

VIRTUAL LEARNING ENVIRONMENT AS A SUBJECT OF CURRENT RESEARCH PROJECTS AT UNIVERSITY OF HRADEC KRÁLOVÉ

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Abstract

The paper deals with research activities run at the University of Hradec Kralove, Faculty of Education and Faculty of Informatics and Management, Czech Republic, which relate to information and communication technologies implemented in the process of instruction in various subjects. Particularly the role of a virtual learning environment (VLE) is mentioned and discussed, and information about core current projects is provided. The project work is understood to be a tool of VLE reflection, which is considered both from generally accepted points of view, and some new approaches are also introduced.

Key words: virtual learning environment, reflection, project, project work.

Introduction

Currently, the implementation of information and communication technologies (ICT) into the process of instruction and forming a virtual learning environment are crucial aspects of developing educational projects, forms of education and designing e-learning products. These processes depend on the level of school technical equipment and computer literacy of students and teachers. It appears quite frequently that psychological, educational, didactic and didactic-technological aspects of preparation and running courses, and evaluation of various virtual learning environments are the matter of research. Conferences, seminars and competitions are held focusing on e-learning, distance education, e-communities etc. Criteria of evaluation applied on e-learning courses in concrete virtual environments mainly focus on following features:

- Course content, i.e. how the educational objectives are defined, general course design, arrangement and originality, implementation of multimedia components, quality and adequacy of additional study materials.
- Ways of activating students, i.e. what tools are applied in communication, team work,

application the knowledge in real life.

- Evaluation of planning and running activities according to the Syllabus and Calendar.
- Feedback provided via tests, self-tests and scheduled assignments.

This "operating" and in the virtual learning environment pre-defined framework, conditioned by strict accepting algorithm procedures, forms a pragmatic position of courses, their successfulness, efficiency, accessibility, interconnection and succession to other sources. Forming educational co-operating e-communities is in a certain sense the result of designers, both of the virtual learning environment and single e-courses. The possibility to continuously update the course content, engage new participants and relate them to others, broaden the space and time available to study are considered to be contributive, as well as the number of course participants who can be educated at once, the open access to systematic education for handicapped students etc. On the other side, objections appear against the trend of ICT implementation to the process of instruction, resulting from neo-phobic approaches in general, from fears of technology, depersonalization, algorithmization, undue rationalization, economization, and in a certain sense fears of a possible simplified approach to world, people and themselves. Technical scientist civilization considers the ICT an optimal tool for efficient and productive education towards the further development. The question, asked by philosophers, educators, psychologists, e-course designers and learners, is the question aiming at the content of education in differing world, and consequences of reducing the "being education" (i.e. education of man as the whole) to education for technocratic, bureaucratic civilization, for roles we play and have to play if we want to succeed (e.g. Palouš, 2009). Thanks to their potential the ICT and educational courses do not constrain the "being education", because they can substantially respect the necessity of setting student-oriented, teacher-oriented and content-oriented educational objectives. They can individualize the instruction from the point of pace, standard and non-standard educational offer. In the future the ICT do not have to be understood as a tool of technocratic dictate. ICT-based virtual learning environments can take into account value, emotional, ethic and aesthetic relations and consequences of cognitive contents, and thus contribute to personality development (Bílek, Semrádová, Šimonová, 2010).

Authors contribute to the reflection of virtual learning environment by solving several research projects, e.g. "Interaction of real and virtual environment in early science education", "Evaluation of the modern technologies contributing towards forming and development university student competences", "A flexible model of the ICT supported educational process reflecting individual learning styles", and they participated in preparation of a new project "Contexts of e-learning. Reflection of the Virtual (Learning) Environment in Education" dealing with other, not so commonly researched areas and approaches to e-learning contexts. The latest project results are provided and discussed below. The field of e-learning is in the centre of pedagogical attention because of continuous search of new ways and new strategies applying the information and communication technologies.

Project Work

The current society offers people new chances but at the same time requires new competences from them. In the last decade the lifelong professions were disappearing, and competences aimed at one profession became useless and non-contributive. It is necessary to find, define and develop such competences which will be useful in most (still unknown) professions, which enable solving (still unknown) problems, prepare man to cope with fast changes in professional, private and social life. This is not a private matter, but it requires a kind and helpful social environment.

University of Hradec Kralove (UHK), led by the Faculty of Informatics and Manage-

ment (FIM), belongs to active new competence providers, project applicants and supporters of project work. It has been offering the staff (both academic and administrative) courses towards developing the required competences, mostly in the distance electronic way for a decade, and the whole process of ICT implementation is closely connected to project work. It started at the beginning of 1990s by using shared directories where study materials were presented. Step by step the importance of electronic mail increased for communication between students, and students and teachers; then other services followed - electronic administration of credits and examinations, displaying syllabi, timetables, entrance exams results, university websites were designed and e-magazine Telegraph published. Teachers' websites supporting instruction appeared, and in 1997 nearly 25% of teachers used them. Then the professional virtual learning environment Learning Space was bought, in 2001 it was replaced by WebCT. The first distance on-line course was designed in 1998 within the Tempus Project MUDILT (Multimedia and Distance Learning for Teachers). Thanks to this project the first team was created which started to deal with this field actively. In 2000 within the Tempus Project PATER (Public Administrators' Training Towards EU) the ECDL (European Computer Driving Licence) course was the first one prepared in the electronic distance form, other courses followed. In 2001 the Institute of Further Education was established to offer the courses to public. Experience gained in designing and running these courses resulted in the OLIVA Project (On-Line Výuka, on-line learning) targeting at university students. Consequently, that was why the process of training teachers in designing and running on-line courses started. New courses for university students appeared. First, in the field of Informatics, Economy and Management, then in foreign languages, Psychology, Ethics etc. Some of them were designed for the distance education, others supported present lessons. In January 2010 more than 170 courses are accessible in WebCT; 2,000 students of FIM use more than 10,000 chairs. Thus the WebCT implementation in the instructional process has become common standard, for both students and teachers. All WebCT users were trained in effective designing and teaching or studying, the newly interested have chance to gain this competence continuously. Training courses for teachers, future course tutors, are often run in the distance form where participants are in the position of students. It provides them important experience. Currently, having undergone the starting period of material and technical problems, the time came we dealt with didactic aspects of ICT implementation into the instructional process. And what are the results?

- Are teachers able to apply suitable methods and forms of instruction, create and use appropriate didactic means which are offered by new technologies?
- Do students have higher level of knowledge if they attend lessons managed by ICT or run traditionally by teachers?
- Are the new didactic means (methods and forms supported by digital technologies) able to optimize the cognitive process of creating knowledge?

Teams of the University of Hradec Kralove carried out several important project activities in co-operation with other Czech and international universities. In last five years the projects concentrated on interuniversity study based on virtual mobilities, when students can enrol at selected courses of any partner university and study the subject. The successful projects are e.g.:

- the RIUS Project (**R**un-up of **I**nter**U**niversity **S**tudy in selected universities in the Czech Republic, CZ.04.1.03/3.2.15.1/0067, <https://www.uhk.cz/fim/projekty/1360>) and
- the EVENE Project (**E**rasmus **V**irtual **E**conomics&**M**anagement **S**tudies, 2005-3857/001-001, <https://www.uhk.cz/fim/projekty/1740>).
- The REKAP Project (**R**ozvoj **e**-learningových **k**ompetencí **a**kademických **p**racovníků, CZ.04.1.03/3.2.15.3/0406, <https://www.uhk.cz/fim/projekty/2080>) deals with ensuring the continual process of developing e-learning competences of academics at university.

Currently Running Projects

As mentioned above, information and communication technologies and e-learning have become standard for both the teachers and students, and researches proving the efficiency and users' satisfaction are available (Bílek & Skalická, 2009); (Bílek, Poulová, & Šimonová, 2009). The team dealing with this field consists of academics of the Faculty of Education (M. Bílek) and Faculty of Informatics and Management (P. Poulová, I Šimonová) being supported by specialists from other branches. The three-year projects the team is working on are supported by the Czech Science Foundation (GA ČR). Projects intentionally are of similar structure, methodology and outcomes so that results could be easily generalized and recommendations provided to the wide range of users.

The project "*Possibilities and Limits of Real and Virtual Environment in Primary Science Education*" arose from today's situation when the Science teacher is expected to master not only his/her field and subject, but also have basic knowledge in Informatics and applied software. Progress in digital technologies and their applications in natural science and technical fields is rapid, so it cannot be expected teachers will minutely master most of the offered products. What is expected, it is general knowledge and orientation in principles, and paying more attention to perspective information systems according to the subject they teach. Focusing on new didactic means, both material and non-material, and their application into the process of instruction in a certain subject in theory and practice belong to the field of didactics. It is not acceptable to define didactics as an intersection of a subject (branch) and didactics only, but it is necessary to discover wider relations and contexts. Currently, a new item has appeared connecting all field didactics – technology of education. This new stimulus should facilitate the implementation of latest technologies into the instruction. Simultaneously, it is possible to advocate that two sciences operate each other as methodologies, mainly in situations when the science reflecting less demanding fields of phenomena carries out the function of methodological tool towards the other science which solves more complicated problems. When using this approach it is necessary to realize that apart from specific functions (originating from natural sciences), computers can also have another function, i.e. the didactic one. This results in the main objectives of the project which are as follows:

- Analysis of results in blended real and simulative experiment in natural science instruction abroad.
- Researching the effectiveness in application of selected simulative and animating experiments in primary chemical education by applying pedagogical research methods, especially direct and indirect observation, interview and pedagogical experiment.
- Researching the influence of preconcepts, individual learning styles and other pedagogical-psychological phenomena of effective learning on application of simulations and animations in primary Chemistry instruction.

This project is solved in three phases, starting from bibliographic search and concept activities. Results have been partly published in a monograph containing survey studies of authors participating in the project and other addressed national and international experts; it was published by the Faculty of Education, University of Hradec Kralove, in edition "Didactics of Science and Technical Subjects"; partly the research concept was specified according to the analysis results, i.e. preparation and choice of materials suitable for research activities (in the form of school chemical experiments and their simulations, including practice sheets) and tools for collecting data from empirical research activities (Bílek et al., 2009).

The orientation of project "*Evaluation of the modern technologies contributing towards forming and development university student competences*" arose from the current state in the society (Poulová, 2005). Its changes are defined by generally acknowledged theses of fast development of ICT and their influence on the educational process, globalization of the world and

the necessity of new key competences, availability of education and its influence on changes in lifestyle. The project aims at working up the theory of educational science on university level in the field of electronic education. Its main objectives are as follows:

- To find out the impact of different ways of the instructional process management on the quality and durability of students' knowledge, i.e. research students' results in the process of instruction managed by ICT, or by a real teacher.
- To evaluate the quality, meaningfulness, effectiveness and limits in the field of ICT implementation in the instructional process, present proposals to its optimum choice and extent.

The project started with the pedagogical experiment dealing with comparison of study results in the present and distance form of instruction. Students' knowledge was tested before the process of instruction started by a didactic test evaluating the entrance level of knowledge (pre-test), then when it finished (post-test), and finally after a three-month period. According to the collected data the project will result in recommendations towards improving the efficiency (quality) of the process of instruction run in both ways. The first phase resulted in a monograph of bibliography survey of authors-project solvers and other outstanding experts in this subject field (Šimonová, Poulová, & Šabatová, 2009). The second phase was divided in two parts (12 months each) in which the experiment was and will be organized twice (in 2009/10 and 2010/11). Then results of both experiments will be compared and conclusions presented. The final period will be devoted to summarizing final results. The research group consists of students of University of Hradec Kralove, Faculty of Informatics and Management and Faculty of Education. Outcomes are expected in the field of educational science where appropriate proposals towards optimizing the process of instruction managed by LMS will be provided according to the gained results, and in the field of publishing activities where two monographs will be published.

Another related topic is worked out in the project "*A flexible model of the ICT supported educational process reflecting individual learning styles*". Teaching and learning styles play an important role in the instructional process (Lašek, 2006), (Mareš, 1998), especially if it is managed by learning management systems, as they offer designers a wide range of tools which accommodate all learning styles, and students can choose such types of study materials and activities which suit them best. Despite this advantage, there exist several conflicting ideas concerning practical application of learning styles which should be taken into consideration, and teachers' and students' awareness of styles may help substantially (Felder, 2010).

Both learning styles and e-learning are frequently researched phenomena but dealing with the two topics within one research is not so common. The three-year project has been running at the University of Hradec Kralove (UHK) since January 2010. The main objective is to prove that university students reach better knowledge if they are taught according their learning style. A pedagogical experiment is running which compares the increase in knowledge in experimental and control group of university students. Both groups study in the distance electronic course on the Internet in the learning management system (LMS) WebCT. This LMS was designed as a learning environment so it provides all tools necessary for running the process of instruction. All students' knowledge is tested before the process of instruction starts. Students in the experimental group are offered such study materials, exercises, assignments, discussions and other activities which suit their individual learning style. It is made electronically by an application which automatically generates the "offer", i.e. it provides each student with appropriate materials according to his/her learning style. Students in the control group have access to all types of materials, and the process of selection the most appropriate ones is the matter of individual decision. The choice is monitored, and final knowledge in both groups of students is tested when the process of instruction finishes.

The Learning Combination Inventory (LCI), which is used for determining the individu-

al learning style of each student, created by Christina A. Johnston (Johnston, 1996), consists of 28 Likert-scaled statements, and three open-answer questions. The inventory has been piloted at two faculties, the Faculty of Education (FE) and Faculty of Informatics and Management (FIM), University of Hradec Kralove. Total amount of respondents was 201 (FE: 91; male 18, female 73; FIM 110). The result, Johnston calls it “pattern”, is an individual combination of four ways of processing information, as presented below:

– *Sequential Processors* who require clear instructions, do not work well if the directions are changed during the process, prefer strictly planning, organized work and explanations, they like if the teacher goes slowly and makes sure students understand the problem, and provides plenty of in-class practice, they practise answers by going over and over them;

– *Precise Processors* who want to know correct information, to see whether their work is correct, they are frustrated when the teacher does not go into details in explanations, they take detailed notes and activities to reinforce the information;

– *Technical Processors* who prefer hands-on activities to taking notes and reading books, they want to have tools and demonstrate how they work, they learn by living and experiencing it;

– *Confluent Processors* who have their own ideas and want to present them to others, they like their imagination, exploring things, and they learn in a creative, entertaining way, doing non-traditional activities (Johnston, 1996).

The main project follows these steps:

- To adapt the Learning Combination Inventory (LCI) (Johnston, 1996) the conditions of Czech university education, and pilot it. Run an experiment to find out whether using such methods of instruction which reflect individual learning styles results in significantly higher level of students’ knowledge in comparison to the traditional, majority way of instruction.
- To evaluate the quality, meaningfulness, effectiveness and limits of ICT/LMS implementation in the instructional process, and present proposals to its optimal contribution and extent.

A monograph, published in October 2010, will belong to the first project outcomes dealing with the process of cognition and learning from the point of instruction (educational science), psychology, frequently used models defining student’s learning styles, and tools provided by ICT towards accommodating student’s needs. Then the process of determining students’ styles will start. As mentioned above, according to the results students will be provided an electronic distance course offering a wide range of activities accommodating various learning styles. A newly designed electronic application will provide students the most appropriate activities according to student’s individual learning style and monitor what materials they really use (Kulič, 1992). Finally, another monograph will be published presenting the received results and recommendations; partial results will be continuously published on conferences and in journals. Students from all faculties of the University of Hradec Kralove will participate in the project. Their learning style will be determined by the adapted LCI in Czech language, their knowledge monitored by didactic tests evaluating the entrance and final levels of knowledge (pre-test and post-test). According to the gained results appropriate proposals towards optimizing the instructional process in reference to individual learning styles will be provided.

The research started by applying the LCI. Data were statistically processed by t-test, and following results were received. FE students showed statistically significant differences in three variables: gender and learning style, secondary school they graduated from, and student’s age. The data prove female students are more submissive, less independent and creative. They apply the given procedures, strategically organize the work, study carefully, prefer theoretical

definitions, terminology, classifications etc., always prepare assignments. Male students, despite they study humanities, prefer the technical learning style and creative approach. Results are presented in table 1.

Table 1. Preferred learning styles: male / female.

	Sequencing style	Technical style
Male students: Mean	23.61	23.72
Female students: Mean	27.0	20.78

Other differences relate to the secondary school which students graduated from. Students from professional schools reached higher values in comparison to those from grammar schools. A reason could be that the former are used to working independently, hard, deep and more creatively, while grammar school students often have to learn large amounts of study materials, which they may not be interested in, so they study such topics (subjects) without deeper understanding. Results are presented in table 2.

Table 2. Preferred learning styles: secondary grammar / professional schools.

	Technical style: Mean
Professional schools (n = 43)	22.34
Grammar schools (n = 48)	20.47

The correlation between the age and sequencing style shows that with growing age the intensity of style decreases. It proves the mechanical memory becomes less adaptable, and thus learning is in a large extent based on life experience and searching for relations and practical application of the studied topics. So, the sequencing style of learning is less suitable for students of higher age.

The LCI results were supported by measuring autonomy by the non-standardized questionnaire by V. Smekal (2002) consisting of 13 Likert-scaled statements. Autonomy is characterized by independence in forming opinions, emotions, values and activity, both in common life and learning. The collected data were compared to LCI, and results show that:

- the higher the rate of autonomy is, the less frequently the sequencing style appears ($r = -0.25$), and more frequently the technical style is used ($r = 0.31$);
- the higher the independence on other learning styles is, the less frequently the sequencing style is applied ($r = -0.26$), and more frequently the technical style is used ($r = 0.31$);
- the higher the independence on other learning styles is, the more the confluent style appears ($r = 0.45$). It proves there exist relations between independence, decisiveness and the pattern of learning styles.

If data of the two faculties (FE, FIM) are compared, results are as expected. FE students prefer sequencing and precise styles, while most of FIM students use the technical style. Results are presented in table 3.

Table 3. Data comparison: FE/FIM.

Learning style Faculty	Sequencing Processor	Precise Processor	Technical Processor	Confluent Processor
FE Mean	26.34	21.92	21.36	20.33
FE SD	3.62	3.05	3.27	4.37
FIM Mean	25.14	20.78	23.71	21.19
FIM SD	4.08	3.05	3.24	3.48

The study programmes, main subjects and learning content been taken into account, results do not surprise. PE students more frequently work with theoretical facts, concrete instructions, principles, rules and restrictions, which do not provide much space for creative approach. On the other hand, FIM students are expected to be creative, think independently, work with technical data and keep technical restrictions, or solve new problems and tasks.

Nowadays, when the LCI having been piloted for the Czech educational system, other steps will follow, i.e. detecting the learning styles of all students participating in the research, testing students' entrance knowledge, introducing the application for generating materials and activities according to the detected learning style, running the instruction, evaluating students' knowledge and discussing the received results (Pavlíková, 2005). Material and technical problems having been solved, it is high time we devoted to the educational, mainly didactic aspects of the process of instruction supported by ICT. Research activities in the field of learning styles in the process of e-learning belong without hesitation to the topical ones.

Conclusions

Current orientation of university education, which is changing under the influence of latest technology development and new key competences, can be researched from various, different points of view. Education supported by ICT has been spreading because of growing popularity of digital technologies in general. Another reason is it enables easier and more complex realization of the instructional process, offers choice of place, time and pace for studying, allows an individual approach to students preferring various learning styles. These are the key values important for the effectiveness of the process. Material and technical requirements having been satisfied, strong attention must be paid to didactic aspects of the instructional process. To contribute to this process is the main objective of these projects.

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