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## E-Learning Reflected in Research Studies in Czech Republic: Comparative Analyses

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### Abstract

The paper deals with analyses of research activities relating to the ICT-supported university education in the Czech Republic (e-learning). It is divided in two main parts which (1) evaluating 361 studies and structuring them into eight areas of research in e-learning, identifying main methodological problems detected in dissertation theses and analyzing 81 studies presented on recognized conferences in the Czech Republic; (2) introducing the procedure and partial results of the research reflecting individual learning style within the ICT-supported instruction on university level. Despite the hypotheses were not verified, learners declare higher inner satisfaction with the process of instruction reflecting their preferences.

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### 1. Introduction

Education is priority in every developed country. Traditional approach education requires attending lectures and classes, completing assignments and other activities in order to successfully pass subject or course. The ICT-supported education (e-learning) brings new quality to the educational process. Growing demand for university and lifelong education, fast ICT development over the last decade, resulted in necessity of e-learning implementation into educational process. In spite of having lots of both supporters and opponents, e-learning has become an inseparable part of the educational process.

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## 1. Analyses in e-learning

Crucial problems related with process of ICT implementation within the tertiary level of education have been solved, the time came focus on field of didactics. Problems dealing with Czech pedagogical research were analyzed by Vašutová (2008) who focused on annotations of dissertation theses in field of educational science, including the branch didactics. She analyzed 21 works and identified following types of problems:

- unclearness of the research content resulting from absence of the scientific problem or ignorance of the solved problem;
- a wide range of research methods applied without saying which of them relate to researching what problem, and what their advantages or disadvantages are;
- not clearly defined whether the method suits best to solving the topic, mainly because of lacking the scientific problem;
- the questionnaire method frequently occurs, although it belongs to the most difficult and problematic ones,
- methodology of the solution was not provided.

The current situation is developing on in favor of serious research activities in e-learning applications in the Czech Republic and abroad. The "E-learning – Reviews" portal (E-learning – Reviews, 2009) works as the database containing 361 studies structured into eight areas:

1. Pedagogy – educational principles, comprehensibility, communication, evaluation, teaching design, learning situations (112 studies).
2. Human-Computer Interaction – applicability, design principles, information design (45).
3. Strategy – institutional strategies, business models, co-operation, implementation, organization, environment (47).
4. Technology – interactive environment, communication and co-operation, cognitive tools, LMS, learning objects, mobile learning, strategic decisions (64).
5. Quality – general approaches, quality of e-learning, quality management, accreditation and certification (17).
6. Resource Management – project management, management of instruction (13).
7. Culture – operational management, learning environment (climate), complying with users (38).
8. Competence Development – general research, measurements, higher education and retraining (20).

This study focuses on presenting research studies of three important e-learning conferences which were annually held in the last decade in the Czech Republic: e-learning (Faculty of Informatics and Management, University of Hradec Kralove), ICTE (Faculty of Natural Sciences, University of Ostrava) and SCO (Sharable Content Objects, Masaryk University, Brno). From hundreds of contributions published in proceedings of the mentioned conferences we analyzed 81 studies which were declared to be research ones (according to their authors' opinions), and paid attention to following aspects: (a) methodology of the research, (b) explicit defining of hypotheses, (c) research sample and statistic procedures in data processing.

From the point of research methodology there appeared the several frequently used explorative methods were detected within the pedagogical researches. The questionnaire was used in 52 studies (out of 81); the dialogue in three studies; pedagogical experiment was run in 14 research projects; the analysis of e-learning course participants was applied in nine projects and the observation in two of them. One study dealt with designing research methodology (measuring effectiveness of e-learning).

The explicitly defined *hypotheses* of the research project were found in nine studies; description of the research sample was provided by 58 authors.

The *research sample* was described in 58 studies. In 27 studies the research sample included fewer than 100 respondents; 25 studies comprised 101 – 499 respondents and more than 500 respondents participated in six research projects.

The methodology of *data statistic processing* was included in 63 studies (in 54 projects it was descriptive statistics only), in 18 contributions the statistic analyses were not done, even if the qualitative approach had been declared in one study.

It is obvious that quite a large number of authors devote to research in the field of e-learning in the Czech Republic. The traditional methods of pedagogical research are mostly applied, the questionnaire method is the most frequent one. New, non-traditional methods, which would be topical just in such a modern field, are missing. We mean e.g. non-traditional approaches to indirect observation ("virtual observation", eye-tracking), methods of the qualitative research (they were used in one of the analyzed projects), case studies, stoichiometric methods etc.

## 2. Research description

In the second part of the paper an example of research in the field of e-learning is provided. Since 2010 the research project "Flexible model of the ICT-supported instruction reflecting individual learning styles" has been held at the Faculty of Informatics, University of Hradec Kralove. The research procedure and partial results are provided below.

Despite numerous authors have dealt with the theory of learning styles and various solutions have been introduced, e.g. Felder (Felder, 1998), Coffield (Coffield, 2004), Gregorc (Gregorc, 2004), Honey (Honey, 2010), Mitchell (Mitchell, 2004). C. A. Johnston presents another approach to this problem. Her concept "Unlocking the will to learn" (Johnston, 1996) arises from the hypothesis the traditional learning process is based on belief that all learning occurs as part of learner's intelligence. The greater the intelligence, the more a child can learn. Johnston attracts attention to the verb can, as no one says will learn. When describing the whole process of learning, she uses the metaphor of a combination lock saying that cognition (processing), conation (performing) and affectation (developing) work as interlocking tumblers; when aligned they unlock an individual's understanding of his/her learning combination. She designed an inventory for detecting individual learning styles, Learning Combination Inventory (LCI). It differs from other, traditionally and widely used inventories (designed by Kolb, Honey and Mumford etc.). It emphasizes not the product of learning, but the process of learning; it focuses on how to unlock and what unlocks the learner's motivation and ability to learn. The responses form the schema (pattern) that drives learner's will to learn, and respondents are categorized into four groups as follows (Johnston, 1996):

- Sequential Processors, defined as the seekers of clear directions, practiced planners, thoroughly neat workers.
- Precise Processors, identified as the information specialists, info-details researches, answer specialists and report writers. It hides the original content of the Course Content page.
- Technical Processors, specified as the hands-on builders, independent private thinkers and reality seekers.
- Confluent Processors, described as those who march to a different drummer, creative imaginers and unique presenters.

### 2.1. Project description and method

The research question is whether tailoring the process of instruction running within the LMS to student's individual learning style results in significant increase of knowledge. To discover this is the main objective of the above mentioned project.

The process of problem-solving is structured into several phases: (1) to detect the student's learning style by the Johnston's LCI questionnaire; (2) to design an e-application (plug-in) supporting the flexible model of instruction within the LMS WebCT in order to match appropriate types of study materials and activities to individual student's learning style pattern (to reach this objective, not only data on each student's learning style are required but also single items of the Course Content and relating activities are classified according to the suitability to a certain style of learning, i.e. whether the material is appreciated (value 1), accepted (value 0) or rejected (value -1) by the student; (3) to create the on-line e-course for the pedagogical experiment reflecting / ignoring learning styles in the

LMS WebCT; (4) to run the pedagogical experiment, collected data and statistically process and interpret them, and provide recommendations towards improving the whole process of instruction.

## 2.2. *The research concept and partial results*

Before the first phase the project started, the pre-research was done which aimed at detecting whether student's choice of a certain type of study materials and tools is influenced by the detected pattern. For this purpose a questionnaire consisting of nine questions was prepared where students defined their relation to following types of study materials: books and professional literature; electronic study texts; presentations; video-recorded lectures; animations; self-tests; hands-on tasks; other supportive materials, e.g. dictionary.

Students were asked to define what type of study materials they prefer when preparing for lessons during the term and studying for exams. Single items were in the form of statements and evaluated by a five-degree scale (never- hardly any time-sometimes-almost always-always). The questionnaire was distributed to 107 students of the Faculty of Informatics and Management, University of Hradec Kralove, in study programmes Applied Informatics and Information Management. Consequently, mutual relations were researched among single patterns and preferred types of study materials. The received results prove that today's students seldom work with printed sources. Only 1% of students almost always buy the recommended books, one third (33 %) does this sometimes and two thirds (66 %) do not buy books at all. This fact could be influenced by the price. Nevertheless, similar results appeared in question dealing with borrowing printed sources which are available in university library. Only 7% of students borrow books regularly, half of them (48 %) sometimes and 45 % never or hardly any time borrow the recommended books.

As following responses show, today's students mostly prefer electronic study materials. In electronic courses various types of study materials are available, mostly in HTML format, PowerPoint presentations summarizing basic structure of the course, topic or subject, and some supportive tools, e.g. e-dictionary. Vast majority of students (87 %) always and almost always works with electronic study texts, 10 % use them sometimes. Nearly all students (93 %) always and almost always use presentations of the topics. Other types of study materials (e.g. dictionary) are used in a considerably little extent, i.e. 42 % of students always and almost always use them and another 41 % use them sometimes.

In some e-learning courses animations, video-recorded lectures or case studies are available which make some difficult parts of learning content easier to understand. The research proves these materials are used less than presentations or study texts. Animations are more frequently used; more than half of students always and almost always use them (53 %) if they are available. Video-recordings, which are more demanding to be prepared and can be found only in selected e-learning courses, are less popular among students. More than one third of students (38 %) never and hardly any time uses them, one third (33 %) sometimes and even fewer students (29 %) always and almost always work with them if they are available.

Authors of e-learning courses include various feedback-providing tools, such as self-tests and numerous hands-on examples or tasks. Although these are to help students understand the problem, they are used less frequently than study texts and presentations. More than two thirds of students (68 %) always and almost always use the provided examples. Self-tests are even less used. More than one fourth never and hardly any time uses them, 39 % sometimes and only fewer than one third (31 %) always and almost always work with them.

## 3. **Research results**

Totally 94 students of the Faculty of Informatics and Management participated in the entire research. As mentioned above, the student's individual learning style was detected by the Learning Combination Inventory (LCI) within the first phase. Consequently, using the NCSS2007 statistic software, relations between single patterns and types of study materials were detected.

According to the results, students preferring the Sequential style mostly use electronic study texts, books and professional literature, video-recorded lectures and presentations; they reject self-tests and other supportive

materials, e.g. dictionaries. Students preferring the Precise style work with books and professional literature, animations, examples, electronic study texts and other supportive materials, e.g. dictionary; they do not like video-recorded lectures. Students preferring the Technical style often use animations and video-recorded lectures; they do not work with electronic study texts, other supportive materials, e.g. dictionaries and presentations. Students preferring the Confluent style prefer books and professional literature and self-tests; they do not use electronic study texts, video-recorded lectures, presentations and other supportive materials, e.g. dictionaries.

Internet applications providing the electronic support to the process of instruction within the online course in LMS WebCT was designed within the second phase of the problem solving. The LMS provides numerous tools and the course is expected to suit most students despite it reflects the designer's and tutor's teaching style. The main objective of the e-application is to re-organize the introductory page of the e-course where the Course Content is presented to students, i.e. Study Materials, exercises, assignments, assessments, communication and other activities applied within the process of instruction, and present them in such an order which accommodates student's preferences.

An online e-course for the pedagogical experiment reflecting / non-reflecting learning styles was designed in LMS WebCT within the third phase of project solving. The content focuses on library services, which is a topic students have to master before they start studying but they often have hardly any system of knowledge and skills in this field (Šimonová et al., 2010). The study materials, exercises, assignments and all activities included in the course are provided to students in a wide scale of types so that each student can choose the appropriate ones which suit him/her best according to the individual style. Students' process of study in the course is monitored, and the tracking and study results will prove to what extent the individual learning style is reflected.

Finally, the pedagogical experiment ran within the fourth phase. It was designed on the "pre-test – instruction – post-test structure. More than 400 respondents participated in the pre-test. Three approaches are applied to provide the process of instruction, following (1) learner's style where the content is tailored to the individual needs, i.e. generated by the plug-in (Experimental group 1, LCI); (2) providing all types of study materials to the learner and monitoring his/her choice (experimental group 2, CG); (3) following the teacher's style of instruction (control group, K).

Two hypotheses to be verified were defined as follows:

*H1: Students reach higher increase in knowledge if the process of instruction is adjusted to their learning style (experimental group 1) in comparison to the process reflecting teacher's style of instruction (group K).*

*H2: Students reach higher increase in knowledge if they can study independently using all types of provided study materials (experimental group 2) in comparison to the process reflecting teacher's style of instruction (group K).*

Three statistic tests were applied to process the data collected after testing students' knowledge by pre-tests before the instruction:

- the parametric equal variance t-test for the normal data distribution;
- the non-parametric Kolmogorov-Smirnov (K-S) test for different distribution;
- the Mann-Whitney test for difference in medians (Z-value) was applied.

The results proved no statistically significant differences in pre-test and post-test performances of the experimental group 1 (exp1) and the control group (K) and the experimental group 2 (exp2) and the control group (K).

Thus it can be concluded *no statistically significant differences were discovered in students' knowledge whether their learning preferences are reflected within the process of instruction (exp1), whether they work independently being provided all types of study materials and activities (exp2) or the process follows teacher's style of instruction (group K).*

#### **4. Results Interpretation and Discussions**

Unfortunately, neither the research results, nor learners' evaluation proved our expectations that the reflection of individual learning style might be the means which (if applied in the didactic and sensitive manner) could help them

substantially within the process of online learning. This result was surprising for the team because the learning style reflection was understood to be a powerful factor providing strong impact on the process of learning, and statistically significant increase in knowledge of the LCI course participants was expected.

There might be several reasons how to interpret the results.

(1) Neither strong, nor marginal preferences were discovered in patterns within the sample group which could produce statistically significant differences. We agree with e.g. Gregorc (2004) or Mitchell (1994) saying that not tailoring the process of instruction to learners' individual preferences results in increase the knowledge but they consider the developing new learning strategies to be more contributive to the learner. Thus the research question is as follows: Is it really worth dealing with learning styles if the pedagogical experiment did not prove any increase in knowledge?

(2) There do exist some researches (and researchers) that reject the theory of learning styles resulting in the individually tailored process of instruction. The proposal might be to work with learners showing very strong preferences in one learning style and help them develop other strategies and approaches; attract attention and show those who have very weak preferences and able to study efficiently using any strategy that there exist approaches and methods which might suit them better, which finally can increase their motivation in learning, make the process more interesting for them, which is not of little importance.

(3) There could be several other reasons why the expectations and hypotheses were not verified, both on the researchers' and learners' side. In further research activities other approaches to running the process of instruction reflecting individual learning styles can be tested, i.e. tutor's role as a facilitator could be strengthened and emphasized so that learners feel and study in a more friendly environment, being provided wider technical and didactic support; learner's experience in online learning developed in this course could be extended and many other measures could be taken. On the learners' side the skill of independent work and study must be supported and gradually developed, as online learning has become standard not only in the tertiary education but particularly in lifelong learning.

## 5. Conclusions

Thus it can be concluded that despite the contribution of the learning style theory to the online learning process was not proved within this project, no decrease in learners knowledge was discovered in comparison to the traditionally led process of learning which follows teacher's style of instruction. It means we agree and confirm research results provided by Gregory (2004), Mitchell (1994) or Honey and Mumford (2002) who also described results not verifying the learning styles contribution to the knowledge development and reaching educational objectives.

The final question still exists: What else can be done to make the process of learning easier? Following the Felder's multi style approach (Felder, 2010) we would recommend to use a wide range of methods, strategies and approaches which have been successfully applied in the face-to-face form of instruction for ages and use them under the conditions of e-learning. The Bloom's digital taxonomy introduced by Churches (2010) might be one of the tools.

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## References

- Coffield, F. et al. (2004) Learning styles and pedagogy in post-16 learning. *A systematic and critical review*. Newcastle University report on learning styles. [Online] 2004. [Cited: 10 31, 2011.] <http://www.lsda.org.uk/files/PDF/1543.pdf>.  
E-learning – Reviews. [on-line] Available at: <http://www.e-learning-reviews.org/> (Access date 9. 10. 2009)

- Felder, R. M., Silverman, L. K. (1998). Learning/Teaching styles in engineering education. *Journal of engineering education*, vol. 78(8), pp.674-681
- Felder, R. M. (2010) *Are Learning Styles Invalid? (Hint: No!)*. [Online] 2010. [Cited: 8 22, 2012.] [http://www4.ncsu.edu/unity/lockers/users/f/felder/public/Papers/LS\\_Validity\(On-Course\).pdf](http://www4.ncsu.edu/unity/lockers/users/f/felder/public/Papers/LS_Validity(On-Course).pdf).
- Gregorc, A. (2004) *Gregorc's mind styles*. [Online] 2004. [Cited: 8 22, 2012.] <http://www.colorfulleadership.info/papers/concrete.htm>.
- Honey, P. , Mumford, A. (2002) *Using your learning styles*. Maidenhead: Peter Honey Publications.
- Honey, P. (2010) *Learning styles - the key to personalised e-learning*. [Online] 2010. [Cited: 1 13, 2012.] [www.bbmatters.net/bb\\_matters.../Learning%20styles\\_peter%20honey.pdf](http://www.bbmatters.net/bb_matters.../Learning%20styles_peter%20honey.pdf).
- Churches, A. (2010) *Bloom's Digital Taxonomy*. [Online] 2010. [Cited: 10 24, 2010.] <http://edorigami.wikispaces.com/Bloom%27s+Digital+Taxonomy>.
- Johnston, C. A. (1996) *Unlocking the will to learn*. Thousand Oaks: Corwin Press, Inc.
- Mitchell, D. P. et al. (2004) *Learning style: a critical analysis of the concept and its assessment*. London: Kogan Page..
- Mitchell, D. P. (1994) *Learning style: a critical analysis of the concept and its assessment*. London: Kogan Page.
- Šimonová, I. et al. (2010) *Styly učení v aplikacích e-learningu*. Hradec Králové: M&V, 2010. ISBN 978-80-86771-44-1.
- Vašutová, J. (2008) *Analýza anotací doktorských disertací v oboru pedagogika (akademický rok 2005/2006)*. [on-line] Available at: <http://www.pdf.cuni.cz/ovc/index.php?link=30&m=42> (Access date 19. 11. 2012)