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e-Learning – State of the Art

An Appraisal

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Chapters of the Book

Foreword

Today terms of learning are inevitably related to essential and conceptual elements of e-learning. Currently there is an intensive discussion concerning the future use of these media: will they substitute the teacher´s work completely or will they only support the teacher, depending on the objectives he has or the situation. This paper presents a comprehensive description of the state of the art of e-learning concepts. After that the future perspectives of e-learning are discussed, taking into account the discussion about standards of structuring and exchanging content.

As a concrete example the expertise describes an e-Learning-model conceptualized and realized at the University of Duisburg-Essen, which considers the demands of teachers in practice. A self-developed *data base based developing environment* plays a leading role to generate modules on the basis of basic objects as well as more complex specifications. These modules can ultimately be integrated into learning platforms in order to contribute, as learning objects, to more effective e-learning.

Whether or not e-learning will be effective for learners will depend on many different factors and relationships between them. It is the task of didactics and appropriate evaluation strategies to set up a toolbox of e-learning-components wide spectrum of learning and teaching situations. In our opinion only the first step of a stony way is made and up to now no one can say, whether e-learning is not only a short-lived way of learning but the lasting one in the future.

After the Goldrush – Great Expectations Revisited

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After the Goldrush – Great Expectations Revisited

"***Everybody was enthusiastic at the beginning, they invested their money haphazardly and built virtual castles in the air. Now the pieces are picked up and it turns out that not all attempts have failed. This applies to the new Economy's e-business as well as to e-Learning at German universities."***

(Süddeutsche Zeitung, October 6, 2003)

„The hype is over (…) the internet has arrived at reality."

(Maresch 2001)

According to many professional social observers, modern information society has reached a point from which an increase of information and knowledge does not go hand in hand with an increase of orientation. Education, in an emphatic sense, could solve this problem straightforwardly on the individual as well as on the social level.

Thus the task of educational policy then would be to grant a suitable framework for the employees of the education system in a way that enables them to organize their work effectively and efficiently on the solid foundation of clearly set targets and constantly secure resources. According to the employees of the education system, however, nothing could be farther from the truth. The difference between vision and reality shows exemplarily on the field of e-Learning.

The first chapter of the expertise will describe e-Learning viewed from an educational and an economical angle. It will sketch the new opportunities for teaching and learning that emerge thanks to the application of new media. The current state of implementation of e-Learning courses at universities will be reflected against the background of constantly high

expectations and limited financial resources. This chapter also names the influences that hamper respectively or support the use of new media for teaching purposes in all fields of application. It will show the limits and prospects of e-Learning on the example of the currently favourite concept of blended learning especially considering communicative aspects.

1 e-Learning: After the “PISA shock”

“Lifelong learning”, “self-administered learning”, or “self-regulated learning”, “learning-on-demand”: this list could be extended almost infinitely, however, it only shows that the individuals are reminded of their duty and are to adapt themselves to the ever-changing conditions of the working world. Learning becomes an activity that shapes everybody’s consciousness and working life, so that it can no longer be exclusively linked to a particular phase in one’s life. The framework for individual and collective learning has changed dramatically, accompanied by the latest results of cerebral research and the general triumph of the new media. For some time, it seemed as if the problems of imparting knowledge could be solved by digitalizing and virtualizing the learning contents and by afterwards assigning it to the individual who is regarded as a self-administering and self-responsible being. The PISA-results dispelled any remaining doubts that learning has to be regarded as a social process whose foundations and conditions represent a substantial criterion for didactic structuring of learning scenarios.

With PISA, the discussion shifted from computer-assisted learning, “media-points” and computer-rooms, web- or computer-based training to educational promoting in early childhood, language-based problems of migration and the formation of elites. The study’s figures have been costly ascertained and never have been any comparable results. The bad valuation of the German education system, in comparison with other countries, has been very effective publicity. On the one hand, it has gained a lot of

political attention and has already decisively supported the linking of within Germany. On the other hand, it serves as a motivation to review the biographical and the institutional basis of learning and education.

The relation between reading and speech competence and success in school was recently corroborated by other, smaller studies that resulted in a shifted focus in discussions in science as well as in public. Thus, the new media's symbols - internet and computers – have come to play a role only as factors that hamper or support the learning process. This applies to individual learning as well as to institutionalized learning.

The new technologies of information and communication represent a gate through which the economy wins influence on the strategic alignment of the education system. It the implementation is not to be limited but wide-ranging, the implementation of these new technologies cannot be carried out without economic and participation of the state, due to the immense costs. Providing but all schools with laptops would cost 41.414.642 €, as Kubicek and Breiter estimated in 1998. Other possibilities of linking-up schools have quickly been considered as second best on the part of the state. A general provision of schools with laptops has almost ceased to be a topic, only five years after those grandiose soapbox-speeches. Politicians are boasting of having connected all general schools with the internet and having provided them with free access to it. However, this can not conceal the fact that the per-capita-provision of general schools with computers and access to the internet still is inferior compared with international standards. A large amount of company donations, competitions, etc. have not brought about substantial changes. The arrival of the new media at school still is a nuisance for most of the teachers and is regarded as an attempt of the economy to extend their influence on the education sector. The explicit demand of representatives of the economy and politicians responsible for education for so called public-private-partnerships makes teachers feel under double pressure. From their point of view, the new

media are like a Trojan Horse that breaks through the pedagogical barriers of school. Their evaluation proves to be quite accurate if one follows the political discourse on e-Learning.

2 e-Learning Viewed from the Economical and the Political Point of View

2.1 e-Learning as the Trojan Horse of Education Politics

Since e-Learning was implemented at schools and universities and since schools were linked, one of the most substantial hopes was that the new media could be able to break down the ossified structures of teaching and learning. The unexploited motivation of pupils and students was to be increased, teaching and learning were to be improved, and the involved institutes' system of organization were to be modernized. e-Learning was and still is regarded as a "Trojan Horse" with which these changes could be realized at once within the framework of today's education policy.

However, education policy currently seems to be dominated less by clear set targets derived from pedagogical ideals but more by a reform actionism that is guided by the idea of national and international competitiveness. Experienced actors face this actionism in the education system with a "sit-it-out" policy. Somebody who, nevertheless, is committed not only needs a high level of tolerance to frustration but also should familiarize themselves with the market laws of the "economy of attention" (Rötzer 1999). This applies especially to those who act in the field of e-Learning, which is a delicate topic in education policy. Gloomy predictions proclaim a sort of "radio silence for electronic learning" and reveal the growing market of e-Learning as a subsidized "economic trap" that supports insular solutions that are not accepted on the market (Armbruster 2002, Schulmeister 2001). Predictions of this kind lead almost immediately

to a sustainable withdrawal of financial means (which is currently the case). Furthermore, it leads to a profound mistrust of the reliability of the persons involved in the project and a mistrust of the prospects of the success of the programme as a whole (which could be the case in future).

This is the situation for most of the employees who are still working for one of the more than hundred integrated projects supported by the central project “Neue Medien in der Bildung” (New media in the education system). Most of these projects had the objective to create multimedially edited learning contents and to integrate them into the daily business of university teaching when they started in 2001. Many participants in the projects did not know, however, how to realise their objectives in detail that is due to the lack of standards and the ever-changing technological basic conditions.

- Learning platforms and communication platforms have been established simultaneously to the supported projects at many project sites or have been developed *ad libitum* within the respective project. This has not only set new tasks for the pioneers working in the field of e-Learning, but has also made it necessary to critically evaluate the project’s objectives against the background of new technological opportunities.

- A similar picture shows in the field of copyright regulations. Very few of the participants in the projects would consider themselves to be informed on this field. The field of copyright regulations is crucial to the producing, creating, and using of learning contents. However, this field has been dominated in particular by unclear conditions, which led to a lasting state of uncertainty of the participants. According to experts, the revised German copyright regulations concerning university and school purposes will cause a sustainable

stagnation of content production and will in the same way hamper the future development of e-Learning.

The fact that the central project's coordinators have been ignoring these problems has been criticized at many workshops accompanying the projects. The fundamental importance of these processes for developing and using learning contents seemed to have surprised the central project's managers themselves – and even seemed to have asked too much of them according to some participants of the single projects. Learning what is possible and what is impossible in the field of e-Learning has been a reciprocal process between both parties. It is thus a co-evolutive process, theoretically spoken. Now it is of utmost importance to transfer the acquired knowledge into solid structures and provide the staff and institutes necessary to prevent e-Learning from remaining a marginal phenomenon on national and international level.

Most of the participants of the projects regard the end of the supporting phase not only as the end of their employment but also as a danger to the results of their projects. The terms "phase of consolidation" (Kleimann 2003) and "crossroads" (Seufert/Euler 2003) describe the dramatic situation in a rather euphemistic manner. About 2300 courses of study have been developed within the projects, but they do not improve the situation because the majority of them have a kind of "best-before-date", i.e. their provision with staff and financial resources is very limited. This is why a lasting phase of implementation is of crucial importance for the research results, which vary in significance, to prevent that they, too, end up on the "cemetery of educational technologies" (Seufert/Euler 2003, p.2) like language laboratories, educational television, and programmed instructions. It already shows, however, that an extensive brain drain will take place, due to the uncertainty about a future adoption of the instruments and aids developed within the projects into the normal range of university courses. This will endanger the continuation and further development of the pro-

jects' results and thus will endanger the success of the programme as a whole.

2.2 e-Learning as an Element of Change Management Viewed from the Economic Angle

From the early stages of e-Learning, economists and scientists have obviously evaluated and perceived the potential of e-Learning in significantly different ways. It comes as no surprise that recent market researches show that worldwide operating companies in particular have a pragmatic attitude towards e-Learning. Only if there is a sufficient amount of customers and / or there are no alternative ways of instruction, will companies make use of the advantages of e-Learning, as e. g. flexibility, speed, profitability, and possibilities of standardization. Rapid methods of instruction are of utmost significance for employees of sales departments and technical staff. e-Learning can also be used effectively when rapid structural changes are required. This especially applies to the teaching of foreign languages, which becomes more and more important because of the many international relationships between companies. This also applies to IT-instructions that become necessary when the operating system is replaced or new software has to be introduced in order to serve for a / to a larger quantity of users.

The success of these courses is judged by the degree of how content the students were rather than by the scientific point of view (determination of the students' progress in learning). This pragmatic attitude is the foundation for a second stage of e-Learning, in accordance with the results of a market research by DETECON, which reflect the opinion of executives of important companies. This second stage combines all varieties of learning to an extended model of e-Learning and helps to consolidate the market position of e-Learning as an additional possibility for acquiring qualification (DETECON 2002). The companies do not, however, consider a complete

replacement of presence-requiring teaching with e-Learning any more, as they did in the wake of the euphoria at the start of the new millennium. Today, companies rather intend to coordinate separate initiatives in a better way so that they can make use of synergetic effects and of existing potentials of rationalization. With regard to the costs, especially companies with decentralized budgeting will need control structures to avoid multiple buying of the same product or undesirable double developing. It thus is also advisable for companies to decide on **one** learning and communication platform in order to limit the amount of adaptation and maintenance measures to the necessary minimum of staff and financial means.

The extensive and lasting financial crisis of public budgets makes it important for universities as well as for companies to regard e-Learning from the commercial point of view as part of a comprehensive system of the cycle of the learning net product. This system includes infra-structural requirements, learning contents, the processes of teaching and learning, and the learning culture of the respective organisation.

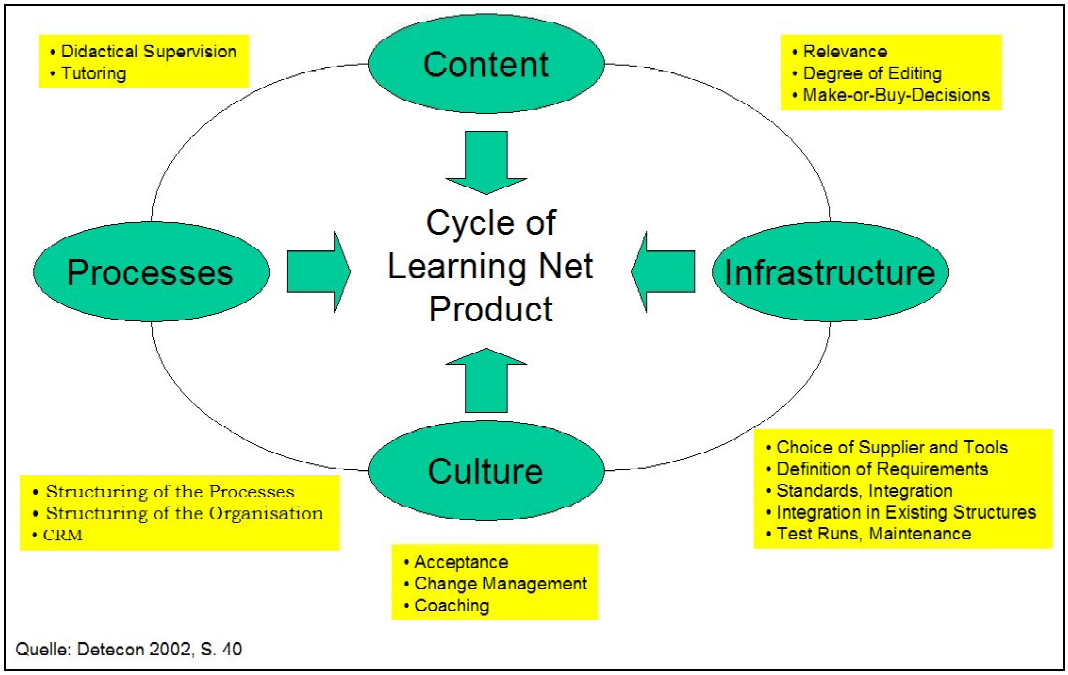

Fig. 1: Cycle of Learning Net Product (after DETECON 2002, p. 40)

3 From Information Society to Knowledge Society

3.1 Why Information Society is Not Enough

The shock caused by the PISA study, whose effect was not limited to the German education system, also has its origin in the fact that the improved technical opportunities of acquiring information have not been used to integrate this information into useful structural contexts. Modern information society has thus reached a point from which an increase of information and knowledge does not go hand in hand with an increase of orientation. “Our knowledge society still is a mere information society. We still have to take the big step to transform information into knowledge and then find out how to deal with this knowledge.” (Schulmeister 2001, p. 362).

Information is not equal to knowledge. Information itself has no value; it just marks a difference that has consequences (Gregory Bateson). Accumulated knowledge serves as a background against which the decision is taken whether the information is useful and valuable or not. “Digital information has nothing to do with ’sense’.” (Bolz 2002, p. 205). The assessing of information with regard to its potential of connection and its social effect is left to processes of decision-making that are based on socio-culturally founded criteria.

Only a small part of the information that humans are exposed to in everyday life is perceived consciously. An even smaller amount of this information leads to connecting thoughts or actions. Attention seems to be a scarce good, considering the frequently mentioned “overflow of information” and the limited ability of humans of conscious perception and parsing of information. The “economy of attention” (Georg Franck) has become the economy of the age of information and redefines the conditions of distributing information and imparting of knowledge. The increase of information has not led to its devaluation but, paradoxically, to a general worry of missing or misjudging of crucial information. This is the reason for the im-

portance of institutions that select information and edit it for communication (e. g. press agencies, editorial offices, also: publishers of non-fictional literature, educational institutions). They relieve the individuals who have to focus their attention and who have only a limited capacity for parsing information. It is thus of crucial importance for the transition from information to knowledge society that information can be charged with significance and be used for generating knowledge.

The invention of computers as a universal machine for manipulating figures in whatever way has shifted the economic focus from production towards IT-service because entering, storing and manipulating of data play an important role. The editing and transforming of data into communicable information (like news) produces a marketable added value.

This process of editing and transforming data into information and its communication is necessary to improve the chance to generate knowledge. Electronic data processing, in this context, is the basic requirement for efficiently dealing with complex information and is thus the basic condition of linked-up learning scenarios.

In addition to this, this **process of constructing knowledge** becomes the substantial factor of the continuing existence of modern societies. Knowledge itself becomes the decisive resource of social reproduction; this decisive force of production will strongly be influenced by the way in which individuals, companies, and institutions, and finally society as a whole manages the generating, distributing, and using of knowledge.

3.2 Knowledge as the Central Force of Production

The limited resources of parsing information are opposite to the potentially unlimited opportunities of generating knowledge. Knowledge can seemingly be increased and accumulated to any desired amount, unlike

productivity factors as property, capital, or labour. Thus knowledge represents the central resource of labour and employment in modern society, which holds true for all fields of society.

Knowledge intensive branches set up nearly half of the newly created jobs between 1999 and 2000. “51 % of German employees will be working in knowledge intensive jobs in 2005.” (Glotz 2002) This prognosis may be viewed critically. So does Peter Glotz, expert on educational questions. There are, however, clear indicators that show the individually and socially increased value of knowledge. The following two examples will demonstrate this:

1. The number of unemployed persons with a low level of education is already three times higher than the number of unemployed persons with academic education
2. The value of a product is more and more defined by the quantity of knowledge that is required for its production; the material or the required time are already of lesser importance than the necessary knowledge

The required amount of knowledge is not always available to the persons involved in the production. The accelerated speed of innovation processes in the industrial sector and in the field of applied sciences makes companies and educational institutes aware of the problem of how to distribute knowledge as quick as possible. Normal instruments of further vocational training are not sufficient for this purpose. “Relevant knowledge changes faster than employees can travel to the place where seminars take place.” (Magnus 2001, p. 24).

Education policy that deserves its name has to reflect the changed social frame. Furthermore, it has to answer the question of how to deal with the contradictory tendencies of social globalisation, individualization, and rationalization. This must be done in a constructive way and on the basis of

values and knowledge that have to be imparted. A possible answer could be: e-Learning.

3.3 European Education Policy in the Age of Knowledge Industries

An increasing degree of orientation towards the labour market has marked the education policy in Europe since the middle of the nineteen nineties. Career orientated education gets increasingly operationalized for economic purposes and also gets integrated into the policy of job creation by means of "quantificationable targets, national campaigns, and multilateral control mechanisms" (Weber 2002, p. 37) on European level. Education policy similarly becomes more and more orientated on the requirements of the knowledge industries whose capital consists in the creativity and the intelligence of their employees. Economy and education converge with the help of intelligence as force of production, says Berlin media-philosopher Norbert Bolz.

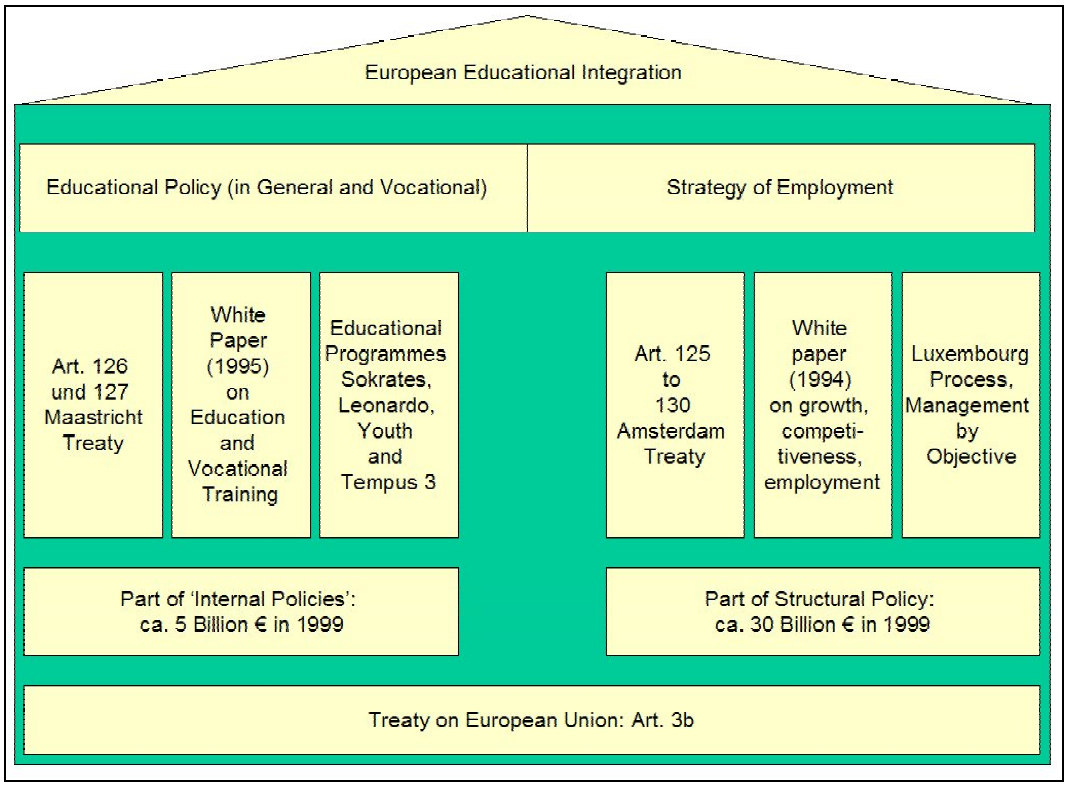

Fig. 2: European Education Policy (Weber 2002, p. 36)

When the European heads of state met in Lisbon in 2000, it was not surprising that they set as their goal the knowledge based acceleration of the E.U.'s economic growth. The initiative "*e*-Learning" is to provide the foundation for the field of education. This means:

- all schools are to be provided with multimedia PCs within the frame of a provision campaign,
- the training of teachers in the subject of informational technology is to be secured and improved throughout Europe,
- supporting the development of educational services and software that supports the learning process, both of which are to be applicable throughout Europe,
- accelerating the linking-up of schools and instructors.

The use of e-Learning applications is an indispensable condition for establishing a European academic area on the analogy of the European economic area. This academic area is to be a counterweight in the field of education to the North American universities, which are already successfully operating on the market. Concerning e-Learning, the close link between European support programmes and national launched research programmes already represent a guideline that is to:

- establish and secure quality standards for teaching and training
- facilitate mobility for students, researchers, and teachers
- clarify the European dimension within education
- support the educational policy of lifelong learning
- set up the conditions for a technology-based participation for of all university members

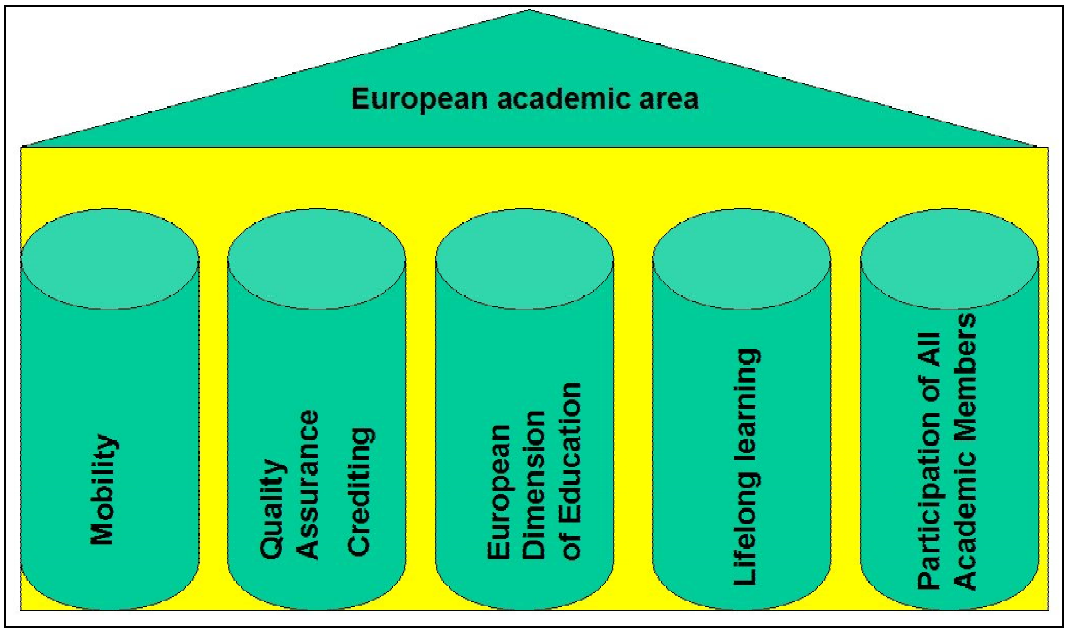

Fig. 3: European academic area

Functional e-Learning strategies adapted to the cultural and structural frame conditions are the *conditio sine qua non*, if the process that has been initiated in Bologna shall become a success. It has already become obvious that some of the various fields of education are in favour of technology while others refrain from it. Graded courses of studies, for example, are rather accepted and spread in the fields of informatics, international business management and electrical engineering.

The implications of the use of e-Learning concerning education policy and economy have been outlined sufficiently up to here. Now we will have a look at the meaning of e-Learning for the structuring of teaching and learning processes. Which expectations have been fulfilled and which have proved to be illusions?

4 e-Learning – Evolution or Revolution of Learning?

The term “e-Learning” applies to the controversial discussion of the new media’s role in the learning process. What are its conditions and conse-

quences with regard to social, psychological, and organizational aspects? Some experts consider the consequences important enough to call the use of new media a “revolution of learning” (Scheffer/Hesse 2002). Leading politicians share this point of view that has been propagated with help of the mass media. In 1999, former German President Roman Herzog expected a “revolution in the classrooms” initiated by the use of informational technology**;** although the pedagogy for the age of information still had to be “invented”, as Herzog added (Herzog 1999). From the official point of view, schools and universities have successfully been equipped with information technology. However, Herzog’s far-sighted call still holds true. It is even more urgent than ever, concerning in particular the omnipresent variety of technological possibilities. Or, to put it like the media philosopher Norbert Bolz did, the internet provides us with the answers. We now have to find the adequate questions.

This means in concrete terms: one has to indispensably take into account the reflection upon the fundamental principles of learning, about the significance of didactics, and about the influence of organizational structures and the media on the learning process, when creating e-Learning applications. Now, what does “e-Learning” mean exactly?

4.1 Some Definitions of “e-Learning”

The term “e-Learning” is the common abbreviation of *electronic learning*. **Precisely**, it means all forms of web-assisted or electronically linked-up learning and is often used synonymously with the term of on-line learning (Lang 2002). It denotes **more generally** all forms of learning that include imparting digitalized contents. This includes, aside from web-assisted forms of imparting information, the use of off-line media like CD-ROM, video, television, etc. From the economical point of view, e-Learning can also be defined as “combining net-assisted learning with the commercial potential of education products (Bullinger 2001, after Seufert/Mayr 2002,

p. 47). Furthermore, “e-Learning basically is self-administered learning by means of multimedia or interactive learning modules that are supported by opportunities to communicate with a tutor or a learning group.” (Nacke / Neumann 2002, p. 18). Taking this into account, e-Learning matches the concept of blended learning.

Whatever point of view is chosen to look at e-Learning, so much is certain: in most of the cases, a mere supply with e-Learning applications and learning contents that are available on-line is sufficient to successfully structure learning processes. Most cases require contextual, didactically founded imbedding of e-Learning applications into the learning scenario to enable the learners to evaluate their successes in comparison with their fellow learners and to construct new knowledge. There is also the need to practise mechanisms that enable the learners to regulate the learning process on their own.

This is why e-Learning is decreasingly considered a mere substitute but a supplement to teaching that requires the physical presence of both teacher and learners [presence-requiring teaching). Dichanz and Ernst thus propose to introduce the term *ES-learning (ESL)*, short for *electronically supported learning*. This term is more suitable to emphasize the supportive character of electronic media, according to the authors (Dichanz/Ernst 2002, p. 48 ff).

4.2 e-Learning in Learning Scenarios: Dreams and Reality

The vision scientists had concerning *“Artificial Intelligence” (A.I.)* was to be able to reproduce learning processes in automated form. This vision was elaborated with models of e-Learning which consider teachers a relict of the past. Instead, they trust in the mechanisms of self-regulation of a society willing to learn. Interactivity (here: communication requiring physical

presence) is regarded as a factor, which is to be compensated by technological means in order to minimize its costs.

Nevertheless, e-Learning is to support learning, both individual **and** in a group, independent of time- or space-related restrictions. It is also to provide teachers with an easier way of selecting, structuring and presenting their material, and to facilitate the access to this material. e-Learning, furthermore, has to increase the efficiency of learning, to cut back on expenses in the education system, in the medium and in the long term and to make profit.

Even insiders are left astonished of how lasting these high expectations are (Schwarz 2001). A comparative analysis by Schulmeister of 11 national and international statements on the development of the universities in Germany and Europe published between 1996 and 2000 lists 19 (!) different expectations to be met by using e-Learning in teaching at universities (Schulmeister 2001, p. 10 – 25):

a) *Effects on Teaching and Learning*

- improving the quality of teaching
- increasing the efficiency of teaching
- integrating e-Learning applications into the regular teaching at universities
- supporting problem-oriented and interdisciplinary learning
- increasing the amount of self-administered learning through interactive materials

b) *Effects on Teachers and Learners Themselves*

- time-saving for teachers
- changing the understanding of both teachers and learners for their respective roles

- defining media proficiency as a key qualification

c) *Effects on the Developing of Curricula*
   - supporting concepts of quality–ensuring measures and evaluation
   - modularising of the courses of study
   - making studies more flexible
   - linking-up of teaching and working

d) *Effects on Education and Suppliers of Education*
   - convergence of presence-requiring studies and distance learning (e.g. on models of blended learning)
   - internationalisation of education
   - openness and equality in education

e) *Effects on the Infrastructure and the Structures of Organisation of Education Suppliers, Especially of Universities*
   - cooperation between computer and media centres and libraries in order to establish competence centres
   - reduction of expenses in the medium and long term
   - setting up of campus networks
   - increase in the amount of public/private partnerships

Without going into details, it has to be noted that after three years of intensive support by the state, the communities, and the economy most of those expectations are just beginning to be realised or at best are at the point of being consolidated. There may be single news of success from some institute or other, there are, nevertheless, only a few thousand students who are registered for on-line courses of study at German universities at the start of the winter term of 2003/2004. As announced by the federal coordination project “Virtuelle Fachhochschule” (a consortium of mostly Lower Saxony universities, sited in Lübeck), only 280 new students were have been enrolled for the winter term of 2003/2004 with the

number of applicants, from home and abroad, being about five times higher (idw press announcement by Fachhochschule Lübeck, September 23th, 2003). The central office of distance learning at Fachhochschulen has, also, reported a rate of increase of 25%. These figures could *pars pro toto* be interpreted as an increasing requirement for job-related further education that could be supported effectively and efficiently by using e-Learning applications. Teachers and learners thus have to be provided with e-Learning applications that are didactically up-to-date. Only with them, planning and carrying out of courses can effectively be simplified, and can learners acquire a subject in a constructivistic manner. The tools developed for this purpose should be provided in **modular form** to thereby provide the learners with the necessary flexibility to cope with all kinds of situations.

e-Learning can support internalisation and flexible use of education possibilities if cooperating utilization-communities are successfully established on national and international level. The central aims of this are interchanging of learning contents and adapting of regulations concerning the different curricula along with a mutual adaptation of existing e-Learning applications in order to facilitate their joint use in different contexts and constellations. Synergetic effects for all those involved can only be expected with these requirements met.

5 How Using e-Learning Applications Influences the Creation of Learning Scenarios, and Why Presence-Requiring Teaching Stays Indispensable

Perception and significance of time- and space-related factors for the learning process have been changed decisively by the new media being principally available for the creation of learning processes. The advantages and disadvantages of presence-requiring teaching respectively distance teaching are evaluated and the results are taken into considera-

tion when creating new learning scenarios. Selective decisions in favour or against using a particular medium are no longer arbitrary, or due to the teachers' preferences. These decisions have increasingly to be taken in a profit-seeking context within which they have to be justified by results of research and evaluation with regard to cost-benefit analyses. Yet there is no satisfying agreement on which way of imparting learning contents will lead reliably to optimal learning results. There are, nevertheless, good reasons for using e-Learning applications in the creation of teaching-learning scenarios. The following will briefly explain them.

5.1 The Advantages of Creating Learning Scenarios that Include Using of e-Learning Applications

The reasons for choosing e-Learning as a possible guideline of future educational policies show clearly when looking at the advantages of using e-Learning applications for the imparting of knowledge. With the help of the new media:

- information can be edited in a way that permits to address the visual, the auditory, and the tactile channel of communication simultaneously which supports the reception of information by activating both halves of the brain. Information can also be edited in medially different forms and thus can be presented as is required for the different types of learners. Depicting structural knowledge in explicit and pictorial forms results in a greater closeness of the knowledge and thus uses the affective parts of perception to increase the learning performance (Pöppel 2000, p. 39)
- information can also be combined in a non-linear, non-hierarchical way to form so called hypertext structures. Hypertext structures facilitate the linking-up of single words or of one text with other texts that do not necessarily have to be included in the same text. They make it possible to arrange information segments in a way that allows the learners to move easily from one segment to another.

Hypermedia systems combine pictures, films, videos, sounds, etc. in a way similar to hypertext structures. Information segments that are arranged in the form of clusters allow the learners to acquire information in an individual way.

- Learning scenarios can be developed in a way that allow the learners to communicate with one another independently from time- or space-related requirements. Learning scenarios of this type take into account the significance of dialogues for the learning process because they are necessary to grant the learners a joint construction of complex stores of knowledge. In this context, the opportunity to exchange information may enable the learners to describe information more precisely and to distinct more precisely between what was said and what was meant.

This applies particularly to presence-requiring learning (which requires physical presence at a particular point of time). The face-to-face situation, however, has the advantage of direct interaction and communication, which facilitates a high efficiency when working on complex subjects and thus supports in developing strategies for problem-solving and overcoming crises. Team-discussions allow to transfer individual knowledge easily into collective knowledge and to store it. The thus acquired knowledge then can show new ways of solution.

The storing of knowledge in a material and thus sustainable way has been possible since the development of the classic media of books and newspapers. This, too, has offered the opportunity to become independent from the time- and space-related requirements of the didactical triangle of teacher – subject – learner. The thus created freedom on the other hand requires the ability to self-regulate the learning process. Successful self-regulated learning is, however, dependent on the personal abilities of the individual learner. This is why distance learning is frequently supported by regional seminar-like meetings. They are established for the particular

purpose of joint learning, i.e. they take into account the principle of dialogues as an integral part in generating knowledge.

The significance of communication for the learning process is considered, too, when developing concepts for on-line learning. On-line based imparting of knowledge requires a particular form of editing information and has to take into account the restrictions inherent in the medium. The new media facilitates a real-time interchange of information and stored knowledge; they also facilitate an instant discussion on the presented contents. On-line learning thus includes so called learning communities, which provide virtual rooms for collaborative learning. At least, theoretically they are to. The real situation at universities differs from that in the majority of the cases. e-Learning often proves to be obstructed by certain circumstances.

5.2 Factors With Negative Influence on the Successful and Sustainable Use of e-Learning Programmes

Schulmeister compares the numerous different demands on the use of e-Learning with the almost equally numerous unrealistic prognoses for its future. Some of these predictions have been proved false within a year's time (Schulmeister 2001, p. 27 – 29, esp. p. 28). He notices that **factors**, which obstruct a widespread implementation of e-Learning, **are seriously underestimated**. Among these factors are:

- obstructions of socio-demographical origin, especially if the staff at schools or universities is of a high average age which can result in a certain unwillingness or even refusal to learn
- legal obstructions for the implementation; Schulmeister relates these to the state monopoly on education and the legally laid down freedom of teaching, both of which will result in a delay of the return-on-investment that is strived for from the economical point of view

- extending e-Learning to those parts of the study that require e. g. practical training in laboratories, demonstration lessons, therapeutic sessions, and so on. Especially strictly virtual learning scenarios can have a negative influence on this
- lack of a learning culture within which “self-regulated learning and the willingness to interchange knowledge and experiences are cultivated, and are practised for purposes of research and working” (Hesse et. al. 2000, p. 33).

e-Learning requires high-level abilities concerning autonomous learning. Hesse et. al. list the following requirements (2000, p. 40):

- media proficiency, especially concerning the technical level
- the ability to estimate the quality of an e-Learning programme concerning subject, technology, and didactics
- the ability to distinguish between relevant and less relevant contents
- the ability to choose a programme in accordance with the individual learning resources
- the ability to structure great amounts of information in a useful way
- the ability to generate meta knowledge in the sense of developing learning strategies with the help of the new media

These capabilities can be subsumed under the term of *information literacy*. If the specifications for e-Learning are completed by the aspects of media proficiency and informational literacy, the actual state of the integration of e-Learning devices into academic education can only be described as inadequate (Gavriidilis 2001). Courses that offer imparting of media proficiency and information literacy are dependent on initiatives of individual teachers and are rarely integrated into the curricula or the teaching structures. Successful and sustainable use of e-Learning applications in

teaching requires their structural integration. This can hardly be realized without supply of appropriated financial means in the medium term. Due to their limited character, previous forms of financial support have proved to be inadequate for sustainable use, maintenance and further development of the projects' results. This means that new ways of gathering financial means have to be found, which are necessary for granting professional assistance at the universities for the developing of e-Learning applications, multimedial learning contents, models for further education, and promising models of business in general. There have already been some efforts (like establishing e-Learning competence centres, arranging public-private partnerships in the context of action programmes, employment of experts). Most of these measures are still in the testing stage and are by far not sufficient to prevent the breaking of the use of e-Learning at universities.

Imprecise legal copyright regulations on the use and the distribution of multimedial teaching- and learning-contents, many of which are still in *status nascendi*, add to the problematic status quo of the tools and learning contents that have been developed in e-Learning projects. The amendments to German copyright regulations have extended the rights of authors and publishers whilst weakening the position of those who work at schools or universities. Systematic deficiencies of this amount endanger the further developing of e-Learning applications. This cannot be compensated by the incentive system like awards or competitions for the use of e-Learning applications in the teaching although this system is desirable in other contexts.

This highly uncertain and thus extremely risky situation makes it seem unlikely that schools and universities will integrate media-supported teaching in guidelines without exterior assistance and that they will modify their strict regulations on degrees in favour of innovative and explorative projects. Quite the contrary, the national and international standardization of qualification standards will probably result in an increasing return to the

classic, measurable criteria and to well-tried methods of teaching which leave little scope for the testing of innovative media within the regular course of teaching.

Apart from general and administrative problems, there are rather trite reasons for the insufficient use of e-Learning applications (especially in the case of on-line learning). This holds true spite of allegedly successful supplying campaigns. Among the problems (see chap. 6) most frequently mentioned by students are:

- missing or difficult access to the internet
- high expenses for the access (basic charge plus costs per unit / traffic)
- lack of competence in using PCs and the internet (students are afraid of virus or of destroying something)
- low data transfer speed that slows the working with the internet
- outdated or no home PCs
- PCs at the universities lack functionalities
- lack of communication in a forum
- exercises do not make sufficient use of the opportunities of e-Learning
- no budget for tutoring staff; tutors with adequate qualification would have to be trained yet
- getting a general idea of the subject and gaining an overview becomes more difficult because of the module-structure of the contents.

These statements are not exclusively for universities. In companies, the acceptance of the use of e-Learning applications decreases significantly if the frame conditions do not meet medial requirements. The acceptance of e-Learning was subject of an empirical study by COGNOS and the Institut für Innovationsforschung, Technologiemanagement und Entrepreneurship

(*Institute of Innovation Research, Technological Management and Entrepreneurship*) in June 2002. The authors conclude that company employees consider themselves as insufficiently informed about the opportunities of e-Learning at their working places. The equipment of the working places is not suitable for e-Learning, there is no-one to contact in the companies for questions of e-Learning. This is why "companies have to establish structural and time-related frame conditions to facilitate efficient and undisturbed electronic learning" (COGNOS 2002, p. 7). This similarly applies to the situation at schools and universities. It comes as no surprise that Hochschul-Informations-System GmbH (*University Informational System, Ltd.*) states in an accompanying study to the support programme "Neue Medien in der Bildung" (*New Media in Education*): "Although there have been considerable efforts concerning infra-structural equipping, strategies for the use of media, and evaluation of e-Learning applications, there still remains a large amount of factors that obstruct innovation and implementation." (Kleimann 2003, p. 3).

5.3 e-Learning and Money

One of the most significant obstructions for a rapid and successful implementation of e-Learning at universities (not only there!) is caused by the investment and maintenance costs that are necessary for an extensive use of e-Learning that meets high didactical standards. There are only a few field studies on these problems. Most of the studies rely on data from the field of further vocational training and try to apply the so ascertained expenses on the field of teaching at universities (Glotz/Kubicek 2000). The results are, in a word, shattering, not only at first glance. "The annual additional expenses of about 4 million DM (2.045.167 €) per course of study exceed the share of 30% of the budget that most of the institutes can spend on on-line costs." (Glotz/Kubicek 2000, p. 132). The calculated expenses are based on conservative estimations and take into account possible ways of cost saving. Commissioning and licence fees are factors

that must not be underestimated. Producing e-Learning applications in the frame of content developing and establishing innovative models of organization is the only way to, at least partly, solve this problem. There are some concepts being developed at universities, e.g. the media concept of the University of Dortmund (http://www.mz.uni-dortmund.de/uebersicht/medienkonzept.pdf). This concept supports the multimedial editing of learning contents on a central level and in a standardized and sustainable way. “The developing is to be carried out in accordance with the project. The following has to be considered:

1. the conceptional stage with a proper project team
2. the developing stage and its coordination with the help of an organization chart.”

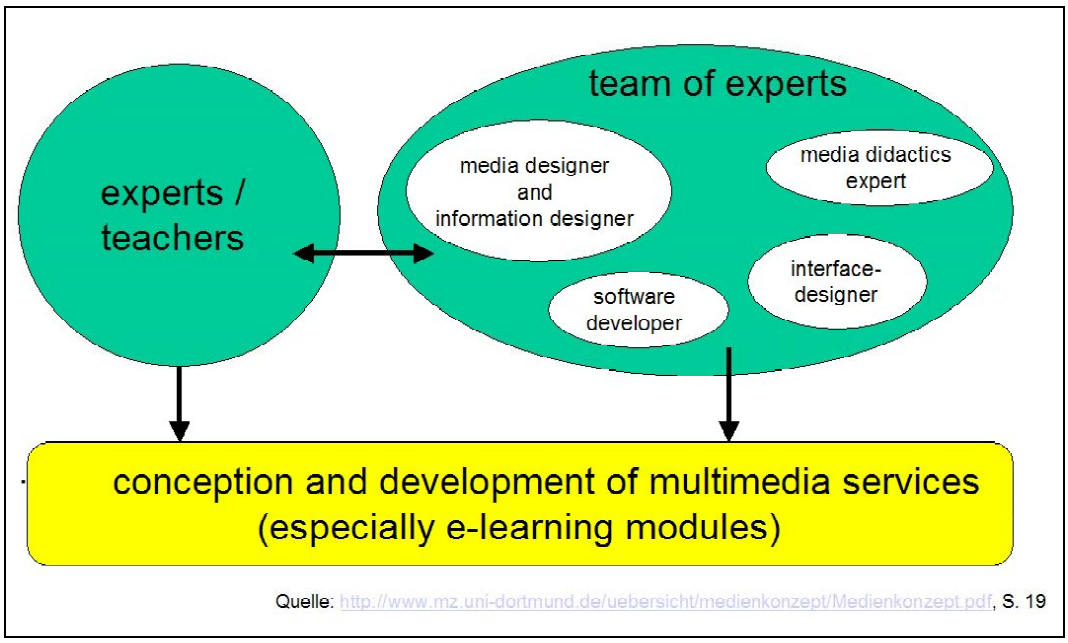

Fig. 4: Organization Chart of the Production of Multimedially Edited Learning Contents

Sustainable workable agreements on cooperation with providers of further of education and training, publishers, and service-providers remain exceptional and are “not trivial. Worldwide, there are no examples of multimedial applications which fully meet the required improvement in learning and

which are economically profitable."(Glotz/Kubicek 2000, p. 133). Educational policy has to focus on the support of agreements on cooperation (see above) in order to support innovative structures of using and marketing e-Learning, as Glotz and Kubicek have stated in 2000. This is now being adapted as criterion for coming support programmes at national and at state level. Companies also adopt this concept, e. g. in an agreement of cooperation between CDI GmbH (*Ltd.*), Germany's biggest IT-training company, and imc AG, market-leader in e-Learning (Reinmann-Rothmeier 2003, p. 28).

After the boom, the universities are now returning to the basics. They try to come to terms with the different equipment of different sites and replace the term of e-Learning with the term of *blended learning*.

6 From e-Learning to Blended Learning - Compromise or Ideal Way? How to Make Sustainable Use of e-Learning Applications?

> There are still no reliable methods to really make somebody learn just by teaching him. This also applies to e-Learning."
>
> **(Dichanz/Ernst 2002, p. 51)**

The collapse of the New Economy, the PISA-shock, and the global economic crisis have changed the conditions within the education system concerning the creation of learning-scenarios. Imparting knowledge by means of e-Learning applications is increasingly looked at under primarily pragmatic aspects:

- How many staff members are available for the creation and realization of learning contents and scenarios?
- How much money can be spent on the project?

- Which infra-structural aspects have to be taken into account during the realization the project?
- Is there scientifically ascertained knowledge about the success of the teaching method used in the project?
- Which requirements, including media proficiency in particular, have to be met by the learners for using the e-Learning applications?
- With regard to cost-benefit aspects, how can the advantages of both presence-requiring learning and distance-Learning be combined and integrated into learning scenarios?

e-Learning was to start an informational revolution within the education system, whereas blended learning is less strict and 'meets teacher and learners where they are, from the didactic and technological point of view'. A return to "the basic facts of didactic reality" (Reinmann-Rothmeier 2003, p. 17) is called for even by experts for e-Learning. The term "blended learning" marks this change in the way of thinking. It applies to a blending of components from both e-Learning and presence-requiring learning into a learning scenario that meets the specific contextual requirements of the single projects. The illustration below shows the different levels of blended learning on a theoretical level.

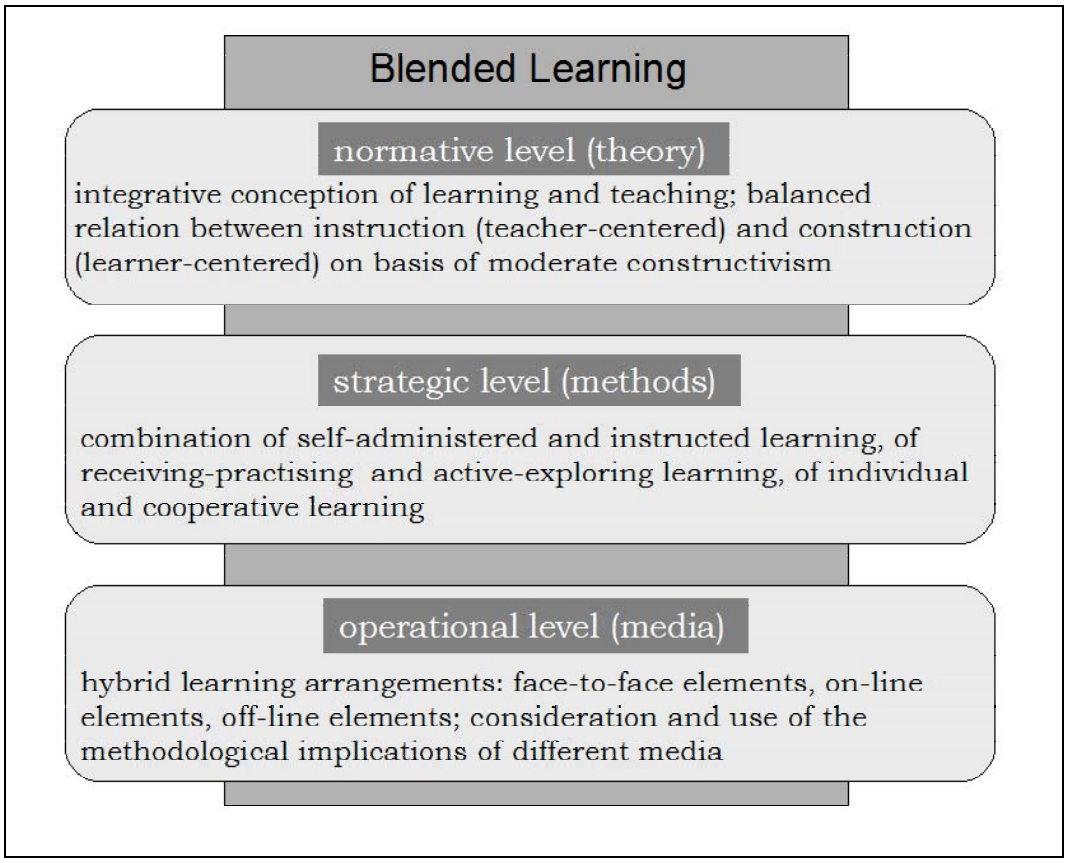

Fig. 5: Integration by Means of Blended Learning (Reinmann-Rothmeier 2003, p. 41)

Blended learning is, apart from other things, a didactical reaction to a technologically induced lack of information that proves to be disadvantageous for strictly net-based learning scenarios. This lack consists of the absence of elements like facial expressions, gestures, intonation, etc. This facilitates to assess the given information concerning e.g. its reliability or personal relevance to communicating persons in a face-to-face-situation. On-line-based learning scenarios tend to abolish some rules of social interaction, like “turn-taking” which means that the speakers take turns in speaking, or keep to text coherence (Hron et. al. 2002, p. 83). This can only partially be compensated for by establishing rules of communication, e.g. for chats or video conferences. These limitations can be an obstruction when coping with complex problems (see chap. 6) which can require exterior intervention. This very example also shows that on-line based learning scenarios have to be supported and accompanied by a didacti-

cally coherent concept in order to optimise individual learning processes on a technological basis (see illustration below).

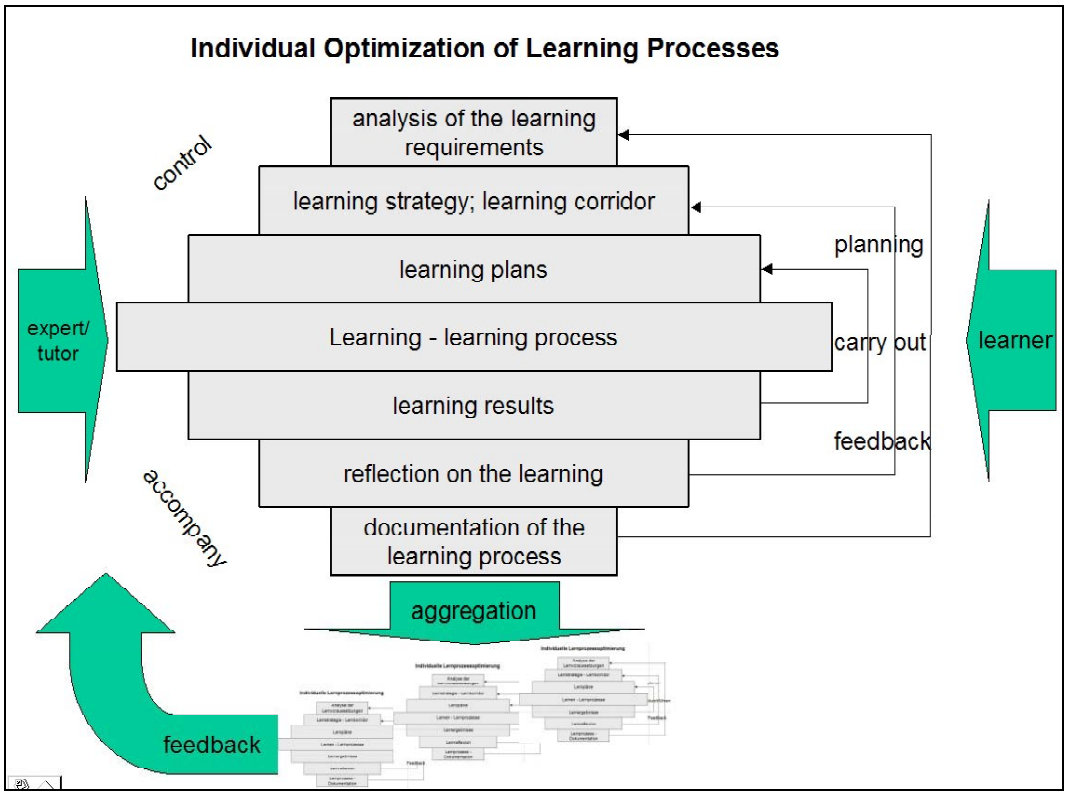

Fig. 6: System of the optimization of learning processes in blended learning (after Sauer/Sauter 2002, p. 89)

Blended learning concepts are better suited for learning goals that are to be reached with an hands-on-approach than with strictly virtual courses. Integrating presence-requiring phases into rather on-line based learning scenarios allows the learners to better get to know each other, to work together as a team, and, in general, build up trust in each other and in the participating tutors and experts. The concrete realization of a model of blended learning for the subject of technology is described in part 2 of this expertise.

References and Links

Armbruster, Jörg (2002)
„Funkstille beim elektronischen Lernen. Wege aus der Wachstumsfalle."
http://www.nzz.ch/2002/03/19/se/page-article819ST.html, referenced 17.9.2003

Bertelsmann Stiftung (Hrsg.) (2002)
Was kommt nach der Informationsgesellschaft? 11 Antworten. Second Edition. Gütersloh 2002

Bolz, Norbert (2002)
Blindflug ins 21. Jahrhundert. In: Bertelsmann Stiftung (Ed.) (2002), p. 196-220.

Bullinger, Hans-Jörg (2001)
Einsatz neuer Medien in der Personalentwicklung. Key Note Presentation at the IAO-Forum „Betriebliche Weiterbildung mit digitalen Medien", 22.2.2001, Fraunhofer Institut, Stuttgart

COGNOS (2002)
Eine empirische Studie in Zusammenarbeit von Cognos und dem Institut für Innovationsforschung, Technologiemanagement und Entrepreneurship, Juli 2002, Frankfurt/M.
http://support.cognos1.de/dach/schulung/studie_ueberblick.pdf, referenced 31.10.2003

DETECON (2002)
e-Learning. Die zweite Welle. White Paper. November 2002. Marktforschungsstudie von Detecon&Diebold Consultants.

Dichanz, Horst/Annette Ernst (2002)
e-Learning – begriffliche, psychologische und didaktische Überlegungen. In: Scheffer/Hesse (Eds.) (2002), p. 43-66.

Gavriidilis, Konstantin (2001)
Kein Qualitätssprung in Sicht. Empirische Ergebnisse zur Integration und Nutzung elektronischer Fachinformationen in der Hochschulausbildung. In: Wagner, Erwin/Michael Kindt (Eds.): Virtueller Campus. Szenarien – Strategien – Studium. Münster a.o. 2001, p. 266-274.

Glotz, Peter (2002)
Wissensmanagement und Wissensarbeiter. Über Strukturveränderungen der deutschen Gesellschaft im digitalen Kapitalismus. Transcripion of an Audio-Recording of a key note presentation at the ver.di-congress „Wissen

ist was wert“, 11.2 - 13.2.2003 in Bremen. http://www.wissen-ist-was-wert.de/vortraege/plenum2_glotz_manuskript.pdf, referenced 6.10.2003

Herzog, Roman (1999)
Rede von Bundespräsident Roman Herzog auf dem Deutschen Bildungskongreß in Bonn vom 13. April 1999, http://www.bundespraesident.de/top/dokumente/Rede/ix_12049.htm, referenced 17.9.2003

Hesse, Friedrich W./Heinz Mandl (2000)
Neue Technik verlangt neue pädagogische Konzepte. Empfehlungen zur Gestaltung und Nutzung von multimedialen Lehr- und Lernumgebungen. In: Bertelsmann Stiftung/Heinz Nixdorf Stiftung (Eds.): Studium online. Hochschulentwicklung durch neue Medien. Gütersloh 2000, p. 31-49.

Hron, Aemilian/Friedrich W. Hesse/Helmut F. Friedrich (2002)
Gemeinsam lernt es sich besser. Kooperatives Lernen und kognitive Prozesse in netzbasierten Systemen. In: Scheffer/Hesse (Eds.) (2002), a.a.O., p. 83-100.

Jantke, Klaus P./Wolfgang S. Wittig, Jörg Herrmann (Eds.) (2003)
Von e-Learning bis e-Payment. Das Internet als sicherer Marktplatz. Conference Volume LIT `03. 24.-26. September 2003, Leipzig. Berlin 2003

Kleimann, Bernd (2003)
e-Learning revisited: Maßnahmen für eine nachhaltige Integration in die Hochschullehre. In: Jantke, Klaus P. a.o., p. 1-18.

Kubicek, Herbert/Andreas Breiter (1998)
Die Finanzierung neuer Medien in Schulen. Probleme und Lösungsmöglichkeiten in Deutschland und in den USA. An Appraisal. Provisional Version, 25.5.1998. Gütersloh 1998.

Lang, Norbert (2002)
Lernen in der Informationsgesellschaft. Mediengestütztes Lernen im Zentrum einer neuen Lernkultur. In: Scheffer/Hesse (Eds.) (2002), p. 23-42

Magnus, Stephan (2001)
e-Learning. Die Zukunft des digitalen Lernens im Betrieb. Wiesbaden 2001

Maresch, Rudolf (2001)
Der Hype ist vorbei. Das Internet ist in der Realität angekommen. http://www.rudolf-maresch.de/texte/46.pdf, referenced 4.9.2003, Printed in: Medien und Erziehung. Vol. 45, H. 4, p. 235-242

Nacke, Ralf/Reiner Neumann (2002)
Killer app oder Hype? e-Learning im Überblick. In: Neumann, Reiner/Ralf

Nacke/Alexander Ross: Corporate e-Learning. Strategien, Märkte, Anwendungen. Wiesbaden 2002, p. 18-27.
Pöppel, Ernst (2000)
Drei Welten des Wissens – Koordinaten einer Wissenswelt. In: Maar, Christa/Hans Ulrich Obrist/Ernst Pöppel (Eds.): Weltwissen – Wissenswelt. Köln 2000, p. 21-39.

Reinmann-Rothmeier, Gabi (2003)
Didaktische Innovation durch Blended Learning. Leitlinien anhand eines Beispiels aus der Hochschule. Bern u.a. 2003

Rötzer, Florian (1999)
Geschäftsmodelle in der Aufmerksamkeitsökonomie.
http://www.heise.de/tp/deutsch/special/auf/6366/1.html, referenced 10.10.2003

Sauter, Werner/Annette M. Sauter (2002)
Blended Learning. Effiziente Integration von e-Learning und Präsenztraining. Neuwied 2002.

Scheffer, Ute/Friedrich W. Hesse (Hrsg.) (2002)
e-Learning. Die Revolution des Lernens gewinnbringend einsetzen. Stuttgart 2002.

Schulmeister, Rolf (2001)
Virtuelle Universität – Virtuelles Lernen. München, Wien 2001

Schwarz, Christine (2001)
e-Learning und Bildungspolitik: Von der Nachhaltigkeit hoher Erwartungen. In: Wagner, Erwin/Michael Kindt (Eds.): Virtueller Campus. Szenarien – Strategien – Studium. Münster u. a. 2001

Seufert, Sabine/Peter Mayr (2002)
Fachlexikon e-le@rning. Wegweiser durch das E-Vokabular. Bonn 2002

Seufert, Sabine/Dieter Euler (2003)
Nachhaltigkeit von e-Learning-Innovationen. 1. SCIL-Working Paper.
St. Gallen, Juni 2003

Weber, Peter J. (2002)
Technisierung und Marktorientierung von Bildung in Europa. In: Lohmann, Ingrid/Rainer Rilling (Eds.): Die verkaufte Bildung. Kritik und Kontroversen zur Kommerzialisierung von Schule, Weiterbildung, Erziehung und Wissenschaft. Opladen 2002, p. 29-43.

Teledidactics
From the Cybernetic Didactics of the Sixties to Constructivistic Didactics and Back Again?

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Table of Contents

1 Introduction

Observers of the today's e-Learning scene might get the impression that there is a big retrograde step in didactics. Presently used key words like *programmed learning, computer aided learning, learning environment,* etc. are rather reminiscent of the reach of *cybernetic didactics* in the sixties. A comparison of the respective vocabularies at first glance shows no significant differences. Terms like *learning goal-orientation, learning goal, self-regulated learning, individual learning, self-determined learning* are used again. The reasons given for the use of computers are not very different from those that were given at that time. The foresight of the cybernetic concepts is remarkable in the view of the given the fact that there were no suitable computers for realizing the concepts of cybernetic didactics then. Some of the methods of cybernetic didactics, however, were realized with the means available then. Various books were written in order to facilitate programmed learning. Multimedial learning scenarios were created for the same purpose, some of them with a great deal of effort and money. The instructions were provided in writing while the necessary units of information were given via the media available at that time i.e. texts, films, slides, and tape recordings. If the media are classified with generic terms, it becomes apparent that there has been no revolutionary change in the depiction of information (script, picture, film, sound). The use of computers thus simply addresses the hearing and the seeing. So, where are the differences between the didactics of the sixties and today? Has there been only an improvement in technology? Will then developed techniques now be realized? Which items of criticism concerning computer-based learning are still valid?

The following text will deal with these questions. The answers will then be used to resume the possibilities of the official use of computers in education, with regard to recent psychological, sociological, and political aspects.

2 Comparison of the cybernetic didactics of the sixties and seventies with didactics based on constructivism

The following chapter describes both didactics in a simplified way in order to point out the significant differences.

2.1 The cybernetic didactics of the sixties and seventies

The cybernetic didactics of the 1960ies and 1970ies is based on the model of a control circuit. This control circuit consists of the scheduled value (learning goals), the control unit (teacher), the actuators (methods), the control variable (learner to be instructed), the actual value (the instructed learner), and the measuring head (achievement control). Concerning psychology of learning, this model bases on the learning theory of the behaviourism. Skinner's work on programmed instructing has provided the foundations. He also developed a first simple learning machine. In accordance with this model, the learning process is regulated by the teaching process. The teacher sets subject and learning method and then decides by means of tests how to continue the teaching process (control). The learner themselves as control variable and actual value have no influence on their learning behaviour they only can do their best to meet the requirements. They have no possibility to influence the learning process. Contrary to the common method of teaching that centres on the teacher and is determined by the amount of the contents, this method has the advantage to enable the teacher to respond to the learner's individual problems. It thus represents a type of teaching that orients towards the learner as actual value. This is not, however, the absolute criterion for a suitable individual supervision of the learners. The teacher does not analyse the learning problems of the learners, but simply confronts them once again with the particular item they did not understand. It was believed then that repetition itself will generate the understanding.

Summary: This model of teaching is suitable from the teacher's point of view. The learners become observed objects on whose reactions the teacher will respond. The method has the disadvantage that the learners have no possibilities to regulate or optimise the learning process on their own. The teacher has only a control function. This is the decisive difference to didactics that base on constructivism as theory of knowledge.

2.2 Didactics on the basis of constructivism

The central idea of the constructivism is that the human beings construct their environment themselves, because their perceptions and the thus resulting experiences are individual. This is why the radical constructivism calls any learning process into question and establishes the thesis that teaching is impossible. The more moderate constructivism allows to draw conclusions from the knowledge by the individual perception and experience which help to understand learning problems and to solve them.

1. The learners have to learn by themselves (noone can do the learning for them)
2. Experiences and knowledge are processed on the basis of experiences and knowledge
3. New knowledge is based on old one
4. Learners have their individual ways of learning

If these conclusions are incorporated into a didactical concept, this concept will be orient at the learners. The learners become protagonists who organize and regulate the learning process. This does not mean, however, that teachers as experts on learning become unnecessary. Their tasks will be to support the learners in the learning and to counsel them. Teachers will have to be able to recognize the learners' problems and to develop individually fitting learning strategies. This requires a relationship of mutual trust between teachers and learners. The learners will have to reveal their problems unconditionally to enable the teachers to get an idea of the learners' experiences and thus to develop learning scenarios in accor-

dance with his knowledge. The learning process is defined by a continuing interchange of information between learners and teachers. This means, the learning process is regulated by the learners' knowledge and way of learning.

2.3 Summary

The difference between the two didactical approaches consists in the conception of the human being which is the basis of their respective concepts. The old cybernetic didactics consider human beings to be trained by external devices, whereas the constructivistic didactics see humans as protagonists and as responsible for their learning process. It is the recognition that an efficient and purposeful learning con only be achieve by the learner's activity.

3 Survey of the present of e-Learning community

Teacher-oriented learning scenarios are the most common form of teaching in Germany. Imparting a great amount of factual knowledge is the goal of this learning scenario, media proficiency plays only a minor role, if at all. The learning itself, i.e. developing a style or ways of learning, is left to the learners. Correspond's advice or help is scarcely provided. The "good didactics" of most teachers is limited to present learning contents in a structurized form and by using different kinds of media. This situation is reflected upon in the field of e-Learning, which in the main makes use of the various forms of presenting contents. The learners are not integrated into the concept, they are mere consuments of the presented learning contents. Hyperlinks suggest an interactivity which sometimes even is described as "constructive learning". However, there are more elaborated learning scenarios represented in the net. This concept of "blended learning" has the special feature of making use of the communicative possibilities of the Internet and thus facilitates the informational inter-

change between the participants and the teacher. The general disadvantage of all these systems is, however, that they do not sufficiently consider the learners. This means, they do not provide the learners with learning aids or counselling. All mentioned systems are based on the premise that the learners are able to organize the learning on their own. On a closer look, most of the learning scenarios are restricted to the mere impartion of factual knowledge. Imparting of media proficiency is carried out by simple methods and is restricted to the initial stages. Teachers mostly are limited to giving tasks and controlling. Computers are applied only to make quicker and more efficient use of established methods and media. The added value of computer-supported learning sceanarios thus is questionable.

4 Developing of computer-supported hands-on approach learning scenarios

This chapter deals with the developing of a learning scenario that makes use of constructivistic knowledge and the possibilities of computers. It starts with a list of requirements and ends with suggestions on the concrete realization.

4.1 Requirements on a modern learning scenario

The learning scenario has to meet the requirements of those who use it. This means that there are special requirements on learning media and learning objects as well as special requirements on teachers and learners.

4.1.1 Primary criteria for learning scenarios

Primary criteria for learning scenarios are defined as criteria that fulfill the requirements concernings didactics and learning psychology. These criteria are:

1. the learners themselves organize and determine the learning with assistance of teachers and computers.

2. the learners can contact the teacher and their fellow learners and can interchange information
3. the learners can choose their learning material without restrictions
4. the teacher can plan the courses on computer-supported basis
5. the teacher can evaluate the learning results on computer-supported basis, the same applies to counselling
6. the teacher is supported in the administration and distribution of learning material

ad 1) The learners themselves determine their learning processes. This does not exclude the assistance of the teacher and counselling in questions of which methods and ways to choose. The teacher acts in an advisory capacity to the learners. The learners have to organize their learning processes and learning material on computer-supported basis to improve the generation of knowledge. Learning material has to be structured in order to file it in a computer which supports an intensely studying of the material. The learners first have to comprehend the material's contents before being able to structurize it. If the learners want to deepen their comprehension of the material at the later time, they will be able to retrieve it faster because it is filed under significant terms.

ad 2) Interchanging contact with fellow learners is a crucial requirement for successful learning, because it enables the learners to control their comprehension of the learning material. This has two advantages: firstly, the necessary verbalization of knowledge requires consideration and thus promotes the process of comprehension, and secondly, the learners have to compare their knowledge with the interpretations of their fellow learners. The generation of knowledge thus becomes a social process, which is the only way to generate sustainable knowledge.

ad 3) The learners are free to include material of their own choice into the learning process and thus are not restricted to the material provided by the teachers.

ad 4) Courses in accordance with the hands-on approach require a complex planning. The teacher has to consider in advance possible and

necessary learning goals and themes, and the methods to be used. The teacher has to be able to provide the learners with corresponding tasks at any time. The teacher thus needs tools to visually support the planning. In order to avoid unnecessary researching, the learning material has to be filed in a structured way.

ad 5) The teacher has to counsel the learners quickly and individually, therefore he needs tools to quickly depict important information and learning processes. It would be desirable if the computers were able to propose suitable measures.

ad 6) There have to be tools that facilitate the safe and easy exchange of digitalized learning material to ensure a frictionless data exchange between teachers and learners.

The above discussed criteria only serve to render the learning process more efficiently. The following subchapter will deal with secondary criteria, i.e. with demands from interest groups which do not primarily focus on the aspect of knowledge imparting.

4.1.2 Secondary criteria for the learning scenario

There are some political and economical requirements on learning scenarios and learning objects. These requirements, however, do not necessarily improve the quality of teaching.

1. learning scenarios, learning contents and learning modules have to be comparable
2. they have to be reusable
3. they have to be suitable for commercialization

ad 1) The comparability of learning scenarios has frequently been demanded for by political side. This means, a method is looked for that allows to evaluate the efficiency of learning scenarios. First steps have been taken by introducing standardized tests at secondary level I with the intention to assure a minimum amount of quality of degrees. This raises the question how to define quality in teaching. A possible answer will be discussed below.

ad 2) The creation of good digital contents is very expensive, thus contents have to be reusable, i.e. the contents have to be created in a way that allows to apply them in as many learning scenarios and factual contexts as possible.
ad 3) Contents have to be suitable for commercialization because of the cost-intensive developing.

4.1.3 Quality in teaching

The topic of quality in teaching is passionately discussed among experts. There are different approaches on the qualifying of teaching, e.g. trying to apply industrial standardizations on teaching, or trying to evaluate the quality of teaching by analysing exams and their results. Evaluation systems and surveys (held by questioning the learners) are to contribute to an objective qualification of teaching. Educationalists will notice that these efforts help to define and qualify everything but teaching itself. This problem can only be solved by answering the question, “What is the aim of teaching?” The answer is rather simple. The learners want to broaden their knowledge by acquiring factual knowledge and want to enlarge their scope of action by acquiring media proficiency. They furthermore want to acquire physical capabilities in e.g. sports, craft, music, or art. This answer provides the solution for quality assurance. The provider (teacher) defines along with the learning unit the learning goal, which shall be achieved by the customer (learner) after having participated in the course or having worked on the learning unit. In order to achieve this, the teacher during the operationalization phase has to define precisely and openly which results and activities are expected from the learners, so that it is possible to judge whether the defined goal has been reached by the learners or not. These requirements are then used as parameters that facilitate the following evaluations:

1. the learners have reached the learning goal, thus they have met the requirements that have been defined during the operationalization phase

2. the learners have not yet reached the learning goal, that means it has to be examined whether they failed to reach it because they did not sufficiently work on the learning unit.
3. the learners have not yet reached the learning goal, thus is has to be examined whether they failed to reach it because the teacher did not sufficiently assist and support them

The teacher should therefore record the learning process in order to be able to prove he has provided the necessary support all the time. This can help to avoid false estimations in the cases 2) and 3).

This approach should be sufficient to guarantee high-quality teaching because:

1. the teachers' work is open to evaluation, thus it is possible to compare intention and result,
2. the teacher must have a critical look at the goals of the learning unit and must examine its coherence.

Quality assurance is thus an integral part of the planning of a learning unit.

4.1.4 Tasks of the teachers

Teachers who develop and apply a learning scenario that bases on constructivistic knowledge have to prepare the lesson in a way rather different from the usual preparations. This type of learning scenario allows the learners to become active, so that the course of a learning scenario can never be predicted or predetermined. It is possible, however, to consider possible courses of action in planning and to prepare suitable concepts of responding. Teachers have only limited ways of influencing the learners' strategies of action during the learning scenario because the motivation of the learners would decrease, if the teacher's influence would increase. This is why the teacher has to have methods and tools at his disposal that allow him to:

1. plan the learning scenario as optimal as possible
2. monitor the learning process of each single learner

3. recognize learning problems and respond to them
4. keep an overall view of the teaching and learning process
5. efficiently take influence on the learning process without giving up the principle of free learning scenarios
6. contact the learners both as individuals and as a group in an easy and simple way
7. have at his disposal well-structured learning material that is organized in accordance with the learning scenario
8. distribute the learning material to the learners in a simple and smooth way

Teachers can hardly meet the above mentioned requirements without the support of a computer, because too much of their time would be consumed by administrative tasks. The above described specifications for tools allow to define the tasks of the "new teacher" which are now:

1. to plan a learning scenario from its beginning to the end (formerly: the teacher would plan the course by the hour, would determine the subject, the learners would have to adapt to this)
2. to evaluate each learners' previous knowledge
3. to develop individual learning strategies in cooperation with the respective learners
4. to compile special methods and material for the learners to enable them to continue with the work on their own.

4.1.5 Tasks of the learners

The learners, too, have to cope with a work flow more complex and demanding than the work flow required by usual learning scenarios. They have to learn how to act, and thus to take the responsibility for what they do or not i.e. it is mostly them who are responsible for their learning success. The learners not only have to deal with the learning material provided by the teacher but also are responsible for choosing the suitable material. Experience has shown that learners willingly take this new re-

sponsibility, they are however confronted with the usual difficulties in learning when they enter the learning phase. It turns out that the process of acquiring knowledge will not be substantially changed by the new technique, if the methodology is not changed fundamentally. The knowledge of constructivism can usefully be applied here. Group discussions have proved to be the best way of acquiring knowledge, for the participants have to deal with the subject of discussion beforehand and then have to present their knowledge to the group and to correct it, if necessary. The following tasks can be derived from the considerations presented above:

1. the learners have to set up their own learning strategie (their personal work flow)
2. they have to compile their learning material on their own, i.e. choose, evaluate, and classify it
3. they have to interchange their knowledge and experiences with fellow learners
4. they will be counselled by the teacher in questions regarding their learning strategies
5. they inform the teacher about the state of their previous knowledge
6. they cope with their tasks out of interest

This list of task clearly shows that the learners have to cope with a workflow far more complex than the work flow of usual teaching methods. To enable the learners to concentrate on the proper learning process, they need to be supported by computers so that they do not have to spend too much time on administrative tasks. The learners thus need tools that support them in the following tasks, or that cope with the following tasks automatically:

1. to plan and visualize learning strategies
2. to compile learning material
3. to file the learning material in a structured and context-related way
4. to interchange learning material with fellow learners in an easy and frictionless way

5. to contact fellow learners and the teacher in an easy and frictionless way
6. to document their knowledge
7. to make their knowledge available to the teacher
8. to document their learning processes and work flow and to make them available to the teacher
9. to compile their own learning material

4.1.6 Self-regulated learning

Within the subject of TUD (*Technologie und Didaktik der Technik* – technology and didactics of engineering), the term “self-regulated learning” is used to describe a learning process that meets the above described requirements on teachers and learners. Currently discussed definitions of self-regulated learning will be left out in favour of a more restricted conception. This approach offers better possibilities to control the learning process with regard to the learning success. The learners’ scope of action seems to be restricted by these demands which are, however, necessary to assure the quality of the learning units concerning media proficiency and subject-related knowledge. (In technology, standard problems can be solved quickly and successfully by using some proven methods. Students should be familiar with these methods and be able to apply them when they have finished a learning unit so that they have the same capabilities as other students.) In the context of TUD, self-regulated learning describes a process that is initiated if the students realize that their knowledge is not sufficient to solve the problem they are trying to solve. They have to fill up the gaps in their knowledge which then enables them to continue their work. This means, their state of knowledge determines the course of learning by determining the contents and the methods that have to be learned in order to reach the learning goal. The students cannot skip this steps, because the teacher has defined a learning goal and the subject-related knowledge and the methods are indispensable to reach the learn-

ing goal. Self-regulated learning in its purest form allows the learners even to determine the learning goal and to evaluate whether they have reached it. There is no possibility to control the learning process or to take quality-assuring measures, because all parameters are open and the learners themselves can decide whether they have reached the learning goal with their achievements.

The gaps in the learners' knowledge become apparent, when they are working the tasks which offers them the possibility to fill these gaps. This concept bases on constructivistic cognitions. The learners' previous knowledge will be explored to serve as a base on which to establish further knowledge.

4.2 Possible solutions

The previous subchapters generally described a learning scenario that meets the requirements on modern teaching methods. In the following, a concept will be outlined that makes use of the possibilities of modern technology in order to support both the teacher and the learners.

The system should facilitate the interchange of data and information as well as their administration. It should allow to store data on the teachers and the learners PCs as well as on joint servers.

It has proved useful to use tree structures when planning a learning scenario in accordance with the hands-on approach. Tree structures are suitable when the relations between problem-oriented questions, tasks, and hierarchies of learning goals are to be depicted in a well-structured way. Furthermore, learners can document their solution for a particular problem with a tree structure. Tools that enable the teachers to compare tree structures would provide them with a valuable instrument for the evaluation of the learners' state of knowledge. Well-structured compilations of tree structures combined with other materials would allow to respond to the learners' demands quickly and to provide them with suit-

able learning materials. This compilations would furthermore help the teacher to structure his materials and to organize their courses.
With these tools, the teachers could manage most of the organisational tasks which would assure that planning and teaching were supported by technology.
Communication between the teacher and the learners should be improved by a better integration of the available communication tools (e-mail, chat, video conferences, forum, etc.) into the platforms. Export of information from one tool into another has to become faster and more simple. The same applies to the integration of information into the existing knowledge structures.
A permanently up-graded data bank with all subject-related knowledge would prove useful.

4.3 State of technology

The requirements that were described under 4.2 can be realized independently from each another with several tools. However, it is rather laborious to exchange data and information with their help, thus it is not suitable for practical purposes. It is possible to compile tree structures with the necessary links, too, but there are no supporting tools to render it more efficiently. According to information scientists it is also, possible to compare the students' tree structures, but suitable criteria still have to be defined. They even claim that it could be possible to realize the above described learning scenarios in a completely automatical form with the help of modern data processing mechanism (Datamining). This would just require a well-structured and an almost complete planning of the learning scenario. Didactical scientists criticize these approaches much the same way they did with cybernetical didactics. According to them, there are too many restrictions for the learners and it is impossible for the teacher to realize a complete planning because of too many unpredictable factors.

There are first considerations in order to examine the facts. Theoretically, there could be only a limited amount of possible ways to solve a problem. This thesis would apply to the fields of technology and natural sciences. It then would be possible to develop systems that enable to counsel students by relating to their tree structures and in a way that leads them to a solution. These systems would be developed by using structured data banks of knowledge and problem-solving strategies and by using Datamining and would be applied in technological and scientific subjects. If such a system would function in practice and if the aspect of the social generation of knowledge would be integrated into such a learning scenario, it would provide us with a tool that would facilitate a high degree of automation in the imparting of knowledge.

There is a great amount of regulations and relations which have to be recognized and defined beforehand if the system shall function. Research in this field would improve teaching a lot. Teachers could accompany their learning scenarios by tools that are suitable both for planning learning scenarios and documenting of learning processes. This would allow to draw important conclusion from the first evaluations that will be useful for further learning scenarios. By means of the summarized information from several learning scenarios it would be possible to draw conclusions for automized learning scenarios and thus to establish rules for them.

5 Summary

A plain “NO” is the answer to the question posed in the article’s title. Although the foundations are the same, essential features have changed and thus there is no retrogression. There are efforts to automize learning, this time in a way that leaves the learners some freedom of choice concerning the course of learning. It is still questionable whether it is possible to realize a computer-assisted learning scenario that meets the requirements on the learners’ scope of action and the necessary processing. Learning scenarios of this kind are based on a huge amount of rules and

knowledge. However, the contrary could prove to be the case: that the necessary knowledge and the set of problem-solving strategies could be limited to an amount that is easy to administer. Future research will have to answer these still open questions.

6 References

Bader R., Jenewein K. (Hrsg.): “Didaktik der Technik zwischen Generalisierung und Spezialisierung“, Frankfurt am Main, Verlag der Ges. zur Förderung arbeitsorientierter Forschung und Bildung, 2000

Cube, F.: “Kybernetische Grundlagen des Lehrens und Lernens“, Klett, Stuttgart, 1965

Foltz, Ch.: “Lehrmaschinen“, Beltz, Weinheim, 1965

Helmar, F.: “Lehrmaschinen in kybernetischer und pädagogischer Sicht“, Klett, Stuttgart/München, 1963

Jank, Werner: “Didaktische Modelle“, Cornelson Sciptor, Berlin, 2002

Jantke P., Wittig W., Herrmann J.: “Von e-Learning bis e-Payment 2002“, Tagungsband LIT’ 02, Akademische Verlagsgesellschaft Aka GmbH, Berlin 2002

Jantke P., Wittig W., Herrmann J.: “Von e-Learning bis e-Payment 2003“, Tagungsband LIT’ 03, Akademische Verlagsgesellschaft Aka GmbH, Berlin, 2003

Meyer H.; “Unterrichtsmethoden I: Theorieband“, Cornelson Scriptor, Berlin, 1997

Meyer H.; “Unterrichtsmethoden II: Praxisband“, Cornelson Scriptor, Berlin, 1997

Meyer H.: “Leitfaden zur Unterrichtsvorbereitung“, Cornelson Scriptor, Berlin, 2001

Ropohl G.: “Allgemeine Technologie, Eine Systemtheorie der Technik“, 2. Auflage - München, Wien: Hanser 1999

Sekundarstufe II Gymnasium/ Gesamtschule Richtlinien und Lehrpläne MSWWF für das Fach Technik, NRW 1. Auflage 1999

Integrating "New Media" with an Educationally Meaningful Learning Environment

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Abridged Version

An extension of media proficiency with adequate consideration of didactic aspects to support learning with multimedial contents can considerably improve study skills. In this context not only the appropriate dealing with New Media is important but also their adequate use during lessons and in education. New Media should be used while taking into account didactical, methodological and psychological aspects. At present, a primary characteristic of learning with multimedial contents is the use and work with learning- and communication platforms; therefore it has a technological character. However, in addition to specific scientific requirements (*technology-product-oriented*), didactic criteria (*pedagogy-process-oriented*) are increasingly gaining importance. Apart from creating contents, the problem of its standardised structuring and implementation remains unresolved. It is also true that those in charge of learning- and communication platforms tend to favour a behaviourist approach in terms of their learning theory, which is no longer contemporary. A three-stage didactic model approach can intensify collaboration between technicians, pedagogues and organisers with respect to effective e-learning support. In addition to passing on media proficiency, in terms of sustainability, didactic added value, which can be achieved through adequate e-learning, is of central significance.

1 Point at issue

As information technological basic education focused on New Media is gaining importance, didactic, methodological and therefore also aspects relating to learning objectives and learning psychology are explicitly to be taken into account [1]. Moreover, particularities and framework conditions of whatever is relevant for learning with multimedial contents must be included. This means each subject has a particular characteristic which has to be strictly followed. In practice, however, besides some stipulated mini-

mum criteria, a certain universality is often attributed to learning- and communication platforms in view of their fields of application. The existence of suitable content is simply taken for granted and the possibilities of standardisation are not debated.

Platforms such as WebCT, Blackboard or OpenUSS – to mention just some - are pointing to the right direction, but they are not universal and therefore not unrestrictedly applicable in any one subject. In this context WebCT and Blackboard are expensive commercially oriented products and OpenUSS has an insufficient administration for users and groups in place.

Available media for learning with electronic means are substantially characterised by the type of respective mediation (CBT, WBT, LMS, etc.). There is not a single learning- and communication platform on the market which is able to satisfy **all** specific requirements.

Therefore, the following question needs to be asked: *how is a didactically justified learning with multimedial contents through adequate use of New Media to be supported?*

2 Model Approach

To any user standardised content should be available in a specifically structured form in a pool. In addition to search options and possibilities of a theme specific restructuring it should also offer consideration of didactical aspects. On this basis, contents that would give meaning to the use of a learning- and communication platform could eventually be prepared. A theme specific restructuring of content can be realised by using a modular approach. In this context, a staggered learning with multimedial contents is preferred to a learning through an exclusive use of learning- and communication platforms. A prerequisite is the media proficiency of the individual, which can go clearly beyond the mediation of information- and user specific basics and which is therefore in parts tied to specific characteristics of individual disciplines.

Within the faculty of Technology, an intensive mediation of media proficiency can primarily be achieved in the area of transcription of information via computer controlled events. At the same time this will provide an improvement of study skills within the faculty of Technology. In this context, the didactic added value which can thereby be achieved is of central importance.

The subject technology, at the university of Duisburg-Essen, Campus Essen, has developed a *three-stage model,* which has been specifically adapted to its requirements for the learning with multimedial contents. It is organised in three inter-dependent stages in a discursive form:

- stage 1: standardised construction of multimedially oriented objects
- stage 2: structured storing of objects and restructured combining of objects to learning objects (learning modules, learning units, courses)
- stage 3: the use of structured learning objects by using learning- and communication platforms in presence courses.

In order to enable the realisation of this model for other disciplines, a conception is necessary which has been adjusted to each organisational and personal environment and adapted to the requirements and conditions of individual faculties.

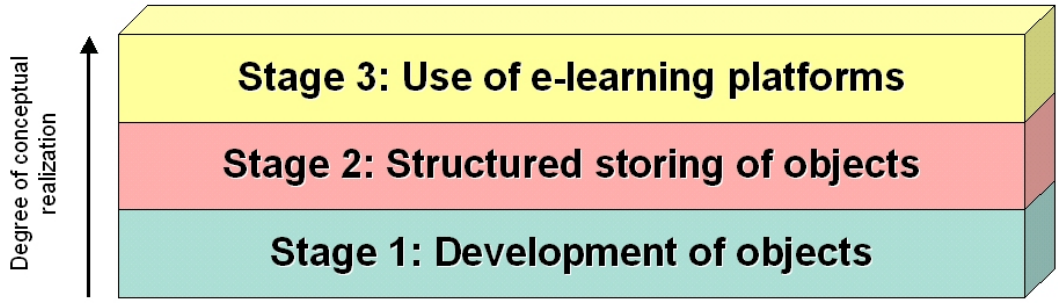

Figure 1: Three stage model for the learning with multimedial contents

A graphic illustration of the three stage model (figure 1), by specifying the **degree of conceptual realization**, points to the stages which build on each other. It thereby reveals all the way from the *standardised creation of*

content through storing and combining *structured contents* to their final use in *e-learning* or blended learning which evolves from it. In this way, didactically based learning with multimedial contents can be supported.
Before thematic conclusions can be derived from this model approach, a clarification of related terminology within the framework of New Media is required.

3 Multimedial Aspects

The notion of multimedial learning including New Media requires a terminological definition of multimedia as an integral part of New Media.
Multimedia is essentially characterised through four properties [2]:

- *Digitalisation of content:* saving and processing different analogue carriers of available data (sound-, picture-, film material, etc.) is carried out on the basis of digitalising methods.
- *Computer based integration of content:* the computer as a tool of digitalisation of data available in analogue format is an integral part of working with different media types. Content oriented structuring is carried out through the use of databases.
- *Multi-modal and multi-codal presentation of content:* In addition to using several sensory organs (multi-modal) such as vision and hearing, different character- and symbol systems, i.e. different formats for coding and encoding (multi-codal) information are used for understanding.
- *User controlled interactive use of content:* in connection with constant representation of relevant objects, there are possibilities of a direct physical manipulation of objects as well as carrying out incremental and reversible operations.

Multimedial learning and the use of New Media is closely related to learning- and communication platforms for e-learning or blended learning. A learning- and communication platform, no matter if it is a VLE, an IDLE or

a LMS, has to have certain stipulated minimum criteria available. These are amongst others:

- avoidance of proprietary standards (by using Open Source Software)
- integration of common MIME types (for the purpose of standardisation)
- modular construction and extending options (under consideration of didactic aspects).

4 Didactic Aspects

In addition to these characteristics which are stipulated for every learning- and communication platform learning can only take place by taking account of generally acknowledged, learning objective oriented and proficiency oriented as well as learning psychology based criteria. Taking into account the most recent debates, which suggest that a "learning objective orientation"[1] is no longer contemporary and favour so called "self regulated learning" on the basis of a constructivist approach [3], there are still certain proven and established factors, which can be very helpful for learning with New Media. It would go too far to introduce didactical aims in terms of analysis and planning of different didactical models at this stage.
The extensive learning objective orientation of curricula[2] requires consideration of an adequate pedagogic intention during the planning of multimedial learning. Therefore, it appears useful at this stage to refer to the "learning objective oriented didactics", of which fundamental aspects have been outlined by Wolfgang Klafki in the “Critical-constructive Didactic” [4]. Particularly in view of the generation of learning objects there is need for an unambiguous definition of **what** is to be learnt. In this context, the following terms should provide an appropriate and comprehensive foundation:

[1] The classic notion of learning objective orientation is closely related to the model of "curricular didactics". The notion of learning objective however remains in this context untouched.
[2] This is referring to the curricula in general, however especially those within the faculty of Technology.

- *Learning objective orientation:* This notion is representing the "objective oriented decision for a certain content" defined by Klafki. In this context, Klafki is talking about the primacy of the objective decision [5]. The determination of a theme or theme area is dissociated with a mere definition of the matter and associated with an objective that is relevant to the object. What it means in practice is, that a subject can only become a theme if it has been selected with respect to a question that is considered pedagogically relevant to be treated in a course. The notion of a theme therefore comprises the objective under which the selected matter is treated in addition to the matter itself. To put it simply: in addition to asking **what** (object) is to be taught it is essential to ask **why** (objective) it should be taught when defining a theme!
- *Learning taxonomy:* an approach oriented to a learning objective is always directed towards a change in behaviour of the target group in the area of cognition in terms of affect and psychomotor [6]. Within the curriculum of the faculty of Technology, this implicative relation becomes very clear through proficiency descriptions, such as e.g. "…ability and preparedness to independently … work on problems", "ability and preparedness, to reflect and evaluate … chances for development and restrictions", "the ability and preparedness to perceive and understand social relations and conflicts…" [7]. The notion **ability** addresses the cognitive and psychomotor dimension. The notion **preparedness** points to the affective dimension. This shows that learning objectives from these three dimensions do not exclude each other but condition each other. The three dimensions mentioned in this context are in a hierarchical order [8]:

    Cognitive dimension: this concerns thought, knowledge, problem solving, background knowledge and intellectual ability. Learning objectives of this dimension are in an ascending hierarchical order according to the degree of their **complexity**:

knowledge, comprehension, application, analysis, synthesis, evaluation.

Affective dimension: this is about changes in interest, about the preparedness to do something or to reflect something, about attitudes and values as well as the development of durability of values. Learning objectives of this dimension are also in an ascending hierarchical order according to the degree of the **internalisation** to be effectuated: receiving, responding, valuing, organise, characterise in a value structure.

Psychomotor dimension: this addresses manipulative and psychomotor abilities. They are also in an ascending hierarchical order according to the degree of **coordination**: perception, set, guided response, mechanism, complex overt response, adaption.

In particular works on the cognitive dimension have already been published by Benjamin S. Bloom in the 1950s. Defining learning objectives in the affective dimension are primarily to be traced back to David R. Krathwohl, those in the psychomotor dimension to J. P. Guilford. The demand for dimensions and hierarchy of learning objectives developed at the time is recognised up until the present day. Naturally there would be many more aspects to be mentioned that are very relevant for an effective learning. The fact is however that this will increasingly be the task of communication- and learning platforms in terms of realising e-learning or blended learning within the framework of a constructivist approach.

- *Central learning objective:* defining a central learning objective provides a specification of the objective within the theme area. This should reveal what is to be learnt beyond the dealing with the subject and what is to be made available in a **transferable** form. This learning addition can be legitimised through the specification of further sub-objectives (refined objectives).

In any case, for the definition of learning objectives it is important to specify the didactically added value (time economy, motivation, communication, evaluation, etc.) with respect to the e-learning which evolves from it, or, whether the intended learning objectives can also be achieved with other, particularly traditional methods.

5 Standardised content

An undeniable prerequisite for supporting learning with multimedial contents is the existence of content. It is available in very different formats and can be identified via the associated MIME type or via their filename endings. By using only three lower case letters for filename endings these would add up to 26^3 different possibilities, hence far more than 17,000 different file formats. This vast variety means that temporary, multimedial, web based, proprietary, antiquated and non standardised formats are included.

Up until quite recently it used to be a common practice, within the framework of using New Media, to produce unstructured content and make it available to the user, no matter in what way. Just gradually the view, that in addition to scientific requirements *(technology product oriented)* didactical criteria *(pedagogy process oriented)* are increasingly gaining importance [9].

This fact is directly leading to the debate on a standardisation for the development of content. It needs however be considered that each content that is to be developed has a very specific target group. This requires additional user specific and learning psychological issues to be considered. It is not sufficient, for instance, to be able to control a commercial application for the generation of simulations (e.g. Flash) in terms of programming it. In fact the programmer needs to be clear about:

- in which specific discipline,
- for which clientele and
- for which learning objective

the content to be developed can be used. Only under consideration of this conditions a programmer will be in a position to programme meaningful interactive elements in a multimedia framework. These decisions can however only be made in a professionalizing process within the framework of sensible collaboration between programmers, scientists and pedagogues.

In addition to the incurring cost for the creation of content, other matters that need to be dealt with in this context include questions regarding the copyright and right of use [10]. These are far from being tackled within the framework of New Media. A revision and amendment of legislation for the "regulation of copyright in the information society" is currently delayed due to differences in opinion between the Bundestag and the Bundesrat. The point at issue is primarily regarding copyright of private norm-works and private copyright [11].

As it is the case that the right of use for many contents which are very suited for lectures and seminars is not only with the publisher but also with associated service providers and authors, only one reaction can evolve from there: *any content must be of one's own making!*

6 Structured content

A sensible description of content through structured data records in order to safely find relevant information even after long periods is an old problem which has apparently still not been solved to a satisfactory level.

An example: "In the mid 90s more than 1.2 million magnet tapes with data from 30 years of space travel had become useless – in part because they were insufficiently assigned to previous space missions and projects. They call it the 'NASA-effect': the tapes were either not, or only poorly labelled" [12]. There is need for a long term solution not only for scantly developed possibilities of labelling in data records but also for problems that regard of inter-operability and portability.

Content descriptions through metadata offer a possible basis to resolve these problems. For metadata, which should be satisfactory for the criteria of inter-operability and portability, syntax as well as semantic are important.

Unfortunately there are very different concepts for an implementation of metadata records for all different areas. Only some of the important ones are to be briefly mentioned at this stage [13]:

- (X)HTML-Metatags[3]
- DCMI[4]
- RDF[5]
- IEEE LOM.

None of these metadata concepts are universally suited. Each is specially made for certain areas of application:

(X)HTML-Metatags provide a metadata structure which is indexed by most Internet based search engines but they are unsuitable for a profound description of content in the form of learning objects. The use of XML would offer a solution. Unfortunately, XML is complicated, can't present web pages and only describes their desired basic structure. And the final implementation must be made with HTML-derivatives, StyleSheets, scripting languages and external files.

The *DCMI* [14] provides a set of 15 basic elements for a structured description of objects. The integration into HTML is carried out with the support of Metatags, those in XHTML or XML by using RDF. The description record after Dublin Core stands out because of its simplicity, for semantic compatibility, for international concordance as well as flexible extensibility and progressive compatibility with RDF. It provides standardised semantic information via digitalised contents. The conventions after DCMI are entirely supported by W3C and they are described concisely in RFC 2413 and in RFC 2731. The IEEE LTSC specifies this coherence.

[3] XHTML on the basis of HTML 4.0 in terms of XML, offers extended specifications.

[4] Further concepts such as GEM, Warwick-Framework and IMS all use simple description elements of Dublin Core in varying degrees of complexity, extensibility and profoundness.

[5] The concept PICS was a precursor of RDF and presented a simple metadata mechanism for the purpose of evaluating web contents.

RDF [15] enables inter-operability between different web based applications and there is an exchange of metadata. The primary goal for developing RDF was to make semantics for databased processing available. It needs to be taken into account that RDF does not define any syntactic conception for metadata and has not been defined by any XML-DTD either. RDF is exclusively defined by an EBNF.
The standard specified by *IEEE LTSC* and suggested in the standardisation IEEE 1484.12 [16] of the LOM Working Group does in fact provide comprehensive approaches for a systematic structuring of objects but it is highly complex and does not offer any generally accepted description format for multimedially focused elements.
It can generally be pointed out "that the exchange, the sharing of learning objects between platforms based on standards is a central, and in many cases unsolved problem" [17]. Meanwhile, in addition to approaches on the bases of the SCORM reference model, there are other approaches on XML basis [18] to ensure exchangeability and reusability of learning objects.

7 e-Learning

As already mentioned under point 5, e-learning or blended learning requires intensive consideration on a *technology product oriented* level as well as on a *pedagogic process oriented* level in order to reach an appropriate implementation of intended objectives.
The *technology product oriented* level is about the technologically relevant, implementable and administrative side of e-learning. Apart from the simple question which communication- and learning platform is to be suitably selected, the question about hard- and software is important.
This involves demanding requirements:

- The *hardware-side* requires a constantly available and reliably working network computer on a fail-safe basis (redundancy system).

- The *software-side* demands a reliably working operating system with effective rights administration and a proficient web server (UNIX or Linux, Apache).

It turned out from past experiences within the faculty of technology that a decentralised installation of a learning- and communication platform is more beneficial than a central one. Some of the reasons for this are faster administration and better access opportunities. In this context, aspects regarding hardware in view of fail-safety as well as software in vies of updating are to be taken into account. A very fundamental knowledge in the area of computer hardware and respective operating system and the actual learning- and communication platform is required. Such an extensive administration requires an intensive involvement with the respective computer system and can only be delivered on the basis of an adequately efficient media proficiency.

On the *pedagogy process oriented* level, the notion of e-learning is deeply involved with the notion of e-teaching: both can be merged into the notion of e-education. Taking into account that not only the technological side plays a central role in this context but also the individual him- or herself, it is actually more correct to use the term "hybrid learning" or blended learning. This means that e-learning provides a methodological variant or complementary component within the individual learning process, which, if suitably applied, makes learning an objective oriented process. The model of self controlled learning is closely related but to be interpreted with care as the outcome of cognitive- and experiment-psychological research showed that the learner will often run into excessive demands [19].

Understanding e-learning as a superordinate for software based learning, the computer must not necessarily be in the centre of this form of learning. The fact is that e-learning enables place- and time independent learning.

Numerous trade fairs, international congresses, seminars and workshops are dealing with the central subject of using New Media and related e-learning in education (ICTE [20], PATT [21], LIT [22], TERC [23]). The essential point of these events can be described in one sentence and

outlines the overall situation of e-learning: "During the authors‘ debate on developing learning techniques, the central question, which of the two was more important, technology or pedagogy, overruled the issue that learning is a social process which involves exchange and care as well as learning objectives and control over whether they have been achieved" [24].

At this stage it becomes clear that behind every communication- and learning platform exists an organisational- and learning theory, which developers and users are only aware of in a minority of cases. Traditional education often requires only a minimum input while the creation of contents for e-learning demands a team of experts. However, it is the didactical concept in addition to expert knowledge that is essential.

Particularly in academic education which represents a blend between presence courses and virtual education the creation of time consuming media is not normally required. It turned out that for time efficiency, large quantities of material are accepted on paper while specific topics and short presentations are better based multimedially and interactively [25].

The three-stage model (standardised creation of content, structured content, e-learning) has proved itself at the University Duisburg-Essen, Campus Essen within the faculty of Technology. The didactical conception for learning with multimedial contents attached to this model contributed to questions not only of scientific contents but also of didactical aspects apart from issues regarding standardisation and structuring.

The success of this model was possible via a systematic implementation of it. Based on a L.A.M.P. approach, a multimedia database with integrated developing environment has been set up, by which stage 2 of this model was implemented. During the work with the multimedia database (MMDB-TU) didactical aspects of multimedial contents are emphasised and required from users. The export-function of learning objects enables an interface for follow up e-learning within the framework of a learning- and communication platform.

On recommendation of the faculty of Technology the learning- and communication platform ILIAS is now used at the University of Duisburg-

Essen, Campus Essen and centrally administered through the university's computer centre.

Conclusion

Standardised creation of content is carried out in compliance with the applicable copyright and right of use, in producing own work. In this context, an interdisciplinary collaboration between technicians, pedagogues, and organisers is necessary. In view of inter-operability, the implementation of standardised elements (MIME-type) is to be taken into account.

There are opportunities to publish already existing multimedially oriented elements on the basis of DCMI in W3 because DCMI has been standardised as a classifying description of semantic information via W3C. In this context and in particular with respect to portablity, proven markup language such as HTML or XHTML should be used for the time being. XHTML can prepare the way for later use of XML and RDF. Also, this step requires a clearly more intensive consideration of pedagogical and learning psychological intentions within the framework of learning objective oriented didactics (learning objective orientation, learning objective taxonomy, focus on learning objective).

A more detailed consideration of selected learning platforms such as Blackboard or WebCT, mentioned above, reveals the commercial background of the operators. For small university divisions that want to subscribe to e-learning these products are rather unsuitable. However, the Open-Source-Community offers alternative learning platforms such as ILIAS or OpenUSS. It should be mentioned that according to experience, these products often have quicker and better support available than their commercial partners as problems arise. It can be said that a decision in favour of LMS ILIAS is easy to take as OpenUSS, as mentioned above, has an insufficient administration for users and groups in place. Moreover, ILIAS is geared towards metadata standards and so far the specifications of DCMI and IMS have, amongst others, been taken into account.

Legend

CBT:	Computer Based Training
DCMI:	Dublin Core Metadata Initiative
DTD:	Document Type Definition
EBNF:	Extended Backus-Naur Form
GEM:	Gateway to Educational Materials
HTML:	Hypertext Markup Language
ICTE:	International Conference on Technology and Education
IDLE:	Integrated Distributed Learning Environment
IEEE:	Institute of Electrical and Electronic Engineers, USA
ILIAS:	Integrated Learning-, Information-, and work cooperAtion-System
IMS:	Instructional Managing System
L.A.M.P.:	Linux, Apache, MySQL, PHP/Perl
LIT:	Leipziger Informatiktage
LMS:	Learning Management System
LOM:	Learning Objects Metadata
LTSC:	Learning Technology Standards Committee
MIME:	Multipurpose Internet Mail Extensions
NASA:	National Aeronautics and Space Administration
OpenUSS:	Open University Support System
PATT:	Pupils' Attitude Towards Technology
Perl:	Practical Extraction and Report Language
PHP:	PHP Hypertext Preprocessor
PICS:	Platform for Internet Content Selection
RDF:	Resource Description Framework
RFC:	Request for Comments
SCORM:	Sharable Content Object Reference Model
SQL:	Structured Query Language
TERC:	Technology Education Research Conference

TUD:	Technologie und Didaktik der Technik an der Universität Duisburg Essen, Campus Essen
URI:	Universal Resource Identifier
VLE:	Virtual Learning Environment
W3:	World Wide Web
W3C:	World Wide Web Consortium
WBT:	Web Based Training
XHTML:	Extensible Hypertext Markup Language
XML:	Extensible Markup Language

References and Links

[1] Aufenanger, S.: Lernen mit neuen Medien – Mehr Wissen und bessere Bildung, Presentation: education quality forum, Series of Presentations: Wirkungen und Wirksamkeit Neuer Medien in der Bildung, 21,22/11/2002, *pdf-Dokument:* http://www.erzwiss.uni-hamburg.de/Personal/Aufenanger/Vortraege/Lernen mit neuen Medien Dortmund_Handzettel.pdf, referenced: 09/02/2003

[2] Blumstengel, A.: Entwicklung hypermedialer Lernsysteme, Berlin, Wissenschaftlicher Verlag Berlin, 1998, ISBN: 3-932089-13-8

[3] Siebert, H.: Pädagogischer Konstruktivismus, 2. completely revised and extended edition, Unterschleißheim/München, Luchterhand, 2003, ISBN: 3-472-05317-8

[4] Klafki, W.: Studien zur Bildungstheorie und Didaktik (Book on Demand), Basel, Beltz Verlag, 1995, ISBN: 3-4071-8092-6

[5] Dohnke, H.: Lernziele, Studienseminar Sek II Recklinghausen, *Webpage:* http://www.learn-line.nrw.de/angebote/lakonkret/, referenced: 16/02/2003

[6] Mager, R. F.: Lernziele und Unterricht, Weinheim, Beltz Verlag, 1994, ISBN: 3-4072-5156-4

[7] Technik, Sekundarstufe II, Gymnasium/Gesamtschule, Richtlinien und Lehrpläne, Nr. 4726, Frechen, Ritterbach Verlag, 1999, ISBN: 3-89314-629-6, S. 6ff

[8] Bloom, B. S./ Krathwohl, D. R.: Taxonomy of Educational Objectives, Boston, Addison-Wesley Verlag, 1984, ISBN: 0-5822-8010-9

[9] Baumgartner, P./ Häfele, H./ Maier-Häfele M.: E-Learning: Didaktische und technische Grundlagen, Sonderdruck, Perg: CD Austria Verlags- und Handelsgesellschaft mbH, 2002; als *pdf-Dokument:* http://iol3.uibk.ac.at:8080/filer/peterManilaWebsite/peter/material/e-learning_sonderheft.pdf, referenced: 19/02/2003

[10] Update-Advice-Service in multimedia right for universities, local ministry of schooling, science and research of the federal state North Rhine-Westphalia, Völklinger Straße 49, 40221 Düsseldorf, Tel.: +49 211 89603, Fax: +49 211 8964514

[11] Institute for copyright and media right, registered association, implementation of copyright reform subject to further delay, *Webpage:* http://www.urheberrecht.org/news/?id=1295&w=&p=1, referenced: 25/05/2003

[12] Rathje, U.: Technisches Konzept für die Datenarchivierung im Bundesarchiv, in: Der Archivar, Mitteilungsblatt für deutsches Archivwesen, Edition 05/2002, Volume 2, Düsseldorf, Nordrhein-Westfälisches Hauptstaatsarchiv, 2002, ISSN: 0003-9500

[13] Holzinger, A.: Interoperabilität und Metadaten, Workshop on the 2nd Business Meeting "Forum Neue Medien", Wien, 2001, *pdf-Dokument:* http://serverprojekt.fh-joanneum.at/sp/thema/meta/metadaten.pdf, referenced: 20/02/2003

[14] Dublin Core Metadata Initiative, *Website:* http://dublincore.org, referenced: 20/02/2003

[15] WorldWideWeb Consortium: Ressource Description Framework (RDF). *Webpage:* http://www.w3.org/RDF/, referenced: 20/02/2003

[16] Institute of Electrical and Electronic Engineers, Learning Technology Standards Committee, IEEE 1484.12 LOM-Working Group, *Webpage:* http://ltsc.ieee.org/wg12/index.html, referenced: 26/03/2003

[17] Interoperabilität und Metadaten, Themenworkshop am Wirtschaftsförderungsinstitut, Wien, 2001, *pdf-Dokument:* http://serverprojekt.fh-joanneum.at/sp/thema/meta/metadat-wsp.pdf, referenced: 14/07/2003, III

[18] Finsterle, L./ Rotard, M.: Mit konventionellen Autorensystemen zum E-Learning Portal, in: Klaus P. Jantke, Wolfgang S. Wittig, Jörg Herrmann (Publisher): Von e-Learning bis e-Payment, Berlin 2002, Akademische Verlagsgesellschaft, AKA, ISBN 3-89838-033-5, pp 111-121

[19] Weinert, F. E. (Hrsg.): Enzyklopädie der Psychologie, Volume 3, Psychologie des Unterrichts und der Schule, Göttingen, Hogrefe Verlag, 1997, ISBN: 3-8017-0539-0

[20] Wehling, J.: Lehrerausbildung für das Fach Technik im Gymnasium im Bereich “Informationstechnologie“, in: Technische Bildung, Ansätze und Perspektiven, 1st Edition, Frankfurt am Main, Lang Verlag, 2002, ISBN 3-631-38548-X, pp 261-266

[21] Wehling, J./ Haupt, W.: Data structuring of online-based courses for technology education, PATT-12 (Pupils' Attitude Towards Technology) conference for Optimal Use of Resources in Technology Education, Cape Town, South Africa, Beute (Publisher), 2001

[22] Langkau, T./ Rudolph, C./ Wehling, J./ Haupt, W.: Multimediales Lernen im Fach Technologie und Didaktik der Technik, in: Klaus P. Jantke, Wolfgang S. Wittig, Jörg Herrmann (Publisher): Von e-Learning bis e-Payment, Berlin 2002, Akademische Verlagsgesellschaft, AKA, ISBN 3-89838-033-5, pp 276-289

[23] Wehling, J./ Haupt, W.: Multimedia in Technology Teacher Education, in: Learning in Technology Education: Challenges for the 21st century, Volume 2, Gold Coast, Queensland, Australia, Centre for Technology Education Research, Griffith University, 2002, ISBN: 0-909291-74-8

[24] Schneller, A.: E-Learning tritt auf der Stelle, in: c't, Magazin für Computertechnik, Ausgabe 05/2003, Hannover, Heise Verlag, 2003, ISSN: 0724-8679

[25] FH Joanneum, Serverprojekt 2002, Newsletter August 2002 – Neue Medien in der Lehre, *pdf-Dokument:* http://serverprojekt.fh-joanneum.at/noflash/new/archiv/august2002.pdf, referenced: 25/02/2003

A Modular Development Approach

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Table of Contents

Abridged Version

A database, which is based on a developing environment offers a possible approach to generate learning modules for e-learning. The basis for these are simple objects (texts, pictures, animations, videos, etc.), which are available in a structured form. With the developing environment one can combine objects to learning modules with new focus areas and re-enter them back into a database. In this way learning modules of a higher order can be created and these offer very flexible ways of use, which is due to their modular structure. These learning modules can finally be used for an e-learning in learning platforms.

1 Intention

Within the framework of technologies that are relevant for the Internet, the area of multimedia plays an increasingly important role. However, in order to use New Media in a meaningful way, it is absolutely necessary for all those who want to deal with these media to broaden their media proficiency. This is to be achieved on the basis of some basic education in information technology.

The contradiction, that not everybody can be an expert in all areas, but that at the same time demand for expertise exists in all areas, can only be resolved by giving all participants the opportunity to make their knowledge available in a structured way via simple but comprehensible interfaces. It follows that every potential user with some basic education in information technology should be able to use these interfaces even without specialist knowledge.

They are realised in a modular approach and a developing environment based on a database offers a convenient way to generate, amongst others, new learning modules with other focus areas. This developing environment offers a high degree in flexibility in dealing with New Media.

And it can compose contents that are systematically grouped with the support of metadata in a structured way and with new focus areas.

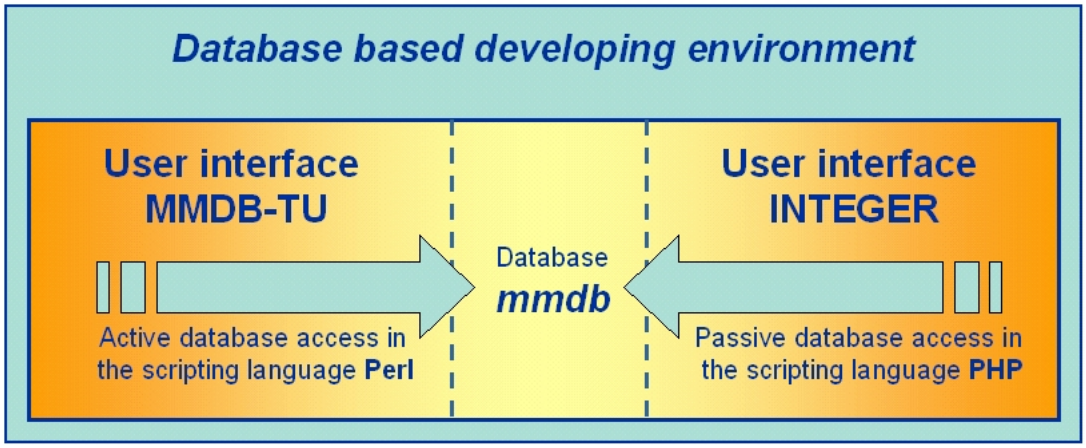


Figure 1: User Interfaces MMDB-TU and INTEGER

2 Modular Approach

The modular approach mentioned above has been realised in various projects within the faculty of Technology and Didactics of Technology TUD within the framework of technology teacher education [4]. It is essentially about the development of teaching and learning modules for the faculty. [5] The term module has been defined as follows: a module consists of at least two objects, which have been joined together into one coherent unit. An object is the smallest undivisible coherent unit (e.g. a picture, a closed text in any one subject, an applet, an animation, etc.). Modules are exclusively available in XHTML-format.

Objects/modules are always described through meta-information and entered into the database *mmdb* via the user interface MMDB-TU. DCMI is providing the basis for a classification in this context [6]. Its approach is informed by the RFC No. 2731 [7]. The conventions of the DCMI are explicitly supported by the W3C [8]. DCMI provides a basic set of 15 meta-elements in order to simplify the search for data of this class. These 15 basic elements (DC.Title, DC.Creator, DC.Subject, DC.Description,

DC.Publisher, DC.Contributor, DC.Date, DC.Type, DC.Format, DC.Identifier, DC.Source, DC.Language, DC.Relation, DC.Coverage and DC.Rights) have to be linked to XHTML-documents in the form of meta-data. For a complete classification, in addition to the 15 basic elements, further element refinements are to be considered. Amongst others, these are: DC.Creator.Email, DC.Subject.Keywords, DC.Relation.IsPartOf, DC.Relation.References.Attributes, DC.Relation.References.Functions and DC.Relation.References.Fields. The latter three element refinements take into account the conception of the Dublin Core, which allows for self-developed elements to be used in order to integrate specific information.

A module has a technology specific expansion, which also allows an integration into technology specific areas and into fields of engineering sciences.
This technology specific, expanded classification follows the scheme of technical devices according to G. Ropohl [9]. In addition to the general criteria of order (attributes), such as material, energy and information, system specific additions (functions) are also possible: transformation, transport and storing. The resulting attribute-function-matrix describes four fields of application, which allow a more refined classification of the information. These fields of application are: supply and disposal, transport and traffic, information and communication, automation. For instance the theme “transmission of information via optical wave guides” [10] can be found in the field of application called information and communication, and the attribute of information is assigned to the function of transport.
The database *mmdb* has been designed on the basis of this modular approach and only takes in data in a strictly structured form. It is a user interface, which has been specifically focused on technology teacher education for interactive dealing with multimedial contents. The basis of the MMDB-TU is the database *mmdb* and has been realised through a L.A.M.P.-approach (Linux, Apache, MySQL, PHP/Perl).

3 Concretisation

The approach according to L.A.M.P. is logically based on Open-Source-Products, which are available as free software. The widespread use of this approach is the result of the implementation of web-applications in professional areas through fail-safe web servers / database servers / file servers. Such systems provide the basis for a focused use of PHP and MySQL in this field. The scripting language Perl is additionally used, not only because of its modular structure but also because of an unintended separation of code and layout for administrative purposes, as well as for the generation of dynamic websites. For instance, every authenticated entry/change of objects/modules in the database *mmdb* as well as their confirmation/assessment by the database *mmdb* is exclusively realised through Perl scripts.

Objects with zipped record description files attached (zip-format), can on a system-administrative level be parsed by a Perl script and in this way automatically be read into the MMDB-TU.

Simple keyword searches and their logical associations are realised through the use of PHP. In this case PHP is the programming language, which is easier to use in order to specifically address the database *mmdb* with MySQL-commands which have already been implemented. A keyword search will generate a result page of objects/modules which can be structured according to the user's requirements, e.g. according to attributes, functions, weighting of keywords according to the frequency of their appearance, etc. Also controlled by PHP, modules with a new thematic focus can be composed from the results and viewed online.

Perl scripts will finally ensure that modules with a new focus can be re-entered into the database *mmdb* or sent to the user as an e-mail attachment. Almost all websites (whether realised in Perl or in PHP) have been provided with JavaScript elements in order to offer maximum efficiency to the user in dealing with the system. In particular, this language has been

used for the implementation of help-functions, information windows and the generation of templates. In May 2001, a computer was set up on a raid system under Linux with the functions web server, database server and file server. Since November 2001 it has been available for registered users under the URI http://www.mmdb-tu.de and http://www.integer-tu.de.

4 User Interface MMDB-TU

Every object which has been entered into the database *mmdb*, regardless of which type of format, must be described in a data record according to DCMI. The user interface MMDB-TU has templates and various input masks available in order to instruct the user correctly. It is possible to generate complete XHTML files with a DCMI data record inserted into their header, or to produce data records according to RDF [11]. The header of the XHTML file will refer to an external RDF-based record description according to DCMI.

The user himself is responsible for entering a data record, which describes the respective object as concisely as possible and in as much detail as necessary. The object is entered into the MMDB-TU exclusively on the basis of this information. It is possible at any time to change object data, which has been entered. Moreover, a help function has been implemented, which provides detailed examples and explication for entering objects and the formulation of basic elements according to DCMI. At the present time (October 2003), the following file formats can be entered into the database *mmdb*: htm/html, txt, jpg, gif, class and swf. In the near future, a gradual extension with the file formats wav and mpg/mpeg is planned. Further formats will follow upon request by the user community.

Every entered object, apart from its name, receives a definite object-ID. The respective user, as well as the system administrator of the database, *mmdb* are both informed about all entries. Every user has the opportunity to administer his entered objects/modules via his user specific, password protected access. A SSL support for such operations is currently planned.

Once the objects have been entered, they can be composed into modules via the user interface INTEGER, which allows different or completely new focus settings.

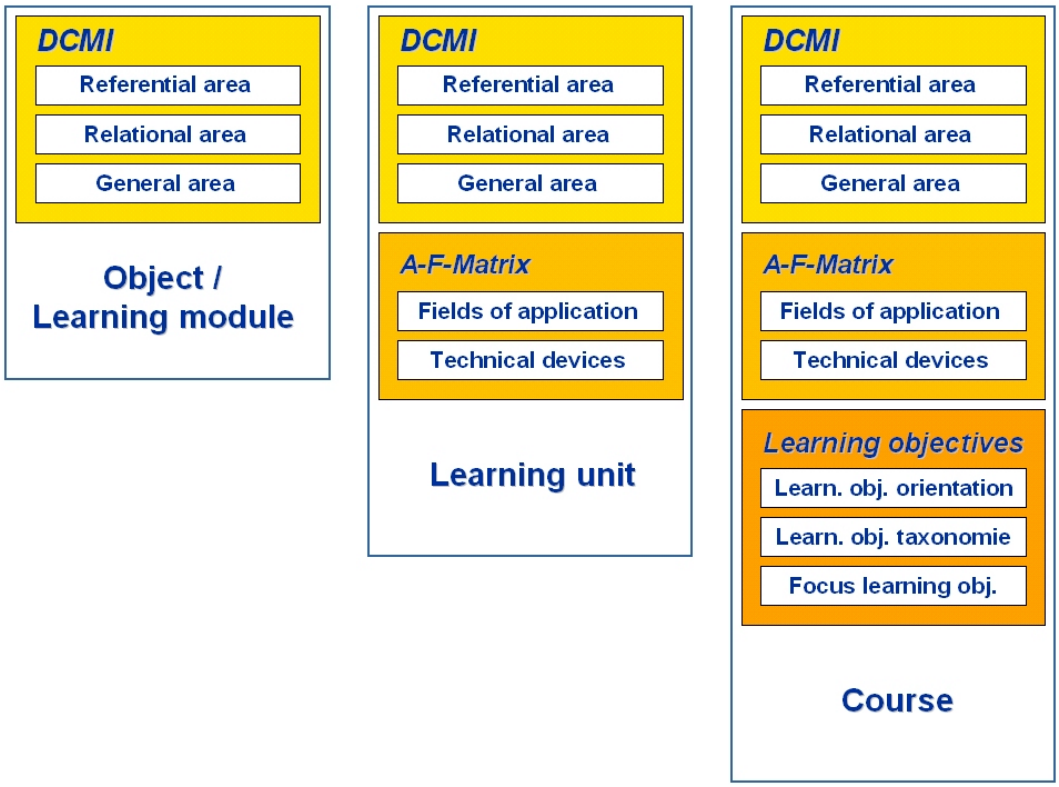


Figure 2: Modular structure (active access): entry of objects/modules

5 User Interface INTEGER

The user interface INTEGER contains a search engine specially programmed for the database *mmdb*. One or several keywords, which can be inter-connected by logical associations are searched. This search can be narrowed, amongst others by previously selected elements from the attributes-functions-matrix. Based on the search results the opportunity to build modules of a basic type or of a higher order from existing objects/modules can be used. The most basic module (module of the basic class), as mentioned, consists of at least two objects. Such a module is

described as a learning module below and can be re-entered into the database *mmdb* under a new record description according to DCMI.
During the generation of modules the user can decide himself which type of module is to be generated. Essentially, learning modules, learning units and courses are to be distinguished.
Learning modules: during the generation of a learning module any chosen number of objects can be combined independently from the selected topic area.
A learning module (module of the basic class) consists of at least two objects. It is generated from a thematically unbiased list, which returns a search to the database *mmdb* as the result of a pure search. When saving to the database *mmdb*, a new data record according to DCMI is to be set up.
Learning units: when generating a learning unit, thematically clearly related contents, therefore closed contents, are created. A learning unit (module of the top class), or proposal, is generated from a thematically weighted and inter-linked list, which, depending on the weighting, returns the result of an enquiry. When saving to the database *mmdb*, an entry into the attributes-functions-matrix must be made in addition to a new data record according to DCMI.
Courses: when generating a course, closed contents are represented under aspects, which are specific to the area of application.
A course (module of the hyper class), or variant, is generated from a thematically weighted and inter-linked list with a specific focus (from the area of the attributes-functions-matrix). When saving to the database *mmdb*, learning objective criteria (e.g. lecture- and class relevance) must be stated in addition to the entry of a new data record according to DCMI and to the new entry in the attributes-functions-matrix. Such a course therefore includes a didactically and methodologically well-founded procedure when choosing the topic area to be studied. It is retrievable with the additional use of learning objective oriented criteria.

Apart from its feature to generate modules, INTEGER thereby provides focused search options for the database *mmdb*. On the basis of a search term, and directed by search masks it is possible to search combinations of attributes, functions and fields of application and also to consider didactic aspects. With every found object (as for instance Gif-animations, Flash-simulations, Java-applets, HTML-texts) or module, the user is able to see the contents and attached data record description according to DCMI. He can in this way carefully decide which objects/modules he needs in order to generate a new individual module with a focus of his choice. After this he has the opportunity to enter the generated module into the database *mmdb* and a new description, matching the newly chosen focus, must be made. When viewing the search results, the user can finally make a simple assessment of objects/modules. He thereby makes a contribution to the maintenance and basic evaluation of the database. A final decision on the continued existence of the, in this way, evaluated, data, however, remains the responsibility of an editorially based administration.

New modules, generated by the user, are retrievable online at any time with suitable search criteria. It is also possible to have objects/modules sent by e-mail attachment in a zip format in order to enable continued work on them. In this context, legal issues (user- and copyright, etc.) have not yet been considered.

It needs to be mentioned that the user interfaces MMDB-TU and INTEGER, on the basis of the database *mmdb*, have not established an online system for evaluating self-assessment studies. Their collaboration makes modules available, which can be entered in existing e-learning platforms, ILIAS or OpenUSS. This fills the gap between mere contents and structured learning objects which are required for the use of learning platforms.

Target groups are universities and general education schools as well as teachers and students. In addition to specialist, subject related issues, also didactic aspects have been taken into consideration.

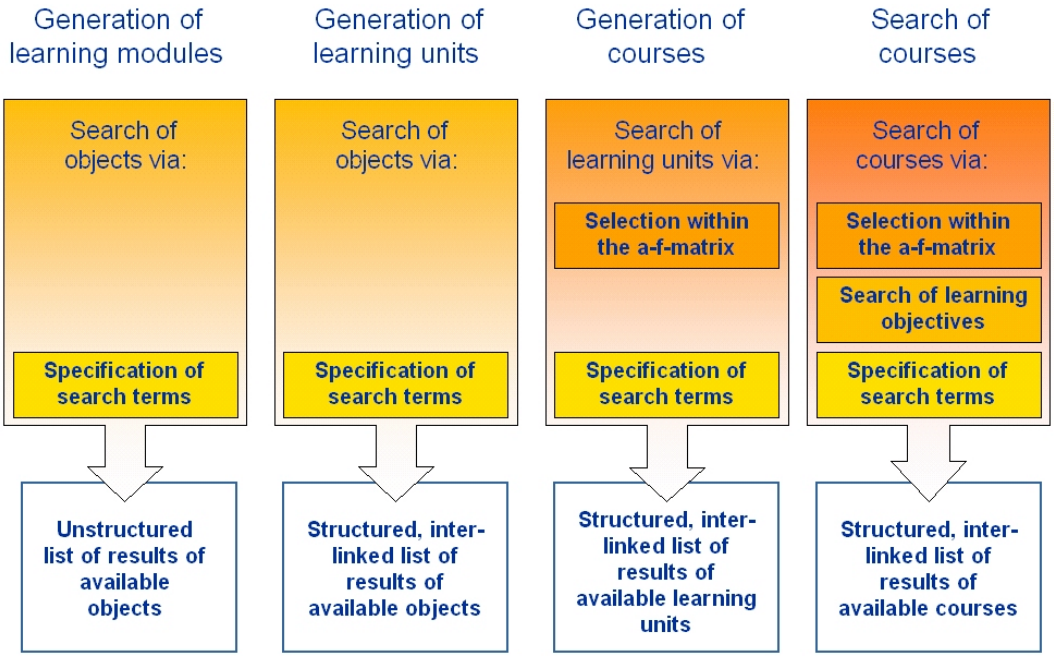


Figure 3: Modular structure (passive access): search of objects/modules

6 Assessment

A further element of the modular approach is the **modular coupling** which offers the option for an assessment of existing objects/modules. In this way it is possible to assess online any objects/modules available via the database *mmdb*. The additional option for assessment is databased and inseparably connected to the contents of the database *mmdb*[6]. The author of an object/module is thereby prompted to consider the scientific correctness of his information. The following picture (figure 4) shows an example of a graphic visualisation of a form of Snellius' law of refraction, as an object with the affiliated object assessment.

By programming, a frame-structure is created which offers the option for assessment in the upper frame and shows the actual object/module to be assessed in the lower frame. The degree of usability can be selected by grading between *1* to *5*: *high* to *medium* to *poor* in the upper frame. In addition to this, the frame contains information on the *theme*, the *object/module-ID* and the e-mail address of the *author*. The median as-

[6] For this purpose there is a particular entity-set.

sessment of the object/module can only be viewed after submitting one's own assessment, hence after pressing the assess button.

This simple form of assessment has been chosen in order to offer the opportunity to the user community to administer their objects/modules themselves. Via e-mail, every registered user can draw the attention of the author of an object/module to possible corrections that might have to be carried out. After a time, set by the administrator of the database *mmdb*, all objects/modules are automatically checked in view of the assessments that have been submitted, and, if applicable, they are removed from the database *mmdb*.

The user community is thereby prompted to deal in a self-responsible, hence consistent way with the contents of the *databased developing environment*. They are responsible for submitting and updating data records and ultimately they determine the existing database.

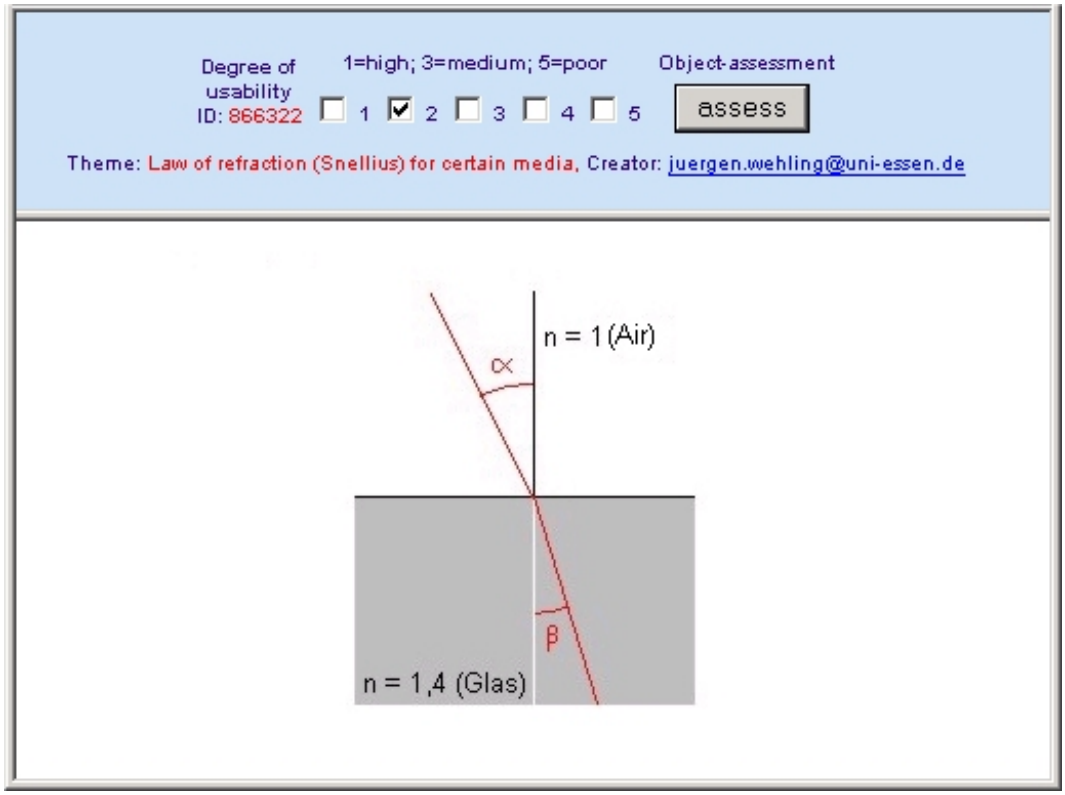


Figure 4: Modular coupling of object and object-evaluation

Summary

With the user interface MMDB-TU and INTEGER, on the basis of the database *mmdb*, education-relevant, technology specific issues and topics as well as correlated areas can individually be very specifically composed under consideration of engineering scientific criteria. Topics in different degrees of complexity can be retrieved and developed auto-didactically. Learning modules, learning units and courses can be set up online [12]. It should be mentioned at this stage that the *database based developing environment* is not only available to the circle of people mentioned above but from January 2004 to any registered user. By then, any legal issues will have been largely dealt with. The database *mmdb* provides an interactive basis for dealing with New Media and is therefore an instrument for the achievement and enhancement of individual media proficiency. Only the ability of INTEGER to generate modules and then write them back into the database *mmdb*, offers the opportunity to test these modules in different learning platforms under evaluating criteria. [13]

In this way, the *database oriented developing environment* provides an interface, which is easy to handle by any user in order to generate modules on the basis of basic objects as well as more complex specifications. And these can ultimately be integrated into learning platforms in order to contribute, as learning objects, to a more effective e-learning.

Screenshots MMDB-TU / INTEGER

The two screenshots following demonstrate the ability of the MMDB-TU for the entry of objects in different ways (Figure 5) as well as the use of INTEGER for the generation of a new learning unit (Figure 6). Both user interfaces are available under the known URI http://www.mmdb-tu.de and http://www.integer-tu.de .

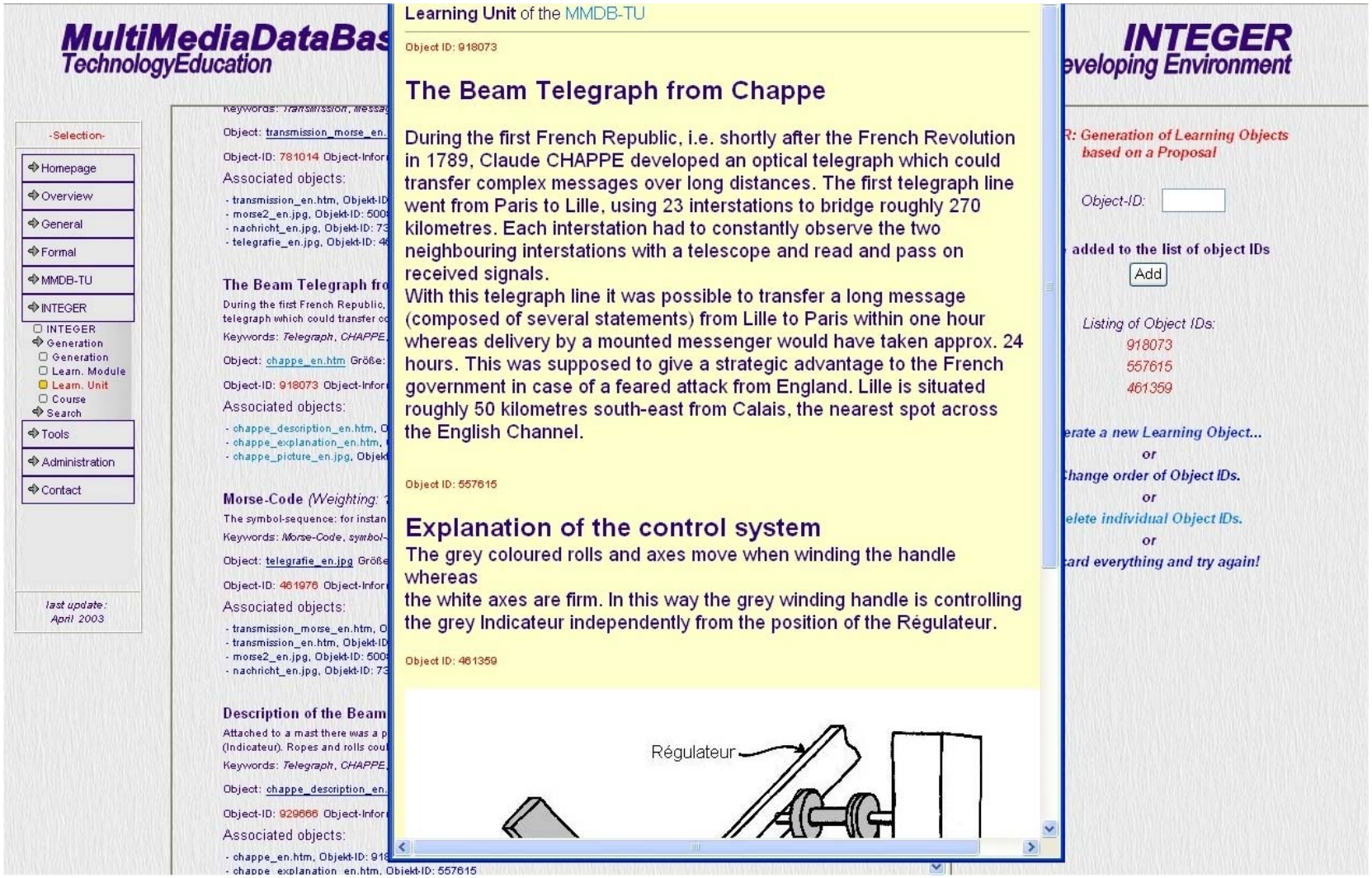


Figure 5: Generation of a learning unit

Figure 6: Entry of objects

MultiMediaDataBase
TechnologyEducation

INTEGER
Integrated Developing Environment

-Selection-

- Homepage
- Overview
- General
- Formal
- MMDB-TU
  - MMDB-TU
  - Entry
    - Entry
    - Object
    - Module
    - Extension
  - Correction
  - Generators
- INTEGER
- Tools
- Administration
- To the Author

last update: September 2003

MMDB-TU, Entry: Object

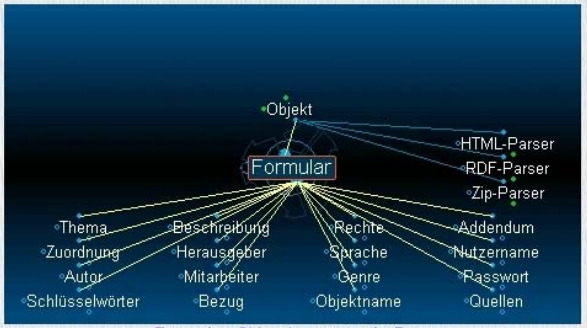
The term **object** stands for the smallest, not further divisible element, which can be part of a module. A module is composed of at least two objects.

In this way, an object can be e.g. a picture file (image.jpg) or an unformatted ASCII-text (description.txt). The entry-masks by which objects can find access to the MMDB-TU offer the possibility for searching their own data carriers for the object to be transferred. Once the object has been chosen, a transfer and an entry of the object into the MMDB-TU will follow.

The MMDB-TU offers multiple options to enter an object. In addition to the username and password, only e.g. a file has to be named which contains the object and/or the description of the object. It is possible to enter an object

- by means of a form, (*.htm, *.html, *.shtm, *.shtml, *.txt, *.jpg, *.gif, *.class, *.swf)
- on the basis of HTML, (*.htm, *.html, *.shtm, *.shtml)
- by using an associated rdf-file, (*.htm, *.html, *.shtm, *.shtml, *.txt, *.jpg, *.gif, *.class, *.swf) mit *.rdf
- via transfer of a zip-file.

The last option is reserved for administrative purposes.



Entry of an Object by means of a Form

After a successful entry a confirmation page will be issued which informs the user about the object-ID under which the particular object is stored inside the MMDB-TU. All specifications that have been made on the object can be found there. Specific details on the object which did not have to be explicitly specified by the user can also be transferred; e.g. the MIME-type of the object or its size. At the same time the user will receive an automatically generated e-mail which again contains all the relevant data for the object as well.

E-MAIL feedback@mmdb-tu.de

Legend

DCMI:	Dublin Core Metadata Initiative
HTML:	Hypertext Markup Language
ILIAS:	Integrated Learning-, Information-, and work cooperAtion-System
INTEGER:	INTegrated developing Environment for the GenERation of learning modules, learning units and courses
L.A.M.P.:	Linux, Apache, MySQL, PHP/Perl
MMDB-TU:	MultiMediaDataBase for Technology Education
OpenUSS:	Open University Support System
Perl:	Practical Extraction and Report Language
PHP:	PHP Hypertext Preprocessor
RDF:	Resource Description Framework
RFC:	Request for Comments
SQL:	Structured Query Language
SSL:	Secure Sockets Layer
TUD:	Technologie und Didaktik der Technik an der Universität Duisburg Essen, Campus Essen
URI:	Universal Resource Identifier
W3C:	World Wide Web Consortium
XHTML:	Extensible Hypertext Markup Language

References and Links

[1] Wehling, J./ Bhattacharya, D.: "New Media in Technology Education: University teacher education for courses Information Technology", Mottier/De Vries, PATT-11 conference, Haarlem, Netherlands, 2001

[2] Haupt, W./ Wehling, J.: An online based learning module: "Optical Wave Guide" in technology education, N. Beute, PATT-12 conference, Cape Town, South Africa, 2001

[3] Langkau, T./ Rudolph, C./ Wehling, J./ Haupt, W.: Multimediales Lernen im Fach Technologie und Didaktik der Technik, in: Klaus P. Jantke, Wolfgang S. Wittig, Jörg Herrmann (Publisher): Von e-Learning bis e-Payment, Berlin 2002, Akademische Verlagsgesellschaft, AKA, ISBN 3-89838-033-5, pp. 276-289

[4] Entry portal to the projects of the faculty of technology and didactics of technology, homepage: http://lpf.tud.uni-essen.de

[5] Wehling, J.: "Technische Bildung. Ansätze und Perspektiven: Lehrerausbildung für das Fach Technik im Gymnasium im Bereich Informationstechnolgie", Europäischer Verlag der Wissenschaften, 1st Edition, 2002, ISBN 3-631-38548-X, pp 261-266 (also available as Special Edition)

[6] Dublin Core Metadata Initiative, DCMI, Homepage: http://dublincore.org

[7] Request for Comment, RFC, Homepage: http://www.faqs.org/rfcs/

[8] WorldWideWeb Consortium, Homepage: http://www.w3c.org

[9] Ropohl, G.: "Allgemeine Technologie. Eine Systemtheorie der Technik", Hanser-Verlag, München, 2nd Edition, 1999

[10] Asano, R./ Bhattacharya, D./ Wehling, J.: "Multimedia Module Optical Wave Guides", homepage: http://it.tud.uni-essen.de , 2001

[11] Resource Description Framework, RDF Vocabulary Description Language http://www.w3.org/TR/rdf-schema , 2002

[12] Wehling, J./ Haupt, W.: "Data structuring of online-based courses for technology education", N. Beute, PATT-12 conference, Cape Town, South Africa, 2001

[13] Wehling, J./ Haupt, W.: Multimedia in Technology Teacher Education, in: Learning in Technology Education: Challenges for the 21st century, Volume 2, Gold Coast, Queensland, Australia, Centre for Technology Education Research, Griffith University, 2002, ISBN: 0-909291-74-8

From the Toolbox
How to Make Best Use of XML
or
Practical Examples for Programming e-Learning Applications

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Table of Contents

1 Introduction

Creating a content is a time-consuming and laborious process. This is why any developer of a good content wants to be able to use it repeatedly. Thus it is undesirable that the content becomes useless after some time because programmes for its depiction are not available any more or because the respective institute, university, school, etc. has chosen a new platform. Depending on the content's quantity of data, one has to choose the right form of archiving to make sure that the content can be found at any time and does not get lost in a collection of data. Briefly said, the content shall be universally applicable and be easily found. The fact that programming requires structuring additionally supports a teacher in creating of contents and learning scenarios.

This article deals with these problems and shows possible solutions. The first item will be a rough specification that considers most of the requirements of the average content-developer and content-user. Subsequently XML will be introduced, a descriptive language that enables the user to meet the requirements of the specification. Some areas of application in which XML has already been used will be introduced in a further chapter. Having shown the capabilities of XML, the article then deals with tools that make it possible to apply XML. The fifth chapter will show a practical example of how XML is used in the subject TUD (Technology and Didactics of Technology, at the University of Duisburg-Essen, Campus Essen) not only to describe contents but also for the future planning of courses. Some tools, which have already been developed for future use, are represented in the penultimate chapter.

2 Specification of the features of contents

This chapter surveys the many requirements developers have to meet when creating a content. The given requirements result from the experiences gained from the subject of TUD (Technology and Didactics of Technology) as well as from demands expressed on conferences, workshops and other events on the subject of e-learning. This survey only

considers requirements of general interest, the many special topics are left out deliberately. Nevertheless, it will show that because of its free specification XML (eXtensible Markup Language) is excellently suitable for creating and describing contents, especially regarding specific requirements.
This chapter will chronologically work out the requirements in the normal order of appearance in the process of creating and applying a content. The features of content are strongly connected with the functionalities of the tools which are applied to create it. This is why the chapter does not work out the features of contents in the first place and then formulate the requirements on the tools, but will directly formulate the features both of contents and tools according to their mutual dependence.

2.1 Creating of contents

Content-developers have to decide first which editor to use for the development of the content. The construction of a simple text can turn into a complex problem. There are various possibilities to write a text, but the possibilities of depicting are limited by the editing programme chosen to create the text. Some examples will clarify this problem.
If a text is written with a word-processing programme, content-users have to use the same programme or will have to use a converter avialble to be able to work with the content. If this content is to be presented in the web in a different form, content-developers have no choice but to re-formate the content. There are a number of converters for word-processing, but concerning picture-files or sound-files converting is more difficult. Each different format requires a special viewer or player. Depicting picture-files can also represent a problem, if they are depicted in vector-format or in pixel-format. Converting a vector-format into a pixel-format does not represent a big problem, but in doing so important information gets lost and thus makes an adequate re-converting impossible. Converting a pixel-format into a vector-format is problematic as well and can also cause a loss of information.

The presented examples show the need for an editor that records only the basic information of the various objects. Concerning the text this means that only the factual part of the text, i.e. the structure (like headline, text body, quotation, formulae etc.) is captured. The format (typeface, page layout etc.) is not included. A concrete example will show the advantage of this approach. A mathematical formula for instance can be depicted in various types of formats. It can be plotted graphically (with a radical sign $\sqrt{\frac{1}{2}}$, integral sign $\int x$ etc.), it can be described with normal font (substitute symbols for the radical sign or integrals, fractions in sequential order: 1/2 instead of ½) or even in braille. If simply the mathematical information of the formula is described, then its form does not have to be chosen before publishing it.

The same applies to picture files: simply the content of the picture is stored without giving its features (like size, resolution, brightness, contrast, etc.), which are determined when presenting the picture. This approach has the advantage that a picture will always and in any size have an optimal quality. This is only feasible with a vector-format.

This also applies to problems regarding other digitally depicted objects: one has to find a depiction for objects which simply captures the basic information of the object.

Requirement on the editor: The editor has to facilitate the creating of format-reduced objects

This technique would allow to separate information from format and thus to publish the same contents of information in different formats. This results in the next requirement on the editor. The editor has to support the developer in creating format patterns that can transform the format-reduced objects of information into the format chosen by the user.

Requirement on the editor: The editor has to support the developer in creating format patterns

With these two requirements met, the creating of contents for any chosen platform or programme would be feasible. The adaptation to the platform

or programme would be carried out through the format pattern. The description of already existing solutions follows in chapter 6.

2.2 Description of the content

Once the content is complete, the developer wants to prevent it from disappearing in the data base. This raises the question of how to archive it and to optimize a method of searching it. Somebody who is searching a content wants to find only content that fits quite precisely to their search data input. They do not want to memorize key words but want the search engine to accept synonyms, too. This seems to be an unsolvable problem, however, currently there are intelligent search engines that are able to cope with it. Search engines simply need meta data as a basis for this function. Meta data are data that describe the content-object. The more meta data there are to describe an object, the more precisely and fast it can be sifted out from a data set. Concerning learning objects, several meta data models (LOMS, SCORM, etc.) have been specified. The problem with these models is, however, that they are scarcely applied, because of the great amount of meta data they specify. They specify data ranging from general details (like type of file, author, creation date, etc.) to didactic details. If one tries to look at an object from as many points of view as possible, the amount of its meta data can be astonishingly huge. This is why most developers do not put meta data on their contents. Specifying the content with meta data takes too much of their time and labour. A possible solution could be to consider the available meta data from the models as a data set from which to select data and then only to use those that are special for the user's particular fields of employ while the rest of the meta data is simply left out. The important thing is that the description of the meta data has been clearly defined once.
Furthermore, it would be desirable that users are able to adapt the meta data to meet their own needs, so that they can store contents according to their own criteria. One last important requirement on meta data is that an

object always be sent together with the meta data in order to prevent a loss of important information (like author, version, etc.)

2.3 Possibilities to combine contents

The last two paragraphs explained which criteria one has to consider when creating objects and how objects can be found after having archived them. The following will set up criteria for possibilities to combine objects. There are several possible ways how objects can be combined.

The objects can be arranged in a simple sequence (e.g. text, picture, text, window for a video)
The objects can be linked to other objects in other windows
An object shall be called up from within another object with an application, a viewer or player (opening of Excel tables, flash files, pdf files, etc.)
These are the most frequent ways how objects can be combined. Most operating systems and browsers support functions which make possible to combine and call up objects.
To ensure that objects can be combined, developers of content-objects have to meet some requirements. The objects have to be encapsulated so they can be recognized as objects by parsers or converters. The objects have to contain information about which additional programmes (parsers, converters, add-ons, etc.) are necessary to facilitate their integration into depicting platforms. If this information is given together with the object, parsers can be developed which independently integrate and link objects.

3 XML - The solution for all problems?

The above mentioned problems are solvable with XML. The following paragraph will introduce XML for a better understanding of the necessary processes.
XML – eXtensible Markup Language is a sublanguage of SGML - Standard Generalized Markup Language. As SGML is too complex a language for a developer to quickly learn how to use it, XML has been specified.

XML serves as a substitute for HTML (Hyper Text Markup Language), too. HTLM was initially developed as a descriptive language for the quick creating of structured documents without having to think about their final depiction. e.g. the author only has to define a line either as headline or as a normal text. The eventual way of depicting it is defined only by the browser or another tool of depiction.
As designing tasks are left to specialists, the author can concentrate on the main structuring and the content. The fast development and the increasing commercialization of the Internet necessitated more possibilities of designing web-contents. Thus the functions of HTLM had to be extended so that texts with preselected designs can be produced. This deviation from the basic idea of HTML requires languages more powerful than HTML. So XML has been developed as a subset of HTML. The difference between the two languages is that users are able to define their own tags in XML whereas they have to use pre-defined tags when applying HTML.

What is XML?
XML is a descriptive language which consists of tags and elements of text. A tag in XML is simply an agreement on where something starts and where it ends, the “something” being the element in XML.
Example:

<*HEADLINE*> *This is the Headline* <*HEADLINE*>

<*HEADLINE*> is the beginning of the headline

</*HEADLINE*> is the end of the headline

This is the Headline is the text of the headline

This way, any possible structuring can be realized on condition that there is a root-tag, so that all possible structures are based on a tree structure.

Example:

```
<DOCUMENT>
 <CHAPTER>
  <HEADLINE>
    This is the headline 1.
  </HEADLINE>
  <TEXT>
   This is the text.
  </TEXT>
 </CHAPTER>
  <CHAPTER>
  <HEADLINE>
    This is the headline2.
  </HEADLINE>
  <TEXT>
   This is the text.
  </TEXT>
 </CHAPTER>
</DOCUMENT>
```

It is obvious that this example shows a document with two chapters. It has a tree structure with DOCUMENT as root level and CHAPTER as branches. The chapters comprise the templates HEADLINE and TEXT as elements which can now be provided with features.

Example:

```
<CHAPTER NAME = "Chapter 1">
    I'm the first chapter
</CHAPTER>
```

NAME is the feature of the element *CHAPTER*. The value of the property is *Chapter1*.

The structure of an XML-document is defined by rules comprised in the specification of XML. These rules are of an unlimited character so that developers are quite free to realise a great amount of functions through their own definitions.

If everything is freely definable, this raises the question of how to use the documents. Browsers normally depict only the XML-text as it is given in the example above. Even the tree structure may be ignored, depending on the browser. So there has to be a parser which is able to interpret the elements and their features and which comprises rules for how to deal with the elements.

Parsers are able to transform XML-files in two possible ways. First, it is possible that the basic XML-file contains only basic information, similar to a data record. Now another XML-file is created which comprises rules of how to deal with every single datum of the basic information. The parser then transforms the data into the required form by using the transformation file. In this process it does not matter whether the transformation file generates a formatted text, or calculates, filters or in other ways manipulates the basic data. The second possibility is to create only one XML-file that comprises the information needed for the transformation along with the basic data so that the parser does not need another file. This approach has, however, the disadvantage of taking too many selections whilst entering the basic information and thus limiting a universal distribution of the information.

This shows that an XML-document alone is quite useless and that it takes a parser to reveal the advantage of XML.

What is this advantage? The advantage of XML is that it is a specified descriptive language. Various programming languages support these specifications with functions that allow to easily develop a parser which is able to evaluate a document and generate new ones. The specifications of XML allow to develop new languages in a short time which are optimized for particular purposes and applications. Up to now, many meta languages have been developed for special purposes (MathML for depicting mathe-

matical formulae, SMIL for integrating and controlling multimedia objects, SVG for describing drawings, etc.). One language has been developed exclusively for print media purposes which allows its users to quickly publish news in different formats of edition. This language facilitates an effective support of the work flow from entering the news to publishing them. Once the informational content of the news has been entered, different departments take care of the publishing (newspaper articles, website, broadcasting news, etc.).

4 Examples for successful XML-applications

Several applications have already been established in practice that successfully optimized the work flow of special fields. NewsML, VoxML, SMIL and MathML shall be introduced as examples in the following.

4.1 NewsML

NewsML serves to enter, distribute and publish news. The news is entered in NewsML. Along with its actual content goes a large amount of meta data which are necessary for the distribution of data. This standardization allows editorial offices to quickly buy news from the news agencies and to publish them in a format of their choice.

The basic condition for this is that all systems involved in the work flow are able to import and export NewsML.

4.2 VoxML

VoxML is used for interactive voice-activated applications. With VoxML it is possible to create service dialogues for automatic interactive helplines (as used at Vodafone or for the e-plus account server). The authors only have to follow a particular structure and thus are able to create dialogues between customer and speech processor in a simple way.

4.3 SMIL

SMIL is a descriptive language used for arranging multimedia applications. This language uses its own time model, so that different multimedia applications can be integrated according to the required time frame.

4.4 MathML

MathML is a descriptive language used for capturing mathematical functions. After integrating formulas with appropriate format patterns, they can be published in all sorts of formats (e.g. graphical depiction, spoken, in braille, etc.).

5 Example for the creation of content used for courses with problem-oriented hands-on approach

After having explained the basic features and capabilities of XML, a practical example shall serve to outline how to plan a problem- oriented hands-on course with the help of XML (basic concepts see C. J. Rudolph: *Teledidactics – From the cybernetic didactics of the sixties to constructivistic didactics and back again?).*

5.1 Description of the learning scenario

The scenario starts with a complex task which is to be dealt with by the participants of a seminar. The task is set in the form of a learning unit, which provides the students with a collection of material and with information about the learning goal, the standards to meet and the products to create in order to get their achievements certified. The students are to work independently on the task and to keep a record of their work, so that in each single phase of the work the teacher will be able to recognize the state of knowledge of each student and will be able to compare it to former phases. This requires a specification, so that this quite complex and laborious work can be done with the support of a computer. If students have

problems with the task, the teacher will support them with further learning units in order to help them to solve their particular problems on their own and to eliminate their problems' causes (the lack of knowledge concerning this particular problem).

The goal of this approach is to teach the students how to solve problems on their own. Therefore they are taught a strategy of solving problems to help them to successfully cope with standard situations by dividing the main problem into smaller, solvable sub-problems. In the course of this, they are to draw up a tree diagram of the problem in order to better understand the relations between its subproblems (Figure 1).

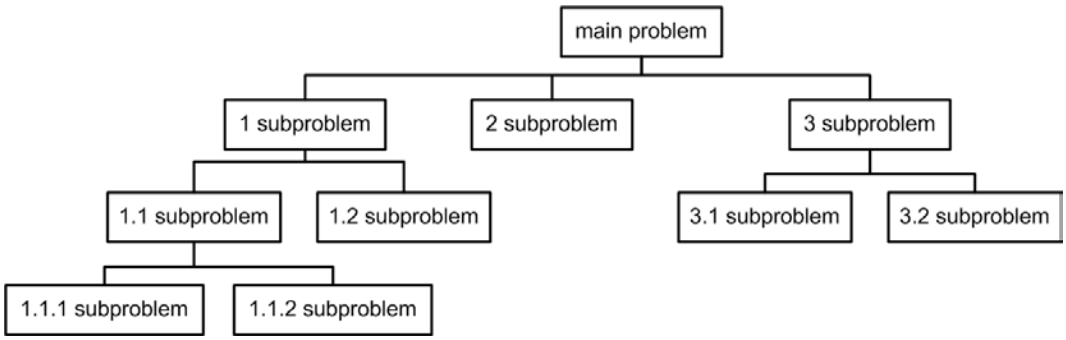

Figure 1: Structure of the problem

Such free and partially unpredictable learning scenarios require thorough planning by the teacher, if he wants to run the course successfully. The teacher also needs supportive computer tools to keep track of the organizational tasks and the didactic and technical interrelations. Furthermore he needs access to a well-structured collection of material to help him to support the individual students quickly and effectively.

5.2 Concrete realization of the planning phase

The following will show how XML can support teachers in planning a learning scenario.

Step 1: The teacher lays down the learning goal of his course

The students are to learn how to optimize a technological system

Step 2: Which sub-goals are needed to reach the main goal?

to analyse the systems

dividing into subsystems

to discern input and output

to discern features and functions of the system

to discern features that can be expressed as parameters

to discern interrelations between parameters and their functions

to adapt the single features and functions to the system in order to reach a higher degree of effectiveness

Step 3: Fundamental principles of the scientific and technical connections

This planning process may be supported by assistants that generate the following XML-document which represents a structuring of the educational object.

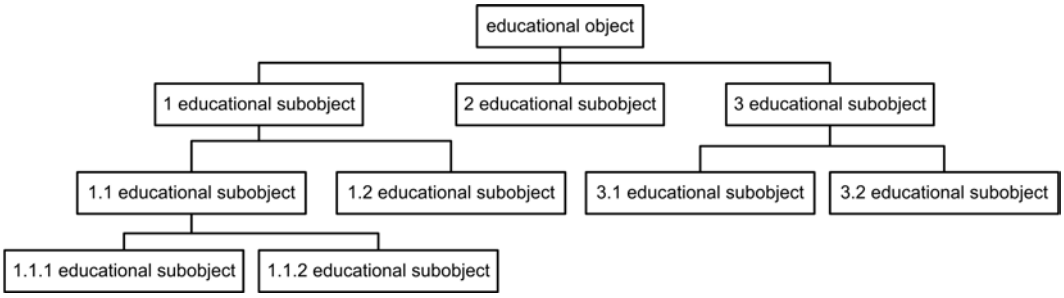

Figure 2: Structure of the educational object

The teacher defines down a hierarchy of the educational object determining firstly the main educational object of the course or a section of the course (Figure 2). Then the learning goals necessary to reach the main goal are depicted in a tree structure. Doing this, the teacher can decide on which learning goals he wants to put the focus of the course.

5.3 Defining the subject

The subject now is structured with regard to the pertinent connections and the educational object. These structures are depicted hierarchically, another tree structure is drawn which also comprises materials that are necessary or useful for the single areas of the subject (Figure 3).

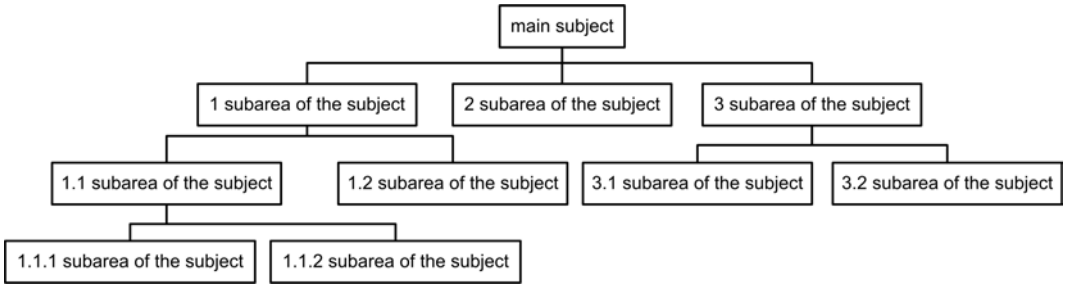

Figure 3: Structure of the subject

A hierarchy of the learning units can now be created based on the two previous structurings. A learning unit comprises the educational object of the learning unit, the strategies or means by which the students are to be enabled to solve the problems, the task itself and a collection of material.

5.4 Assistance for the student

The students also need some assistance in order to structure their learning process in a useful way. They need tools that enable them to administer their learning units, materials and strategies of solving problems. The students should be able to store their learning units in a structure of their own. This structure then is to be stored in XML, but shall be available on a graphic viewer for further editing. Figure 4 and Figure 5 show exemplarily the XML translation of the learning unit as well as a simple graphic depiction of the structure.

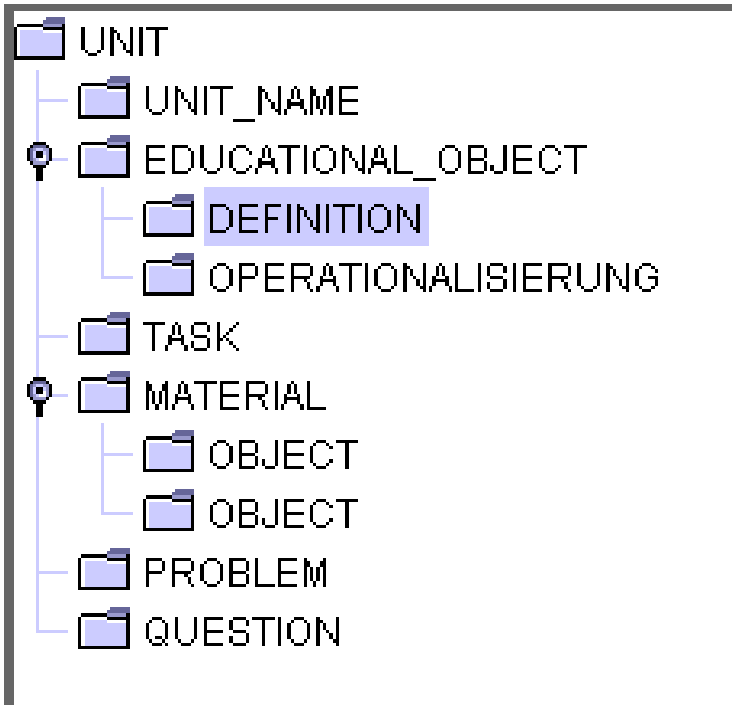

Figure 4: Tree structure of a learning unit

```
1:  <?xml version="1.0" encoding="UTF-8"?>
2:  <UNIT>
3:  <UNIT_NAME>Name of the unit</UNIT_NAME>
4:  <EDUCATIONAL_OBJECT>
5:          <DEFINITION>description of the educational object</DEFINITION>
6:          <OPERATIONALISATION>Products und results, showing the reaching of the educational
6:  object</OPERATIONALISATION>
7:      </EDUCATIONAL_OBJECT>
8:  <TASK>problematic nature</TASK>
9:          <MATERIAL>
10:         <OBJECT>Object name</OBJECT>
11:         <OBJECT>Object name</OBJECT>
12:     </MATERIAL>
13:     <PROBLEM>description of the problem, following from the problematic nature</PROBLEM>
14:     <QUESTION>questions, following from the problem </QUESTION>
15: </UNIT>
16:
```

Figure 5: XML - code view of a learning unit

6 Tools for developing and combining of content on basis of XML

Several tools for creating contents on the basis of XML are presently being developed. There are two different types of tools. The first type is developed for the depiction of contents and facilitates creating texts, formulae, pictures and graphic depictions (eg. OpenOffice with additional tools from

the University of Stuttgart for creating structured content, MathML, SVG, etc.). In addition, there are efforts to define suitable sets for the meta data. As was pointed out in chapter 3, there can be any amount of meta data, thus every author can decide which meta data are important for him. The description of the single meta datum ought to be standardized to enable other authors to find content-objects in data banks.

The second type of tools facilitates the combination of different content-objects. The application of these tools is to be kept quite simple, so some new languages have been developed (MathKit, SMIL, VoxML, etc.). The problem is that these developments still have to be brought in line with one another; this applies especially to teaching purposes. Some universities are currently working on this problem within the framework of the German Federal Ministry of Education and Research's project *Neue Medien in der Hochschule (New media at universities).*

7 Summary

XML-documents are highly suitable for dealing with and creating of tree structures which are highly efficient for depicting hierarchical dependencies. If the planning and learning process of a learning scenario is to be supported by suitable assistants, then tools have to be developed which graphically support the creating of XML-documents. As mentioned above, tree structures are especially suitable for planning and organizing teaching and learning processes. Currently available tools for creating structured XML-documents are still in the developing phase and still have to be optimized for special requirements. However, the first test versions show that it is possible to support the planning and the learning phase on the basis of XML and to produce content which is universally applicable provided that the authors keep to a minor set of rules.

8 References

Bader R., Jenewein K. (Hrsg.),: “Didaktik der Technik zwischen Generalisierung und Spezialisierung“, Frankfurt am Main, Verlag der Ges. zur Förderung arbeitsorientierter Forschung und Bildung, 2000

Bellahsene, “Z: Database und XML technologies“, Springer, Berlin, 2003

Bodendorf F.: “Daten- und Wissensmanagement“, Springer, Berlin, 2003

Cube, F.: “Kybernetische Grundlagen des Lehrens und Lernens“, Klett, Stuttgart, 1965

Foltz, Ch.: “Lehrmaschinen“, Beltz, Weinheim, 1965

Helmar, F.: “Lehrmaschinen in kybernetischer und pädagogischer Sicht“, Klett, Stuttgart/München, 1963

Holzner S.: “XSLT – Anwendung und Referenz: XML – Transformationen, XPath, Einsatz mit Java, JSP und ASP“, Markt und Technik, München Germany, 2002

Holzner, S.: “Inside XML“, Markt und Technik, München Germany, 2001

Horstmann, C. S., Cornell, G.: „Java2 Band 1” and “Java Band 2”, Markt und Technik, München Germany, 2002

Jank, Werner: “Didaktische Modelle“, Cornelson Sciptor, Berlin, 2002

Jantke P., Wittig W., Herrmann J.: “Von e-Learning bis e-Payment 2002“, Tagungsband LIT’ 02, Akademische Verlagsgesellschaft Aka GmbH, Berlin 2002

Jantke P., Wittig W., Herrmann J.: “Von e-Learning bis e-Payment 2003“, Tagungsband LIT’ 03, Akademische Verlagsgesellschaft Aka GmbH, Berlin, 2003

Meyer H.; “Unterrichtsmethoden I: Theorieband“, Cornelson Scriptor, Berlin, 1997

Meyer H.; “Unterrichtsmethoden II: Praxisband“, Cornelson Scriptor, Berlin, 1997

Meyer H.: “Leitfaden zur Unterrichtsvorbereitung“, Cornelson Scriptor, Berlin, 2001

Ropohl G.: “Allgemeine Technologie: Eine Systemtheorie der Technik“, 2. Auflage - München, Wien: Hanser 1999

Sekundarstufe II Gymnasium/ Gesamtschule Richtlinien und Lehrpläne MSWWF für das Fach Technik, NRW 1. Auflage 1999

Wutka, M.: “J2EE – Developer’s Guide“, Markt und Technik, München Germany, 2002

Everybody is Busy Evaluating Everybody Else – Do We Really Know How to Get the Best Out of e-Learning?

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Everybody is Busy Evaluating Everybody Else – Do We Really Know How to Get the Best Out of e-Learning?

Education has become a product, a merchandise. Education can be designed and marketed in the form of education offers. On this premise, it is obvious that these education offers are comparable and that there are good ones and bad ones. They thus can be listed in rankings in accordance with their price/performance ratio. The increasing economic orientation of education offers goes hand in hand with the attempt to establish nationwide standards. Private suppliers of education can orientate on these standards, too (Weber 2002, p. 30).

Evaluation is to support the quality-assurance of education offers, especially concerning e-learning. There is, however, a particular difficulty: "There are no standardized specifications for e-learning, not even on national level. This comes as no surprise, as there is no such thing as "the" interactive education product. There is rather a variety of applications for different purposes that have been developed to meet different demands." (Glowalla et. al., 2000, p. 65) It is thus of crucial importance for successful evaluation that the evaluation strategies are highly suitable for the subject. Now, what exactly does "evaluation" mean?

1 What Evaluation is All About

Evaluation seems to be a magical word today, and like all magical words it should be used with some care. Kromrey (2001a, p. 105 ff) distinguishes three meanings of "evaluation":

1. Evaluation in the common sense means **the act of evaluating**. It is also applied to a specific thought pattern in the sense of a verifiable procedure.

2. Evaluation on a second level describes a process of information processing that follows a methodical approach and orientates on usability and valuation.
3. Evaluation on the third level means to compile the ascertained knowledge in form of an evaluation report or a similar paper.

Approaches on the first level are trivial, they mean: ”Somebody somehow evaluates something in accordance with some set of criteria.” (Kromrey 2001a, p. 106) This is the typical constellation of the evaluation of courses, according to the social scientist Kromrey (Kromrey 2001b, p. 42). These approaches are scientifically irrelevant and do not improve the acceptance of evaluation procedures. It would instead be important to state more precisely the undetermined parts from the first level and to scientifically ascertain the subject of the evaluation, the qualification of the evaluating persons, the criteria of evaluation, and the methodology by defining them. This has, of course, to be carried out before starting the evaluation.

This means for the field of e-learning that the criteria concerning the different subjects and actors of the evaluation have to be defined before carrying out the e-learning application.

However, fields of application-related projects (both middle-term and long-term) are strongly influenced by a high degree of innovation and a highly dynamical development, which undoubtedly applies to the field of e-learning applications. The nature of these influences increases the probability of a change in the defined criteria because of new technological possibilities and social demands. Concerning these fields, evaluators take an active part in the process of developing, implementing and optimizing programmes. They thus have the status of observers, who compare the different perspectives of those involved in the project, which often implies that the evaluators take the part of mediators. Such a re-definition of the function proper often takes place within projects of evaluating complex e-learning applications.

Evaluations can be organized with regard to different aspects, depending on which **function the evaluation shall have: research, control, or development-support**. On the whole, evaluations can be described as a "systematically- and target-oriented compilation, analysis and valuation of data for purposes of quality control and quality assurance".

In the field of education, evaluation means the "valuation of the planning, development, organisation, and application of education offers or particular parts of these offers (methods, media, programmes, parts of programmes) with regard to aspects of quality, functionality, effects, efficiency, and usefulness." (Friedrich et al. 1997, quoted after Janetzko 2002, p. 103)

2 Fundamental Criteria for Evaluation Projects

Evaluations can be characterized using the following five criteria:

1. The aim to be reached
2. The tasks of evaluation
3. The persons / organisations responsible for the evaluation (evaluators)
4. The paradigms of the enquiry
5. The time of the evaluation

ad 1: **The Aim to be Reached**

Evaluations can have different aims, whereas scientific precision is not always in the focus of interest. These aims can be:

- increase of knowledge,
- start the communicative process of a dialogue,
- cost control,
- reasons for particular measures or a project.

The orientation of the evaluation and thus the choice of suitable parameters of measuring depend on the aim that has been defined for the project. This crucial decision, nevertheless, is often taken late or not at all.

ad 2: **The Tasks of Evaluation**

The following tasks occur during the course of an evaluation:

- to observe processes and to assess the process-related potentials within the frame of a particular measure,
- to observe and document causal relationships on the basis of an examination of relevance and significance or on basis of ascertainable trends,
- to check the effectiveness of a particular measure, i.e. to ascertain if the measure led to the expected effects and if these effects are due to the execution of the measure.

Learning effects can generally not be related to only one cause but are the result of a complex interaction of several factors, which partially are of mutual influence on one another. Evaluations in the field of education are often merely ascertaining the user's acceptance.

ad 3: **The Evaluators**

In the course of an evaluation one has to distinguish between internal and external evaluators. Internal evaluators belong to the organisation that has developed the programme or executes it, external evaluators come from outside. Smaller research projects are normally subject of internal evaluation whereas bigger projects or projects with a high conflict potential are more often subject of external evaluation. The advantages and disadvantages of both variants are obvious and can be described as follows:

- In general, internal evaluation can be executed quickly, without much effort and at a high level of expertise. However, a lower degree of methodological competence and the closeness to the participants in the project may prove disadvantageous. It is probable that the levels of both content and relationships have a mutual influence on each other. There also is the risk of obtaining results that are "dressed up" with regard to the interests of the organisation.

- In general, external evaluation is characterized by a higher degree of methodological competence and independence. This increases the credibility of the evaluation, which can support reforms in institutions and organisations, if the evaluation leads to appropriate results. On the other hand, external evaluators generally have a lower degree of factual knowledge, which can prove to be disadvantageous. Another disadvantage can consist in defensive reactions on the part of the evaluated group of people, which will probably cause problems when applying the suggestions resulting from the evaluation.

ad 4: **The Paradigms of the Enquiry**

There are two paradigms for evaluations, an empiric-scientific one and an emancipatorily action-oriented one. The first paradigm is based on the well-known principles of critical, rational, and logical research and applies the equally well-known methods of empiric research. The second approach does not aim at ascertaining a scientific truth but wants to construct a reality that helps the respective groups of people, the projects, institutions, or organisations to consider their perceptions and actions from a different point of view. This could help to recognize and realize new and possibly more efficient ways of developing.

ad 5: **The Time of the Evaluation**

In accordance with the beginning of the enquiry, evaluations can be characterized as formative or as summarizing-analytical.

Formative evaluations are carried out in the course of a process or project and mainly serve purposes of quality optimizing or quality assurance. This type of evaluation has a formative influence on the course of the project because the results of the evaluation are continuously fed back to the project. Thus the evaluation increases its practical relevance. At the same time, it continuously changes the subject that is evaluated and thereby

changes its initial state, which makes a standard analysis of effects impossible.

The second type of evaluation, the summarizing-analytical approach, focuses on the analysis of the effects of the project, which means they have no formative influence on the project. The beginning and the end of the evaluation can be defined precisely.

The figure below shows a survey of the possibilities of evaluation in the field of e-learning.

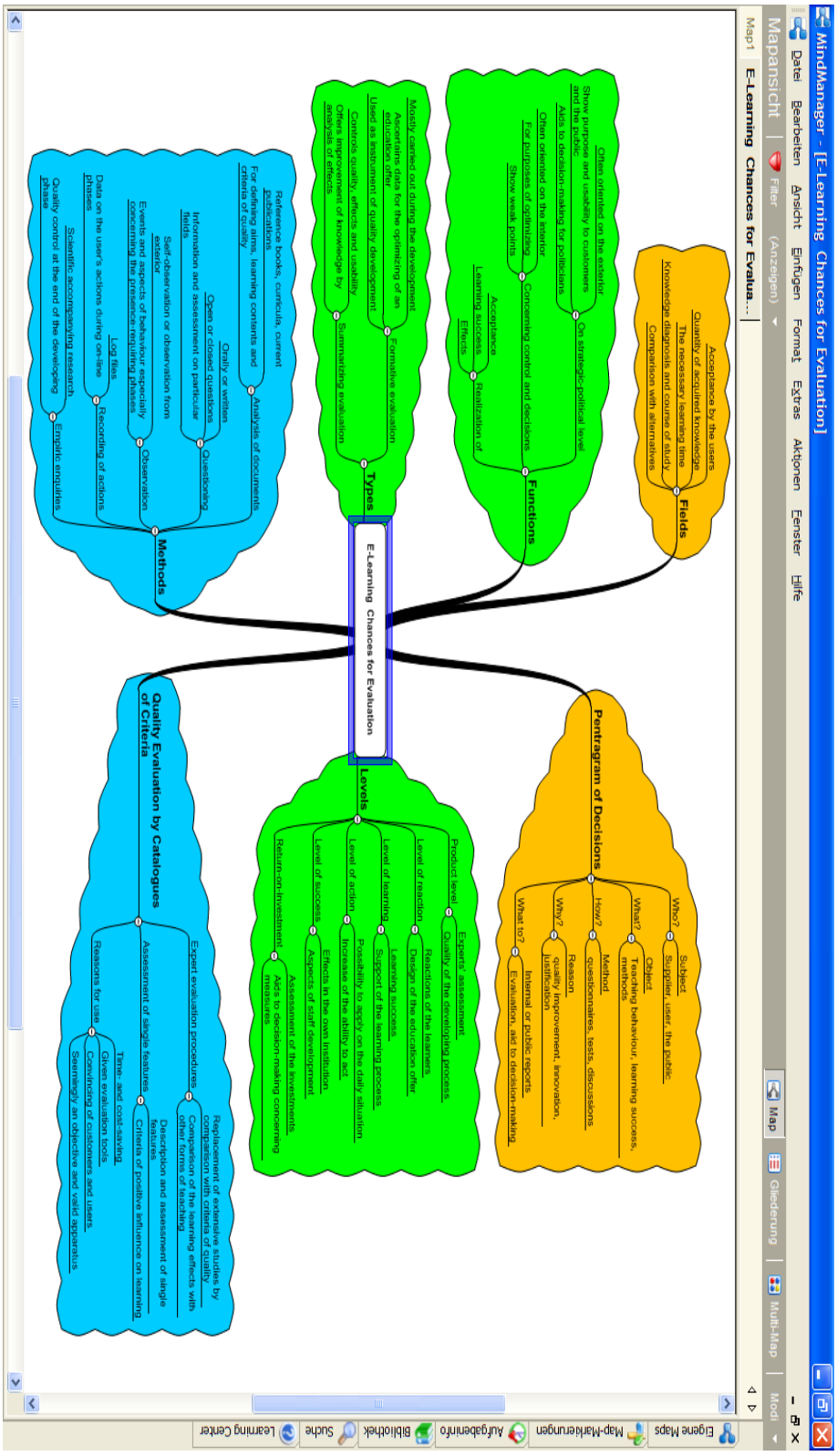

Fig. 1: e-Learning - Chances for Evaluation

3 Evaluation of e-Learning Applications

An evaluation of e-learning applications in general is carried out in accordance with the described above criteria concerning its foundations and differentiations. In the context of e-learning applications, however, there are some decisive factors, which can endanger a successful evaluation right from the beginning. Some of these factors will now be looked at in more detail.

3.1 Causal Analysis of Problems in Evaluating Programmes within the Frame of Teaching

The evaluation of project-related measures is based on the following premise. The implementation of a measure will lead to measurable effects, which can be related to decisive factors within the relation of cause and effect. It is thus indispensable for the definition of this relation to ascertain aim, measure, effects, and programme environment with suitable empirical data. The measures of the programme are defined as independent variables, and it is related to the criteria concerning the achievement of the aim (dependent variables).

The analytical distinction between effects caused by the use of the programme and effects caused by environmental factors ("exogenous factors") can be problematic. A successful analysis requires consistent Ancillary conditions which concerning the use and evaluation of e-learning applications can only be realized under laboratory conditions. A "realistic evaluation" (Tergan 2003) of e-learning applications can thus not be realized. It also seems problematic that the theoretical foundation necessary for the developing of a valid system of indicators exists at the most in initial stages (Kromrey 2001b).

The evaluation of e-learning applications can be executed at best in the form of an "open evaluation", especially when evaluating complex systems of e-learning (like Learning Management Systems). "Open evaluations" focus less on the ascertaining of 'objective' data but can

instead follow the approach of “objectification by proceeding” (Kromrey 2001b, p. 40). This approach allows all participating groups to comment on the ascertained data and to validate them by means of communication. Ensuing this, definite (measurable) aims would be set and a follow-up evaluation would be executed. These follow-up evaluations can be more control-oriented than the initial evaluation. These two steps shall assure the effectiveness of the measures of the evaluation. This open form of evaluation does not record the single learning processes but concentrates more and more on learning cultures, which increasingly orientate on constructivistic principles.

3.2 Decisive Factors

As mentioned above evaluating e-learning applications by analizing causal relationships between the educational offer and learning effects is a something like a mission impossible. Despite the fact that an analytical distinction between programme effects and environmental influence on learning results can hardly be made, some decisive factors for the outcome of e-learning applications in use by educational offers can be listed. In the following sections some of these factors will be looked at with regard to the problems of use implicated.

3.2.1 Cost-benefit Analysis

“It is not very useful to ask ‘how expensive an education product is’ because one has to distinguish a multitude of variants here, like one has in concerning the benefit.” (Glowalla 2000, p. 65)

The benefit of innovative concepts that concern an entire institution (e.g. the definite implementation of a learning and communication platform for all faculties and institutes of a university) cannot, not even primarily, be regarded and evaluated with regard to their costs. A quantification of the benefit concerning strategic projects is not considered as serious by Glowalla et al.

Problems of budgeting are common at universities. Detailed planning seems desirable against the background of mostly over-generalized cost control. At the same time, detailed planning seems unrealistic when considering the real conditions of academic research projects. Demands like “The planning of costs and benefits has to be carried out strictly before the project starts” (Glowalla et al. 2000, p. 59) remind of Brecht’s ballad of the insufficiency of human efforts, when considering the development, organisation, and use of e-learning applications.
(http://www.darmstadt.gmd.de/schulen/BBB/bb-100/bb-streben.htm)
“The design and further development of successful learning systems is time- and cost-consuming. At the same time, students expect and need personal instructions and personal training in interaction.” (Glowalla et al. 2000, p. 71). Taking this into account students value things like

- practical usability,
- reliability,
- routines,
- cost-saving (see also 6.4.2).

3.2.2 Methodological Approach

Scientists who favour the empiric approach in social research decline a direct comparison of the effectiveness of e-learning applications with the effectiveness of conventional course offers out of methodological reasons. There are too many factors that cannot be controlled (members of the respective group, commitment of the teacher, situational influences, cultural influences) and thus do not allow a transfer of the results from one group on the other. This means that the results can seemingly not be generalized. Efforts in order to consider these hardly controllable factors require enormous research capacities (TIMMS, PISA), which can hardly be realized outside the frame of a research project dedicated to this special purpose. Furthermore, e-learning applications are constantly being improved and further developed, which is to have a positive effect on the learners’ success and to make the ap-

plications more acceptable. For example, the currently popular comparisons of different learning platforms and communication platforms are valid for only about half a year, for the platforms will be further developed in this period of time, which would call for another evaluation. Glowalla et. all. Rightly state that the users' acceptance of applications with multimedia features depends on the technical status quo of the opportunities how they can be presented. For example, ILIAS, a communication and learning platform which was employed for the first time within the "VIRTUS" project at the university of Cologne in 1998, is "not up to date anymore" or "antiquated", according to a large number of today's users. This also shows that "there can be a problem concerning the amortization of these applications, due to the continuing further development" (Glowalla et al. 2000, p. 72).

3.2.3 Acceptance of the Offer

The acceptance of a programme offer can be regarded as an important factor for the success of a measure. This applies especially when the cooperation of the learners is regarded as an important goal of the programme. The acceptance of the programme is a necessary, however not sufficient, requirement for the success of a learning process. Acceptance itself consists of different aspects which have an influence on the organizational and personal context in which e-learning takes place. The following criteria support the acceptance of an e-learning application in use:

- embedment into the curricula,
- subjective learning success,
- acceptance by the teachers,
- acceptance by the learners.

Spoken from a theoretical point of view acceptance of an e-learning application opens the door for interacting more intense with the content presented.

3.2.4 Information-technological Ergonomics

e-Learning applications should be created in accordance with the principles of technical design, although especially well-depicted contents may have an unwanted effect, paradoxical at it seems. They may cause the “illusion of knowing”, i.e. the learners believe they have learned something because the contents appear and function in a proper way on the monitor. To make sure that the learners have really comprehended a process or a structural interrelation, there has to be an examination in form of control questions or control exercises.

The evaluation of e-learning applications often starts at the media surface, implicitly assuming that an optimal design assures an optimal learning process and thereby an optimal learning success. Tergan considers this assumption as unrealistic because it does not sufficiently consider the interrelations between media features, learning conditions and learning context (Tergan 2003).

Despite all that some factors can be stated, which are top of the list when it comes to develop knowledge in a constructivistic manner and which are taken into account when it comes to evaluate the potentials of a Learning Management System:

- tools for developing, allowing the
- structured creation of the contents and the
- structured filing of the contents, assuring the
- usability of the depicted contents, depending not at least on
- modularizing of the contents, which allows
- storing the data in a way that allows their use in different media and the
- depiction in a way that allows the use on several platforms. Last but not least
- the easy maintenance and service of the application (see chapter 3 and 4).

3.2.5 Effectiveness of Learning

To measure the effectiveness of learning is perhaps the most common and at the same time the most difficult factor, which influences the results of an evaluation process in the field of e-learning. Starting with the problem of selecting the appropriate measuring method it soon comes clear that in most cases the original aim is out of sight for evaluation (i.e. changed behaviour in real work conditions) and has to be operationalized by indicators that can be questioned easily. But, as Glowalla et al. put it: “To comprehend an information is necessary but not enough for a sustainable memorizing it.” (Glowalla et al. 2000, p. 59)

So if it comes to evaluate the quality of a course, one has to develop a strategy, which relies on a balanced combination of the different factors mentioned above.

4 Implementing e-Learning at Universities - Some Examples of Evaluation Strategies and their Outcome

The evaluation of academic teaching has a rather bad reputation. Their execution is considered as unsystematic, their effects are considered insufficient, and many lecturers consider them as a necessary evil used as an alibi. They are often limited to mere questioning in written form at the end of the term. Their results are interpreted arbitrarily and disappear in the respective lecturer’s chest of drawers. This is why the evaluation has no significance for the evaluated course. Many lecturers think that the evaluation of courses by means of surveying students does not provide an acceptable foundation for assessing the quality of the course. Quite the contrary is the case. The results of such evaluations can be used to construct a multifactoral model for measuring the quality of a course. Concerning presence-requiring courses, such a model has now been developed and has been sufficiently corroborated by statistics (Rindermann 2001). For the many variants of e-learning, such a model still has to be developed. A simple adoption of Rinder-

mann's concept HILVE-II ("Heidelberger Inventar zur Lehr-Veranstaltungs-Evaluation") for purposes of evaluating e-learning applications is not possible because of the significant role of the lecturer within this concept. One can assume that concepts of blended learning will put an equal or even increasing stress on the significance of the lecturer and his way of presenting contents.

Presently available evaluations are generally based on a methodological blending that shall enable to relate quantitative data and qualitative data. Concerning this, it has become a standard procedure to ascertain the individual and technical qualifications of the participants at the beginning of a course in order to relate these data with those concerning the usability of the offered course.

The integration of such complex models of analysis into the daily business of academic teaching seems more than uncertain, given that evaluation requires a lot of organizing, technical equipment and time of both lecturers and students. The demand for comprehensible standards and centralized evaluation departments is rather understandable against this background. A different question will be if these instruments really are suitable for the individual purposes of the respective lecturer. Two examples in the following subchapter will show how evaluation can constructively support the implementation of e-learning applications at academic teaching.

4.1 CIELT (Concept for Interdisciplinary Evaluation of Learning Technologies)

CIELT, a concept of evaluation, has been developed at the institute of industrial psychology at the ETH ("Eidgenössische Technische Hochschule", university for electrical engineering) of Zurich. This concept aims at the integration of factors that have been left out within the frames of summarizing evaluations (which in general means product-oriented evaluations). These factors, however, are of crucial importance

for successful learning. Among them are the learning motivation of the students, the course of learning when using e-learning applications, and the students' assessment of the quality of the application. The evaluation of the e-learning application has an 'open character', i.e. the results of the analysis may also lead to a "retrogression concerning media" (Grund/Windlinger/Grote 2002) if this seems useful from the didactical and organizational point of view.

4.1.1 Conceptual Approach

The concept is based on a pyramid of conditions that define the use and usability of e-learning applications. Within this, the factors accessibility and system stability are the basis of the users' acceptance of an e-learning application. These two factors also provide a reliable basis for analyzing of the length of use as well as for drawing up of access profiles by analyzing of log-files. The users' acceptance of an e-learning application is also influenced by the degree of its integration into the curricula and by the didactical concept of a course. Changes on the level of organization and the development of learning cultures can be expected only after having applied e-learning applications for a certain period of time.

The course that was to be evaluated was based on the concept of blended learning, i.e. it alternately offered on-line supported phases of individual learning and presence-requiring phases of intensified discussions. The students learned individually or in groups or with assistance of a tutor.

4.1.2 Methodological Approach

The methodological approach of the evaluation is based on a blending of several methods and allows to consider five different sources of data. An on-line questionnaire was used to ascertain the following data from the students: the socio-demographic data, the attitude towards the computer as a means of learning and studying, the knowledge concerning hardware and software, the technical equipment at hand, the

evaluation of the new media concerning their relevance for the study, the usability of different methods of teaching and learning, and the favoured method of teaching. The students had to fill in a questionnaire each time after having been on-line in order to increase the meaningfulness of the log-files data, which because of their nature cannot measure the real learning time.

The tutors had to keep a record book to document the following items: the time of contact, the person who is seeking the contact, the medium of contact, the content of the enquiry, the length of the interaction, a possible change of medium, and the success of the supervision.

A final on-line questionnaire had to be filled in at the end of the course to ascertain data concerning the usability, the didactical structure, the learning materials, media, activities, the introducing of the system, the organisation of the course, the supervision, the virtual cooperation, and a general evaluation of the course (see also chapter 1).

4.1.3 Results

The students have had an average background knowledge and an average technical equipment. Web-based training offers were only of an average use for them. The students had access to all possibilities of communication that are provided by learning platforms and communication platforms, still, only the possibilities of e-mail were used frequently. Chat-rooms did not play any role at all, and forums were only used to read administrative advice but not for communication with fellow students.

The decisive criterion for the evaluation of the course, apart from tutorial supervision, was the way the lecturer responded to the students' achievements during the course. The students demanded more feedback concerning this. They did, however, appreciate the opportunity to

control achievements on their own by filling in the offered multiple-choice tests.

The evaluation of blended learning offers had ambivalent results. According to the evaluators, careful considerations have to be taken before virtualizing social functions at universities whose teaching is based on presence-requiring course offers.

4.2 The Use of a Learning Platform and Preliminary Outcome of Evaluations

4.2.1 Objectives and Selection

The debate around the subject of e-learning is essentially shaped by the appropriate use of communication- and learning platforms. Within this context it remains often unclear which effect the use of such a platform (however the individual type may be designed) is to have within the subject or on the students. In terms of the evaluation, however, objectives are of central importance in order to be able to assess the quality of a platform in practice. Objectives, in this case, can be considered as a blend of what is desirable in terms of technology and what is didactically necessary. A blend, which takes account of both, the existing structures of offers and future prospects of the subject. In practice this means: the objective of the faculty of TUD (Technologie und Didaktik der Technik an der Universität Duisburg Essen, Campus Essen) is the continuous use of a communication- and learning platform as equipment. The equipment, which is to be developed further is available within the framework of the Campus-Source-Initiative NRW (http: \\www.campussource.de) and is to support the cooperative use, development of and work on learning modules in order to continuously improve studies within the faculty. In principle, e-learning platforms as such, offer teachers the opportunity to make information and didactically prepared contents available in a structured form for self-study and for revision of what has already been taught before to interested students. One could however not refer to it as a communication-platform if

the student had the opportunity to send feedback to the teaching information provider via a specified e-mail-address. Only in conjunction with additional activities, etc. with high interactive potential, such as chat, whiteboard, group discussion, the learning platform becomes a communication- and learning platform. For the faculty of TUD this makes up some concrete requirements for the efficiency of an e-learning platform:

- As a learning platform, it is to enable students to access any digitally prepared documents which are used during courses at any time and place via the Internet and to make self-developed learning modules available to other students so as to allow for critical debate.
- As a communication-platform, it is to maintain communication between students and the dialogue between students and lecturers even during times when there is no presence-teaching and to help reduce inhibitions in making first approaches.

Systems, which can satisfy this requirement and which have further functionalities for course management, for evaluation, for certification and examination procedures normally involve high licence-fees and are neither designed for individual subjects at university nor are they affordable. Moreover, they have the disadvantage that adjustments and extensions of the platform involve further charges and in practice it is rather rare that the purchaser gets involved in active participation for further development – even though firms would state the opposite to all this. Alternatively, potential buyers who do neither have sufficient financial resources nor want to wait for university- or even inter-regionally based agreements for an implementation of a communication- and learning platform, can make use of the offer of the Campus-Source-Initiative in NRW (North Rhine-Westphalia) which is connected to the Linux-Concept. The platforms mentioned above, are available free of charge. They are only subject to compliance with a version of the GNU Public Licence (GPL), which has been adapted to German law (http:\\www.gnu.org/copyleft/gpl.html. A detailed discussion of this issue can be found under:

http:\\www.campussource.de/lizenz/index.html). From the large number of different communication- and learning platforms, the faculty of TUD has for theoretic (Open-Source-basis, differences in structure and design) and pragmatic reasons (costs, necessary system requirements, availability) decided on the communication- and learning platform ILIAS in order to test it as a beneficial complement for the use of learning modules developed with the support of INTEGER (see chapter 3) in selected presence courses of the faculty. ILIAS was evaluated during the summer semester of 2002. The aim of the first evaluation period was an evaluation of the e-learning platform in its practical use. The stability of the system was to be tested and assessed: its handling in everyday use by administrators, lecturers and students, its acceptance by all those involved and its functionality, particularly in terms of its interactive potential. In order to establish some valid data, a mix of methods was used. This included quantitatively oriented forms of the online supported survey (Data Entry Enterprise Server of the company SPSS) and files analysis (log-file-analysis, evaluation of e-mails and terminated files) as well as qualitatively oriented forms (main theme-interviews, participating observation, records of conversations).

4.2.2 Choice and Socio-Demographic Features of Courses

The use of the communication- and learning platform ILIAS during the summer semester of 2002 has first been evaluated in only two seminars within the faculty of TUD. These were primarily dealing with socio-technological problems and are to be considered extreme groups in view of the students involved. The seminar “Interactivity between Technology, Economy and Society” is designed for first stage students and is attended by more than 90% female students (!) who are at the beginning of their course of study. Most attendants have only little background knowledge in using computers and the Internet. The seminar “Socio-Technology I” is designed for students of the faculty of technology who have enrolled in a course of study for the secondary stage of education (SEK I or II) and who are already in their advanced

stage of study. This seminar is on average attended by 70% male students. IT background knowledge is expected. Other than usual course offers, this one follows a methodologically and design-technologically limited, open seminar concept (Krause 2002), which demands a great proportion of own initiative by the students. In view of their contents, both seminars examine the effects of the digital revolution (at different levels), based on the example of the use of the Internet in general education schools. Both seminar groups could log on to ILIAS during and outside the courses. For this purpose, a radio network set up within the faculty with a total of 10 laptops was available. For an assessment of the evaluation results it is significant to mention that both seminar offers are compulsory courses within the framework of each course of study. By means of specific exercises, students were therefore advised to use ILIAS.

4.2.3 Description of the Learning platform ILIAS

"ILIAS has been developed within the framework of the VIRTUS-Project at the faculty of economics and social sciences at the University of Cologne. (...) Part of the comprehensive features of ILIAS are amongst others:

- personal desk
- learning environment with glossary, notebook and exercises
- internal news system, forums for discussion, chat
- group system for cooperative work
- integrated support by meta data on all content-levels by a system of authors
- context sensitive help
- user- and system administration."

(http:\\www.ilias.uni-koeln.de, referenced: 7.8.2002)

As the outcome of a comprehensive evaluation of learning platforms, ILIAS is recommended as the only Open-Source-Model by the Austrian

Virtual Learning Community (http:\\www.virtual-learning.at). ILIAS is designed as a Client-Server-System, which, based on a database (SQL), generates dynamic websites supported by the scripting language PHP on the server side. It requires an online connection on the part of the user. Comprehensive teaching- and learning units can however be provided in a compressed form for downloading. In contrast to other platforms, ILIAS contains an integrated authors-tool, which allows for the (joint) creation and operation of teaching-/ learning materials. But it can also be used for other purposes (confirmation of scores, cooperative work on a project, creation of homework). In this context however it is absolutely necessary, to revoke - at least partly - the allocation of rights outlined by ILIAS in terms of a role-splitting into administrators, authors (lecturers), students and guests. What this means in practice is that for didactical reasons, certain authors' and administrators' rights are conferred upon students. It meant however also that teaching material created by lecturers was subject to the risk of alterations by the students. In this particular case, the risk appeared tolerable to us, from the lecturers' point of view, as compared to the potential prospects thereby created. A belief, which later found confirmation in the evaluation results and the way that seminars were operating.

4.2.4 Preliminary Evaluation Results

a) Students

Admission requirements and PC-knowledge

A total of 33 students took part in a written introductory survey at the beginning of both seminars. This survey was about establishing access opportunities for PC and Internet as well as user behaviour and self-assessment in dealing with PCs and Internet on the part of the student. With 27 of those questioned being female, women were clearly in the majority. The average age varied between 23 (first stage students) and 27 (second stage students), according to the respective stage of the course. With one exception all students had their own PC and 30% of them had it already for more than 5 years. More than 90% of those

questioned had access to the Internet at the time. Within this group, 45% were using a modem and only 12% had access via DSL. 15% were not able to provide any figures regarding the connection speed 14 of 28 of those answering claimed to be checking their e-mails once or several times a day; 10 people check them “once a week”; the remaining 4 less often or even never. Almost 60% of those answering stated that they did not use the forums for discussion. Only two persons claimed to use them on a daily basis or several times per day. Data transfer per ftp is either unknown to those questioned (36%) or not used (43%). Only one person claimed to be chatting on a daily basis and more than 90% of those questioned are not using this option at all. 94% of those questioned had not yet created their own website at the time. Still, only 4 of 28 of those answering considered their skills in dealing with PCs and the Internet “bad” or “rather bad”. In discordance to lecturers’ point of view during the seminars, 8 of those questioned considered their skills “good”.

Assessment by ILIAS

First evaluation results from the final survey of both seminars (socio-demographic data, see above) prove that the use of a communication- and learning platform such as ILIAS does **not** by itself have a motivating effect on students in the concrete context of a presence seminar. Rather the opposite is the case. However the reasons for a rejection can vary.

First contact and intuitive use of the system

Of central importance in this context is the first contact of the potential user with the platform. In one particular case for instance, the users have deliberately not been comprehensively introduced to ILIAS in order to be in a position to assess the possibilities of an intuitive dealing with the system. In retrospect, this procedure does not seem to be a potentially successful strategy for ILIAS and the target group evaluated by us. A statement such as: “I am already having aggressions when I only hear about ILIAS”, is just as valid in terms of evidence as the over

53% of all participating students who categorically denied the statement “ILIAS is easy to understand”. More than 40% of all course members found that ILIAS was **not** “easy to understand” but “unclear”. When those questioned were openly asked for the things that they did not like about ILIAS, this proportion would then climb to over 60% as people complained about a necessary online-integration and a “less helpful help-function”. It is therefore not surprising that no less than 6 of those questioned found a better introduction, or help-functions in ILIAS desirable. Further reasons, which had a negative effect, were a lack of time and evolving online costs. These were mentioned by far more than half of those questioned as reasons which would work against an intensive use of ILIAS. For no less than 8 female participants, of the first stage seminar, “lack of interest” was an essential impediment.

Continuous Support

In view of these results it might look surprising that ILIAS is still considered a “beneficial support to the courses” by almost 70 percent of those questioned. And yet 63% of the students could figure to use ILIAS also for other courses after finishing the seminars. For more than half of those attending the seminars it was of crucial importance to be able to communicate with other students and or make files available for exchange and for information. There was also a positive outcome in terms of the evaluation of quick downloading times in conjunction with a low transfer capacity and constant availability and stability of the system.

Access profiles

A cursory assessment of the Access-Log-Files of ILIAS is giving first clues about the user behaviour of the students. On average ILIAS registered 57 visits per day over a seminar period of 100 days. During intensive work periods, ILIAS registered up to 534 visits per week. In other words, 76 visits per day with an average visiting period of 3 minutes and 9 pages logged on to. Most visits were on the day before, and on the same day of the seminar; mostly in the afternoon between 3.00 – 4.00pm or in the evening between 7.00 – midnight.

b) Lecturers/Administrators

Unlike the students who had difficulties in operating the system, the problems for lecturers (who simultaneously acted as administrators and assessors of the system) were concentrated on the actual administration. The possibility for administrating lecturers to access basic settings of the system proved generally necessary as well as beneficial, which, in our view clearly speaks **against** a central administration of the system at university level.

In particular during the introduction period of the communication- and learning platform into the seminars the basic settings of the system must for a short period be adjustable to didactical objectives and information-strategic issues. In practice this means that for instance not everyone who used to be registered as an author with the system would automatically receive a system-message about the change of a learning unit, which, itself was only designed for one particular group. Also should the students in a co-operating sense be authors, which was put in place with some efforts on the administrative part. Altogether, the role-concept of the system (see above) proved hard to handle in terms of the allocation of rights.

On the positive side, in addition to a straightforward installation of the system, which was carried out by a member of the ILIAS-team on the basis of a Linux-Server-System, there was a high stability of the system as a whole: it did not crash a single time during a three month seminar period and was also able to handle simultaneous logs of multiple users on individual pages of the platform without problems. Easy organisational and technical problems could be solved quickly (normally within a day) on the phone or via posting to an internet-based forum (http:\\www.ilias.uni-koeln.de, referenced: 7.8.2002), which was set up by the initiators of ILIAS.

c) Evaluation of Special System-Functions

Personal Desktop

After a personal registration follows access to the e-learning platform ILIAS via the so called personal desktop (as with most learning platforms). Inside ILIAS, the personal desktop informs about newly arrived e-mails, latest page-visits on the teaching materials, new contributions in the chat rooms subscribed to, and open exercises. With its support, individual learning processes as well as the communicative exchange within the group are to be promoted. A basic requirement however is, that students log on to ILIAS typically at least once a day in order to find out about news. Altogether, the opportunity to get a quick overview in this way was accepted by the students. Evidence are screenshots made during spot-checks at the end of the seminar, which, in addition to the answers given at a final questioning, forms the base for an evaluation. They give insight into unread e-mails and contributions to discussions as well as latest page logs. An allocation of individual computer logs to ILIAS seems not practicable in view of dynamically distributed IP-addresses via many providers.

E-mail-function

For seminar communication outside the presence-time, the e-mail-function plays a key role. A sense of unity is created for those involved in the seminars. 84% of the students perceived the ILIAS-integral e-mail-function “easy” or “very easy” to use. The fact of a total of 237 e-mails received by the lecturers during the seminar period also supports the outcome. Students of the first stage sent on average 5 e-mails per semester and students of the second stage 9. However, considerable differences in terms of the frequency of use amongst individuals can be revealed. What this means for the first stage students is that the only male participant accounted for more than 15% of all e-mails whereas 8 female participants did not write any e-mails to the lecturers at all. This finding matches the answer of 31% of those questioned, which claimed to have used the e-mail-function in ILIAS either never or only rarely. In

some cases, screenshots revealed 11 up to 26 unread e-mails. This is the equivalent of an information deficit of more than one month.

Chat rooms

Apart from an e-mail function ILIAS offers the opportunity to set up chat rooms in a closed or open form. These can either refer to a group or a learning module. It offers the possibility to discuss contents, or simply to ask groups directly for information. In the eyes of the lecturers, the e-mail-function should support students particularly during periods of autonomous work and enable lecturers to receive feedback on their method of working, and progress on dealing with a task. In retrospect, one can see that besides during a phase of general orientation in ILIAS, when the clearing of technical issues was the main concern, chat rooms and contributions placed in them did hardly find any attention. Even topics with more than 2 contributions dried up after a short time. Chat rooms set up with a focus on specific tasks or topic areas remained entirely disregarded. Attempts by the lecturers to put things in gear with an initialising question could not change anything about this either. It matches the fact that 80% of those questioned stated to “never” or only “rarely” have used this tool. Problems in handling the tool cannot be blamed for its low acceptability as more than 65% of those questioned stated that it was “easy” or even “very easy” to use. This is also supported by the fact that almost all students made mention of chat rooms in their reply to an open question for available functions of ILIAS. Almost one third listed this function first. Many things therefore suggest that the use of a chat room as a medium for communication is tied to specific didactical conditions, which give rise to the use of this tool.

Storing of Files

e-Learning platforms normally offer the option to store files of a different format and to call them up again. This function can beneficially be used for cooperative project work if the platform has a decent referential system at its disposal, which informs those involved in the project about innovations and changes. This has certainly not been the case with the

ILIAS version, which was available to us. Neither the owner of a formed project group nor its members could be informed about changes on files, or innovations in index lists, in an automated form: a deficiency, which particularly the lecturers complained about, and must become a problem, also for the administrators of a system with increasing complexity. In spite of this disadvantage, the option to store files in a central location in order to be able to download them again to any one computer connected to the Internet has been used by students across individual seminar-boarders: It was highlighted as a positive option even by inexperienced users.

Authors' Tool

In contrast to most other e-learning platforms ILIAS provides its own tool for the publication of websites in ILIAS. Whether the use of this tool makes sense in a practical work related, and didactical way had already been discussed by the lecturers prior to the start of the seminars. Finally, the fact that there was hardly any background amongst the students in terms of experience with other HTML-editors for the design of websites led to the decision to use the ILIAS authors' tool for the transfer of information and for the design of work results. This was problematic decision, also in retrospect, as particularly the use of the authors' tool was first perceived as confusing and awkward by the students and therefore not working in favour of an increasing overall acceptance. 60% of those questioned judged the authors' tool "awkward" to "very awkward" to use, or they did not use it at all (16%). From the lecturers' point of view, it is common view that students need a careful introduction, particularly to the use of the authors' tool – an introduction that would highlight the benefits of this system as compared to other editors. Especially during its introductory use, the nature of the task during the seminar must be adapted to any particularities of this system so that the necessary feeling of achievement in terms of psychological motivation can become a reality.

Other system functions (bookmark administration, literature)

Compared to ILIAS communication functions, other system functions, such as e.g. the individual bookmark administration or a list of references for general use played only a minor role during seminar practice. They were not intensively used, neither by the lecturers nor by the students. The reason for becomes obvious when looking into the ILIAS-Internet chat rooms. Many of the postings stored there, reveal a strong need for action and clarification, particularly in these areas.

d) Summarising Evaluation of ILIAS for the Support of Presence-Courses

In summarising the outcome, one can see that ILIAS can cope to a satisfactory or good level with its task especially with regard to its communication functions. Moreover, it was revealed to be a stable and reliable system (In contrast to this: Kiedrowski 2001). The use of ILIAS supported a sense of unity and mutual support within the group to an extent, which can well be developed further. Many students for instance wish for a chat function, which has already been put in place in the current version 2.21beta (updated: 09/08/2002), so as to be able to get in touch directly within ILIAS, e.g. for the purpose of online correspondence during work on a website (see also the roadmap for a further development of ILIAS: http://www.ilias.uni-koeln.de, referenced: 7.8.2002). In addition, on the part of the lecturers, it can finally be said that particularly the unfamiliar use of ILIAS for the Windows user requires a special introduction to the system and has to be considered in terms of time commitment when planning the seminars. One can therefore only agree to a current press release of the IAO (Fraunhofer-Institute for Work-Economy and Organisation), which claims that “e-learning is not auto-dynamic because important input factors in conception and introduction often remain unconsidered. The result is a missing acceptance and motivation on the part of those concerned as well as a lack of use of existing potentials. It is a difficult and success-related task to analyse the additional benefits of e-learning in one’s own work environment and to introduce the steps needed for realisation.” (idw- press

release Fraunhofer-Institute for Work-Economy and Organisation IAO, 13/06/2002)

5 ”It’s the End of the World as We Know It and I Feel Fine“ - The ”Quarry of Learning“ as a Treasury of Knowledge Imparting

Both the ‘architecture’ of the media offer and the way the media is used in an arrangement will influence the access of the learners to subject and learning contents (subject-oriented perspective) as well as to “secondary aims” like competence and orientation. E.g., if a defined corpus of knowledge is presented as a linked compilation of detailed information (in form of a hypertext e.g.), this means that the learners will have to have at least basic knowledge of how contents can be structured, or it means that comprehending this structure will be the aim of the teaching arrangement (instead of imparting information).

Material that is available in integrated teaching/learning environments meets the increasing demands for possibilities of recombination and for more dynamic teaching contents. Economic requirements on teaching at universities and schools favour the necessary development of a “quarry of learning” (Keil-Slawik 1998). Each teacher and learner can ‘chisel’ the material they need from this quarry, in accordance with the respective learning situation. With regard to this, the central criterion does not consist in the usability of a learning module but in the practical use of the learning environment. This environment will become less ‘frightening’ by daily use and will return to be a mere medium that disappears behind the learning content.

The future of learning in the knowledge society will be defined by an alternation of individual learning (multimedia or conventional) and joint learning (multimedially supported or conventional), in spite of what all the prophets of multimedia learning may say. Surveys show that learn-

ers increasingly want to be able to communicate with fellow learners about their subject and about problems of learning.

e-Learning platforms cannot guarantee learning' success, they can only support teachers and learners in the learning process by supplying them with learning material and author's tools. They do offer the opportunity to organize learning (both individual and joint) with multimedia support, which allows working in a group-specific and subject-oriented way. Furthermore, they allow to working with a flexible schedule and independently of space-related restrictions. And finally, they motivate the learners to make the results of their joint learning ready for presentation.

The infrastructural and organisational requirements on the respective platforms are of an enormous amount and demand a certain degree of training and discipline from the participants. These are crucial aspects, which have to be imparted in special learning offers with the help of real learning situations.

Keil-Slawik (1999) lists four decisive criteria that should be considered when using and developing teaching / learning material.

- neutrality of resources: no use of additional project means, no changes in the routines of the subject
- multipurpose use: without further adaptation, the material should be usable for other subjects, by other persons, and in other learning situations
- flexibility: the different media should be easy to combine when used in the learning situation, future learning situations should not be dependent on technical features
- sustainability: flexible formats and independence from platforms

In his opinion, the focus is on the „selective finding of multimedia documents via the Net" rather than on the multimedia reorganization of existing courses (Keil-Slawik 1999, page 31). However, this does not

mean that we can do completely without reorganizing course material for teachers and learners in order to make it more professional. Hüvelmeyer is right in stating that media pedagogues, media designers, software developers, and respective experts are to be included in the process of developing new material for teachers and learners (Hüvelmeyer 2001, page 2).

Despite the enormous effort concerning the production of material, **the effect of individual documents on the learner is not what is most important**. The focus is rather on the fact that documents should constantly be available and that they should fit into various contexts. Individual documents should have an adequate size and so it should be easy to keep them up to date or to exchange them with other documents. In times when knowledge is subject to continuous change, our society cannot, and will certainly not want to, rely on systems which require cost-intensive fix set ups, i. e. decisions that are hard to alter.

Within such a learning culture, there is no need of isolated acquisition of knowledge, but it is of vital importance to actively deal with knowledge in all social contexts of learning and to build up knowledge interactively.

Keil-Slawik stresses that the realization of such an offer equals a learning process itself. It always comes up with surprises and its effect on learning cannot be measured with the standardized research methods of social science.

References and Links

Friedrich, H.F., Eigler, H., Mandl, H., Schnotz, W., Schott, F. & Seel, N.M. (Hrsg.). (1997)
Multimediale Lernumgebungen in der betrieblichen Weiterbildung. Gestaltung, Lernstrategien und Qualitätssicherung. Neuwied 1997

Glowalla, Ulrich/Heinz Lothar Grob/Rainer Thome (2000)
Qualitätssicherung interaktiver Studienangebote. In: Bertelmann Stiftung, Heinz Nixdorf Stiftung (Hrsg.): Studium online. Hochschulentwicklung durch neue Medien. Gütersloh, p. 51-73.

Grund, Sven/Lukas Windlinger/Gudela Grote (2002)
„Wunsch“ und „Wirklichkeit“ in der Nutzung eines webbasierten Kurses an einer Universität.
http://www.getinvolved.unizh.ch/pdf/eCF_evaluation_2001_02.pdf, referenced 20.10.2003

Hüvelmeyer, Josef (2001)
Organisation der Lehre. Manuscript. Dortmund 2001

Janetzko, Dietmar (2002)
Und was bringt uns das? Grundlagen der Evaluation des Lernens im Internet. In: Scheffer/Hesse (Eds.), p. 101-116.

Keil-Slawik, Reinhard (1998)
Multimedia als Steinbruch des Lernens. In: Hauff, M. (Ed.): media@uni-multi.media? Entwicklung – Gestaltung - Evaluation neuer Medien. Münster 1998, p. 81-99

Keil-Slawik, Reinhard (1999)
Evaluation als evolutionäre Systemgestaltung. In: Kindt, M. (Hrsg.): Projektevaluation in der Lehre. Münster a. o. 1999, p. 11-36.

Kiedrowski, Joachim von (2001):
Learning platforms for e-learning-processes of professional further education providers. Botermann & Botermann, Cologne 2001

Detlev Krause (2002)
Aspects of media use in the open seminar concept, in: Wolf-Gideon Bleek (publ.), Media supported learning, 2002, S. 41-59, http: \\www.wisspro.de.

Kromrey, Helmut (2001a)
Evaluation – ein vielschichtiges Konzept. Begriff und Methodik von Evaluierung und Evaluationsforschung. Empfehlungen für die Praxis. In: Sozialwissenschaften und Berufspraxis. Vol. 24, H. 2, 2001, p. 105-131,

http://userpage.fu-berlin.de/~ifs/bds/downloads/2001-2-kromrey.pdf, referenced 15.9.2003.

Kromrey, Helmut (2001b)
Evaluation von Lehre und Studium- Anforderungen an Methodik und Design. In: Evaluation universitärer Lehre – zwischen Qualitätsmanagement und Selbstzweck. Münster 2001, p. 21-59.

Rindermann, Heiner (2001)
Lehrevaluation. Einführung und Überblick zur Forschung und Praxis der Lehrveranstaltungsevaluation an Hochschulen mit einem Beitrag zur Evaluation computerbasierten Unterrichts. Landau 2001

Scheffer, Ute/Friedrich W. Hesse (Eds.) (2002)
e-Learning. Die Revolution des Lernens gewinnbringend einsetzen. Stuttgart 2002.

Tergan, Sigmar-Olaf (2003)
Realistische Evaluation des Lernpotenzials von e-Learning. Presented at the workshop “Evaluation von e-Learning - Zielrichtungen, methodologische Aspekte, Zukunftsperspektiven”, 11./12.3.2003, Tübingen, http://www.iwm-kmrc.de/kevih/workshops/evamat/Tergan1_2003.pdf, referenced: 20.9.2003

Weber, Peter J. (2002)
Technisierung und Marktorientierung von Bildung in Europa. In: Lohmann, Ingrid/Rainer Rilling (Eds.): Die verkaufte Bildung. Kritik und Kontroversen zur Kommerzialisierung von Schule, Weiterbildung, Erziehung und Wissenschaft. Opladen 2002, p. 29-43.