# Adaptivity in e-learning

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The general purpose of educational platforms is to provide students with information as well as with practical opportunities in order to help learners to acquire certain skills and to increase their active knowledge about a studied topic. However, different learners may have different characteristics, prior knowledge, motivation or needs. This diversity commonly requires the presentation of different information to different learners in a different format. That is why it is very important to develop adaptive educational systems which consider various aspects of individual students and tailor the learning process to meet the actual learner's needs. In this paper there are described basic demands put on an adaptive e-learning system. Basic types of barriers discouraging e-learning systems from being more used are mentioned. Comparison of several available e-learning systems (mostly open source ones) is done from the point of their adaptivity. Practical experience with utilization of various e-learning systems is given in the end of the paper. In particular there are three systems discussed - Moodle, MULTIPES and MetaTool.

**Keywords:** adaptivity, e-learning barriers, students' involvement, Moodle

## 1. Introduction

The general purpose of educational platforms is to provide students with information as well as with practical opportunities in order to help learners to acquire certain skills and to increase their active knowledge about a studied topic. However, different learners may have different characteristics, prior knowledge, motivation or needs. This diversity commonly requires the presentation of different information to different learners in a different format. That is why it is very important to develop adaptive educational systems which consider various aspects of individual students when presenting information and/or practise opportunities in order to make the learning process as effective, efficient, and motivating as possible [20]. This adaptation takes place independently of the course creator or teacher.

Thus successful learning is regarded as [15]:

- an active process
- one in which the learner constructs meaning and systems of meaning
- a reflective activity - in which 'hands on' processes inform 'mental' ones
- a social activity - learning takes place through discussion and interaction with others, not just on a one-to-one basis with a student and information
- context dependent
- often requiring a long period for assimilation
- heavily dependent on motivation

Following educational requirements for adaptive systems can be identified [20]:

- Information should adapt to what a learner already knows (prior knowledge) or can do (prior skill).
- Information should adapt to a learners' learning capabilities.
- Information should adapt to a learners' learning preferences or style.
- Information should adapt to a learners' performance level and knowledge state (i.e. system should provide feedback)

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- Information should adapt to a learners' interests.
- Information should adapt to a learners' personal circumstances (location, tempo, etc.).
- Information should adapt to a learners' motivation.

In this paper we concern educational systems - Course Management Systems (CMS) or Learning Management Systems (LMS), we are focusing on course creation, from the point of their ability of adaptation to user needs and requirements.

## 2. Basic e-learning barriers and adaptivity in e-lerning

General factors influencing usage of e-learning courses are: gender, age, study location, computer competence, owns computer, computer training, education, e-learning experiences. Typical users of courses are European middle aged men owing computer with internet connection and have some computer experiences. So courses are often obviously designed to suit this people. But we should think about how to extend e-learning to be more used even by groups of people which are not familiar with information and communication technologies (ICTs).
There are several types of e-learning barriers [1], and we list here only types, which are in some sense relevant in order to course creation or CMS development and it is important to have them in mind. These barriers are protecting CMS courses from being more used.

- **Personal Barriers** (Attitude towards e-learning, Learning style or preferences...)
- **Organizational Barriers** (Lack of time for study, Interpersonal barriers, Registration system problems...)
- **Technological barriers** (Course Management Systems quality, Limitations of technical support, Loss of data and inability to save or transfer data...)
- **Content-Suitability Barriers** (Content not audience-specific, Poor content duality and limited rigor, Poorly constructed assessments...)
- **Instructional Barriers** (Lack of progress reports and feedback, Limited learner engagement, Poor instructional design, Limited reference materials, Access and navigation problems, Limited use of multimedia, Unclear or inconsistent instructions, Inability to save work, Information overload, Lack of instructor presence/interaction...)

The thing that could help to overcome the above mentioned barriers and help e-learning to be more used is some kind of adaptivity of systems to the user needs. In recent years we have witnessed an increasingly heightened awareness of the potential benefits of adaptivity in e-Learning [3]. This has been mainly driven by the realization that the ideal of individualized learning (i.e., learning tailored to the specific requirements and preferences of the individual) cannot be achieved, especially at a "massive" scale, us any traditional approaches.
Factors that further contribute in this direction include [2]:

- the diversity in the "target" population participating in learning activities (intensified by the gradual attainment of life-long learning practices)
- the diversity in the access media and modalities that one can effectively utilize today in order to access, manipulate, or collaborate on, educational content or learning activities
- diversity in the context of use of such technologies
- the anticipated proliferation of free educational content, which will need to be "harvested" in order to "assemble" learning objects, spaces and activities

As a result we summarize some propositions for course creators and developers. The developer of the CMS should consider these recommendations. System should have several kinds of basic visual settings. So every user will use the preferred setting. It doesn't just mean that the learner will like how the system looks like, but he should be able to set properties in order to his abilities, experiences and opportunities. It means settings like a simpler or more complicated setting and controls for less and more experienced

computer users, different kinds of colour, sounds and video settings, preferred mouse / keyboard / other control, smaller / bigger size of characters, less / more help provided to the learner… In CMS there should be developed tools for archiving and managing all types of fines (documents, tables, presentations, audio and video files…), tools for direct communication between learner and instructor or among learners themselves.

Teachers or instructors, who are creating the course, should have prepared some alternations of the course for better or weaker students. Of course there has to be some minimum, which is required for all students. But the course should be able to restructuralize or adapt the process of course according to the learners study abilities or preferences. There should be different way how the learner can obtain required information (text / audio / video). Different types of group work are also advisable – different types of exercises or works for different types of groups. Learner then can choose what he prefers

## 4. Current situation in CMS systems

The following text summarizes existing e-learning software packages. The main emphasis is put on Open Source platforms, which are free to download, use, modify or distribute (under the terms of the GNU General Public License). At present, a great variety of e-learning software packages exists. Even when focusing on the class of open source course management systems, one can still identify a quite extensive range of systems. Their exhaustive overview can be found for example at [21].

In the light of described findings, let's now explore the current state of the art of CMS systems from the point of user friendlyness and their potency of adapting the courses to the specific user needs. But it will be more about user-friendlyness rather than adaptivity in the sense we have discussed it in previous text. We have examined these CMS – Moodle [7], .LRN [8], DoceboLMS [9], ATutor [10], Claroline [11] and Dokeos [12].

We tried to compare particular features of different systems and put emphasis on user friendliness and possibility of adaptivity. There is a comparison in the table 1.

**Table 1**    Comparison of e-learning systems (1 – poor, 5 – excellent)

|  | .LRN | Docebo | Moodle | Dokeos | ATutor | Claroline |
|---|---|---|---|---|---|---|
| documents publishing | 4 | 3 | 3 | 4 | 3 | 4 |
| Calendar | 5 | 2 | 5 | 3 | 2 | 2 |
| chat / forums | 3 | 4 | 4 | 4 | 4 | 3 |
| grades / tests | 4 | 3 | 5 | 4 | 3 | 3 |
| Surveys | 4 | 1 | 4 | 2 | 4 | 2 |

## 5. Practical experience of our team in the e-learning domain

### 5.1 Moodle courses

This section describes our practical experience and experiments with Moodle. We are currently using Moodle for several subjects taught on our department. The e-learning courses and materials complement classical lectures and seminars and they are never taken independently. The e-learning courses make available various sources that support the students' laboratory assignments, the references or they facilitate the final examination. The courses are created in such a way that integrates the students into an active collaboration within the subject being studied. We have put a special emphasis upon adaptive features inherited into the Moodle system:

*Wiki* – In general, a wiki enables documents to be authored collectively in a simple markup language using a web browser. The Wiki module enables participants to work together on web pages to add, ex-

pand and change the content. This feature proved to be very useful as it brings a rapid course development and a great degree of cooperation and activity.

*Lesson* - A lesson delivers content in interesting and flexible ways. It consists of a number of pages. Each page leads to another page. Students are given content and choices which determine the next page they see. The question page is the most common type. It has content which ends with a question and the page shows a number of possible answers. The student's answer choice determines the next page they see. Branch tables are another type of page where students see content and can choose to move to different parts of the lesson by labelled buttons. Navigation through the lesson can be straight forward or complex and depends upon the structure of the material being presented

*Forums* - This activity can be the most important – it is here that most discussion takes place. Forums may be structured in different ways, and can include peer rating of each posting. Generally, forum postings may be edited up to 30 minutes after posting. The postings can be viewed in a variety for formats, and can include attachments. By subscribing to a forum, participants will receive copies of each new posting in their email. A teacher can impose subscription on everyone if they want to.

During the course of the several-year practical utilization of the Moodle platform we got the following experience. Students have to be positively motivated and led to an active application of the adaptive features mentioned above. Their mere availability is not sufficient without the positive feedback of the course creator or teacher. The students appreciate the added value that is brought by the e-learning platform but it cannot get along without a detailed demonstration and explanation of the Moodle features and its eventual bottlenecks. If the course participants know the conceivable problems in advance they are much more ready to tackle them and keep their positive attitude towards the course. Last but not least, the early and profound foreknowledge anticipates future willingness and motivation to experiment with the system and utilize its affirmative features at cent per sent.

### 5.2 METOD project

Our team is a member of METOD (MEta TOol for educational platform Design) consortium [19]. The project aims to design a general computer supported educational platform development paradigm. To fulfill this goal the MetaTool package is being developed. It is a software package consisting of various self-adaptable and flexible tools that enable different types of users  to develop, adapt and maintain their own e-learning platforms. The package integrates machine learning and machine intelligence and enables self-adaptation according to special educators' and trainees' needs and characteristics. In consequence, the MetaTool enables all kind of educators (including parents or senior family members) to develop, adapt and maintain their own educational platforms without great effort, i.e., to develop self adaptable and flexible tools for various target groups using the MetaTool. The long term aims are to improve the skills and competence of people by the integration of new computer supported educational platforms specially designed for specific environments and requirements into the training and educational process. Concerning the issue of adaptivity, the MetaTool enables adaptive course delivery via self-adaptiveness of created e-learning platform materials. The materials adapt to user needs by means of Suggested Learning Path (SLP). The learning path organizes materials and exercises into a logical sequence. The sequence differs for different student and learning types. The project creator defines a learning path first. During the course the path evolves in accordance with the user capabilities and progress. Even though two different users start with the same SLP, they do not have the same actual learning path as it is a subject of adaptation.

### 5.3 MULTIPES platform

MULTIPES is an e-learning system [18] developed and used at our department as an educational support tool for students in full-time study and as teaching material for students of life-long learning and in distant form. It helps to increase quality of education continuously and to introduce the latest research results in the education. The MultiPeS e-learning system is designed as an open modular system which

enables its simple reuse. In addition to multimedia tools, MultiPeS contains a number of modules that significantly contribute to easier acquisition of information, creating relations among pieces of information and their successive remembering and refreshing. Courses developed in MultiPeS environment can be run both in on-line and off-line mode.

## 6. Conclusions

In this paper we showed that adaptivity makes an essential part of every effective educational process and therefore it should be implemented in e-learning systems too. We described main functions of adaptive e-learning systems and general requirements put on these systems. Adaptivity can be one of the most important tools to overcome basic e-learning barriers and can also help to spread e-learning among the non-typical ICT users. We compared particular features of different systems and put emphasis on user friendliness and possibility of adaptivity. Moodle and .LRN systems appeared to be the best at the moment. But the full adaptivity was not reached in any of the systems. Our experience with several e-learning platforms confirmed its importance as adaptive features of an e-learning system make the main contribution in comparison with the classical lectures. Regarding pedagogical issues, the students have to be positively motivated and led to an active application of these adaptive features.

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