significant.

t-test for dependent samples *Italic* differences are significant on the level. p < 0.05								
Variable	Mean	Standard dev.	N	Differ-ence	Standard dev.	t	df	p
Classical calculat.	0.467	0.674						
Module usage	2.086	1.848	197	-1.620	1.895	-11.997	196	0.0

Table 3: Output of the calculation – pair t-test

For the analysis of qualitative data according to a contingency table, we transferred the point evaluation only to the possibility of passing the exam (three points and more) and failing (two and fewer points). Such a criterion would represent a low demand for students' knowledge. However, we chose it for the purpose of stricter testing of the impact of SW modules usage in classes. A two-dimensional table (see table 3) was tested by means of McNemar test for dependent symbols (p=0.00000). The value of χ^2 was 61.016 and C_p was 0.173. The test shown the differences between (non)usage of SW module and the result of the test.

Classical calculation	Module usage		
	yes	no	Total
yes	3	0	3
no	*63*	*131*	194
Total	66	131	197

Table 4: Contingency table – module usage x classical calculation

For the item analysis of how good the student is, we used the results of the first part of a credit test which was written in the middle of the term. At the time of results processing into this paper it was the only one proper overall characteristics of the students that was already available. We did not differ among single test variants, i. e. we considered the questions in single variants to be the same questions. The analysis included 5 items for every realization of the test from the both realizations (i. e. 10 items). The first three items are the first three questions stated in the part of Material and Methods, i. e. the questions about the change of an optimum variable value when changing the value of the right-hand side (CV), the change of an optimum value of the objective function when changing the value of the right-hand side (COF), and the limit of the stability interval of the right-hand side (LSI). Remaining three items that students must fill in when answering the fourth question concerning the entering of a non-base variable into the base (EVB), are aggregated into the fourth item. As the last item we evaluate the overall result of the student during the test (OR).

The sample for the item analysis involved only 191 students because 6 students did not participate in the above mentioned credit test (for instance due to their ilness or because of other serious reasons).

We summarize the item analysis results in the table 5 (using the abbreviations given above).

Classical calculation					
	CV	COF	LSI	EVB	OR
Facility	11.78%	15.45%	0.52%	6.28%	7.77%
DI	0.092	0.075	0.015	0.032	0.046
DC	0.133	0.116	0.137	0.039	0.162

Module usage					
	CV	COF	LSI	EVB	OR
Facility	32.98%	56.54%	12.74%	13.79%	35.08%
DI	0.149	0.350	0.080	0.059	0.182
DC	0.160	0.330	0.231	0.173	0.294

Table 5: Item analysis results

Found out facility of single questions in the case when students could use only classical calculation corresponds to the fact of how difficult single questions are usually considered. Clearly the most difficult is the LSI determination. The difficulty of this question was strengthened by the fact that the question was asked on a factual, economic level, not downright explicitly in the terms of the operations research and the linear programming theory. In another case of relatively low facility of the question for EVB determination, a negative role is played by a considerable numerical demandness of the calculation.

When using LINKOSA module, the facility of the test considersably increased. With the questions for CV and COF it was roughly three times. The most considerable increase was with the LSI determination that was probably caused by the fact that the stability intervals are calculated by LINKOSA directly and that is why the student did not have to realize additional model calculations with adjusted data. Moreover, when looking into the LINKOSA results s/he could comprehend that even despite the above mentioned factual character of the question formulation the answer could be found directly in them. On the contrary, the fact that with the question for the EVB determination the facility increased relatively less could be caused by the fact that there was not explicitly given the value of the profit for which it should increase. If the student wanted to use LINKOSA, first of all s/he had to realize that this value must exceed the LSI of the cost coefficient, then select such a value higher than the LSI of the cost coefficient, and only then make the calculation. As it was shown, the students quite often failed in this sequence of steps. However, even despite this, LINKOSA made it easier for the students to solve this question more than twice.

DIs and DCs were all positive. This means that among the items there is not any that would be easier for worse students and more difficult for better ones. From this point of view, the choice of questions for the test was proper (they do not confuse good students etc.) When looking into the results we are attracted by the fact that the DIs and DCs are with all the items considerably higher while using LINKOSA than with the classical calculation. It implies quite an interesting finding that LINKOSA helped particularly good students when solving all the questions. Owing to the fact that in the analyzed sample the correlations are significant on the level of $\alpha = 0.05$ if they are bigger than approximately 0.15, low values of DC, which are actually correlation coefficients, show that in the case of classical calculation the results of single students when solving individual questions practically do not depend on the fact wheather the student was good. A certain dependence was shown at the overall result of the test. On the contrary, when using LINKOSA the DCs reveal the dependence of achieved

results on the fact how good the student is, also with single questions.

If we return to the DCs of single items of the test with the classical calcultion, the DC of the question to determine EVB is shown as considerably lower than others. It probably testifies its above mentined numerical demandness because numerical mistakes are made by all the students regadless of how talented they are from the point of view of the professional side of the subject. When using the LINKOSA module for the calculation, the biggest dependence of achieved results on the quality of the student is shown whilst determining COF. LSI determination has also somewhat higher DC which will be probably caused by the factual formulation of this question.

If we focus on the DI values with single items, we will surely notice that there are bigger differences among them than in the case of the DCs. It is caused by the fact that DIs are influenced by the facility of the questions (with questions of low facility more frequent bad answers of good students lower their DI). From this point of view the DIs in general correspond with single items to their facility and DC.

Finally, let us mention another interesting point that resulted from the DI calculation and shows how big contribution LINKOSA represents for the students. The third of the worst students (according to the credit test, examined for the purpose of the DI calculation) on average reached better results using LINKOSA than the third of the best students (according to the same criterion) with the classical calculation. If we look for how many students reached the overall result of the test with a classical calculation at least the same that was the average of overall results of the above mentioned worst third using LINKOSA, we will find out that there were only 15 of such students, i. e. less than 8%.

Conclusion

The results definitely confirmed the assumption about a positive impact of software LINKOSA module usage. According to the results of the item analysis, LINKOSA helps particularly those students who are more talented and more successful for the operations research study. At the same time it helped them when solving all followed fields and topics of linear programming.

Most of all, it will help the students with such data where LINKOSA provided them with the required answer directly in the results, while the classical calculation without its utilisation is relatively difficult. Thus students need not waste their time on a technical side of the calculation while trying hard to comprehend and understand it. In these cases LINKOSA can also serve for results (not procedures) checking while practicing hand calculation. A clearly organized spreadsheet form, which is provided by MS-Excel also enables to comprehend what these data mean as far as the matter-of-fact side is concerned. If the question is set in this way, the students know where to look for the required information in the results.

LINKOSA also helps the students when studying and comprehending the dependence of the change of the solution on the change of a certain parameter (as it was shown for instance with the question concerning the entering of a non-base variable into the base). A lot of patience is required from the students when experimenting with the model, successive changing of a given parameter and examining its influence on the final solution. For this they are rewarded by finding out and comprehending when there occur just quantitative changes, which do not represent the change of the solution structure, and on the contrary, when there occur the changes that can be considered important and qualitative.

In general, LINKOSA enables and deepens the understanding of linear programming of the students. Acquired knowledge can be used by the students in their future practice. Moreover, after the experience with LINKOSA it will be easier for them to work with the professional software.

A similar impact can be expected with other modules owing to their nearly equal user environment and similar way of usage in practice. The exact evaluation of a newly prepared module impact will be possible after its implementation into the classes.

Modules created in the DSE environment cannot be considered to be the substitute of professionally developed software packages. They cannot substitute SW used in a firm or public and administrative environment within the preparation for real problems and within the preparation of real experts in advanced courses. However, they enable the chart demonstration of results and procedures of single methods and in this way they have a considerable importance for the performance, results and knowledge of students.

References

Benešová, A., Skočdopolová, V., Kuncová, M. (2010) "*MS Excel Add-in Applications in MCDM Education*", Proceedings of the 7th International Conference on ERIE 2010, pp. 33-41. ISBN 978-80-213-2084-0

De Champlain, A.F. (2010) "*A Primer on Classical Test Theory and Item Response Theory for Assessments in Medical Education*", Medical Education, Vol. 44, No. 1, pp. 109-117. ISSN 0308-0110

De Mesquita, M.A., Hernandez, A.E. (2006) "*Discrete-Event Simulation of Queues with Spreadsheets: A Teaching Case*", Proceedings - Winter Simulation Conference, Art. no. 4117880, pp. 2277-2283. ISSN 0891-7736

Elizandro, D., Matson, J. (2005) "*Discrete Event Simulation Using Excel/VBA*", ASEE Annual Conference and Exposition, Conference Proceedings, pp. 4673-4683.

Grossman Jr., T.A. (1999) "*Teachers' Forum: Spreadsheet Modeling and Simulation Improves Understanding of Queues*", Interfaces, Vol. 29, No. 3, pp. 88-103. ISSN 0092-2102

Hall, J.A.J., McKinnon, K.I.M. (2004) "*The Simplest Examples Where the Simplex Method Cycles and Conditions Where EXPAND Fails to Prevent Cycling*", Mathematical Programming, Vol. 100, No. 1, pp 133-150. ISSN 0025-5610

Hendl, J. (2004) Přehled statistických metod zpracování dat – Analýza a metaanalýza dat, Portál, s.r.o., Praha, ISBN 80-7178-820-1

Kučera, P., Krejčí, I., Vydrová, H., Kučírková, L. (2010), "*Educational Impact of VBA Modules*", Proceedings of the 7th International Conference on ERIE 2010, pp. 196-202. ISBN 978-80-213-2084-0

Lagová, M., Kalčevová, J. (2008) "*Automatic Testing Framework for Linear Optimization Problems*", Proceedings of the 26th International Conference on Mathematical Methods in Economics 2008, pp 317-321. ISBN 978-80-7372-387-3

Lagová, M., Kalčevová, J. (2006) "Computer Support of Courses of Linear Optimization Models", Proceedings of the 24th International Conference on Mathematical Methods in Economics 2006, pp 333-337. ISBN 978-80-7043-480-2

Lagová, M., Kalčevová, J. (2007) "Linear Programming by the Game - Computer Support of Courses", Proceedings of the 25th International Conference on Mathematical Methods in Economics 2007, pp 188-194. ISBN 978-80-248-1457-5

LeBlanc, L.J., Galbreth, M.R. (2007) "Implementing Large-Scale Optimization Models in Excel Using VBA", Interfaces, Vol. 37, No. 4, pp 370-382. ISSN 0092-2102

Lonn, S., Teasley, S.D. (2009) "Saving Time or Innovating Practice: Investigating Perceptions and Uses of Learning Management Systems", Computers and Education, Vol. 53, No. 3, pp 686-694, ISSN 0360-1315

Martin, A. (2000) "An Iintegrated Introduction to Spreadsheet and Programming Skills for Operational Research Students", Journal of the Operational Research Society, Vol. 51, No. 12, pp 1399-1408. ISSN 0160-5682

McNemar, Q. (1947) "Note on the Sampling Error of the Difference Between Correlated Proportions or Percentages", Psychometrika, Vol. 12, No. 2, pp 153-157. ISSN 0033-3123.

Nassar, K. (2002) "Simulation Gaming in Construction: ER, the Equipment Replacement Game", Journal of Construction Education, Vol. 7, No. 1, pp 16-30. ISSN 1522-8150

Pataki, G. (2003) "Teaching Integer Programming Formulations Using the Traveling Salesman Problem", SIAM Review, Vol. 45, No. 1, pp 116-123. ISSN 0036-1445

Tehrani Nejad Moghaddam, A., Michelot, C. A (2009) "Contribution to the Linear Programming Approach to Joint Cost Allocation: Methodology and Application", European Journal of Operational Research, Vol. 197, No. 3, pp 999-1011, ISSN 0377-2217

Zach, P., Holoubek, J., Kolman, P. (2010) "Animated Critical Path Method", Proceedings of the 7th International Conference on ERIE 2010, pp 183-291. ISBN 978-80-213-2084-0

Zimmerman, D., W. A (1997) "Note on Interpretation of the Paired-Samples t Test", *Journal of Educational and Behavioral Statistics*, Vol. 22, No. 3, pp 349-360. ISSN 1935-1054.

CONDITIONS AND LIMITATIONS OF MULTIMEDIA SENIOR EDUCATION IN REGIONS

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Abstract

The present paper is aimed at proposing and verifying new methods of distance education that is carried out by means of multimedia tools. It also deals with the development of network services availability in the countryside. Furthermore, computer literacy of education organizers and participants and economic benefits of virtual education are targeted in the paper. The system of the Virtual University of the Third Age that has been offered since 2008 at the Faculty of Economics and Management of Czech University of Life Sciences Prague (CULS Prague) serves here as a tool or prototype for verification of multimedia senior education opportunities in the regions. The above-mentioned system also reacts to and at the same time develops the so-called „third role of universities".

Key Words

Introduction

People nowadays experience their retirement age in a good physical and mental health and as a result, they are able to participate actively in various all-society events. However, maintaining such a good and desirable condition as long as possible requires an active lifestyle. Senior education represents not only a vigorous approach to ageing, but at the same time, one of the means of looking for a way of life, life values, learning opportunities and necessities of life (Lemieux, Boutin and Riendeau, 2007; Šemberová, 2008). Education, one of key life values, represents the "good" in life, a zest of spirit that can be and should be available to all people. At this point, we should mention a new focus of universities, the so-called third role of universities. Since Humboldt reforms at the beginning of 19th century, teaching and research have traditionally been considered as the two main, if not the only, functions of universities. The above-mentioned third role of universities, in other words their "public service function" or "community service function" represents another important mission of universities which goes hand in hand with greater social responsibility and a wider spectrum of university tasks (Čerych, 2009). One of these activities is the University of the Third Age (U3A).

According to Williamson (2000), the University of the Third Age is an activity with a tradition and history of more than thirty years. At present, it takes place under different forms at almost all Czech universities. It is generally estimated that more than 400 various educational programs are offered and more than 20, 000 senior citizens are enrolled in the Czech Republic. As a matter of fact, nearly all educational programmes are bound to universities, i.e. to Prague and regional capital cities. It means that the U3A as an active way of spending retirement time is practically not available to most seniors from smaller towns and rural areas.

However, Huang (2005) or Stadelhofer and Marquard (2008) mention that fast developing information and communication technologies represent a unique opportunity in many countries to make senior education accessible to the widest possible number of interested people and consequently to provide equal opportunities to all seniors regardless to the place of their residency.

The aim of the paper is to propose and verify new methods of distance (virtual) education carried out by means of multimedia tools (Swindell, 2002) and the development of network services availability in the countryside, as described in Šimek, Vaněk and Jarolímek (2008).

Other examined aspects are computer literacy of education organizers and participants (trainees) and also economic benefits of virtual education (Micheuz, 2006).

At present, several projects dealing with the access to education in regions are being solved at the Czech University of Life Sciences Prague. Optimal technologies available in regions, various forms and methods of both group and individual education are being explored. Replacing personal, face-to-face contact by the electronic one and a sheet of paper by a web is simply not enough. The process requires a substantial change of accustomed, conventional procedures, which can be the most difficult task.

Material and Methods

The system of the Virtual University of the Third Age (VU3A) that has been offered since 2008 at the Faculty of Economics and Management of Czech University of Life Sciences Prague serves here as a tool or prototype for verification of multimedia senior education opportunities in the regions (Jarolímek, Vaněk and Šimek, 2010).

The University of the Third Age provides seniors and elderly persons with both general and special-interest non-professional education at the university level. It has been developed in many countries for more than 20 years (Schuller and Bostyn, 1992). The range of educational activities is very wide, diverse and differentiated. It includes comprehensive educational programmes (1 – 3 years), innovative courses focused on new technologies, conversational language courses, activities supporting good physical and mental health and, last but not least, various programmes developing self-directed learning strategies.

The main objectives of the University of the Third Age:

- "bio-psycho-social" development
- adaptation to the ever changing life and social conditions (technologies)
- cross-generational dialogue

Even if we may perceive seniors as a more or less homogeneous age group and therefore assume the tasks and needs of such a group, there exist a real need for plurality and variability of senior programs as well as unacceptability of unified approach and narrowing the "needs of old age" to a minimum.

As described in Farell (1999) or Van de Vord (2010), **the Virtual University of the Third Age** represents a new alternative to conventional lecture teaching. It is based on the use of new communication technologies and the internet, combining the elements of distance education and eLearning. It can also be a suitable complement to classical full-time or attendance education.

Modern didactical means of university education develop very fast. In close connection with that development, new areas of the so-called media didactics and media pedagogy are born. **The media didactics** deals with the integration of component media into the education process in order to reach its optimization. **The media pedagogy** creates the media as such and deals with their usage as the object of the analysis. Both of the before-mentioned relate to each other and blend together. Virtual education uses both the theories and practical experience that stems from university pedagogy.

Following current global trends, media tools are expected to be more and more used in all types of education. Interactive technologies and creation of systems that enable all users to be actively involved have been analyzed. For instance, Yves Bertrand, world-famous pedagogue, indicates the creation of open models (thus true virtual courses) as a basic general principle of media background arrangements.

Nehodová (2010) mentions that this kind of education has a **virtual character** – multimedia lectures exist only in an electronic form, they have actually never taken place and they can neither take place in this form. Multimedia lectures also contain video-sequences from real lectures, but their main asset is a special interpretation accompanying the video material – shot in exteriors and laboratories including details from a microscope or telescope, charts, diagrams, scientific pictures, computer animations etc. Besides that, audio records, supporting music or other acoustic background can be used as well.

Virtual education is primarily focused on staff/worker education in regions, i.e. on users who cannot take part in present form lectures for different reasons. Topical cycles of multimedia lectures, accompanied by generated tests, syllabi, questions for a lecturer, discussion forums or further study materials are displayed on a virtual education portal. Registered students can return to virtual educational materials on the portal anytime. The participants can repeatedly go either through the whole lecture or just through its parts according to their need; without place, time or background limitation. Completing the generated tests, students get an immediate feedback on their understanding and topic mastering. While filling-in the tests, students can check the lecture or any detail of it and work the test out at their own pace, without any time limitation and stress.

The participants as well appreciate the possibility to ask the lecturer later on – several days after the lecture, i.e. after thinking the topic or subject over, whereas in conventional education there is just a limited time for questions immediately after the end of a lecture.
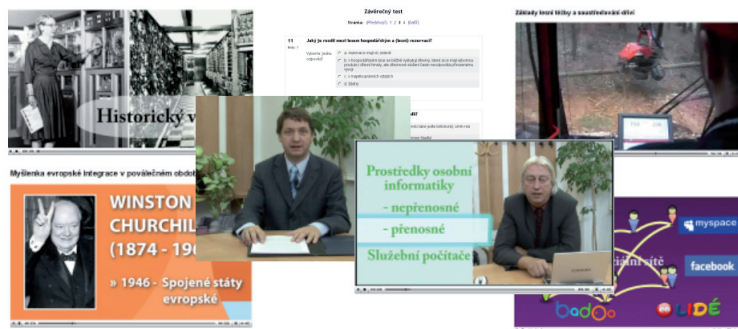

Figure 1: Illustration of multimedia lectures and other study materials (Jarolímek, Vaněk and Šimek, 2010)

As far as conventional presence lectures are concerned, their participants can carry off only what they managed to note down and remember; they have no possibility to return anyhow to the speech of the lecturer and eventual printed study materials never fully substitute it. The main didactical advantage of the virtual method of education over conventional presence lectures is the possibility of repetition – *repetitio mater studiorum*.

Selected terms of the Virtual University of the Third Age

- a study program of U3A – mostly a two-year study programme composed of 4 thematic term courses; the study is usually terminated with a certificate of program graduation; some courses take the form of virtual education

- a course – a collection of four to twelve thematic lectures taking place within one term

- a lecture – a particular lecture on a given topic, recommended length of a multimedia virtual lecture for seniors is 35 – 45 minutes

- a course guarantor - the university which created the program thematically

- a chief lecturer – a university pedagogue responsible for the content quality and methodological aspects of the course; he/she manages a team of lecturers; each lecturer is then liable for the quality of his/her lecture and for keeping instructions of the chief lecturer.

- a consultancy center (CC) – a workplace contracted by universities in order to offer their study programs. The consultancy center provides technical equipment/facilities and determines the contact person.

- a contact person – a person that ensures the administration, selects course topics, registers participants and sends applications to the course guarantor. He/she leads the general organization of group education and secures technical aspects of the education (the start of education, technical support in test filling or in sending questions to a lecturer).

- a participant of VU3A – a senior citizen registered by means of on a written application in a consultancy center; he/she participates in lectures and observes the rules.

- a course schedule – the schedule of virtual learning, gives the dates when each section of teaching - lectures, seminar papers, tests, etc. must be completed during the semester

- a virtual education portal - the main presentation, evidence and communication tool of the virtual education www.e-senior.cz

The VU3A has been realized at the CULS Prague since the academic year 2008/2009. The results shown in the table below have been obtained within five consecutive terms:

Semester	Number of consultancy centers	Number of seniors involved
Winter Term 2008/09	8	124
Summer Term 2008/09	12	201
Winter Term 2009/10	20	293
Summer Term 2009/10	25	398
Winter Term 2010/11	36	612

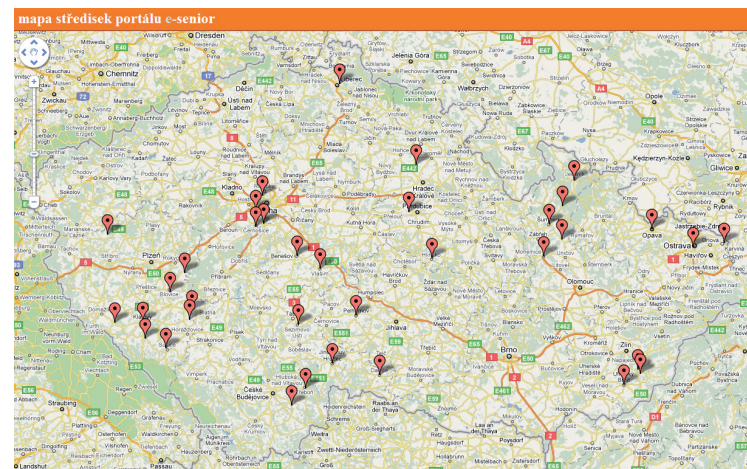Table 1: Development of the number of participants and consultancy centers

Figure 2: Consultancy centers allocation

At present, 8 educational courses are prepared (each consisting of 6 multimedia lectures accompanied by tests and syllabi):

- Astronomy (guarantor: Faculty of Mathematics and Physics, Charles University in Prague)

- The Development of Information Technologies (guarantor: Department of Information Technologies, FEM CULS in Prague)

- Ethics as the Way Out of the Society Crisis (guarantor: Technical University of Liberec)

- The Development and the Present State of the European Union (guarantor: Department of Economics, FEM CULS in Prague)

- Decision-Making Support and Management (guarantor: Department of System Engineering, FEM CULS in Prague)

- Forestry (guarantor: Faculty of Forestry and Wood Sciences, CULS in Prague)
- Growing and Using Edible and Medicinal Mushrooms (guarantor: Faculty of Economics and Management, CULS in Prague)
- Game Management (guarantor: Faculty of Forestry and Wood Sciences, CULS in Prague)
- The feedback was obtained on the basis of
- statistical outputs from LMS (Learning Management System) Moodle that is used to provide the educational process
- questionnaire survey (initial and final) within the participants
- interviews with lecturers and guarantors in the consultancy centers

Results

Technological availability

As far as the basic technology is concerned, high-quality internet connectivity represents a crucial limitation and prerequisite. Internet quality requirements vary according to the individual elements of virtual education. While streamed video is the most demanding from a view-point of transmission quality, particular lectures set up a basic structure of the whole education system. With regard to group projection, there is a need for higher quality resolution, it means for a bigger amount of the data transmitted.

From the very first experiments with the virtual education, there have been problems arising from the video transmission quality in some consultancy centers.

Other components of virtual education – syllabi, tests, communication and seminar papers - are not so demanding as for the transmitted data amount and though do not bring any fundamental problems at present.

Due to the above-mentioned connectivity problems, transmission possibilities of the individual consultancy centers (especially of the newly developing ones) are checked. The video format is 682 x 384 pixels (16:9) which means that the minimum constant transmission speed of 1 Mb/s needs to be secured during all the presentation.

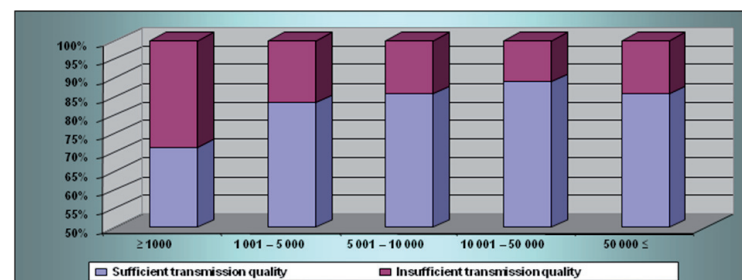The following figure shows a division of consultancy centers according to the municipality size:

Figure 3: Comparison of internet connection quality in consultation centers (in % according to municipality size – number of inhabitants)

The technology used influences the security of transmission quality the most. In the examined sample, only the WIFI and ADSL technologies are used. Despite the declared connection

quality that should theoretically secure sufficient transmission quality, the reality is different (Figure 3). It is also necessary to mention at this point that consultancy centres representatives claim to use the best available technology in municipalities with up to 10, 000 inhabitants. Insufficient quality in centres with more than 50, 000 inhabitants is caused by adopting rather cheaper technologies than the best available ones.

Problematic availability of high-quality video in some centers, especially in smaller villages, could be resolved by recording and sending a DVD. It is a non-system and unfortunate solution, however, the only feasible for maintenance of the overall accessibility of the Virtual University of the Third Age.

Computer literacy

While talking about computer literacy in the VU3A, it is necessary to distinguish between two groups: contact persons and VU3A participants.

The computer literacy of contact persons is absolutely fundamental for a successful realization of group education as they provide an essential service such as e.g. connectivity, audio and video projection, problem-solving, troubleshooting etc. Moreover, they have to be able to solve incurred problems under pressure.

Providing consultancy and teaching basic computer skills and LMS are an integral part of contact persons duties and responsibilities. Absence of the above pieces of knowledge and skills can lead to an education collapse in the given consultancy centre.

As for the VU3A participants, at least basic computer skills are an advantage, however, they are not conditional for participation and successful graduation. To overcome initial difficulties,

group work, consultancy and contact persons teaching are extremely important. The group work is an interesting aspect of the whole education process when smaller heterogeneous groups are formed, having various levels of computer skills and different problems to discuss. Participants of such a group enrich each other with their pieces of knowledge and skills. It is already possible to document the ability of educational system mastering. A comparison of abilities at the beginning and at the end of the term is shown in figure 4 and 5.
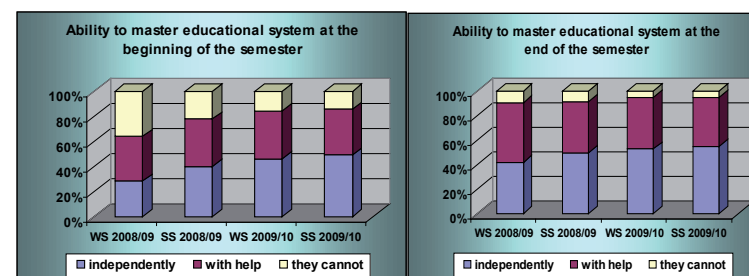

Figure 4, 5: Ability to master educational system at beginning and end of semester

Economic accessibility

Economic aspects of eLearning methods can be evaluated from many different points of view (see e.g. Littlejohn, Falconer, and Mcgill (2008) or Marengo and Marengo (2005)).

The inaccessibility of the Universities of the Third Age in smaller towns and rural regions is caused especially by economic and time demandingness of contact education in remote places and for smaller study groups.

A comparison of virtual and conventional courses is drawn from a group of consultancy centers that use the VU3A. Only the transportation costs and lectors remuneration have been taken into account and compared. Other costs (course rooms rent, technical facilities and organizational support) are similar in both methods.

The number of functioning consultancy centers (CC) in particular terms, average commuting distance to CCs, lector payment and transportation costs refunds set by law (6 CZK/km for using one´s car) have been calculated.

The average commuting distance is calculated from Prague (173 km). However, taking into account the irregular dislocation of consultancy centers within the Czech Republic, the commuting distance e.g. from Liberec is 228 km and from Olomouc even 264 km. Lectors and lecturers from local universities in these towns and cities contribute to the teaching process too. It means their costs would be significantly higher than the presented example of commuting from Prague universities.

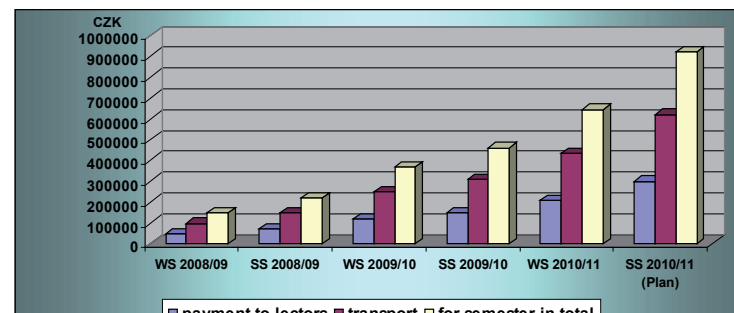Costs of possible contact education are shown below in figures 6 and 7.

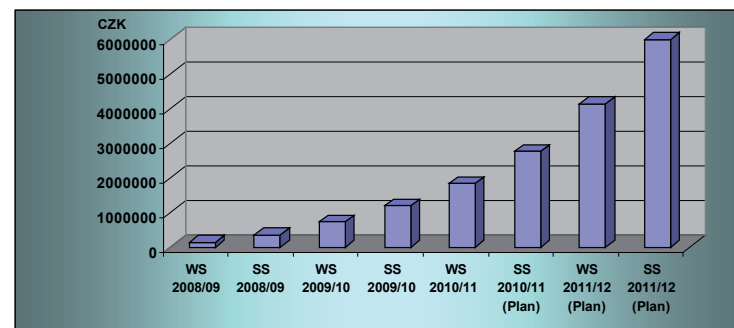**Figure 6: Contact education costs of the University of the Third Age in regions (in CZK)**

Figure 7: Cost development of contact education of the University of the Third Age in regions (in CZK)

Discussion

In terms of discussions concerning suitability and sustainability of the virtual form of senior education, the following problems have been mentioned the most: seniors' ability to use information technologies and social isolation of individuals in the virtual space. After designing the concept of the Virtual University of the Third Age and using it successfully for two years at the CULS Prague, we can affirm that the above factors do not influence the realized education and its development in a negative way. Let alone, the two difficulties are overcome by this form of education.

Computer illiteracy does not mean excluding seniors from being involved in the education; seniors participate in group lectures where the computer skills are not primarily necessary. Seniors subsequently form work groups composed of various skills degrees – in cooperation with the advanced users, participants who lack the skills and knowledge are spontaneously motivated and taught how to use different educational tools. At the same time, a contact person of the consultancy center is in touch with them and provides all necessary information and consultancy.

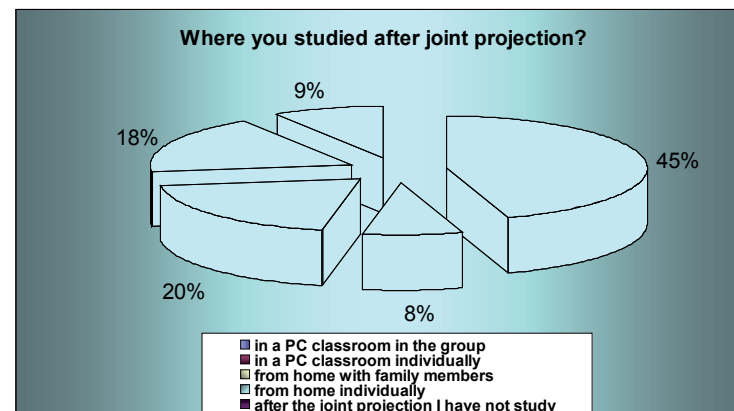**Where did you study after the joint projection?**

Figure 8: Localization of self-study activities in virtual education

Main reasons for studying the VU3A are the following: acquisition of new pieces of knowledge, keeping in a good mental and physical condition, purposeful leisure time spending and keeping in touch with other people. A positive development is obvious from the answers obtained while asking participants whether they have learnt something new in the courses. 88 % of the interviewed answered positively; which is an improvement of 24% as compared to last year. This positive trend stems from education content improvement and from the increased level of the subject matter explained. The respondents as well valued very positively the technical aspects of projection and understanding of the subject matter. Students were also supposed to evaluate virtual education advantages. Effortless availability of the study and the possibility to study at one's own pace were the main advantages to be mentioned. 9 % of respondents are interested in taking other course in the future.

While comparing the particular results of both monitored years, there is an evident improvement in almost all indicators. The results obtained prove that virtual education at the Universities of the Third Age is suitable for seniors and elderly people as it is adapted to their needs and likely worse health condition. The participants have several options such as e.g. adapting the text size on the internet portal, running the lectures in particular parts, elaborating tests on each topic and returning to the subject matter repeatedly.
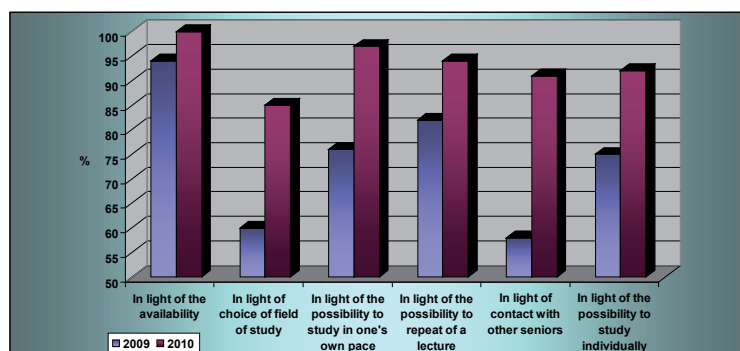
Figure 9: Development of virtual education advantages perception in 2009/2010

The presented computer skills improvement creates a presumption for the development of new forms of increasing computer literacy within senior or other groups. Up-to-now most methods and procedures to increase seniors' computer literacy were focused on more or less conventional teaching of mastering computer and the most common software tools with all their positive and negative aspects (see e.g. Poynton (2005)). The virtual education system in question is not primarily focused on teaching computer skills. Nevertheless, the results clearly approve a considerable improvement of seniors' skills and knowledge in this area. It deals with a new learning method where knowledge is acquired through spontaneous group work (i.e. through cooperation of more experienced users with the less experienced ones) and communication, as Havlíček et al. (2010) describe.

This system can significantly contribute to the elimination or better to say significant reduction of the so-called digital divide (Jeffrey, 2008; Seong-Jae, 2010), both in senior education (as a solution of general social exclusion) and education in rural areas within the concept "education goes to a learner" where social exclusion stems from the place of residency (Saunders, 2004).

Concerning the multimedia character of the courses while lectures are concentrated in the consultancy centers where they have to be presented (projected) in a desirable quality, the main limiting factor is appropriate connectivity. Not only a sufficient theoretical transmission speed but also its really achieved values and steady parameters during all transmission time. Connectivity problems are being registered in 17.1 % of consultancy centers at present. Considerable differences relate to different municipality sizes. While municipalities with up to 1,000 inhabitants show 28.6% of problematic connections, municipalities with over 10, 000 inhabitants record "only" 11.1 % of these. This also illustrates different dynamics of high-speed connection availability in urban areas and in the country.

With the development of broadband connectivity, a gradual qualitative shift towards higher transmission speed can be supposed. The connectivity is or can be as well one of the criteria while searching for and selecting the placement of a consultancy

center, of course together with organization provision and other requirements (appropriate rooms, equipment and so on).

The main contribution of the Virtual University of the Third Age is its unconditional accessibility, i.e. the VU3A can work even there where "traditional" contact teaching of the University of the Third Age cannot be realized especially because of the lecturers' time potential and commuting to many remote places (consultancy centers). An economic comparison is then to some extent just hypothetical; we cannot compare something that practically cannot happen with something that really works. Nevertheless, the above mentioned savings calculation of travelling expenses and lecturers pay give us at least some economic framework.

A comparison of virtual education and contact education is presented below in table 2.

Indicator	Contact education		Virtual education	
	+	-	+	-
accessibility		bound to a specific place and time	unlimited by place and time 24x7	
communication	personal	unrepeated	continuous, saved for further education	impersonal
comprehensibility		depends on the lecturer, repetition is not possible	vivid, illustrative, use of multimedia, repeatability	
preparation	relatively fast			time-consuming and finance demanding
costs	low initial costs	high costs of repetition	minimal costs of repetition	high initial costs
time demands	low initial	high for repetition (time of a lecturer is a limiting factor of repeatability and extensibility)	minimal for repetition	high initial
technical background	independent			dependence, minimum of facilities
computer literacy	not needed		develops	at least minimal
social aspects	exist		exist in group education	do not exist in individual education

Table 2: Comparison of contact and virtual education (Jarolímek, Vaněk and Šimek, 2010)

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Conclusion

Insufficient transmission/communication infrastructure, especially in rural regions, and low computer literacy represent the two main obstacles to a full exploitation of multimedia education in regions. However, the results obtained during the verification lasting for more than two years clearly approve the applicability of virtual education method in senior education; especially in rural regions where the accessibility of contact, face-to-face education is quite problematic and limited.

The application of modern education methods within a group of inhabitants in rural regions, i.e. regions where other educational forms are not economically viable, is the main contribution of the projects solved. Although there is still a certain restraint concerning the use of information and communication technologies, the Virtual U3A can be also considered as a new method of mastering computer skills by senior citizens.

Acknowledgements

References

Čerych, L. (2009) "Neziskový sektor a třetí role univerzit – úvodní poznámka", In: Collection of papers "Třetí role vysokých škol a občanská společnost", NROS Foundation, pp. 5-8.

Farell, M.G. (1999) "The Development of Virtual Education: A Global Perspective: A Study of Current Trends in the Virtual Delivery of Education", Open Learning Agency, 178 p.

Havlíček, Z., Vaněk, J., Lohr, V. and Červenková, E. (2010) "IT for more effective team collaboration", Agris online – Papers in Economics and Informatics, vol. 2, no. 1, pp. 31-40.

Huang, Ch. (2005) "The Development of a University for Older Adults in Taiwan: An Interpretive Perspective", Educational Gerontology, vol. 31, no. 7, pp. 503 - 519.

Jarolímek, J., Vaněk, J. and Šimek, P. (2010) "Virtual University of third Age – Education of seniors in Region", In: Proceedings of the conference ERIE 2010, pp. 154-163.

Jeffrey, J. (2008) "Digital Divide Complacency: Misconceptions and Dangers" The Information Society: An International Journal, vol. 24, no. 1, pp. 54-61.

Lemieux, A., Boutin, G. and Riendeau, J. (2007) "Faculties of Education in Traditional Universities and Universities of the Third Age: A Partnership Model in Gerontagogy", Higher Education in Europe, vol. 32, no. 2&3, pp. 151–161.

Littlejohn, A., Falconer, I. and Mcgill, L. (2008) "Characterising effective eLearning resources", Computers & Education, vol. 50, pp. 757–771.

Marengo, A. and Marengo, V. (2005) "Measuring the Economic Benefits of E-Learning: A Proposal for a New Index for Academic Environments", Journal of Information Technology Education, vol. 4, pp. 329-346.

Micheuz, P. (2006) "Is it Computer Literacy, IT, ICT or Informatics? ", IFIP International Federation for Information Processing, vol 210, pp. 369-373.

Nehodová, K. (2010) "Virtuální Univerzita třetího věku v regionech (Virtual University of the Third Age in regions)", Collection of papers E-learning forum 2010, Jan Amos Komenský University Prague, vol 9., pp. 15-20.

Poynton, T. (2005) "Computer literacy across the lifespan: a review with implications for educators", Computers in Human Behavior, vol. 21, no. 6., pp. 861–872.

Saunders, J. (2004) "Maximizing computer use among the elderly in rural senior centres", Educational Gerontology, vol. 30, no. 7, pp. 537-585.

Schuller T. and Bostyn A.M. (1992) "Education and training for the third age in the UK: A preliminary report from the Carnegie Inquiry", International Review of Education", vol. 38, no. 4, pp. 375-392.

Seong-Jae, M. (2010) "From the Digital Divide to the Democratic Divide: Internet Skills, Political Interest and Second-Level Digital Divide in Political Internet Use" Journal of Information Technology & Politics, vol. 7, no. 1, pp. 22-35.

Stadelhofer, C. and Marquard, M. (2008) "The Internet as a chance for continuing education of seniors in a united Europe", eLearning in Later Life (eLiLL), University of Ulm, pp. 10-17.

Swindell, R. (2002) "U3A Online a virtual university of the third age for isolated older people", International Journal of Lifelong Education, vol. 21, no. 5, pp. 414 – 429.

Šemberová, J. (2008) "Opportunities and perspectives of lifelong learning in older age", eLearning in Later Life (eLiLL), University of Ulm, 2008, pp. 18-23.

Šimek, P., Vaněk, J. and Jarolímek, J. (2008) "Information and communication technologies and multifunctional agri-food systems in the Czech Republic", Plant, Soil and Environment, vol. 54, no. 12, pp. 547-551.

Van de Vord, R. (2010) "Distance students and online research: Promoting information literacy through media literacy" Internet and Higher Education, vol. 13, no. 3, pp. 170–175.

Williamson, A. (2000) "Gender Issues in Older Adults´ Participation in Learning: Viewpoints and Experiences of Learners in the University of the Third Age (U3A)", Educational Gerontology, vol. 26, no. 1, pp. 49 – 66.

INTERNET AND SENIORS

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Abstract

The article deals about the possibilities of using the internet for seniors. Authors suggest using www pages as alternative of retrospective therapy. Authors describe barriers of internet access for seniors. The authors of the article consider about utilization of internet for the reminiscent therapy of seniors. The target group of this article are the workers of the information centres, gerontopeds and the other persons working as the pedagogues. The objective of this article is to summarize ways of using internet for helping seniors to better life. The authors describe terms e-senior. The authors suggest methodological approach to exercising user's skills.

Key Words

Internet, barriers of internet access, e-seniors

Introduction

The history of the mankind is interwoven by plenty of the fascinating technical inventions. When in the year 1876 sir Alexander Graham Bell set together the first telephone, he wouldn't anticipate not even in the dream, that it will come the period, when will the people walk through the streets with mobile phones. He wouldn't also think, that the telephone will serve one day as a technical tool for the transition of the multimedia information of the internet.

A lot of people associate the internet and information technology above all with the young generation. Maybe therefore, that the modern conceived education and breeding are interwoven by the informatics and cybernetics. The young generation grows up in the over-engineered environment. If we should use the words of Kevin Kelly, we could say, that the young generation grows up „in the world of atoms, which is influenced by the world of bits." The internet doesn't respect the state and continent borders, the time zones don't play their role, even the physical location of communicating subjects isn't the essential element of the communication. It governs as well, that the PC skills and the work with the internet browser or the e-mail client is becoming more easy. It's why we can suppose, that the utilization of the internet doesn't know the generation barriers.

In articles (Silva, 2009) and (Losh, 2003) authors say that young people largely drove the early stages of the internet growth but in recent years the sharpest rise in Web use in developed nations has been amongst people aged 70 and over, experts said Monday. "Older adults are the fastest growing demographic on the internet," said Professor Vicki Hanson of the School of Computing at Scotland's University of Dundee on the opening day of a global World Wide Web conference in Madrid. (Silva, 2009)

While just over one-fourth, or 26 percent, of 70-75 year olds went online in the United States in 2005, the proportion was 45 percent last year, according to data from the Pew Internet & American Life Project, she said.

The percentage of those aged 76 years and over who surf the Web rose during the same period from 17 percent to 27 percent. Britain has experienced similar sharp gains in the internet use by people in this age group, said Andrew Arch of the World Wide Web Consortium (W3C), the main international standards organisation for the Web.

"They are basically doing the same things as everyone else. Using the Web for communication, then quickly moving to other activities like information seeking, online banking, shopping," said Arch who works to boost Web accessibility for older and disabled users. (Silva, 2009) Sending and receiving e-mail is the most popular online activity for the internet users age 64 and older, according to the Pew study. But older internet users are less likely than younger Web surfers to do online banking and shopping -- and far less likely to use social networking sites, it found.

"They are not on Twitter," said Hanson, referring to the micro blogging Web site whose popularity got a huge boost last week as US talk show diva Oprah Winfrey became the latest big name celebrity to join the craze. With the percentage of the population aged 60 and over expected to reach 20 percent by 2050, experts said the numbers of older Web browsers is set to continue to rise. And with many countries increasing the retirement age, being able to use the Web will become a requirement for an increasing number of older workers.

But the physical problems that come with old age still act as a barrier to getting online. Poor vision can make reading text on the screen a challenge. Arthritis and motor control problems

can make manoeuvring a mouse difficult. Web sites can make it easier for older surfers by using larger fonts, higher contrast and extra spaces at the end of sentences, said Arch.

"The typical web developer does not really understand that the world is ageing the way it is," he said, adding the changes he is suggesting would make it easier for people of all ages to use the Internet. (Silva, 2009)

"It is like footpaths. They were initially set up for the disabled but then everyone found them very useful," he said. The number of people going online has surpassed one billion for the first time, according to online metrics company comScore.

It counts only unique users above the age of 15 and excludes access in internet cafes and through mobile phones. The authors of the article outline in the following text some possibilities of the utilization of the internet for seniors.

Material and Methods

The authors of the article consider about utilization of the internet for the reminiscent therapy of seniors. The target groups of this article are the workers of the information centres, teachers in organizations for seniors, and the other persons working as the pedagogues. Authors participate in questionnaire form research – collaboration in formulation of particular questions and evaluation about IT and the internet for seniors.

In the analyzing process of the papers that selection was subjected to citation survey in Scopus database and on the basis prepared search strategy has been applied deductive / inductive approach.

Data collection for confirmation of the initial hypothesis has been solved by questionnaire in the selected group i. e. in the framework of indicative research has been used structured interview with predefined questions and with predefined questions order. This form of interview has been used for detection possibility of occurrence certain propensity to analyzing effects.

The partial findings of research have been presented in the defended dissertation thesis: Pikola P. Economic Context of Social Care Services in Retirement Homes (2009).

Results

It is possible generally to say, that the internet is for a lot of seniors technically and knowledge way inaccessible. In the time, when today's seniors were in the productive age, was the information education / computer literacy very underestimated. There was a great lack of the computers for practical education; beyond this computers were with their constitution and operating far-away from today's PC. For the information technologies use is necessary the PC and connection of this computer to the internet. While the providing of the hardware is the simple investment (it is possible to provide the average HW for c. 12 000 Kč), the user of the internet pays for the networking periodically (generally once a month). The payments for networking are either the fixed or they are calculated according to the time of the active networking / according to another connection features. Through steady (and unfortunately just slow) fall of the prices for networking, the operation costs pose one of the essentials barriers of the bigger spreading of the internet among the social groups with low pays. As well the ownership of the PC isn't quite common among the people with low pays. The government institutions are trying to eliminate these barriers with building of so called information kiosks, installation of the internet in the state libraries or endowment support of the

special educational plans. The raising of information literacy of seniors is possible to divide methodically into several stages:

1. Motivation and elimination of the barriers

It's probable, that lots of seniors will consider about the internet with certain disregard. It is possible to expect, that more conservative users won't want to use the internet, because they found out in the news about negatives, which brings internet. Probably a part of seniors will think, that „its not for me", or „I wouldn't manage this novelty." That is reason why it's important to overcome the distaste and to motivate suitably. (Jung and Moran, 2010)

2. General identification with terminology, basic principles and links

For the third period of practical training is necessary to introduce to the students the basic terminology. It's suitable to speak shortly about the history of the internet, about the reasons of the information boom, about the sway of the network economy, about the positives and negatives of the information society and as well about the visions of the future development. This introduction is suitable to conceive with popular-scientifically form with the use of understandable language. Further is suitable to go through the essential ideas in brief: The Internet, WWW, URL, hypertext, hyperlink, etc. This stage will provide the support for the practical training. By results source (Schumacher and Morahan - Martin, 2001) the gender has a positive impact on average daily time spent on the use of the internet. Age has a positive impact on average daily use of the internet in general and a negative impact on the use of the internet for information access/downloading/entertainment. The authors of (Schumacher and Morahan - Martin, 2001) declare that income was not found to have an impact on empirical factors. Generally gender, age and income do not have any significant impact on average daily

use of internet for electronic services. In spite of this fact we suppose to make short lessons (between 20 and 45 min.).

3. Practical utilization of the particular services of the internet

As most suitable appears the practical training in the PC-room or internet-cafe. It is suitable to lead the training in the form of the controlled imitation (The lector demonstrates the work procedure on the screen; the participants repeat the work procedure). So it is possible to fix the general description of the work procedure as the practical skill. With a view to the age of the senior isn't the goal the quantity of the passed skills. On the contrary is suitable to select the services, which are usable for seniors and train them intensively.

4. Regular utilization of the acquired skills

The acquired skill is suitable to strengthen through the regular practicing. After certain cycles of repetitions the control over the mouse and keyboard automates. The user can since this instant pay the attention fully to the information content of the internet.

Discussion

We recommended organizing particular stages in such a periodicity and extent, that the quantity of the presented information didn't threaten the quality of memory trace.

It's suitable to instruct the user, not to confine the personal data (name, address, bank connection, number of credit cards etc.) in the unsecured communication. In order to seniors have fun with work with the internet, is suitable to support their creativity and motivate them to experiment.

Conclusion

The internet offers to seniors especially these services:

- E-mail
- Conferences
- Social nets / communities
- USENET (Netnews, Newsgroups)
- FTP (File Transfer Protocol)
- E-shops
- World Wide Web
- On-line services
- Skype

There are huge of possibilities for using the internet. It depends on each senior; it depends on equipment and users skills. The internet represents interesting and communication channel witch transforms "traditional senior" to position of "digital senior."

E-senior can be characterized using these points:

- E-senior is an internet user which is able to use the internet several ways.
- E-senior uses the internet actively and also passively; E-senior is good skilled user able to find and publish useful information. In these days use plenty of active senior's the internet as a daily shell. (Guus et al., 2001)
- E-senior uses the internet in combination with special software / operating system shells (e. g. speech SW).
- E-senior use the internet for overcoming their immobility and isolation.

- E-senior is an active user which can use the internet for studying. Universities of the third age use www pages as the basic shall.
- E-senior is able to offer all services using the internet.
- E-senior uses the internet for answering the questions or need additional, one-to-one support with senior issues. Several servers offer direct and telephone access to experts that specialize in senior financial, legal, short- and long-term care issues, and more.
- E-senior can use several senior tools. E. g. server http://www.eseniormatters.com/ offer online Personal Health Record (PHR) that outlines a complete medical history. Get prepared in case of emergency. And use our online links and personal assessments to learn more about senior-themed concerns.
- E-senior can use the internet for seeking the discounts or special seniors offer.
- E-senior is very perspective user category for software houses.
- The special senior's category represents so-called "senior managers." To be a "senior manager" means to have practical experiences. In actual situation on the labour market enterprises prefer especially people with relevant and long practice, to be older isn't so big barrier as before the beginning of financial crises. "To an EIS was introduced as a support tool for senior executives at the beginning of the eighties. To make effective use of an EIS, managers must accept it, learn how to interact directly with aspects of the hardware and software, and adapt it to their requirements." (Pijpers et al., 2001)

Authors will plan continuing in research of the seniors and the internet relation. In the next research is suitable to find motivation aspects for using the internet in context of seniors. It is necessary to empower computer literacy of seniors in context of applying and development of e-government strategies.

Apendix

Research was realized in 465 rest homes. Returnability was 20,6%.

H 7   Questions for seniors in rest home

Have seniors interest in internet studying

		Frequency	Percent	Valid Percent	Cumultive Percent
Valid	Yes	50,0	52,1	54,9	54,9
	No	41,0	42,7	45,1	100,0
	Total	91,0	94,8	100,0	

Table 1: Seniors interest in internet studying
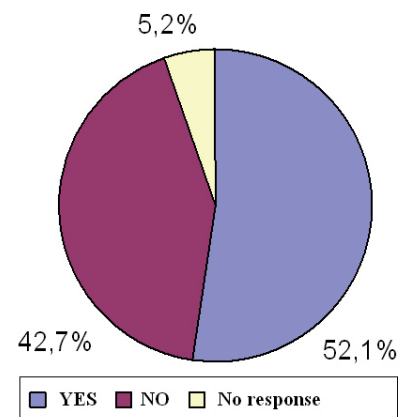
Figure 1: Seniors interest in internet studying

References

GUUS G. M. P., BEMELMANS T. M. A., HEEMSTRA F. J., MONTFORT K. A. G. M. (2001): *Senior executives' use of information technology*, Information and Software Technology, Volume 43, Issue 15, pp. 959-971, ISSN: 0950-5849.

JUNG, Y., MORAN M. (2010): *Low-Income Minority Seniors´ Enrollment in a Cybercafe Psychological Barriers to Crossing the Digital Divide*. Educational Gerontology, 36, 3, pp. 193-212.- ISSN: 0360-1277.

LOSH S. C. (2003): *Gender and Educational Digital Chasms in Computer and Internet Access and Use over Time*: 1983-2000. IT&Society ,1(4),pp.73-86.- ISSN: d0000080.

Pijpers, G. G. M., Bemelmans G. M., Heemstra T. M. A., Montfort F. J. (2001): *Senior executives' use of Information Technology.* Information and Software technology, Vol 43, I.15, pp.959-971. ISSN: 0950-5849.

PIKOLA P. (2009): *Economic Context of Social Care Services in Retirement Homes*, dissertation thesis, Praha, 260 s.

Schumacher P.; Morahan - Martin J. (2001): *Gender, Internet and computer attitudes and experiences,* Computers in Human Behavior, 2001, Volume 17, Issue 1, pp. 95-110. ISSN: 0747-5632.

SILVA, D. (2009): *Senior citizens flocking to the Internet.* 2009. [cit. 2010-03-21]. Available on World Wide Web: <http://news.smh.com.au/breaking-news-technology/senior-citizens-flocking-to-the-internet-20090421-acuz.html>.

COMMUNITIES OF PRACTICE AND THEIR ROLE IN THE FIELD OF HIGHER EDUCATION

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Abstract

Communities of practice are social structures based on voluntary participation of members, who regularly share their knowledge. They are natural and very common phenomenon and they can be found in many organizations as Hewlett Packard, Shell or Daimler Chrysler. This article deals with various definitions of these structures, mentions different types of these communities, the way of their development and also various roles of their members. The article is finally focused on the role of these communities in the field of higher education. The contribution of communities of practice for both areas, research and education, is defined. The article shows the possibilities of how communities of practice could facilitate development in area of higher education.

Key Words

Communities of practice, Knowledge sharing, Higher Education, Research

ERIES Journal

Introduction

Communities of practice are natural and very common phenomenon and they can be found in many organizations. They are called by various names, but their basic function is the same. They are called "learning communities" (at Hewlett Packard), "family groups" (at XEROX), "thematic groups" (at the World Bank) or "peer groups" (at the British Petroleum).

Wenger (2005) defines them as groups of people, who share a common interest for something that they are already acquainted with, interacting with each other on a regular basis, in order to learn more about it.

Chris Collinson and Geoff Parcell (2004), argue that communities of practice are meant to bring together people with similar interests and experiences, who subsequently share their know-how, either in order to increase the qualifications of each individual, enabling them to do their job better, or to attain a common goal.

According to Roberts (2006), communities of practice have emerged as a potential theory of knowledge creation in recent years.

Material and Methods

This article is based on method of the literature review. The aim of a literature review is to show, compare and contrast different authors' views on an issue; to group authors who draw similar conclusions; note areas in which authors are in disagreement; highlight gaps in research; conclude by summarizing what the literature says (Trochim, Donnelly 2008).

This review is based on 32 different sources (publications, articles, online sources and strategy documents). Framework for concept of communities of practice is based on publication of Etienne Wenger and his co-authors whom are considered to be the most recognized authors on the field. For part dedicated to possible application of communities of practice in the area of higher education articles were found in the Scopus database, which ensures quality of these sources.

Results and discussion

Communities of Practice

Though the systematic study of communities of practice has first been undertaken by Lave and Wenger in their book "Situated Learning" (1991), or even in Wenger's later book, "Communities of Practice: learning, meaning and identity" (1998), but the concept of communities of practice was known much earlier and has already been applied in medical sciences, in law, psychology, education and theology (Wallace 2007). However, Wenger's position as a leading figure in this field cannot be denied. He was the pioneer of this concept in the area of management.

In his latest book, called "Cultivating Communities of Practice" (2002), Wenger and his co-authors, Richard McDermott and William M. Snyder (2002), gave a definition of communities of practice as being groups of people, who share common interests, a set of common problems, or a fascination for a specific theme, and who broaden their knowledge and experiences in their given field of interest by interacting among each other. Wenger (2004) describes members of the community as knowledgeable actors (specialists) in the given area.

Leader and Strock (2001) speak of communities of practice as groups based on a common interest, with members who regularly share information and learn from one another.

McDermott (2000a) considers communities of practice to be "ideal vehicles for leveraging tacit knowledge because they enable person-to-person interaction and engage a whole group in advancing their field of practice. As a result, they can spread the insight from that collaborative thinking across the whole organization."

Etienne Wenger (2004) distinguished three basic characteristics of communities of practice, i.e. domain, community and practice. He defines the domain as a field of knowledge, which interlinks the members of the community and thus creates the community's identity. Community is a group of people who are concerned with the domain, with the quality of mutual relationships and also with the line of demarcation, between the internal and the external environment of the specific group. Wenger argues that experience (practice) constitutes the fundament of knowledge (methods, instruments, biography, events and documents) which is shared and further developed by community members. He assumes that by combining these three elements communities of practice are able to manage knowledge.

Hasanali et al. (2002) found that communities "can be a highly structured group that follows well-defined procedures for sharing practices or a very informal, loose collection of individuals sharing ideas." Other authors (Wenger, McDermott, Snyder 2002) acknowledge that communities of practice could be formalised, but they assume that communities should stay informal in order to function accordingly.

Communities offer an environment in which members of an organization feel at ease, and thus, without fear, can discover unexplored regions (Krogh, Ichio, Nonaka 2000). Wenger, McDermott and Snyder (2002) maintain the same idea. They even mention creation of this "hometown" atmosphere as one of the principles for cultivating communities of practice.

All of mentioned definitions are connected by emphasis on process of learning and sharing information, experiences and knowledge. How this learning process in communities works is described by Wenger McDermott, Snyder (2002). They assume that communities of practice contribute to the learning process at the workplace (work place learning), because of the double role of its members (community membership and work team membership). This double membership creates the so called learning loop (see Fig. 1).
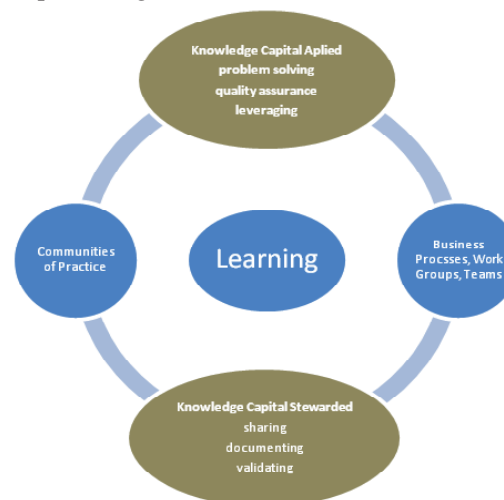

Figure 1: The learning process in communities of practice, (Wenger, McDermott, Snyder 2002)

This idea of "Double-knit" Knowledge Organisation stems probably from Argiris' (1977) concept of "double-loop" learning in organization.

Development of communities of practice

Collinson and Parcella (2004) speak of the life cycle of communities of practice. They have identified five life phases in each community: launching, building momentum, sustaining and closing. Another model was developed by McDermott (2000b). The model is also based on five stages (see Fig. 2).
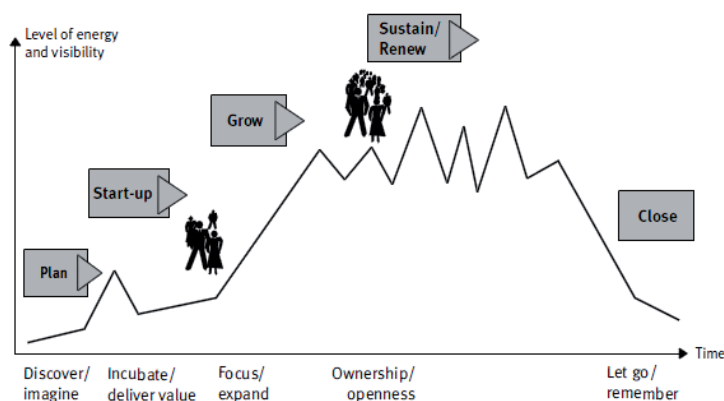

Figure 2: The stages of community development, (McDermott 2000b)

Another model, describing the development of communities of practice, has been presented by Patricia Gongla and Christiane Rizzuto (2001). Their model is based on observation and research on communities of practice which was commissioned by IBM. As in the Collinson and Parcella life cycle, their development model also comprises five stages.

According to Gongla and Rizzuto (2001) at the first stage (potential), the basic function of a community is creating contacts. Members come to know each other and have ties. At the stage of building, the so called memory of the community is created. The members come to know each other better and start to share their experience and knowledge. At the stage of engagement structures and processes built in the previous stage are set in motion. The main function of the community is to enable interaction between members and their access to the knowledge and experience of the community. Cooperation is the main function of a community at the stage of action. Specifically focused working groups start to manifest. The community starts to develop a relationship with other communities of practice in its region. At the stage of adaptation a community starts to develop the capacity to react to changes in external conditions, while simultaneously influencing and changing them.

Typology according to the relation between the official organisation and the community

There are several types of communities of practice, depending on the type of relation that exists between the community and the official organisation. If a community appears to the organisation, and sometimes even to members, as being invisible, we speak of an unrecognised community. If it is visible to only a limited circle of individuals, it's called a bootlegged community. If it is officially recognised, it is called a legitimized community. In case that it receives funds from the organisation it is called a supported community. When a community reaches official status in the organisation, it is called an institutionalized community (Wenger, McDermott, Snyder 2002).

Hasanali et al. (2002) defined four types of communities based on their strategic intent: helping communities, best-practice communities, knowledge-stewarding communities and innovation communities. Many characteristics of the community

(kind of knowledge and practices, key activities, structure and even leadership) are strongly influenced by its type.

Membership and role in communities of practice

Wenger, McDermott and Snyder (2002) distinguish a variety of communities of practice. According to them communities are composed of key members, active members and fringe members. Though non-members are outside of the community, but they are not devoid of contact with the community. Borzillo et al. (2010) uncovered a sequence of activities encompassed in a 5-phase integration process through which peripheral members become fully integrated and legitimized core community of practice members (see Fig. 3).
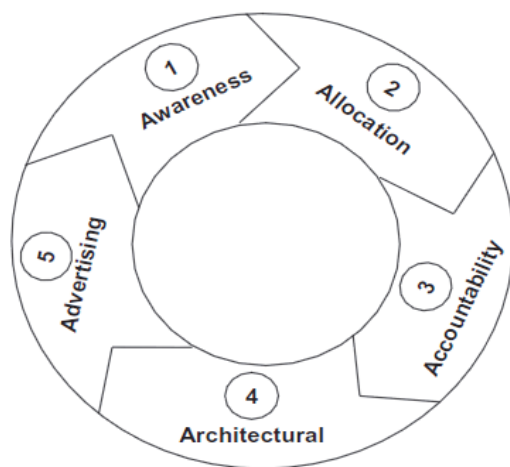
Figure 3: The "5As integration process model" (Borzillo et al. 2010)

Fred Nickols (2003) identifies 6 distinct roles that individuals may play in a community. He distinguished champion, facilitator, information integrator, member, practical leader

and sponsor. Gammelmark (2006) mentions 4 additional roles: editor, knowledge administrator, head of IT projects and IT developer. While Hasanali et al. (2002) emphasizes only 3 basic roles: sponsor, leader and member. The others roles as IT specialists, subject matter experts, content managers, and librarians Hasanali et al. (2002) describes as additional but also valuable.

Benefits and costs of communities of practice

People in organizations create communities of practice for various reasons. They may want to keep in contact with colleagues, or they want to take part in organizational changes, or in reaction to changes, which come from the company's external environment.

A short summary of the benefits derived from communities of practice is given by the HP Company in its book called HP Community Handbook (Gammelmark 2006). Amongst the main benefits we find: shortening the work cycle, re-using materials, expertise, experience in problem solving for the benefit of the involved partners as well as the client, cooperation throughout the branch that stimulates innovation, avoiding repeated mistakes, eliminating unnecessary work, effective learning through proper timing, localisation and development of knowledge and experience, availability of necessary information quickly and easily.

When studied communities of practice Gammelmark chose quite simple approach which is consistent with nature of company handbook. While this conception is acceptable for getting a quick overview of problem area, it could be confusing when it comes to deeper understanding. More sophisticated approach to study of benefits is represented by Fontaine and Millen or by Wenger, McDermott and Snyder.

Fontaine and Millen (2004) divided benefits of communities of practice into tree different groups: individual benefits, community benefits and organization benefits. Similar approach is applied by Wenger, McDermott and Snyder (2002), but they created only two main categories (individual benefits, organization benefits) which are further partitioned to subgroups (long-term, short-term benefits).

Appreciation of the benefits that communities of practice bring to an organization depends on a proper level of expectation. It is unreasonable to assume that communities of practice could replace teams or entrepreneurial units. These units are usually not involved in the learning process and sharing of knowledge. Entrepreneurial units focus on immediate business opportunities; learning is not in the centre of their attention. On the other hand, project teams exist temporarily and the knowledge generated gets lost with their demise (Wenger, McDermott, Snyder 2002).

Communities of practice not only yield benefits, but generate additional costs. Millen, Fontaine and Muller (2002) identified 4 basic areas, which are related to costs of supporting communities of practice: costs related to the time that community members spend, costs related to the organization of meetings and conferences, costs for technical appliances and costs of publications and propagation.

The influence of communities of practice on company performance

Communities of practice are most natural phenomena and they appear spontaneously. Therefore, it is not necessary to create them artificially. Organizations who wish to enhance the process of learning and sharing should focus on already existing communities and subsequently foster and support them by all means. In order to fully utilise the potential of communities of practice, organizations should deliberately create an environment, in which these communities can thrive. They should appreciate their benefits in the area of learning; they should allow them enough time and resources required for their activities. Furthermore, they should encourage participation and remove obstacles. Communities of practice should be integrated in the organization as such. It is necessary that they are involved in the decision making processes, they should be allowed to influence the working units and set up internal processes for the management of values generated by the community (Wenger, McDermott, Snyder 2002).

Eric L. Lesser and John Strock (2001) have focused their attention on the relationship existing between communities of practice and company performance. They consider communities to be "motors" of the development of social capital, thus positively influencing company performance. They identified four specific consequences of the influence of communities of practice: faster training of new employees, quicker response to the needs and requirements of customers, reduction of repair related costs and repeated breakdowns, creation of an environment for the development of new, product-related innovative ideas.

Earlier, Eric Leader and Larry Prusak (in Lesser et al. 2000) have already written about the correlation existing between social capital and communities of practice.

Communities of practice in the field of higher education

Hezemans and Ritzen (2004) identified benefits of communities of practice for individuals and educational organisations. They demonstrate them on the cause of University for Professional Education and Applied Science, Utrecht. The table below (see tab. 1) shows their results.

	Short term benefits	Long term benefits
	Optimisation of the learning environment	*Educational innovation*
Benefits for the organisation	Environment conductive to solving problems Multiple point of view with regard to the solution of the problem Coordination, standardisation and synergy between teams Source for implementation-strategies	Retaining talent Capacity for knowledge development project Capacity for developing new strategies Raising visibility for undiscovered talent
	Raising the quality of work	*Innovation by the profession*
Benefits for community members	Help with challenges Access to a source of expertise Taking enjoyment from working whit colleagues The feeling to belonging to something	Platform for dissemination of skills and expertise Fortification of professional reputation Fortification of professional identity

Table 1: Benefits of CoPs for individuals and educational organisations, (Hezemans, Ritzen 2004)

A few differences could be found by comparison of this list of benefits with the one composed by Wenger, McDermott and Snyder (2002). Hezemans a Ritzen chose similar approach as Wenger, McDermott and Snyder which is mentioned in previous paragraphs. The list created by Wenger, McDermott, and Snyder is much wider, because there is no specific type of the organisation involved. Nevertheless Hezemans and Ritzen identify one additional benefit in the field of higher education, the raising visibility for undiscovered talent.

Andrew at al. (2009) confirmed one of the benefits identified by Hezemans and Ritzen (also mentioned by Wenger, McDermott, and Snyder). They emphasize importance of communities of practice in process of developing professional identity.

Andrew at al. (2009) focused their attention on the role of communities of practice in the process of developing professional identity in nursing academics. They assume that there are professions, as teaching and nursing, where knowledge may be more tacit than explicit, linked to the development of a professional identity. In such case workplace communities provide fertile ground for the evolution of personal and professional practice development, allowing groups of individuals to collaborate and share their experiences.

Study provided by Garrow and Tawse (2009) discovered another benefit of communities of practice in academic field which was not mentioned by Wenger, McDermott and Snyder or Hezemans a Ritzen.

Garrow and Tawse (2009) have focused on how new academics were introduced to the assessment process within a Higher Education context. They consider "that new academics coming into an established community of practice appear to be able to differentiate fairly rapidly between systems of assessment that have a tendency to encourage conformity for both markers and

learners and systems of assessment that enable more creative and critical possibilities."

Others authors emphasize involvement of communities of practice in research. Short, Jackson and Nugus (2009) have paid their attention to communities of practice engaging in clinical research. They have focused on possibility to extend research capacity via an integrated academic and practitioner community of practice. They assume that integration of communities of practice "may offer the opportunity to enhance research skills and knowledge building which underpin the growth of a research culture. This approach has the potential to re-focus the research effort from the individual and provide the necessary ''support'' for research and the development of clinician–researchers." Short, Jackson and Nugus (2009) consider that by supporting a research community of practice it is possible to systematically link academic and clinical knowledge.

Discussion

According mentioned authors communities of practice are suitable instrument to manage, to share and to create knowledge. They could facilitate the realization of strategy in various types of organisations. Presented empirical studies show that concept of communities of practice could be successfully applied on academic environment.

Because of increasing importance of research and development in knowledge economy universities are expected to be active in this process (Kopicová 2010). Short, Jackson and Nugus (2009) emphasize the contribution of the communities of practise for research. Nowadays, university evaluation process is based on several performance indicators. The one of the most important criteria is outcome of university research (Ministerstvo školství, mládeže a tělovýchovy 2010). Because of this fact communities

of practice could be considered as useful tool for develop this area.

Another possible application of communities of practice is in the area of PhD studies. Increasing attention should be paid to this area because there are changes in the way of financing postgraduate studies in the Czech Republic. In near future universities will be penalized for any unsuccessful student. Study of Garrow and Tawse (2009) shows that communities of practice could have facilitate involvement of recent PhD graduates in all aspects of academic sphere.

Verification of the premise that communities of practice affect completion of PhD study creates possibility for additional research.

Although communities of practice are considered to be a valuable concept there are several issues.

First of all creating, managing and the most of all participating in communities of practice are time consuming. It can possibly leads to lower work performance which is basically the opposite of what is expected. Another problem which is also related to performance is possible lose of focus on work related issues. In this case community activities could be reduced to social chitchat far away from its original goals.

It is unrealistic to expect that every member contributes to the community with same intensity. Although this is common aspect of every social structure some members could be disappointed by it. This could lead to tension inside the community and result in corruption of the special friendly atmosphere mentioned by Krogh, Ichio, Nonaka (2000) and also by Wenger, McDermott and Snyder (2002).

As many social structures communities of practice reflect personal characteristic (strengths and weakness) of its

members. For instance members could be so confident about their knowledge and expertise that they become arrogant and ignore outside inputs completely. They simply believe that they know all there is to know. This results to separation instead of interconnection and rigidity of knowledge base instead of flexible and continuous learning process. As Wenger, McDermott and Snyder (2002) said:"failed community is often worse that no community at all."

Another relevant issue here is defensive reasoning defined by Argyris (1991). He argues that there are several reasons for defensive behaviour such as remaining in unilateral control, maximizing "winning" and minimizing "losing", suppressing negative feeling and being as "rational" as possible (Argyris 1991). Base on this premise it safe to assume that people in organization tend to protect their knowledge domain instead of share it through the community and to compete with others instead of cooperate. This behaviour of course has negative impact on learning process in communities a therefore in the whole organization. Argyris studied group of professional consultants, meaning highly educated and intelligent people who are supposed to teach others. He assumed that these characteristics increase the defensive reasoning. That is why his study is relevant in academic environment. In terms of humanities lots of parallels can be found between consultants and academics.

Conclusion

The Lisbon agenda calls for efforts from a wide range of players. These include the universities, which have a particularly important role to play. This is because of their twofold traditional vocation of research and teaching, their increasing role in the complex process of innovation, along with their other contributions to economic competitiveness and social cohesion (European Commission 2003).

According to Letiner (2002) universities and research organizations are confronted with specific challenges: new public funding mechanism and greater autonomy; competition for grants and research contracts; measurement and evaluation of outputs which are intangible by nature; increasing demand for strategic development and systematic management of their most valuable resources, which are their intangibles; general call for accountability and transparency.

According studies mentioned in this article, communities of practice have potential to aid universities to meet these challenges and requirements.

Acknowledgements

References

Argyris, C. (1977). Double Loop Learning in Organisation. Harvard Business Review, Sept-Oct, pp. 118-119.

Argyris, C. (1991). Teaching Smart People How to Learn. Harvard Business Review, Volume 4, Number 2, pp. 4-15.

Andrew, N. et al. (2009). Developing professional identity in nursing academics: The role of communities of practice, Nurse Education Today, vol. 29, no 6, August, pp. 607–611.

Borzillo, S. et al., (2010). A journey through communities of practice: How and why members move from the periphery to the core, European Management Journal, vol. 29, no 1, February, pp. 25-42.

Collinson, CH. and Parcella, G. (2004). Learning to fly, Chichester: Capstone Publishing Limited.

Commission of the European Communities. (2003). The role of the universities in the Europe of knowledge [online]. Brussel: Commission of the European Communities, [cit. 2009-04-07]. Available from www:

<ftp://ftp.cordis.europa.eu/pub/documents_r5/natdir0000038/s_1940005_20030317_144432_GERC031941en.pdf>

Fontaine, M. F. and Millen, D. R. (2004). Understanding the Benefits and impact of

Communities of Practice, in Paul Hildreth and Chris Kimble (ed.) Knowledge Networks: Innovation through Communities of Practice. Idea Group Publishing.

Gammelmark, P. (2006). HP Community Handbook, Hewlett-Packard Company.

Garrow, A. and Tawse, S. (2009). An exploration of the assessment experiences of new academics as they engage with a community of practice in higher education, Nurse Education Today, vol. 29, no 6, August, pp. 580–584.

Gongla, P. and Rizzuto, C.R. (2001). Evolving communities of practice: IBM Global Services Experience, IBM Systems Journal, vol. 40, no. 4, October, pp. 842 – 862.

Hasanali, F. et al.(2002). Communities of Practice, Houston: APQC.

Hezemans, M. and Ritzen, M. (2005). Communities of Practice in Higher Education, Information and Communication Technologies and Real-Life Learning, IFIP International Federation for Information Processing, vol. 182 pp. 39-46.

Kopicová, M. (2010). Dlouhodobý záměr vzdělávací a vědecké, výzkumné, vývojové a inovační, umělecké a další tvůrčí činnosti pro oblast vysokých škol na období 2011 – 2015. Praha: Ministerstvo školství, mládeže a tělovýchovy.

Lave, J., Wenger, E. (1991). Situated Learning: Legitimate peripheral participation. New York: Cambridge University Press.

Leitner, K.H. (2002). Intellectual Capital Reporting in Research Organisations and Universities: Recent developments in Austria [online]. [cit. 2009-03-20]. Available fromwww: <http://www.ferraraonintangibles.net/OECD-erraraIntangiblesConference/ppt/leitner_3b.pdf>

Leader, E., Prusak, L. (2000).Communities of Practice, Social Capital and Organizational Knowledge. In E.L. Lesser et. al. (Eds.) Knowledge and Communities, Butterworth-Heinemann, pp. 123-131.

Lesser, E.L.and Storck, J. (2001). Communities of practice and organizational performance, IBM SYSTEMS JOURNAL [online]. 2001, 4 [cit. 2009-01-02]. Available from www: <http://www.research.ibm.com/journal/sj/404/lesser.pdf>

McDermott, R. (2000a). Knowing in Community: 10 Critical Success Factors in Building Communities of Practice, IHRIM Journal, vol. IV-1, March, pp. 19 – 26.

McDermott, R. (2000b). Community Development as a Natural Step: Five Stage of

Community development, Knowledge Management Review,vol. November/December, no. 5, pp. 6 – 9.

Millen, D. R., Fontaine, M. A, & Muller, M. J. (2002). Understanding the Benefits and Costs of Community of Practice, Communicaions of the ACM, vol. 45, no. 4, pp. 1-10.

Ministerstvo školství, mládeže a tělovýchovy (2010). Zásady financování a pravidla stanovení rozpočtu veřejných vysokých škol pro rok 2011 a další. Praha: Ministerstvo školství, mládeže a tělovýchovy.

Nickols, F. (2003). Communities of practice An Overview. [online]. [cit. 2009-01-05]. Available from www: <http://home.att.net/~discon/KM/CoPOverview.pdf>

Roberts, J. (2006). Limits to communities of practice, Journal of Management Studies, vol. 43, no. 3, pp. 623-639.

Trochim, W.M.K. and Donnelly, J.P. (2008). The research methods Knowledge Base. Mason: Atomic Dog, Cengage Learning.

von Krogh, G., Ichijo K. and Nonaka, I. (2000). Enabling Knowledge Creation, New York: Oxford University Press.

Wallace, D.P. (2007). Knowledge Management: historical and cross/disciplinary themes, Westport: Libraries Unlimited.

Wenger, E. (2004). Knowledge management as a doughnut: Shaping your knowledge strategy through communities of practice', IVEY BUSINESS JOURNAL [online]. [cit. 2009-01-02]. Available from www: <http://home.att.net/~discon/KM/CoPOverview.pdf>

Wenger, E. (2005). Communities of practice a brief introduction. Communities of practice [online]. [cit. 2009-01-05]. Available from www: <http://home.att.net/~discon/KM/CoPOverview.pdf>

Wenger, E. (1998). Communities of practice: Learning, Meaning and Identity. New York: Cambridge University Press.

Wenger, E., Mcdermott, R. and Snyder, W. M. (2002). Cultivating Communities of Practice, Boston: Harvard Business School Publishing.

Wenger, E.; Snyder, W. M. (2000). Communities of Practice: The Organizational Frontier, Harvard Business Review [online]. January - February [cit. 2009-01-05]. Available from www: <http://www.stevens-tech.edu/cce/NEW/PDFs/commprac.pdf>

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