The Empirical Analysis of a Web 2.0-based Learning Platform

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***Abstract*— The paper presents and analyses the new elements of instruction which have recently appeared as a consequence of the development of ICT (Information and Communications Technology) such as interactive and mobile communication tools or the applications contributing to 3D visual viewing at a university of significant traditions. The author also deals with the use of the special environment of networked learning based on atypical learning modes, the possibilities of instructional material and management development issues in details, as well as its typical effects on the active participants paying special attention to the forming new teaching and learning styles. Some extremely important parameters and their tendencies during the development decision making processes have been considered as essential by the lecturers involved by means of the application of different statistical algorithms and the webmining technology. Examining the learning activity of students of mainly traditional full-time courses in atypical learning environments, the possibilities of effective learning, network-based cooperation, students' attitudes and the development of key qualifications were evaluated in connection with our blended learning courses supported by electronic learning management systems. (An example of such a course is *Digital Pedagogy*.) By introducing this course attracting a high number of students (3-400 students per course), we wish to present our latest experimental developments, such as course topics, students' assignments, microcontent, blogs, and e-portfolio. The learning patterns of the present – day student popular on demands the integration of the atypical modes in to the teaching/ learning process. Such as electronic new generation learning environment is Moodle (Modular Object - Oriented Dynamic Learning Environment), whose selection was supposted by its open source character modular structure to be easily further – developed and its word wide popularity. The popular on using the atypical learning environment presented in the paper cannot be considered to be representative, however, can be the starting point of the further - development of our learning environments.**

Keywords - ICT; learning support systems; Moodle e-portfolio; web 2.0; online learning.

I. INTRODUCTION

The mathematical model of the description of network structures, such as the Erdős - Rényi model of the 1960s, has been known for a long time [1]. This model was used for the description for random networks consisting of nodes and the connecting lines, and could be describe by means of Poisson distribution. The BACON game [1], mainly popular in the US, was based on such an algorithm.

In accordance with Albert - László Barabássi's theory based on recent researches [1], the operation of complex networks can only be understood through the structures, which implies the interpretation of complex systems and the preparation of maps. All these, require the paradigm shift of human thinking to be able to interpret the available databases appropriately. The complex systems are more than the behaviour of a network. Such a system can be the human mind or an economic system, or the systems of learning processes. Furthermore the given complex systems changes with time, and we need to understand how it changes. The measurement and study of human behaviour patterns, learning behaviours can help to achieve this goal. It can also imply the measurement of human mobility or learning environments. The study of up-to-date ICT tools (as like smartphones, interactive systems, pc-s, multimedia systems), social webpages or electronic learning environments contribute to these measurements. These complex systems can be interpreted as scale independent networks, an example being the worldwide web or the learning network, whose understanding requires modern theories in addition to the already existing up-to-date ICT. So our task is to create such models. This is the science of the future. Our paper wishes to present on one hand the ICT environment, on the other hand student behavior patterns [1].

The classic educational environments have radically changed. It could be best characterized by the increasing use of atypical learning modes. The learning environments these learning modes rely on are supported by ICT technologies in a great degree. The 'learning space' can be compared to the physical behavior of light. Encouraging learning by activities can be considered as such impulses whose effects have been examined in the case of learning networks in the Moodle environment for a relatively great population of students. The impulses are such "flashes" which result in significant, although short student activities. It is supposed that the "flashes" can be developed into a flow of steady light in the learning space by means of appropriate techniques especially by encouraging horizontal activities. The paper calls attention to the above mentioned

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phenomenon and formulates statements concerning the sustainability of the active phases of learning based on Moodle statistical analyses. The intensive growing of the students' horizontal communication (use of forums, chat rooms) and the increase of the frequency of learning communication in the informal learning space directly related to the formal learning process can have such a stabilizing effect on formal learning that can lead to the recognition of design and methodological relationships [2].

II. PROPOSAL

A. *ICT tools supporting instruction and learning*

The new strata of the information society grow up in the environment of the most up-to-date technology, so they might be called digital natives. They are familiar with IPTV, smart mobiles and homes, 3D TV, IPv6 network, thin client terminals, network communities (facebook, twitter, hi5) and Web 3.0 protocols [3]. This fact has such important potentials from the viewpoint of teaching and learning that should be relied on when designing and implementing courses. However, to be able to realize it successfully and effectively, we need to analyse the available results and experiences.

One of the new and at present innovative fields is the world of 3Ds. The problem of how 3D reality can be illustrated in one dimension has long been studied. The main goal of the technique is to provide an exact representation, a geometrical analysis, interpretation of spatial figures. In this sense, the two most important forms of visual communication are the representation and the interpretation of figures. Cognition, thinking and creation are interrelated in both forms of visual communication. Visual cognition means using pictures, images, that is, we wish to understand the ability of visual thinking starting from basic procedures. They imply such mental activities as analysis, synthesis or abstraction. Visual images are made dynamic by means of such procedures [4].

A classic example is the visionary turning, transformation of a spatial figure. Procedures by means of mental images can be interpreted as analogical processes of thinking, as opposed to the logical processes of conceptual thinking. If these procedures can become experience-like in a real physical environment, then the above mentioned thinking can be developed. Such a real environment is provided by the ICT system, the "Leonardo3Do", whose development increases Hungary's reputation. Students are able to create, formulate, cut off, and distort spatial figures, then improving their abilities of visual thinking and spatial visual abilities. In addition to it, the most important tool of visual seeing is the so-called bird, which is directly connected to its operator. In addition, the realization of visual thinking is strengthened by the so called active eye glasses the camera system and the control PC, most important tool of visual seeing (see Figure 1).

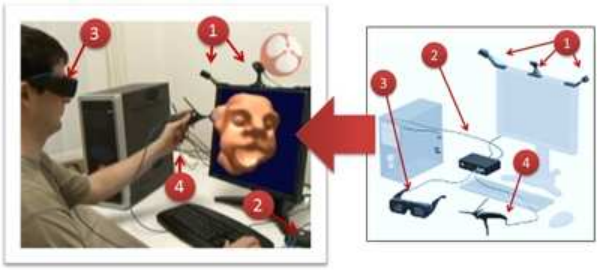

Figure 1. Leonar3Do [17]

Smart phones, IPADs and kinect units providing real life-like simulation, as well as kinect units, games, and the network-based web 2.0 and its applications (Google documents, Google, slide share, Google questionnaires, Google mobiles, Google calendars, Goggle blog, (Facebook, Twitter, Hi5, LinkedIn), whose peripheries are replaced by human fingers. The group of interactive online integrated tools (6^{th} sense technology), in which peripheries are replaced by human fingers is also a new direction of developments, equipped with a mobile small monitor instead of the traditional monitor, the PC by a PDA (See Figure 2) [15].

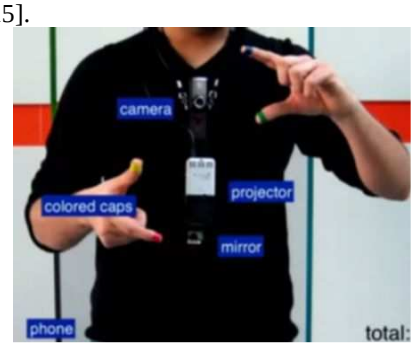

Figure 2. Interactive mobile system [18]

B. *Networked learning and its characteristics*

Having taken into consideration student attitude, learning characteristics, platform independence and the possibilities of development, the Department of Technical Education decided on introducing Moodle LMS system a few years ago. The word Moodle is an acronym of the notion Modular Object - Oriented Dynamic Learning Environment. Moodle is actually a kind of LMS (Learning Management System) application, more exactly a learning management system or an e-learning system shell integrated into the web 2.0 environment. The general task of the LMS is to identify its users and to match them with the adequate subject-matters (courses) according to their roles and rights. The network servers of these systems provide the right databases for system users and simultaneously log their activities and relevant learning data that can be used for generating statistics in the future. This data provide important information on the proficiency of students and also suitable for evaluation of the curricular effectiveness

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[16]. Moodle is a web-based system, as it was mentioned before, so its use requires a PC with Internet/intranet and a browser access, a server and its URL given by the service provider. For example: http://mpt.moodle.appi.bme.hu/ (See Figure 3).

Figure 3. Opening page of the Moodle LMS of the Department, Source: own photo

The main page of the Department's Moodle LMS provides a list of all the courses of the Department structured by different categories such as academic years, types of programmes and whether the course is mandatory or optional.

The Moodle platform of the Department offers learning management services for 3,869 participants at present, and their number is increasing semester by semester.

The LMS provides detailed statistical data about the activity of the participants. The following figure shows the activity tendencies covering the past three years, with the red curve presenting the learners' activities. It is to be seen that the maximums of the amplitudes overlap with the dates of performance measurement, that is, the dates of assignment submission or test writing.

The paper presents the structure, characteristics, and the students' activities of an optional course, Digital Pedagogy preferred by the students and attracting a huge number of students. The course has been supported by the Moodle LMS for four years. The course is offered in a blended learning mode, as in addition to the face-to-face lectures, the students are provided the opportunity of networked content creation and that of synchronous communication.

As the above suggests networked communication starts at the beginning of the semester to harmonize topics, to have it approved by the lecturer and to have it assessed on both the students' and the lecturer's side. For this purpose, the system provides a set of activities, such as tests, activities, forums. The communication carried out on these channels can be followed in Moodle, but the participants also get a copy of each via e-mail, which makes the flow of information faster in a great degree [5].

It is possible to prepare log files of a given course – the last lesson of the course, activities, participation, as well as simple statistical curves - by means of the reporting motor of the electronic learning environment.

Figure 4 shows all the activities of all participants (teachers, students, and administrators) in a given semester, which well illustrates that the activity levels are the highest around the dates of assignments submission and tests (see Figure 4).

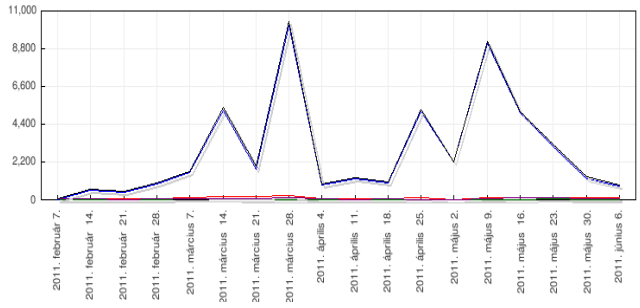

Figure 4. Activities of one semester of Digital Pedagogy course, Source: own photo

Out of the administration blocks of a given course the points report is an excellent way of having information about the full performance of a student in a given semester in a given course – assignments, topic selection, on-line tests, - with given points and comments. It also provides an opportunity of monitoring the student-student and student-lecturer horizontal and vertical communications. All student activities can also be summarized.

Our experiences of several years show that while the lecturers are mainly active in the daytime, the students are active more often than not late in the evening or at night. Since the system is connected to the participants' e-mail systems, most of the students stay online for 10-12 hours a day, so interactivity and quick feedback can be realized. The scope of activities to be carried out suggests that the students prefer the new generation activities, such as microcontent/related activities or the e-portfolio. The assignments are stored by the system, consequently they can be found any time. The following figure is an example of microcontent. The students' activities are stored at a delegated page, and are used to prepare an illustrative collection of them (see Figure 5).

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Figure 5. An example of microcontent

The e-portfolio integrated into the Moodle system is very popular among the students. Each student was required to log in and join the group of students of Digital Pedagogy. After entering, the participants could share the uploaded materials and their contributions. The e-portfolio group was used by 253 students in a course, and each of them prepared 4-5 files and introductory portfolios in their profiles.

Both the e-portfolio and the profile editions are user-friendly, as they can be prepared easily and fast, e.g., by means of the clicking and dragging technique (see Figure 6).

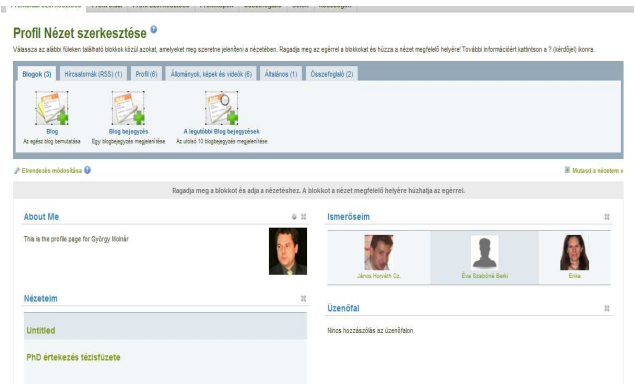

Figure 6. Editing e-portfolio profiles

The students can view their own uploaded and edited contents, on the other hand their own introductory profiles with the photos, as well as the students' acquaintances, groups, notice boards, which are the main forces of the new connectivity learning theories for the participants. By using them, the students can discuss important questions, requirements, solutions related to the course with their peers and their lecturers as well.

C. Web Mining Algorithms

The main objective of the investigation was to explore the most important characteristics of student behaviour or, in other words, the learning activity over the semester by means of web mining methods. The results presented in the previous chapter do not describe classic e-learning but blended learning integrating networked learning phases into the mainstream face to face education and combining the best of both forms of teaching and learning.

In introducing learning activities, two approaches were followed. On one hand, the role of the students' learning process was explored (macroanalysis), and on the other hand the microstructure of processing electronic syllabuses was investigated (microanalysis).

So-called offline web mining methods such as Google Analytics and SPSS Web mining for Clementine [7] and its web mining node are able to provide the possibility of a more profound, more comprehensive and more scientific analyses, far beyond descriptive statistics. It is an aggravating circumstance for the application of online tools that within the virtual learning environment several simultaneous courses are running. The isolation of related results as well as their survey is often too complicated. It is also difficult to perform analyses concerning the levels of the objects comprising the module and the pages comprising SCORM module and the html - based syllabus. Clementine is also capable of extracting related data from the log file. [9].

The application of web mining in VLE is an iterative cycle in which the excavated information and data should "enter the loop of the system and guide, facilitate and enhance learning as a whole, not only turning data into knowledge, but also filtering mined knowledge for decision making". The CRISP-DM (CRoss Industry Standard Process for Data Mining) as a well-known process model consists of six phases (See Figure 7) [12], [14].

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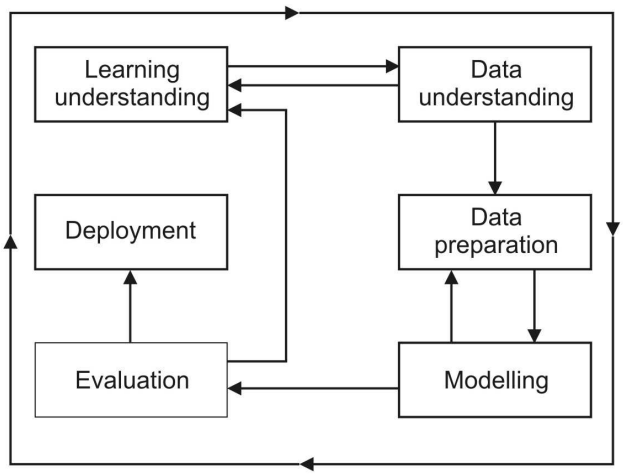

Figure 7. The CRISP-DM model [13]

III. CONCLUSION

The tracking of the work during the semester is supported by log files of Subject sheets. The tracking tools are ready-made and partly built into the learning environment; users' activities, their completed tasks and indices of achievements can be monitored by using statistics and graphs. Moreover, we carried out additional data analyses to obtain information on the progress in reaching the pedagogical goals connected with the course sheet usage. The Google statistical analyzer was used to prepare Figure 8 and Figure 9). The following table shows that how many students visited the the webpage of the course of Digital Pedagogy, how often and the amount of time spent there.

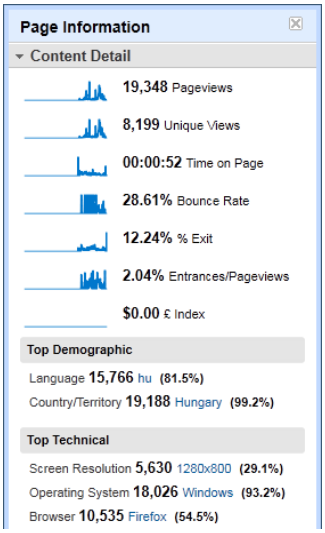

Figure 8. Participant activities of one semester of Digital Pedagogy course

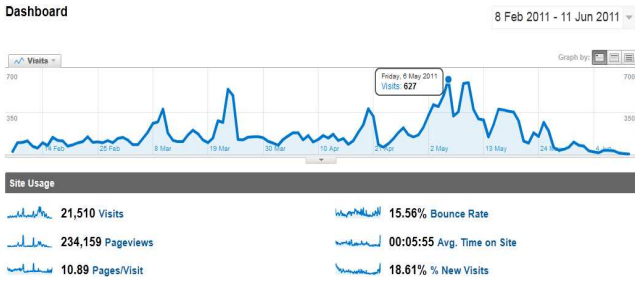

Figure 9. Student activities of one semester of Digital Pedagogy course with google analytics

The report on one single student's performance is an interesting and useful set of statistical data, as it contains the student's points collected during the course on the basis of his/her performance. By means of this, student performance can be evaluated individually and in a realistic way.

Both the students and the lecturers have the opportunity to have access to the detailed report of a student's activity in the function of actual measurements and their points and total points. This is also useful from the viewpoint of the students and the lecturers.

When running a course, all activities of the learning environment are recorded and stored in an appropriate database. Thanks to this data mass, the learning environment becomes suitable for preparing simple statistics without involving any special knowledge. For obtaining reports based on more complex data-correlations, additional data filtering and data combinations need to be done. Therefore, we used data mining techniques for deeper data analyses (SPSS Clementine 12.0 software with WebMining for Clementine) [7].

Using the SPSS Clementine data mining software the content of the log files produced during the use of course sheets can be processed. By doing so, more information can be obtained on the students' behaviour, their learning patterns and the usability of the interface to the electronic learning environment. By means of data mining it is possible to obtain information that could not be gained through other usability tests or queries. By the utilization of the results coming from data mining supported analyses of course sheets and curricula usage we are likely to identify effective education and learning processes and we will able to use the outcome during the development of the electronic curricula as well.

First of all, we formulated questions that could not be answered by means of integrated statistical tools of the learning environment. Then we attempted to answer these questions by using the appropriate data mining software (SPSS Clementine 12.0 software with WebMining for Clementine).

Most LMS have a built - in statistical module which makes possible the fixing of particular items of user activities. Such items can be entry data or download figures per subject item. However, these analysing methods are not qualified for revealing deeper relations or prediction of

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learning/related events. This latter fact is of utmost importance for us, as it makes the learning process more predictable pedagogically. The user interface and usage of the program do not require IT or mathematics skills but that scope of interest could be an advantage (see Figure 10) [8], [10].

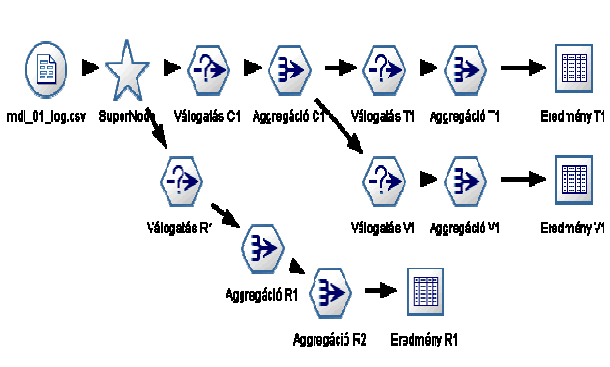

Figure 10. Data analysis with SPSS Clementine 12.0

The students can directly communicate with each other in the system by means of e-mailing, chatting or using forums, the direct communication channels are primarily built around the teacher-student relationship in the electronic earning environment. Our hypothesis, that on one hand the discrete flash-like momentums of networked learning are increasingly becoming continuous and steady, on the other hand the independent branches of the network will also be interrelated, is underlined by our experience and the earlier theories of learning.

We also made an interesting observation that a great deal of the services provided by the electronic learning environment, such as the communication channels of chatting and blogging were not at all used by the students during the learning process. On the contrary, the same services of informal social networking homepages, such as chat module, noticeboard, were used daily, furthermore every one-two hour. For example in the case of facebook, the content of the message can also be related to course content. In addition, the informal network-based learning processes in most cases are carried out either in an open or in a close group in relation to, e.g., a course [11].

Focusing on the future, the Department plans to integrate new forms of network-based communication, that is, community homepages preferred and frequently used by the new generation, such as, e.g., facebook, Hi5, Twitter. These can offer opportunities for fast and wide information provision for the students, furthermore by means of such a channel they like using. This way they learn in an informal way without it seeming to be some sort of external motivation. The Twitter has already been integrated both into the homepage and the Moodle system as well by the Department of Technical Education.

The tools described in the paper and the students' activity help understanding the scale independent networks, by means of which we can get to know the behaviour patterns of students, which can contribute to the orientation in the field of defining future routes of educational development. Educational policy could lead to the formation of a new learning model to be adapted to the new learning environment, based on networks and taking into consideration the learners' characteristics as well. Educational institutions could adopt this model.

Our experiences and our students' opinion suggest that this new – type networked learning support is needed log the present – day student population. Its signs are to be scan in the greatest student activity and in the continuous student – teacher interaction, which had a positive impact on student performance.

REFERENCES

[1] Barabási Albert-László: Behálózva – a hálózatok új tudománya (Networked – the new science of networks) (Magyar Könyvklub, 2003., ISBN 963547895X)

[2] András Benedek (ed.): Curriculum plan on the development of distance education and e-learning, National Institute for Vocational Education, Budapest, 2006.

[3] György Molnár: The requirements and development areas of the ICT aided learning environment, In: András Benedek (ed.): Digital pedagogy – Typotext Budapest 2008., pp. 225-255

[4] Péter Tóth: Seeing and Thinking: Spatial Intuition, Mental Operations, Visual Learning Lab, Budapest, 03.11.2010.

[5] András Benedek - Vidékiné Reményi, Judit (2010): Pedagogy studies in high-tech environment. ATEE 35th Conference, Budapest, Hungary, Responsibility, Challenege and Support in Teacher's Life-long Professional Development, Budapest, 26th-30th August, 2010, Programme and Abstracts, Ed.: Erzsébet Golnhofer, Magdolna Kimmel, Budapest, 2010. p.224.

[6] András Benedek (2009): Mobile Learning: New Horizons and Unstable Summits. Mobile Communication and the Ethics of Social Networking. Communications in the 21st century. Engagement and Exposure. Mobil Communication and Ethics of Social Networking. ed. by Kristóf Nyiri, Vienna: Passagen Verlag, pp. 247-253.

[7] András Benedek - György Molnár, János Horváth Cz. (2010): Moodle-based E-portfolio used in teacher training. (In: Sixth EDEN Research Workshop, User Generated Content Assessment in Learning. Enchanching Trasparency and Quality of Peer Production. Emerging Educational Technologies and Digital Assessment Methods, 24-27 October, 2010, Budapest, Hungary. Edited by Morten Flate Paulsen and András Szűcs, Budapest, 2010. ISBN 978-963-87914-4-3, pp. 131-133.

[8] András Benedek - György Molnár, János Horváth Cz. (2010): Jump over the shadow? From the traditional education to the non-typical one or the experiences of an electronic learning environment. IADIS Multi Conference on Computer Science and Information Systems, Freiburg, Germany, 26-29 july, Proceedings of the IADIS International Conference e Learning, Volume II (Ed. Miguel Baptista Nunes, Maggie McPherson) ISBN:978-972-8939-17-5, pp. 243-246.

[9] Pahl: Data mining technology for the evaluation of learning content interaction. International journal of E-Learning, Vol. 3, 2004, pp. 47-55

[10] SPSS Inc.: Web Mining for Clementine 1.5. User's Guide. NetGenesis, Chicago, 2005, p. 89

[11] György Molnár: ICT, network and mobile communication's solution in mirror of non tipical forms, In: Dr. Anikó

Kálmán(szerk.): Mellearn Conference Proceedings, 5. Hungarian National and International Lifelong Learning Conference - Strategies, Technologies and Methods in a Learning and Knowledge society - Sopron 2009. April 16-17., ISBN: 978-963-87523-9-0, Rexpo Kft., Debrecen, 2009. pp. 85-98

[12] Cristóbal Romero, Sebastián Ventura, Enrique García: Data mining in course management systems: Moodle case study and tutorial. Computers & Education, Vol. 51, No. 1. 2008, pp. 368-384

[13] Gregory Piatetsky - Shapiro: CRISP-DM: A Proposed Global Standard for Data Mining. The On - Line Executive Journal for Data - Intensive Decision Support, Vol. 3, No. 15, 1999

[14] Morten Flate Paulsen : Online Education Systems: Definition of Terms, In: Web - Education Systems in Eu, ZIFF Papiere 118, FernUniversität Hagen, Okt. 2002, pp. 23-28.

[15] McPherson, Maggie and Nunes, J.M. (2008). "Critical Issues for e Learning Delivery: what may seem obvious is not always put into practice". JCAL, **24(6)**, pp. 433-445.

[16] Piet Kommers, Piet A.M. (2010). ICT as explicit factor in the evolution of life-long learning. International journal of continuing engineering education and life-long learning, 20(1/2010), pp. 127-144.

[17] http://about3dtv.com/2010/07/leonar3do-create-3d-virtual-art-in-your-own-home/, downloaded: 15.07.2010.

[18] http://www.mobileUncle.com, downloaded: 15.07.2010.

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