A CASE STUDY: IMPACT OF THE INTERACTIVITY LEVEL TO E-LEARNING OUTCOMES

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Abstract. In pursuance to elaborate distance learning technologies mere information transfer becomes inefficient and induces active learning methods integration into the expositive learning content. Distance learning courses for seniors’ self-learning aspects and quality improvement methods are analyzed in this paper. This will be grounded by practical application peculiarities on the basis of seniors and experts experience from eLSe-Academy project.

Keywords: self-learning, interactivity, graphical model, learning context.

1 Introduction

Recently together with traditional audience learning another means that according to Piskurich [12] is efficient for providing e-learning courses is widely applied – this is internet that ensures a fast exchange of information, learning material versatility and high level of interactivity. However this does not guarantees that e-learning through internet becomes a rich learning environment. Most of the applied interactive learning material becomes useful in the learning process only when a learner has possibilities to apply them usefully, i. e. when he/she is provided with learning activities, which help him/her acquire learning material. Therefore self-learning enhancement possibilities of the developed and implemented Information and Communication Technologies (ICT) skills learning course for seniors is analyzed in this paper using seniors’ opinions and lecturers’ training experience analysis. Whereas this learning course was oriented for the audience of senior age persons, therefore such an issue is analyzed in this paper: what possibilities of self-learning at distance have expositive learning material and traditionally designed tests to be used by learners to master computer applied programs with very high level of interactivity.

2 Interactivity Role in e-learning Environments

A lot of e-learning courses contain either not enough of interactivity or use its wrong types. This can be treated as a problem as interactions are the activities that help learning to occur. Therefore such activities are to be considered carefully for building learning experiences that are meaningful to the learner. One might suppose that student motivation increases if the interactivity level is high enough. However, such an assumption can be misleading in some cases. As Schulmeister says, „An increase of the interactivity level makes for a more varied event space, a more highly diversified representation space and a wider symbol space“. So if the interactivity level is high, we will have a learning environment with lots of choices and possibilities. But it is widely known that if ICT environment is too complex, the learner meets with difficulties.

One solution to this problem would be to use a simulator. For a number of years simulations were mostly used in training activities in aviation, aeronautical industries and similar. Therefore simulators were not “adopted until now on a large scale as learning tools due to some factors like the cost of development and the lack of tools for developing high-quality simulations” [6]. Now, as the situation changes, the costs are getting lower and the technology enhances we can expect a broader simulation usage in various education and training activities. E-learning technologies are advancing rapidly as well; so the next of e-learning is simulation-based e-learning generation [1].

ICT environments usually used for learning have a very high level of interactivity with a lot of universal functions and possibilities. Seniors meet with difficulties in such kind of environments as some of them may lack computer proficiency and a complex environment can be misleading. A simulator can offer a simplified environment, i. e. in this case the interactivity level will be low / middle, but the learner will remain active. We suggest such a simulation environment that reduces the interactivity level, and propose a learning scenario, which allows learning step-by-step.

We suggest reducing the interactivity level for increasing learning efficiency.
3 Interactivity and Learning Context Compatibility

The use of interactions is accepted as one of the key elements in learning in distance education [8][11] and differentiating distance education from traditional face-to-face instruction [11]. Interactivity by interaction is divided into four types: Learner to Content, Learner to Instructor, Learner to Computer (Software/Interface) and Learner to Learner [13]. But Chieu [7] follow a socio-constructivist and interactive approach distinguishes three interdependent dimensions. In each dimension, the author stated one or more postulates, as follows:

1. Constructivist dimension: (a) the individual construct his or her knowledge through his or her own activity, and (b) the object handled during this activity is strictly his or her own knowledge.
2. "Socio" dimension related to social interactions: The student personally constructs his or her knowledge through interactions with other people (i.e., the teacher and peers).
3. Interactive dimension related to interactions with the environment: The student learns concepts "anchored" in situations that are both a source and criterion of knowledge. The situation with which the student is confronted is a source of knowledge because it confronts his or her prior knowledge with situational demands. The situation is also a criterion of knowledge because the student can be efficient in the situation, meaning that his or her knowledge is pertinent.

Learning object (LO) is defined as learning material defined by metadata, which can be re-used in the learning process. On the bases of the LO metadata standard [10] learning objects interactivity dimension is defined by interactivity type and interactivity level. The nature of the learning object is defined by the interactivity type, which can be one of three: active, expositive and mixed. The active learning object invokes learner’s actions directly; it can require a learner to enter meaningful semantic information into a computer or perform other productive actions. The expositive LO provides information but does not require entering meaningful information into a computer. Each of them has a corresponding level of interactivity between end user and computer (see Table 1).

<table>
<thead>
<tr>
<th>Table 1. Interactivity level</th>
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<tr>
<td><strong>Low</strong></td>
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<td>Active</td>
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<td>Expositive</td>
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Interactivity levels are especially important for preparation of active means motivating the learner’s activity in self-learning course, where the learning control is transferred to a learner who becomes an active participant in his learning process. Table 1 present’s different technological means in every level of interactivity; however means of the same type can have a different interactivity level that depends on the context realized in it. In other words, a learning expert preparing self-learning material (expositive material or learning situations based on the learner’s activity) has to consider the presented learning context that is created using the development context.

According to Brezillon [5], the context is based on two classical principles. The first asserts that a context is any information that can be used for characterizing the actual situation. The second asserts that a context is always related to the source that performs a role of attention focusing and forms a procedural context from external and contextual knowledge. The author divides the context into three types according to their participation level in solving the learning situation (Figure 1):

1. Procedural context is a part of the context that defines the learning situation and is used directly by a learner in solving it.
2. Contextual knowledge is a part of the context that is not clearly used, but influences learning situation solving. Contextual knowledge indirectly delimits the learning material space for solution. Contextual knowledge is caused by the presented task but they do not focus on the task solution or aim achievement.
3. External knowledge is a context that has nothing in common with the learning situation solving, but is known for many.

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On the bases of this approach we state that a learning expert in preparing the learning material for self-studies has to prepare learning situations which demands only a limited amount of knowledge and skills. This can be achieved in two ways: 1) by reducing the scope of contextual knowledge, i. e. both limiting the learning material space for solution and reducing the level of interactivity, 2) by forming procedural contexts of as small scope as possible, i. e. developing simple tasks, rejecting multifunctional learning tasks; because multifunctional tasks or very high interactivity level environments mislead a learner in case of self-learning.

The scope of contextual knowledge can be reduced by: 1a) limiting functional possibilities of computer interface and applied programs, or 1b) using additional imitation environment with few controllers for concrete knowledge and skills acquiring. The first way can be realized when special computerized working places are prepared and there are possibilities to reduce application program functionality. In case of the second way, by using additional imitation environment the space for solution can be reduced, good possibilities for feedback can be established and there no needs to change existing environment, so it is applicable for self-learning realization. The second way is proved by Bauer researches [3]: traditionally designed tests, that are good at assessing people’s knowledge of facts, are not useful instruments for assessing skills. In this case, the simulation environment itself may be the best place to assess these skills. In using simulations, students produce sequences of actions while performing tasks.

4 eLSe and eLSe – Academy Projects Peculiarities

Post-professional life is no longer seen as a period of disengagement but rather as a period which opens up new opportunities and new perspectives. Five years ago FIM-NewLearning at the University of Erlangen-Nuremberg, Germany together with six European organizations (KTU is the participant), including the UK’s University of the Third Age (U3A), have taken up the challenge by initiating the project eLSe – eLearning for Seniors [4] [9]. The aims were to develop an overall pedagogical and technological concept for an appropriate eLearning environment especially dedicated to older people who have little or no experience in ICT.

In the project eLSe the course started with a two-day introductory part (mouse, computer basics, first steps in Windows, browser, learning platform). The virtual, web-based course lasted for three months. At home with special eLSe Computers, the eLSe participants were able to acquire adequate ICT skills to write e-mails, use the internet, etc. as a gateway for virtual learning opportunities. However, participants’ independent work realization is not easy and required certain solutions. The learning system consisted of individually configured computers with a learning and communication interface adapted for senior citizens. The computers were handed out as a loan for the duration of the course, the learning and communication platform was based on open source software ILIAS, having synchronous and asynchronous support elements. It was find [8], that in eLSe project „the concepts and products have been implemented, tested, and evaluated in Germany and the United Kingdom and definitely meet the needs of older learners and were well accepted by them“. Afterwards another, eLSe-Academy project was initiated, where Pilot experiments were held in four other countries. In the Lithuanian Pilot experiment a pedagogical concept of blended learning was used, as distinct from eLSe without computers individually adapted for senior citizens. Appropriate eLearning scenarios were developed which meet the needs and the specific restrictions of elderly people.

In the scope of eLSe-Academy project KTU partner organized Basic and Advanced Pilot courses for Kaunas seniors (Pilot LT). Members of Lithuanian Pensioners' Union „BOCIAI“ Kaunas Community, Kaunas U3A and others were course participants. The number of participants of the basic course was 35, of the advanced course – 27. Most participants were women: approximately 90% female and 10% male. The age was from 55 till 75+. Course materials were localized in Lithuanian. The pilot LT course curriculum consists of the kick off meeting, regular face-to-face consultations and hands-on studies at home computers. Seniors worked in a computer class once or twice a week with tutors. Usually there were two tutors in the class.

Figure 1. Context types and their change [5]
During the courses verbal interviews with learners took place in face-to-face consultations as well in the final meeting. Written opinions were expressed in open answers in questionnaires. Course organizers took counsel with participants according to confronted difficulties, technical problems at home computing, etc. After basic and advanced courses it can be stated that course materials were fully prepared for distance learning mode: learners could get all text materials, demonstrations and self control questions through distance at home computers. They can receive necessary tools as well. But individual and separate learning without a tutor at the beginning stage of learning was too complex for seniors. They need individual consultations. Distance courses without face-to-face consultations are insufficient. So it was necessary to organize face-to-face consultations in a computer class according to participants needs during all the study period. The blended learning mode of courses with class lessons and self studies was most appropriate. Further we will discuss possibilities to improve the course that it would be more suitable for self-studies.

5 Experimental Research Results

12 learners who already finished the distance learning course were interviewed in the research. Lecturers’ training experience analysis was used as well. The learners were interviewed on such essential questions: can the prepared learning course be used for self-learning? What means they would need for improving skill acquiring without the help of a tutor?

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**Figure 2a. Self-learning possibilities diagram**

As we see from the diagram (Figure 2a), only 34% of the respondents think that the prepared course can be implemented without tutor consultations and 33% of the respondents think that additional solutions are required. In case of organizing self-learning of the course, one quarter of the respondents think that they would lack experience and 42% state that they would require additional means for self-studying at home (Figure 2b). However, even one third of the respondents wish additional face-to-face meetings and consultations.

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**Figure 3. Self-learning realization analysis diagram**

As well we took interest in the opinion of the respondents on what concrete methodological solutions could improve self-learning possibilities. Even 67% of the learners who participated in the course wished...
learning tools with feedback, i.e. such tools would help in the learning process to evaluate if one performed the task correctly, and if the task was performed wrongly such tools would provide an advice or help (Figure 3). About 41% of the respondents think that self-learning possibilities were improved if they get tools only for a certain task performance, i.e. it would be limited by learning material and interactivity level. This is justified by the opinion of nearly 75% of the respondents who affirm that the work with multifunctional software misleads and it is very difficult to work with such software without additional help.

The performed researched was not thorough; however it shows the main tendencies. Summarizing the research results we noticed that on purpose to adapt the learning course for seniors’ self-learning one need additional methodological and technological solutions based on learners’ active activities. For acquiring practical skills it can be used on-line feedback, the prepared task could be not multifunctional, the interactivity level should correspond users needs and learning goals.

6 Proposals for Self-Learning Development

The work with a computer and its application programs is not complicated as usually one has to perform a sequence of several actions for obtaining a result. However, as the lecturers, who worked with the learners, state, it is complex for inexperienced and elderly users, as there are a lot of possibilities, required and unnecessary for goal achievement. In other words application programs are distinguished by a very high level of interactivity, which causes problems to a users of this project and learning without face-to-face help becomes complicated (Figure 4).

![Figure 4. The applied distance self-learning model](image)

Learning technology accessibility and more flexible possibilities to apply them induce to create and apply active material presentation methods. One of them, which we propose for self-learning improvement, are additional software tools (controllable action imitators) that enable change the task context and interactivity level flexibly (e.g. encompass only the procedural context or interactivity level to limit until very low or low). Certainly, implementing a new means one has to take into account a new task for mastering it.

![Figure 5. The proposed distance self-learning model](image)

The proposed self-learning model has several advantages (Figure 5). First of all, the tutor role is minimized as the simulator takes a part of its functions. Second, the environment of practical skill acquisition
adapted to self-learning is developed; the learning material relation to ICT environment and the simulator is very tight here.

In this paper we propose to implement simulator functions with the graphical simulation environment TestTool. It consists of two parts: the authoring tool for the author and the simulation environment for the learner. The authoring tool is used by the expert of the domain to implement knowledge structure of a graphical model [2]. The authoring tool itself provides many technical facilities for experts of the domain: drawing objects, the collection of simulation control elements, explanations of errors in textual and graphical representation, metadata, multimedia and sound effects. It allows creating an active type of learning objects, consisting of changeable and not changeable graphical components. When designing a graphical model we can create for students’ complete possibilities to choose interactivity level, to experiment in the standard situations, to assess student solutions, show mistakes, and provide explanations.

A screenshot of the example, implemented in TestTool learning environment [1] is presented in Figure 6.

Figure 6. The screenshot of graphical simulation task (learning situation) of very low interactivity level (at left) and the screenshot of its right decision (at right)

Figure 7. The screenshot of graphical simulation task (learning situation) of low interactivity level (at left) and the screenshot its right decision (at right)

Figures 6 and 7 show graphical simulation tasks of different interactivity levels obtained changing the task’s procedural context, which was discussed above. Students can repeat the tasks, obtain evaluations, choose new difficulty or interactivity level; learning individuality and self-sufficiency is achieved in such a way.

7 Conclusions

In case of self-learning when there is no direct relationship among learning process participants, development of interactivity with feedback between learning material (expositive material, interactive means) and learners is a compulsory condition for controllable performance of the learning process. Summarizing the results of the research we can assume that the impact of the interactivity level to learning outcomes is twofold: one part of control elements (depending to the procedural context) are required for task goal realization, however the other part of control elements (depending to contextual knowledge), which enlarge the interactivity level to a high one, is redundant in regard to the solved task and it can mislead a user. The research revealed that
inexperienced users of senior age are misled by multifunctional computer programs of high and very high interactivity level; the simulation environment may be the best place to gain skill. Whereas lecturers according to their experience in seniors’ training experience name face-to-face training as the most productive way to learn. However, additional means for acquiring practical skills are required as seniors have to master their skills at home without the tutor help. Therefore for improving self-learning possibilities for the course prepared in eLSe project we suggest to create and apply graphical simulation tasks based on active learner’s activity; such tasks are characterized by a limited learning context and limited interactivity level. As learning is an iterative process, therefore practical tasks with feedback, complemented with new functions and alternative solution ways ensure consistent self-learning, and in respect of application – a reuse of learning material when a learning expert needs to adjust it minimally to learning objectives.

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References


