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THESIS OF DOCTORAL DISSERTATION

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Learning methodology in online learning environment

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I. Why do we need learning methodology surveys conducted in online learning environments?

The concept of learning and philosophizing about it have been pivotal elements of pedagogical sciences. In the late 20th and early 21st centuries, the age of information technology, a momentous change occurred affecting economy, culture and society. The emphasis on the lifelong learning approach gained prominence across Europe. Simultaneously, the importance of informal learning has also increased, due to learning methods facilitated by technological innovations (digital tools and Internet). As a consequence of these changes, the significance of learning methodology has grown: both internationally and locally, endless examples of literature stress that learners knowledgeable in learning methodology and familiar with the principal factors of efficient learning will be the only ones capable of successful lifelong learning and of successful utilization of the opportunities inherent in informal learning platforms.

We consider the learning methodology research conducted in an online learning environment tenable along the following four points:

- The concepts of knowledge and learning have changed as a result of information technology. These transformations of knowledge- and learning-concepts must be paralleled by developments in learning methodology, as efficient learning remains a didactic objective.
- Learning environments have also changed with the appearance of ICT: with growing typicality, they are associated with computers, intranet, Internet or multimedia materials. The online learning environment sometimes completely supercedes traditional learning environments but more often only complements them. In such combined learning environments, learning strategies and methods applied in traditional learning environments are generally insufficient and unproductive.
- The role of the learner has also changed as a result of ICT: she/he holds significantly greater responsibility regarding her/his learning methods than what used to be common in traditional, pre- ICT education systems. From a didactic viewpoint, this means that when learning is supported by online learning environments then greater emphasis is placed on the ability of self-regulated learning.
- The problem can also be described in practical terms: during teaching activities we experience with increasing regularity that learning methodology shortcomings lie at the bottom of students' non-achievements, inefficiencies and drop-outs. We often fail to train students in learning

methodology thoroughly, either at high school- or at university-level. For instance, the National Curriculum does not provide instructions related to online learning methodology and university curricula similarly overlook it. Meanwhile, a growing number of schools and universities apply online framework systems as education supplements. However, students' usage of these often lacks efficiency – partly due to the missing training in learning methodology.

The research introduced in the thesis –titled **Methods of online learning**- is a survey involving students of higher education. Its aim is to produce a result in form of a learning methodology study aid, which provides support in online learning to students in online learning environments. The research examines the most frequently occurring instructional methodology solution, whereby the traditional learning environment is supplemented by the online learning environment (blended learning).

II. Theoretical framework of the research

To support our research with theoretical foundations we began by subjecting trends of learning methodology to meta-analysis, examining the question of interrelations between theories and online learning. Thus the concept of learning environment, the role of interaction in learning and students' cognitive characteristics became focal points.

In the case of learning environment, in order to supply an interpretation framework to our survey results, we endeavored to demarcate the concept of online learning environment. We described the online learning environment based primarily on the following factors applied in it: (1) tool-system, (2) instructional methodology and (3) relationship with the personal learning environment.

We positioned the student in the imaginary nucleus of the learning environment. We examined the student from various viewpoints, one of the broadest such viewpoints being our notion on the role of the student in an online learning environment. We are convinced that there's a correlation between the perception of the role of students and successful online learning. We have not assessed the role of the student with the usual, belief- and opinion-based questionnaire-analysis method: rather, the issue was addressed in the reflective learning journal. Apart from the interpretation of role we devoted close attention to those learner skills which bear significance in the online environment, with special emphasis on efficient learning, t. i. learning methodology, as an angle of analysis for the subject matter. Based on OECD key-competencies and the ISTE NET-S competency definition, an accurately outlined

onion graph emerged, in which the competency of efficient learning masks, or nearly blankets, competency definitions across the board. (2006/962/EK; ISTE NETS-S, 2011). Grounded on internal and external learning conditions, we analyzed learning methodology parameters of the online environment and certain factors have surfaced thereby, which were included in our study: the impulsive-reflective learning style and the learning orientation. We devoted a separate chapter of our study to the student characteristic labeled self-regulation. Whether we begin with learning theories, with characteristics of online learning environments or with learning methodology explicitly they all prove to be in close correlation with student self-regulation. It is not only with the efficiency of traditional- but also with online-environment-related learning that the ability of self-regulatory learning becomes manifest as an essential condition (Azevedo, 2005; Barnard et al., 2010; Aleven et al.,2010). Therefore we built its screening both into the questionnaire and into the reflective learning diary.

III. Questions and hypotheses

Our *Methods of online learning* research aims to prove the hypotheses below, based on six research question groups.

1. How could we describe self-regulated learning strategies in an online environment? Which strategies are facilitated by the online environment, and which ones are aggravated by it? What benefits does an online environment add to self-regulation?

    Hypothesis 1: Among self-regulatory strategies, planning and follow-up cause difficulties to students in the online environment.

    Hypothesis 2: Among self-regulatory strategies, seeking assistance is solved more easily by students, while self-efficiency is higher.

2. How do self-regulation and learning efficiency correlate in an online environment?

    Hypothesis 3: Primarily, the online environment does not facilitate self-regulated learning, thus it is less productive for students with low self-regulation skills.

3. What type of personal learning environment does the student have?

    Hypothesis 4: The quality of the student's personal learning environment correlates with effectiveness shown in the course.

4. What types of information consuming activity networks can be established in case of online learners? Can these be shown to have typical correlations with effectiveness?

Hypothesis 5: The typical information consuming activity networks of online learning are specifiable.

Hypothesis 6: Varied efficiency indicators can be assigned to the information consuming activity networks specified in the online learning environment.

5. According to the digital Bloom's taxonomy, with what types of student activities could learning efficiency be described in the online environment?

Hypothesis 7.: The student' online activities can be categorized according to the digital Bloom's taxonomy and the student's thinking skills are assessable .

6. What types of other factors influence students' effectiveness in an online environment most and least?

Hypothesis 8.: Management strategies displayed in the online environment and student activities displayed in the online environment are closely interrelated.

Hypothesis 9.: Management strategies displayed in the online environment and learning efficiency are significantly interrelated.

Hypothesis 10.: The online learning efficiency is not influenced significantly by the student's earlier ICT experience.

Hypothesis 11.: It can be shown which learning strategies effect positively the learning efficiency in online learning environment.

IV. Methods, tools and participants of the research

The research was conducted among undergraduates of three courses at three different institutions of higher education during the second term of the 2012-13 school year. The table below sums up the sample characteristics and the tools used.

Survey sample number	Department	Name of course	Online frame-work	Instructional methodology	Number of elements (persons)	Research tools
Course 1.	Teacher MA	Modern tools in pedagogy	moodle	Replacement blended learning	N = 126	Question-naire; logged data; reflective journal
Course 2.	Departments of sport sciences BSc	Communi-cation	moodle	Replacement and conversion blended learning	N = 322	Question-naire; logged data
Course 3.	Departments of economics BA	The psychology of attaining leadership	moodle	conversion blended learning	N = 26	Question-naire; logged data; reflective journal

Three types of research tools have been applied:

- **Questionnaire:** classic empirical questionnaire, online format. Question-groups included: demographical data, learning history, learning styles and orientation, self-regulation, learning- and time-management, personal learning environment, satisfaction. Data processing method: *statistical analysis* (SPSS software)

- **Reflective journal:** we developed our own, reflective-type, structured learning journal to facilitate the screening of self-regulation. With this tool, data have not been taken only once but, in a sort of longitudinal study, at various pre-determined points of the learning process at regular time intervals. Data processing method: **qualitative analysis** (Atlas.ti software).

- **Logged data:** education software frameworks are capable of recording and storing user activities accurately, which is called logging. These log files, containing user data, tell us precisely when and where each person has clicked on the online interface. Data processing method: *data mining analysis* (Clementine software)

V. Hypotheses in light of the results

H1 - The hypothesis could be proved successfully, insomuch as amongst the evaluated self-regulation factors it were planning and follow-up which brought forward the lowest, poorer than medium average scores. Follow-up received no mention in reflective learning journal answers. Planning, however, as a self-regulatory strategy, appeared in textual answers: either in relation to time management or in relation to learning methods. Time management, as a planning process, was a frequently recurring problem according to the answers, causing feelings of success to some and failure to others. Thus, time management might possibly be a central question of online self-regulation.

H2 - Based on questionnaire answers, the hypothesis could be proved successfully, as it was in these two areas that we received the highest average scores from among the six evaluated self-regulation factors, pertaining to both the full sample and partial samples. In the reflective learning journal, seeking help is a factor that appeared with a relatively high ratio in students' answers written during the first week. During later weeks, with the advancement of the course, students began referring to it with decreasing frequency, sometimes within the topic of self-reflection or elsewhere, when listing cooperation-related achievements. Texts related to seeking help are positive in content, without exception: namely, students had no problems with it in the online learning environment. Self-efficiency, interpreted as trust placed in one's own skills, has not appeared in the learning journals, in either of the sub-samples. This part of the hypothesis, the assumption that undergraduates have a high degree of self-efficiency in an online environment, could not be proved, as not enough relevant data has been received, unfortunately.

H3 - Proving the hypothesis was partly successful. Even though it is true neither for the full sample, nor for the sub-samples that the more developed a student's self-regulatory skills, the more successful he/she will be in an online environment we still have partial results that are positive. From among the six assessed factors two correlate to learning effectiveness. One of the significant positive correlations

exists between self-efficiency and learning effectiveness (r = 0,140; p < 0,01); The other between self-supervision and learning effectiveness (r = 0,108; p < 0,05). Among online self-regulation factors we also surveyed whether the student had earlier ICT experience. The independent-sample t-test indicated that those with earlier experience in an e-learning environment have significantly better self-regulatory skills than those without such experience (t'' = 2,302; p = 0,02).

H4 - The digital environment represented by the sample is relatively homogenous, regarding the tool types used. Typically, laptops are used in the main and digital tools are supplemented with paper-based auxiliary materials as follows, based on rank scores: paper-based course-books/notes (2733); computer (2594); paper and pen (2402); internet information sources (2293).

Facebook (and similar social networking websites) was the most popular in all of our researched areas: 80% of undergraduates spend most of their time with it, one fourth of respondents believe that it also supports learning activities efficiently and it is the application that features most frequently as a content sharing surface (80% of respondents share content here).

According to the surveyed sample the two most frequently mentioned applications effective from a learner's viewpoint are Google and Wikipedia, which support information search. Unexpectedly, even though we know that all respondents use education frameworks actively, these are mentioned very seldom among applications that support learning effectively. A bare 12.86% of respondents mentioned education frameworks. This might mean that undergraduates do not consider supporting learning with this type of system an efficient solution. It might also mean that the use of education frameworks has not infiltrated their everyday lives and thus a mention does not even cross their minds.

As for content sharing we can deduce that the interviewed undergraduates do not explicitly conduct online sharing activities. Apart from social networking sites, very few (10-20% of respondents) share content elsewhere and these applications show a strong correspondence with the ones where students spend the most time anyway. Thus, for example, mailing service systems and Youtube are platforms where they would spend much time and share content.

Chi squared tests indicate that there is no learning efficiency difference between students who list Facebook among applications "devouring" the most time and students who do not. Moreover, it has emerged that whether the student considers Facebook, Google or Wikipedia useful applications for learning does not influence learning efficiency directly.

The correlation between personal learning environment and effectiveness could not be proved therefore we are discarding this hypothesis.

H5 – Based on logged data collected from the undergraduates we examined whether the undergraduates can be grouped on the basis of their online activities. We considered cluster analysis the most practicable method for this. During our cluster analysis, three well separated clusters were formed, based on our logged activity data as variables.

- **Cluster 1 = Browsing, peeping group** (N=171): they enter the online surface frequently and perform much activity with relatively few clicks. Their most frequent click is jumping to the home page. Concerning themselves with study materials is not characteristic. Undergraduates of course number 1 belong here, typically.

- **Cluster 2 – Target oriented group** (N=186): they enter seldom but then with strong learning determination (see SCROM and online testing). The variability of their activities and the number of their clicks are both medium. A strongly homogenous group, with members of course number 3 belonging here.

- **Cluster 3 = Heavy user group** (N=76): using the system in the afternoon is typical of them and they click often throughout their varied activities. They place emphasis on study materials, looking at these frequently. Members of this group belong mostly to course number 3, however there are representatives from the other two courses as well.

The hypothesis, according to which information consuming activity networks are specifiable based on activities conducted in an online learning environment, could be proved by describing the above three clusters. In the study we performed separate clustering on two sub-samples (courses number 1 and 3), which strengthened the proof of the hypothesis further.

H6 – Average results of members of the above three clusters are dissimilar in the marks received, meaning that different activity patterns corresponded to different learning results (the hypothesis was proved). Partly to reinforce results, partly due to the distinctness of the courses we deemed it beneficial to also produce the cluster analysis separately for each sub-sample. Resultant of this, we described the characteristics of successful undergraduates from course number 3: (1) they enter the online surface relatively often, (2) they perform varied online activities at the course surface, (3) they view curriculum elements most often, displaying content orientation, (4) night learning is typical of them to a medium degree.

H7 – In case of course number 1 the online framework shows little of the complexity that we can find in the course description. From the logging, it is not possible to deduce any conclusions as to what thinking skills the student has reached during his/her performance, learning at the course. The only conclusion we can draw is that, based on what the framework shows, students were performing at the lowest order of thinking skills, which means they were active. This is also underscored by the cluster analysis where Cluster 1 defines exactly this group of undergraduates, the ones being active browsing, typical of undergraduates in course number 1. At courses number 2 and 3 everything that needed to be achieved appeared in the framework and the SCORM viewings and test completions are traceable at click level as well. Thus these might affirm that, thanks to SCORM study materials, undergraduates attained remembering and understanding thinking skills and with online testing they also touched on evaluating thinking skills. Therefore we consider the proof of the hypothesis partly successful, as analyzed at click level, based on the logged data. We can draw conclusions about the thinking skills of the undergraduate on the grounds of undergraduate activity shown in the online framework. However, this is certainly deficient data regarding the original target of the course, the thinking skills that were expected to be performed and the level of success accomplished by the undergraduate. We believe that this survey has brought us to the conclusion that the number, timing and even the sequence of clicks are insufficient information for determining thinking skills on the basis of the digital Bloom's taxonomy.

H8 – The hypothesis could be proved partially as the correlation exists in case of certain activities. Time management abilities show a significant negative correlation with online video watching and online computer gaming, supposedly resultant of the inherent multimodality and/or entertainment value. The only activity showing significant positive correlation with time management is the online learning activity. The latter also shows a positive correlation with learning management skills (source management, rate of involvement, learning organizations skills). We may conclude that online learning activities contribute to the development and betterment of the student's learning time and learning management skills; furthermore that good time- and learning-management skills may contribute to an increase in the student's online learning activities.

H9 – The hypothesis could be proved partially: in the case of time management it could not be proved, namely, it is not true that the better the student's time management skills, the better his/her efficiency. Neither the correlations, nor the chi squared tests indicate so. However, a significant correlation is outlined between learning management difficulties and effectiveness: the more developed the student's learning management skills the more effective he/she will be in learning ($r = 0,137$; $p < 0,01$). Consequently, appropriate involvement in the learning-teaching process; efficient use of learning

sources; and appropriate organization of learning, namely regular learning and pace-keeping with the teacher are found to be essential for effective online learning.

H10 – The hypothesis could be proved: results indicate that earlier ICT experience and learning effectiveness are correlating variables ($p < 0,01$). Based on our analyzed sample we can observe that among those with poorer results there are fewer individuals with ICT experience than ones inexperienced in an online learning environment. This difference is less -or not at all- manifest with students achieving better results.

VI. Conclusions and reflections

The first task upon summarising our conclusions is to pin down the scope of validity for our findings. Although, regarding students' learning- and cognitive characteristics, we haven't found significant dissimilarities between the course-based student subgroups generally, the activity analyses constantly highlighted the fact that these three courses could not be analyzed within the same category. Not even if the instructional methodology and the applied education framework were identical in all three. The instructional methodology solutions, the assignment types, the deadlines set by the teacher and several other, similar factors influence student activity. Therefore it is reasonable to examine the activity analyses of the courses singly, not in a batch. Consequently, the activity analysis results we have gained are only valid for the surveyed courses and we do not assert that other courses of similar types would yield the same results.

The choice of sample should certainly be more painstaking in subsequent researches: a more homogenous sample would be preferable in order to better facilitate drawing generally valid final conclusions after the evaluation of the results.

Presumably, the methodology of online observation where we analyze activities logged by the frameworks, processing these with data mining methods, is an essential albeit not sufficient requirement in understanding student activities. Simultaneously, it must be observed that it is a major research methodology challenge to implement the means for logging every single click by a student, as user, whether it happened in an official education framework or on alternative online surfaces. Clearly, it would be beneficial to maximize the elimination of self-assessment during observations of personal learning environments, which might also comprise the education framework itself, obviously.

Regarding the learning methodology content of our research, in future we shall place greater emphasis on ways to observe -or inquire of students about- actual learning methods, techniques and strategies. The present research includes buds of this notion, partly in the reflective learning journal, and partly in the assessment of the learning-oriented utilization of online applications. However, its further development and deeper exploration would be reasonable and profitable.

Last but not least, notwithstanding the fact that the present paper has purposefully neglected paying attention to the teacher, we are aware that learning methodology researches cannot run independently of the teacher. In future, an investigation into this area will be inescapable, especially if we position ourselves on the 'medium and method' side in the 'medium or method' polemic. We agree with the notion of methodology being a more emphatic and important factor in learning efficiency than the transmitting medium, nevertheless, we do not consider the medium a negligible factor. That is so, e.g., because of the instructive frameworks primarily: we believe that the applied medium, while not having a direct effect on efficiency, does certainly influence the realized instructional methodology. This latter, in turn, has a definite effect on online learning efficiency. We consider the introduction of digital Bloom's taxonomy to learning methodology research an innovation; nevertheless we found that its monitoring is difficult within closed, instructive framework types. As for the investigation into the relationship between the digital Bloom's taxonomy and learning methodology, a full-scale online observation of student activities might provide a solution to improving its efficiency.

To summarize, we have room for progress in the field of online learning methodology. We believe, however, that our research has set affairs in motion or brought other inquisitive researchers' attentions to the fact that the learning methodology approach still has a place in pedagogy, which is only underscored further by the increasing spread of online learning, as an unfamiliar phenomenon.

Publications related to the topic

Book

- Ollé, J. - Papp-Danka, A. - Lévai, D. - Tóth-Mózer, S. - Virányi, A. 2013. *Educational Technology Methods: Teaching and Learning in the Information Society*, Budapest: ELTE Eötvös Kiadó. 141 p. (ISBN:978-963-312-157-3)
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Studies published in periodicals

- Papp-Danka, A. 2012. 'Modern environment, modern tool supplies'. *Educational Technology,* 1-2. 7 p.
- Papp-Danka, A. 2011. 'Interpretation possibilities for the concept of online learning environment'. *Educational Technology,* 1-2. pp. 43-49.

Conference publications and presentations

- Papp-Danka, A. 2012. *Online learning 2.0 – activities, ICT competencies, self-regulation, learning environment*. 4th Educational Technology Conference. ELTE PPK, Budapest, 3-4 Feb 2012. pp. 62.
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