# ON THE DIDACTICAL POTENTIAL OF E-LEARNING COURSEWARE

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**ABSTRACT:**

The use of information and communication technology (ICT) is becoming an inherent part in higher education. According to recent reports, however, the actual use is concentrated on its qualities as an organisational and logistical tool. The didactical potential does not come into account in teaching scenarios where learning management systems or the like are used to spread materials and announcements. Teachers should become aware of the didactical values new media can bring about through a large diversity of scenarios. In order to realise an appropriate use of ICT in higher education, a variety of competences is needed in the scope of the four dimensions in e-learning (didactics, technology, strategy and multi-media based learning objects).
It is needless to say that these competences can hardly be comprised by one person. Therefore, it is common practice to engage several people in the process of e-learning. This implies a need for a mutual basis for arrangements and action. In other words, a process oriented and team based course of action is necessary for a successful implementation of e-learning. In our contribution, we will demonstrate a process model that takes into account the characteristics of e-learning design and project management. The goal is to establish a common foundation for all participants involved in the processes of an e-learning project, and to provide incentives for teaching/learning scenarios with didactical value. Furthermore, we will show how the didactical attributes of e-learning can be described and visualised for quality assurance and self evaluation means.

**KURZFASSUNG:**

Informations- und Kommunikationstechnologien (IKT) entwickeln sich zu einem festen Bestandteil der Hochschullehre. Neuesten Erkenntnissen zufolge beschränkt sich ihre eigentliche Nutzung allerdings auf ihre Vorzüge als Organisations- und Logistikwerkzeug. Das didaktische Potential kommt in Lehrszenarien nicht zum Tragen, wenn Lernmanagementsysteme oder ähnliches lediglich genutzt werden, um Materialien und Ankündigungen zu verteilen. Lehrende sollen des didaktischen Mehrwerts Neuer Medien bewusst werden, den sie durch eine Vielzahl an Einsatzmöglichkeiten erreichen können. Um den angemessenen Nutzen von IKT in der Hochschullehre zu verwirklichen, sind eine Menge an Kompetenzen im Rahmen der vier Dimensionen des Handlungsfelds E-Learning notwendig (Didaktik, Technologie, Strategie und multimediale Lernobjekte).
Es wird deutlich, dass diese Kompetenzen kaum von einer Person beherrscht werden können. Deshalb ist es Gang und Gäbe, dass mehrere Personen im Rahmen eines E-Learning-Vorhabens beteiligt sind. Dies setzt voraus, dass es eine gemeinsame Basis für Vereinbarungen und Arbeitsschritte gibt. Mit anderen Worten ist ein prozess- und teamorientertes Vorgehen notwendig für eine erfolgreiche Implementierung des E-Learnings. In unserem Beitrag werden wir ein Prozessmodell vorstellen, das die Eigenschaften des E-Learning-Designs und des Projektmanagements berücksichtigt. Das Ziel ist es, eine gemeinsame Grundlage für alle Beteiligte an einem E-Learning-Projekt und Anreize für Lehr-/Lernszenarien mit einem didaktischen Mehrwert zu schaffen. Weiterhin werden wir zeigen, wie didaktische Komponenten des E-Learnings zur Qualitätssicherung und Selbstevaluation beschrieben und visualisiert werden können.

## 1. INTRODUCTION

E-learning is in the process of becoming an important factor in higher education. During the last year, several studies could be carried out covering a larger group of students than it was possible before. The results were not disillusioning, but they gave cause for concern. When asking students about what they found most profitable in using information and communication technology (ICT) for learning, the largest part preferred the possibilities of spreading and organising material and information (Hanekop et al., 2003). It becomes clear that students do not see more than that in the potential of e-learning because they have not been exposed to learning environments with the advanced use of ICT yet (Kleimann et al., 2005). However, they can imagine experiencing it.

So, it is a task of teachers to offer such environments which involve cooperation and collaboration via ICT. And how do they consider the potential of e-learning? In the project *eLearning Academic Network* (ELAN), where the authors are members of, were two categories of teachers involved in e-learning. The tendency of technology-close teachers (such as computer scientists or engineers) who explicitly saw potential of e-learning was in contrast to technology-distant teachers (such as teacher educators or landscape architects) who were quite critical about it. Remarkably, it was the second category of teachers who made use of our workshop offers and advisory services (cp. Albrecht et al., 2005).

On the other hand, the first category of teachers was mostly interested in technological solutions for their e-learning projects, whereas technological aspects are less important for the second category of teachers. . These findings gave cause for concern that the underrepresented aspects of e-learning are not utilised adequately in respect to their potentials of learning and teaching (cp. Frommann & Phan Tan).

This leads to the following two essential questions:

1. What is the didactical potential of e-learning?
2. How can teachers be equipped with the competencies to make use of this potential?

One thing is clear no matter what factors speak for potentials in e-learning: it takes a number of competencies that are hardly coped by one person. As a consequence, it is - even now - common practice to involve several people in the process of e-learning design, development, implementation and evaluation. This in turn makes a consequent quality improvement more difficult, because different parties are involved: teacher, technician, author, designer, evaluator…

We believe that a special procedure is necessary to get all participants at one table. It is necessary to provide competence teams for a comprehensive planning.

At L3S Research Center, we have established the *eLearning Service Team* (eST) covering different expert disciplines and connections to central institutions that might be involved in the e-learning process. Some of our activities that help utilising the potential of e-learning serve as a practical example for necessary measures.

## 2. THE POTENTIALS OF E-LEARNING

Which potentials seem to be realistic as state-of-the-art? Kerres (2004) specifies three aspects that will be presented with practical examples in the following:

1. other possible teaching and learning methods
2. a chance to better organize learning with increased flexibility of time and place
3. shorter study time

### 2.1 Other possible teaching and learning methods

Two examples shall make the possibilities of other teaching and learning methods clear:

**Additional exercise options**

The primary goal of assigning exercises is to ensure the students' learning outcomes. Questions foster the active dealing with the learning material and focus on the demands of the educational objectives. Students get feedback on their own educational level and are eventually motivated to rework a topic or a problem. Questions also foster the construction or reconstruction of knowledge. This constructive thinking accomplishment in turn fosters memory. The effectiveness of exercises is influenced by two factors:

1. The level of requirement has to be high enough for an active work on the task.
2. The feedback should activate thinking processes (reacting on true and false answers) and should not end up in "right" or "wrong".

Face-to-face teaching rarely offers enough time for comprehensive exercises. In addition, students will not get instant feedback if they work on the tasks at home. The possibilities of interactivity in new media solve this problem. Especially intelligent feedback given by a learning system can foster learning.

**Descriptiveness**

A special case of vivid learning can be realized with simulations. Practical exercising and testing usually takes place during internships or trainings. The time schedule is very tight and devices might be highly valuable. Not all students get the chance to make experience with every device. The possibility to learn by experience is therefore very restricted. Nowadays, the medial preparation of laboratories or experimental set-ups can be profoundly enhanced with different presentation methods (e.g. 3D, zooming functions).

Virtual laboratories and simulation can offer an adequate alternative, even though the experiences are conveyed through media. Students get the possibility to control their learning activities while this is not possible in real-life experiments. It is possible to set values and make "mistakes" that do not destroy the experiment set-up but lead to "learning from mistakes". In addition, time and place flexibility increase the access possibilities and repetition rate.

On the basis of existing knowledge, hypotheses are built and checked. The topic is gradually explored on self-directed grounds. So, the learner is able to connect newly learned with existing knowledge in a constructive way.

### 2.2 A chance to better organize learning with increased flexibility of time and place

The following example of project-oriented learning in virtual teams shall illustrate the manifold possibilities of a different learning organisation with increased flexibility of time and place.

In the course of a lecture, it is planned to enhance the active knowledge processing by intensively involving the students. In order to spend less time on the mediation of facts knowledge during face-to-face time, the students are provided with according online learning material for preparation. The students work in project teams and organize themselves independently. The starting point is usually a project-oriented task. Specific collaborative tools (e.g. forum, shared workspace) can support the team-work for communication and documentation. The team outcomes can be presented during the lecture. For different programs of study, this method is used to practice distributed cooperative work as a key qualification for future occupations.

### 2.3 Shorter study time

Shorter study time is Kerres' third aspect as a potential of e-learning. One important possibility for efficient learning is instructional courseware. It is focussed on clearly outlined learning goals and is based on principles of instructional design. Therefore it is mainly aimed at self-directed learning. Due to the high development effort, this form of e-learning is recommended only with large target groups or frequent use. There are, however, attempts to reduce the development effort with according templates (e.g. Catalkaya & Golze, 1999). These learning materials are characterized by the following features:

- The processing order of the learning matter is set. The students are provided with a suggested or a given learning path.
- The organisation and order of the processing do not follow the subject's taxonomy but are based on didactical consideration, mainly about educational objectives.
- The processing method is determined by the implementation of instructive elements. Tutorial components such as exercises, transparent educational objectives, abstracts, variations of tasks and problems, or combinations of image and sound are some examples.

These potentials do not evolve automatically from the implementation of e-learning. It is, moreover, a complex designing task to realize these potentials. In order to do so, a lot of different technological, didactical and organisational tasks have to be accomplished. In the end, the success of e-learning depends on the felicitous implementation in the given teaching-learning-context.

## 3. SUCCESS DEPENDS ON THE EDUCATIONAL CONTEXT

Naturally, the benefit of multimedial educational courseware only comes into account when it is implemented in practice. This may sound self-evident, but it surely is not a trivial task. Developing multimedial teaching holds the danger of producing courseware by exploiting the possibilities of highly developed technology. The outcomes, however, are usually hard to be implemented in practice.

It is therefore important to focus on the implementation of the courseware in everyday teaching during conceptual development. In this way, it is possible to ensure the value of developed material at an early stage. These considerations shall be illustrated by three aspects for implementation of e-learning in an educational context:

- *Acknowledgement of course credits*: If it is possible to obtain course credits from multimedial courseware, the students' acceptance of e-learning and their motivation will increase, because the individual benefit is clear.
- *Relationship to face-to-face teaching*: The use of e-learning courseware does not necessarily mean that face-to-face teaching becomes obsolete. It is, moreover, a matter of consideration how both teaching and organisation modes intertwine in practice and how they are coordinated for a successful implementation.
- *Supporting the students*: The students' requirements and their working methods change with the implementation of new media. Sometimes, it is necessary or possible to support them in new ways depending on the respective educational scenario.

## 4. SUPPORTING PROJECT DEVELOPMENT

This chapter deals with the implementation of the above mentioned potentials in an actual e-learning project. We will focus on the first phase of project development by presenting concrete recommendations. Our operative starting point is the design of introductory phase in an e-learning project. These considerations are based on the experiences and research activities of the *eLearning Service Team* (eST) which is part of the *eLearning Academic Network* (ELAN) in Lower Saxony.

Two theses shall introduce our considerations:

1. E-learning projects (especially interdisciplinary projects) need an external moderation during the introductory phase for an objective-oriented project processing.
2. Expert advice (technical and didactical) is already necessary during the conceptual design of the project.

The following sections will clarify the two theses by specifying what actually has to happen during the initial phase of a project. Furthermore, the third section of this chapter shows how we have put our considerations into practice.

### 4.1 Directing the project

In most cases of larger e-learning projects, there are people involved with different backgrounds. Especially these interdisciplinary teams have - because of their different perspectives on the topic - the potential to reach high-quality results:

1. Mutual encouragement enables teams to develop many, creative ideas.
2. Distributed competence can be useful for one common goal.

The risk lies in the one-dimensioned view of the project. Experts concentrate on their special topic and interpret their project objectives and the evolving tasks from their point of view. At the end of the project, it takes great effort to integrate all different parts to an outcome if possible at all.

An external moderation can help making the maximum use of these potentials by keeping an eye on the project scope, structuring the communication process and methodically supporting it as well as involving all participants in the process. Especially, the last aspect is essential for a successful outcome, for it is common practice that singular opinion leaders evolve from the group who might oversee hidden potentials.

### 4.2 Finding adequate solutions

Especially when project participants are rather inexperienced concerning e-learning, the project team might lack of knowledge about the prospective effort and an adequate procedure to reach the objectives in the scope of implementing tools or a didactical concept.

In order to call upon the potentials, external know-how is needed which cannot be provided by the moderation alone. This expert knowledge is integrated into the process of project design. This may be:

- the responsibility to consider the central parameters of didactical planning within the project scenario,
- a solicitor of awareness that a technical solution is not a solution for learning but that it is always the communication between the learning object and participating persons as well as the integration of e-learning in an educational concept,

- supporting decision processes during the selection of technical tools while sourcing out the phase of decision-making from the actual course of project, and
- the responsibility to develop the scenarios on the basis of realistic potentials.

### 4.3 The course of project introduction

In the following, we will present different steps that are gone through during the very first conceptual phase of a project. In the *eLearning Service Team*, these steps are realized during the first counselling interview with new project teams. These steps shall foster the transparency about common objectives, the initiation of creative processes for project design and the design of the developing process in a comprehensive but effective way. In practice, this leads to a thoroughly structured talk and a consequent visualisation of the working outcomes.

The course of the counselling interview is structured into seven steps:

1. The general conditions of the project are requested by a comprehensive questionnaire. The participants of the projects can review their situation and the advisors get a picture of the given conditions.
2. In the second step, all participants develop a visual sketch of the project. They collect central ideas and correlate them in a *concept map* (figure 1). During this phase, the most important coordination processes concerning conceptual decisions come to pass. Expert advice plays a crucial role, too, in order to answer different questions, e.g. about the technical possibilities or didactical potential.

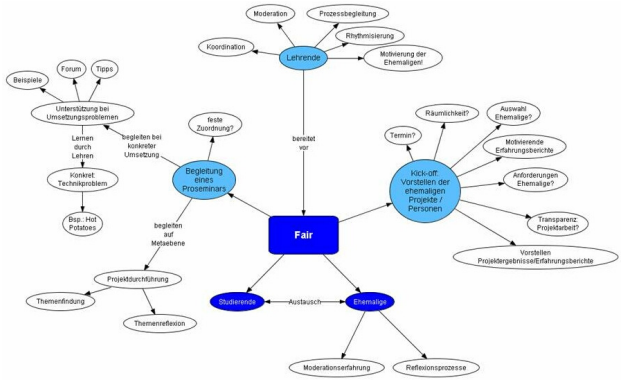


Figure 1. Collection and correlation of central ideas in a concept map

3. Different goals and advantages are collected and structured on moderation cards. During the following coordination process, they are put in order by priority. As an outcome, possibly heterogeneous objectives are harmonized in a catalogue of objectives and - most important - accepted by all participants. From this catalogue of objectives, it is possible to extract work packages (step 6).
4. The risk management is the fourth step, before starting with a detailed collection of ideas for development. It functions as a filter for possible miscalculation. Especially the consideration of preventive measures during planning has proven to be successful in practice.
5. In the fifth step, a combination of *brainstorming* and *mind mapping* leads to ideas in the fields of organisation, methods/tools, materials and social architecture. The collected ideas are eventually arranged in a rough draft for the sequence plan of the course.
6. The work packages extracted from the catalogue of objectives, risk management and collected ideas resemble the obligatory ending of the consultation.
7. Finally, further steps are discussed, e.g. making use of services, planning the evaluation and identification of work packages.

As an outcome, the participants as well as the *eLearning Service Team* have a comprehensive documentation of the project. On the one hand, it is a common basis for further planning and, on the other hand, it is used for preparation and orientation for further advice.

We have experienced that the counselling concept enables a very focussed and objective-oriented processing of the project, mainly due to the systematic visualisation of the working outcomes. The three-hour counselling interview sets an ideal ground for further processing of the project.

## 5. E-LEARNING ELEMENTS

Even though moderation and expert advice are crucial for beginning projects with many people involved, they are sometimes unnecessary for everyday teaching. We have developed the tool *e-learning elements* for the purpose of quality assurance and self-evaluation of e-learning courses[*]. E-learning involves teaching and learning modes that exceed traditional patterns. This also means that the complexity and variability of teaching very much increase. It is then helpful to have a visualisation of one's own teaching concept. The *e-learning elements* support the teacher to keep a general view of his or her teaching.

The *e-learning elements* consist of 15 attributes of e-learning (figure 2), each of them completed with typical specifications (figure 3). Each specification is described and annotated with examples, hyperlinks or literature (figure 4). The characteristics of a course can then be described by colouring the specifications. So, it is possible to see at a glance which attributes are implemented. Unapplied e-learning elements are still on the screen and do not fall into oblivion. They might motivate the teacher to apply them in another course or initiate further studying about didactical topics in e-learning.

[*] The prototype can be downloaded at http://www.l3s.de/elan/kb3/index.php?id=640 (L3S Research Center, 2002)

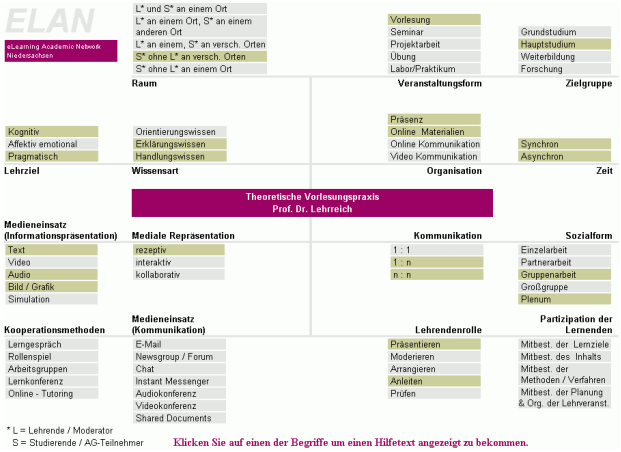


Figure 2. Screenshot of the e-learning elements at a glance

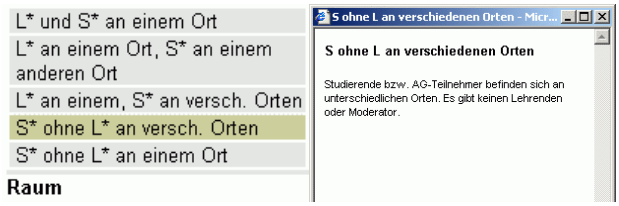


Figure 3&4. Screenshot of an attribute, its specifications and descriptions

The *e-learning elements* can be applied in different phases of e-learning: planning or evaluation. The number of coloured attributes and specifications is not relevant for the quality of an e-learning course. The qualitative aspect lies in the overview of didactical aspects so that the teacher recognizes them as an inherent part of e-learning. The variability of the e-learning elements comes into account when a teacher applies the tool on several courses.

Further possibilities to use the *e-learning elements* are as a presentation tool in class, e.g. to present the objectives of the course, or for peer-evaluation with other teachers.

## 6. CONCLUSION

To sum it up, our experiences in the ELAN project have led to a consolidation of central aspects for the didactical potential in e-learning. As an outlook for the next two years, it is planned to communicate and implement our measures in Lower Saxon universities. Furthermore, the network of experts will grow by connecting local experts and central competences at different locations.

Our *e-learning elements* tool can help to visualise e-learning courses and courseware. On-the-job, teachers can reflect on their plans and adopt didactical basics relevant for e-learning.

The overall goal is to reach an early majority of e-teachers (cp. Rogers, 1995; Albrecht et al., 2005) and improve their teaching qualities. Until now, e-learning has been practiced in the scope of funded projects. Teachers involved may belong to a category of early adopters who are intrinsically motivated to practice innovative teaching. However, in order to achieve a university-wide acceptance of e-learning, the early majority is absolutely necessary. It may include sceptical teachers who are critical about the advantages of e-learning. Therefore, these have to be clearly stated as we have done so in this contribution.

The goal to reach a sufficient number of teachers is only reasonable, if it is accompanied by high-quality teaching measures. Novice teachers have to be equipped with competencies that enable them to use ICT purposefully. We believe that a support from competence teams and a structured project monitoring can lead to a didactical improvement of face-to-face and online-teaching. Especially during the introductory phases of a project, we suggest to fall back on external moderation and get expert advice in technical and didactical matters from the beginning. Technology and didactics shall not be just a stopgap or a fig leaf but systematically integrated in the project development.

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## 8. FURTHER INFORMATION

The *eLearning Academic Network* (ELAN) in Lower Saxony consists of three major net pilots spread all over the federal state. The first phase of the project went from 2002 to 2004; the second phase will prospectively continue until 2006. One of the net pilots is situated in Hanover and Brunswick and deals with the effective and economically sustainable development of e-learning services. For this objective, a substantial concept has

been developed which guarantees the support of Lower Saxon universities with the use of multimedia.

The essential element of the net pilot is a central service group (*eLearning Service Team*) which supports the participating universities with the production of a manifold content portfolio in different faculties. The *eST* consists of experts in the following disciplines: didactics/evaluation, multimedia technology, authoring tools, information and communication systems, and indexing/archiving. It offers support to teachers in higher and further education through advisory service, training, information and technical operation and works in close cooperation with institutions of the participating universities, such as the computer centres, the didactic centre, the didactic centre of Lower Saxony and the German National Library of Science and Technology (TIB). The authors are members of the *eST*.