

# Quizzes are not enough to reach high-level learning objectives!

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**Abstract:** This paper focuses on special problems about essential didactical aspects for course instructors like defining and evaluating learning objectives within the e-learning situation. Therefore, basics about competencies, learning objectives and assessments are treated with a focus on traditional education. By applying these concepts on e-learning, existing problems for e-learning courses are discussed in detail and some possible solutions are suggested. These approaches will be evaluated in the next phase of our research work.

## Introduction

E-learning can be considered to be highly related to learning and teaching as stated in (Jain et al. 2002). Therefore, pedagogy and didactic are important aspects for all facets of e-learning, reaching from the usage of a tool and the creation of the courseware to the evaluation of the learning progress. In particular, didactic has a great impact on designing and mediating learning content (e.g. see Gunawardena & McIsaac 2003). Considering the traditional teaching process, the teacher has to plan which competencies have to be mastered to which extent by the students and how the result of the learning process should be measured. Such considerations are usually realised by determining learning objectives and assessment methods for a course.

This paper comprises a very general and theoretical model about didactical principles within the field of e-learning as a basis for our ongoing research work. The first part deals with planning traditional courses with respect to the experiences of the authors. It has to be remarked that teaching methods which describe how to mediate the learning content will not be discussed here. Projecting the described didactical approach to the e-learning situation, various problematic aspects can be noticed which will be pointed out in the second part of this paper and several possible solutions, which have to be evaluated by the means of concrete studies, will shortly be outlined.

## Basic didactical concepts

Teaching itself is a very complex process and not fully realisable within e-learning systems (see Spector & Ohrazda 2003). Thus, we are just focusing on three critical questions about planning and evaluating a course: What competencies should be mediated to the students? To which extent should these competencies be mastered? And how can the results of the learning process be measured after the course is finished?

## Competencies

With respect to didactic, the first important aspect of teaching deals with the kind of competencies to be mediated to the students. Therefore, (Durand 1998) made up a well accepted theory which is based on Howard Gardner's Multiple Intelligences and describes three main classes of competencies:

- First of all, **knowledge** can be seen as a kind of mental model about parts of the real world. In other words, knowledge corresponds to a number of facts stored in an individual's memory and connected to other pieces of assimilated information. This dimension can be denominated as the cognitive dominion.

- Second, a competency can also be a **skill**, which is related to the capacity of applying and using acquired knowledge. According to (Bloom et al. 1956), a skill can be seen as process where an individual uses appropriate techniques and information in order to examine or solve a problem. Skills can be divided into intellectual skills, which are about mental processes manipulating information, and psychomotor skills, where a neuromuscular coordination is performed.
- Finally, **attitudes** are concerned to social or affective aspects. (Cagne et al. 1988) see attitudes as complex states of human beings affecting the behaviour related to other people, things and events, determining the choice of each one. An attitude can be seen as a feeling, emotion or a degree of acceptance or rejection of a person to other persons, objects or situations.

A competency in praxis is supposed to consist of more than one of these classes. In most cases a strong focus on one of these three classes can be recognised, but there can also be adequately mixed competencies.

### Learning objectives

After considering what should be taught within a course, it is important to decide to which extend and under which circumstances the competencies should be mastered by the students. Therefore, a teacher has to define learning objectives following some kind of taxonomy, for instance the one by (Bloom et al. 1956). For the cognitive domain, the **different levels of objectives** are the following ones:

- The lowest level of objectives is about recognising and recalling assimilated information.
- Based on these abilities, a student can comprehend and explain what he internalised.
- In the next step, the gained knowledge can be applied in new situations.
- At the analysis level, the student is able to analyse, structure and organise the facts and concepts.
- Synthesis describes the ability to reassemble the pieces of assimilated information to create new knowledge.
- At the highest level, a student can even evaluate the value of ideas and cognitive materials.

These different levels of learning objectives can be made up for skills and attitudes, too. Furthermore, it is possible to define other conditions such as the usage of a tool or the time extent for each objective. In general, the procedure for creating the learning objectives for a course starts with defining very abstract objectives which are broken down to the detail subsequently.

### Assessments

(IDS 2002) points out the necessity of assessments which should be performed not only to graduate students, but also to measure if and how good learning objectives were reached. In addition, the assessment method has a great impact on the students' learning behaviour as shown in (Scouller 1998). In traditional education, a teacher determines to examine students using limited-choice or open-ended questions. **Limited-choice questions** such as multiple-choice, true or false questions etc. require students to choose one or more given alternatives and are applied to reach lower-level objectives like recalling facts.

**Open-ended questions** like sentence completion, short answers, essays etc. require students to formulate their own answers which do not have to be pre-determined and unique. It is easy to see that open-ended questions can be used to evaluate higher-level objectives like applying or evaluating assimilated knowledge. Hence, for certain domains like mathematics, physics or programming exercises limited-choice questions might work for assessing higher-level objective because students have to apply their gained knowledge to complete a question with a pre-determined answer like some mathematical calculation.

Teachers have to consider which type of question they use for assessment. These considerations depend on the level of learning objectives, size of the class, reliability in grading prevention of cheating, exam construction and grading time, and several other criteria. Finally, it is important to mention that teachers have the possibility to mix the two types of questions, for instance using crossword techniques (see Lennon & Maurer 2003). As stated here, assessments as well as the assessment methods are very important from the didactical point of view.

## **Problematic didactical aspects for e-learning**

Examining the didactical aspects treated in the last section, the following problematic areas for the e-learning situation can be identified:

- Competencies which can be mediated within an e-learning environment are more or less restricted to knowledge, intellectual skills and attitudes. It is possible to create learning content including facts and information about mental models as well as rules about how to apply these facts and about an expected behaviour. Furthermore, technology can be seen as an enabler for these types of competencies because information can be enriched with multimedia assets (see ADL 2001), intellectual skills can be supported by using interactive elements or tutoring systems (see Park & Lee 2003) and the behaviour of a student can be observed within the context of the e-learning system by terms of the micro-adaptive approach for e-learning (see Park & Lee 2003) or even by using new technology (see Garcia et al. 2004). In fact, it is problematic to mediate psychomotor skills or cultural attitudes within a technology-based learning environment.
- According to Bloom's taxonomy, a teacher designing an e-learning course has to consider the same aspects as described in the former section. Dependent on the target group, it has to be determined which competencies should be reached to which extend by the students. Within an e-learning system, objectives also have to be defined. With respect to the standardisation process in the field of e-learning, specifications such as SCORM even allow to describe objectives as meta-information for the course (see ADL 2004). Nevertheless, we identified the fact that it is hardly possible to reach high-level learning objectives for all three types of competencies within a pure e-learning situation. Furthermore, objectives for psychomotor skills can be hardly defined and evaluated, which is going to be explained now.
- Learning objectives which are defined by a teacher always have to be evaluated in some way – to graduate the students and to improve the quality of the course for future sessions. Considering the possibilities of e-learning, we face the fact that we can assess the gained knowledge by using limited-choice questions like quizzes, multiple-choice questions etc. (see Scouller 1998). But for most areas it is necessary to examine students using open-ended questions. Furthermore, the answers to such questions have to be interpreted and evaluated by experts. Researchers try to imitate such expertises using artificial intelligence methods within intelligent tutoring systems, but the results are rather limited yet (see Park & Lee 2003). In terms of psychomotor skills, we cannot even measure the learning results using technology-based methods without hard efforts.

Concluding this section, we want to point out that the assessment for high-level objectives has to be performed in other ways. (Lennon & Maurer 2003) describes several approaches beginning with the usage of professional authoring software for automatically generating crossword puzzles up to a shift to the constructivistic learning paradigm. Moreover, group activities requiring students to discuss a topic are a powerful element to extend the possibilities of e-learning (see Piaget 1977).

(Gredler 2003) reports about games and simulation in the e-learning situation which can also be seen as a solution to reach high-level objectives, in particular for intellectual skills. Finally, we have to mention that it is also possible to ask open-ended questions within an e-learning course. For instance, students can write an essay about a topic or submit some kind of realised project. It is obvious that answers to such questions have to be evaluated somehow, whether manually by the teacher or automated, e.g. using the Markit<sup>®</sup> system described in (Williams & Dreher 2004).

## **Conclusions and Outlook**

To summarise this paper, we have to state that e-learning examined with respect to basic but essential didactical considerations lacks in terms of these two main aspects: On the one side, it is not possible to teach every competency as efficient as in traditional education. Although multimedia and technology can be a benefit to enhance the teaching process – for instance by multi-coded learning content or a more intensive computer-based tutoring – it is hard or even impossible to mediate certain skills and attitudes through e-learning. On the other side, not all levels of learning objectives can be reached, mainly because the higher levelled objectives can not or only with hard effort be measured.

Thus, we say that quizzes and all kind of limited-choice questions are not enough for e-learning. Technology-mediated courses have to include more sophisticated methods such as group activities, simulations, essay writing etc. to reach high-level objectives. The assessment itself is more extensive – whether a special tutoring system for evaluating open-ended questions has to be implemented or the assessment results have to be reviewed by the instructor. Nevertheless, this effort has to be mastered, because in most courses reaching high-level learning objectives is necessary. For future work, the possibilities to reach high-level objectives within the e-learning scenario have to be researched in detail by means of defining high-level objectives for a course and evaluate the different methods mentioned here.

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