

Without obstacles and detours – sophisticated and effective development of e-Learning offers for higher education

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Abstract—The provision of high-quality e-Learning offers still represents a challenge for lecturers at higher education institutions. Orientation to a well-established method to develop e-Learning environments and cooperation within e-Learning networks can help lecturers to meet this challenge in an effective way.

Index Terms—Content development, e-Learning environment, instructional design theories, e-Learning networks.

I. INTRODUCTION

E-Learning in higher education is nowadays no longer in its infancy. Around the world, experience has been gained with this new teaching and learning method. However, the provision of high-quality e-Learning offers still represents a challenge for lecturers. Meanwhile, a well-established method of developing e-Learning offers is available. Orientation towards this approach can help lecturers to complete this task. But maybe this does not have to be done individually? Besides inserting links to existing e-Learning resources, exchanging or sharing e-Learning materials within networks can be a reasonable way to offer adequate e-Learning materials.

II. E-LEARNING IN HIGHER EDUCATION

E-Learning is not a definite term for an obvious phenomenon: there are several approaches. E-Learning in the sphere of higher education can be understood as learning and teaching using electronic media, which are developed according to methodological-didactical procedures and can be used in different ways, taking into account organisational changes [1]. These changes involve questions such as rooms and attendance obligations, as well as the integration of e-Learning into examination regulations, for example.

E-Learning in the sphere of higher education comprises five components that are to be considered when developing and implementing e-Learning measures: technology, organisation, learning materials, didactics and persons involved. Accordingly, methodological-didactical, technical, organisational, graphical, staff, legal

and financial aspects are to be addressed in the development and implementation of e-Learning offers.

As e-Learning does not exist in a vacuum but in any specific environment, the e-Learning offer to be developed is also referred to here as the e-Learning environment (e.g. *GeoLearning*). An e-Learning environment consists of a physical component (e.g. the learning computer as one part) and a virtual component (e.g. the data streams as one part) and can be divided into several spheres: a presentation sphere where learning contents are presented, an event sphere where interactions occur and access to information is given, and a meaning sphere where the learner gives the contents a meaning [2].

Although e-Learning is not confined to online teaching and learning, the focus here is on web-based e-Learning environments.

E-Learning can take manifold forms. In e-Learning scenarios or models the specific forms - with their different arrangements of the individual components that constitute e-Learning - are specified [3]. These are commonly classified according to organisational aspects (space and time): teleteaching or purely virtual teaching, for example. The meanwhile highly recommended e-Learning scenario for higher education is the blended learning approach which combines elements of class room teaching and online teaching in different proportions [4].

III. METHOD FOR DEVELOPING AN E-LEARNING ENVIRONMENT

A method for developing an e-Learning environment is established. It comprises five major development steps and two accompanying tasks. The development direction is aligned not only one-way; it can also be necessary to go back to a previous step.

By adopting the method presented here, the developers of e-Learning materials can avoid fatal mistakes and unnecessary detours. It helps them to develop the e-Learning environment in an effective and professional

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way, producing adequate results according to the given starting conditions.

1. Recruiting a project team

The first step in the development of an e-Learning environment is to recruit a qualified project team. This introductory phase is crucial for the successful development of an e-Learning offer. The required competences can hardly be covered by one person [5, 6]. The competences involve the technical, didactical and organisational aspects of e-Learning as well as the scientific expertise of the particular teaching content. Further, legal questions have to be clarified in developing any e-Learning offer. Therefore, a team-orientated procedure is needed, involving staff members from different scientific disciplines.

2. Analyses

In the second development phase different analyses are carried out:

- a) demand analysis: As multimedia e-Learning offers are developed to increase the qualification of any group of addresses the competences of the addresses which are to be built up has to be determined by demand analyses. If it is planned to offer the e-Learning environment on the market, a market analysis is to be done in addition.
- b) analysis of addresses: This analysis comprises personal characteristics such as age and sex, as well as the preconditions of learning and motivation. Besides these individual data, group attributes are to be ascertained.
- c) analysis of the context: For the design of the e-Learning environment some information regarding the context of use is necessary. For example: In which workplaces will the e-Learning environment be used? Which technical options are available?
- d) knowledge analysis and analysis of the teaching aims: The focus here lies on the knowledge and skills which the addresses should acquire by the e-Learning offer. Additionally, the targeted competence grade is to be analysed.

- e) analysis of resources: Existing and required resources have to be checked.

The analysis of resources for the conception and creation of the e-Learning environment usually comprises the materials (e.g. hard- and software), personal resources, time and budget.

These analyses are not independent of each other. Especially the knowledge analysis and analysis of the teaching aims affect the kind of learning media which will be developed and therefore the required time, financial and personal resources as well as materials.

The results of these analyses constitute the basis of the conception of the e-Learning environment.

3. Conception of the e-Learning environment

The conception of any e-Learning environment involves several steps to be performed successively.

3.1 Strategic decisions

At the start of the conception phase principal decisions have to be made which predetermine the strategic orientation in the development of the e-Learning environment. The strategic decisions relate first to the choice of didactical orientation and second to the kind and extent of the technique used.

Regarding the pedagogical-didactical aspects, the developer of an e-Learning environment can consult already elaborated theories and models – so-called instructional design theories and models. These can generally contribute to the planning and design of learning and teaching processes by providing instructions and recommendations. These theories and models are based on the well-known learning theories. Thus, behaviouristic, cognitivistic and constructivistic instructional design theories and models can be deduced [7]. Instructional design theories and models aim at increasing the learning success by use of psychological principles (see figure 1). The choice of an instructional design theory depends especially on the teaching content. If basic knowledge is to be taught, orientation towards behaviouristic or cognitivistic theory might be useful. For teaching application-orientated knowledge, however, the recommendations of the constructivistic theory might be appropriate. Also a combination of theories can be a reasonable solution.

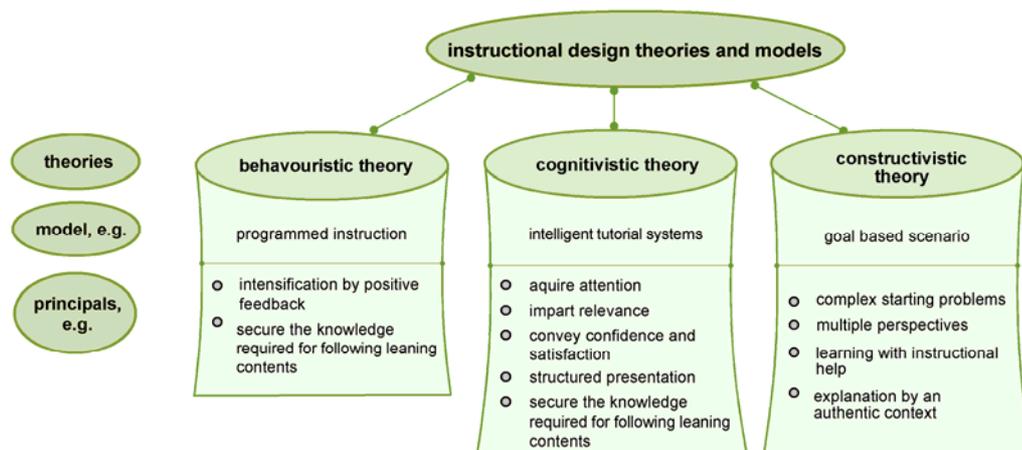


Figure 1. Instructional design theories, models and their principals

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Second, it has to be decided which technical way should be pursued in developing a web-based e-Learning environment. There are several technical approaches available to build up and to design an e-Learning environment. Besides in-house development of the e-Learning offer, what are known as educational technologies come into consideration. The term educational technologies describes several tools and systems that were especially developed for e-Learning and which provide varied functionalities relevant for learning and teaching in higher education. These offer facilities to developers and users which make the effort of their own programming work redundant.

So the first decision is to decide between developing one's own environment or using existing educational technology. Before making this decision it is necessary to consider the requirements and ideas of the e-Learning environment to be built up, as well the general technical and financial conditions.

If the first option is not chosen, the second decision concerns the choice of the technical system by which the e-Learning environment is to be built up. The three most common ones for development of an e-Learning environment for higher education institutions are learning management systems, content management systems and learning content management systems. The decision should be based on the comparison between the advantages and disadvantages of each system with the requirements and needs of the specific project. The requirements of the user depend on several factors (see figure 2).

Furthermore, appropriate authorware (e.g. *Freehand* or *Flash*) has to be selected. This applies normally also for the case that the e-Learning environment is developed in-house.

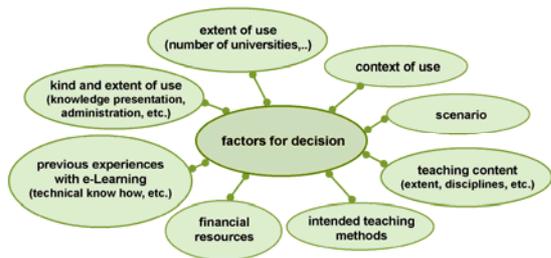


Figure 2. Factors influencing the decision for an appropriate technology

3.2 Functionalities of the e-Learning environment

The next step is to design the functionalities of the web-based e-Learning environment. An essential element is the navigation (see figure 3). This should be comprehensive and well-arranged. Moreover, it can be desirable to provide a glossary, a bibliography or hyperlinks, for example.

3.3 Design of the user interface

Design of the user interface of hypermedial learning environments is very important as this affects the way in which the system is perceived [8]. The conception of the user interface includes the design of the steady user interface and the arrangement of the topics and functionalities. Visual and functional aspects should be considered. To avoid cognitive overloading it is recommended to divide the screen into several parts (see figure 3).

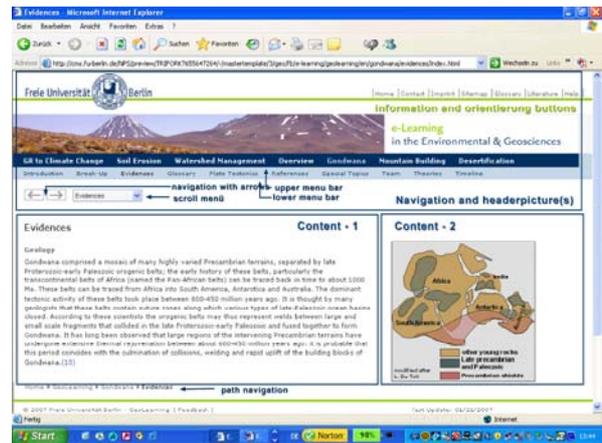


Figure 3. Functionalities and user interface of the e-Learning environment "GeoLearning"

3.4 Selection and transformation of the principles of the didactical theories

According to whether one or a combination of instructional design theories is chosen, the principles of the theories to be used are to be selected. This should be done very carefully as these principles will determine the further design of the learning environment. If constructivistic theory is the approach chosen, following principles can be used, for example: complex starting problems, multiple perspectives, learning with instructional help or explanation by an authentic context. After selection the next step is to consider how to implement the principles (see figure 1).

3.5 Segmentation and sequencing of the teaching content

The fifth step is the segmentation and sequencing of the teaching content. The segmentation is basically dependent on the teaching content and the selected screen design. The sequencing of the teaching content stands in close relation to the building up of learning units and the extent and selection of learning contents. Two principal sequencing patterns can be differentiated if more topics are taught:

- a) linear-gradual structure: It is dealt with one topic as long as the grade of competence which is intended is achieved. Afterwards, the next topic is taught.
- b) spiral structure: Each topic is taught several times; at first, the basic knowledge is taught,

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subsequent the topics are deepened till the grade of competence which is intended is achieved.

3.6 Design decision in the narrow sense

In this step, further design decisions are to be made. These involve the selection of learning media (audios, graphics, etc.), the selection of colours of the media, the screen resolution for which the media is optimised, and the text design.

4. Creation of the e-Learning environment

Once the e-Learning environment has been designed, the next step is to write a story board. This pictures all elements of the e-Learning environment and describes the sequences and the interplay between the different elements. In the production phase the story board is transformed into program and data files. This is carried out by the selected software system.

Before the e-Learning environment is completed, a usability test should be carried out. In multiple tests the manageability is checked by testing persons. If these are successful the e-Learning environment can be implemented.

5. Implementation of the e-Learning environment

The fifth step is to implement the e-Learning environment. Monitoring and evaluation are crucial in this phase especially, but should be done during the entire development of the e-Learning environment. This applies also to reasoned project management.

IV E-LEARNING NETWORKS FOR COOPERATION

Building up or joining e-Learning networks can be a deliberate measure to share e-Learning materials and to discuss experiences with this new learning and teaching method. Additionally, workshops in which the participants can together learn more about the technical, didactical, organisational and legal aspects of e-Learning can be held. An international and interdisciplinary e-Learning network was built up in 2006: *GeoLearning*. Twenty-five scientists from 18 countries in Africa, South America, Asia and Europe met in Berlin, Germany, for the first DAAD-financed Winter School “*e-Learning in the Environmental and Geosciences*”. The participants learnt the basics of e-Learning in theory and practice. In the two following workshops (2007 and 2008) the basic knowledge and skills were extended and a common e-Learning environment was built up by use of a web-based content management system. The modules included are provided especially for the students of all participating lecturers as well as for all persons interested

in the topics taught: “*Mountain building*” “*Gondwana*”, “*Geomorphological response to climate change*”, “*Soil erosion*” as well as “*Watershed Management*”.

Orientation towards the approach presented here and cooperation within e-Learning networks is helpful to offer e-Learning materials in an effective manner.

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