Quality Management for the Implementation of E-Learning

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Abstract

This article focuses on the organizational dimensions of e-learning by merging the concept of quality management and the process of implementation. We suggest a circular model of eight phases to structure the whole process of developing, producing and implementing e-learning systems in public institutions.

Our circular model connects processes on different levels: during the initial phase of analyzing resources, priority is set to macro level objectives. Phases of course development and implementation are mainly to be placed on a meso level. While developing and implementing web-based instruction, however, knowledge about microlearning processes and their didactic support has to be taken into account. Moreover, evaluations that complete every phase of implementation refer to microlearning processes, because data is mostly collected on a micro level. This micro level data is mainly used to modify the process of further development and implementation, which means that it is applied to meso- or even macro-level problems.

1 Introduction

In spite of the continuous growth in the virtualization of teaching in the past decade, the e-learning euphoria of the first years has vanished. The initial phase in which diverse support programs boosted the exponential growth of e-learning offerings at universities appears to be completed worldwide and replaced by the so-called "Trumble-Back"-phase. Failed projects, and the insight that the implementation of e-learning does not automatically lead to improvements in the learning and teaching process, have slowed down the initial enthusiasm. Thereby, the view shifted onto e-learning being successfully and sustainable implemented only if projects are not based on isolated, single initiatives. Rather, it requires an active and coordinated support by educational institutions with all their organizational units, which have to perform an *"organizational cultural change"* (Ehlers, 2006, p. 37). It seems, however, that this change has not yet taken place. At least the OECD report on e-learning stated that internationally we are still deeply located in the "Trumble-Back"-phase (Garrett, 2005). In the third and last phase, the so-called "Re-Birth"-phase, gained experiences are reflected on, e-learning projects are redesigned according to guidelines of a strict quality management, and, above all, they are incorporated into the respective educational institution. Yet, only a few single educational institutions appear to have entered this phase so far (Ehlers, 2006, p. 37).

This article addresses precisely the transition between the "Trumble Back"- and "Re-Birth"-phase and shows how effective quality management can assist the sustainable implementation of Internet-based e-learning or web-learning. Both theoretically-conceptual considerations and first experiences that were made at the University of Erfurt during the implementation and evaluation of a web-based learning environment are made accessible.[1] In detail – starting from the characteristics and potentials of web-learning – a model of the process of implementation is developed, whose basis is composed of both pedagogical research results and quality management strategies. This process of implementation will also be discussed against the background of a new perspective on web-based e-learning, i.e. microlearning.

2 Basic Concepts

E-Learning, Web-Learning, Microlearning

Basically, web-learning means the acquisition of knowledge and behaviours within the framework of web-based instruction. Web-based instruction, in turn, is defined as a hypermedia-based teaching program, which uses the characteristics and offerings of the world wide web to create a meaningful learning environment, in which learning is encouraged and facilitated (Astleitner, 2002, in reference to Abbey, 2000 and Horton, 2000). The terms web-learning and e-learning are often used interchangeably, although the generic term 'e-learning' subsumes the exposure to both offline computer-based and web-based learning programs.

Web-learning requires the existence of networked workstations. Thus, web-based learning environments are not only – like traditional courseware – highly *modularized*, *multimedia-based*, and *machine-interactive*, but also *human-interactive*[2] (i.e. learners can interact with each other, or with a human tutor, and thereby use the synchronous and asynchronous communication opportunities of the WWW, e.g., chats, video conferences, e-mails, discussion forums, etc.), *human- and computer-controlled* (i.e. learning is not only guided by the courseware, but also by human tutors), and *open*

1 More precisely we are talking about the Internet-based learning system CLIC (Computer-based Learning in Communications), that has been developed at the University of Erfurt. So far, it consists of an authoring system (for course development and administration), a communication platform (for the interaction between students and instructors via Internet), and of a learning interface for students, that can be used both online and from CD-ROM. Up to now, two courses have been developed in Erfurt, a comprehensive "Introduction to Communication Science" and an "Introduction to Scientific Research," which is more strongly based on the principles of blended learning. Both courses are incorporated into the communication science curriculum at the University of Erfurt as central required first semester courses. More information is available at www.clic-online.de.
For the sustainable implementation of the learning system CLIC, an Eight-Phase-Model has been developed simultaneously. It has already been introduced – although with a focus on the specifics of communications teaching (Kinnebrock & Baeßler, 2004).

2 The differentiation between machine-interactive and human-interactive is borrowed from Gerpott & Schlegel (2000, pp. 349-50).

(i.e. students have the possibility to move outside of their immediate learning environment and use other sources of information from the WWW). In contrast to a merely computer-based learning system, web-based learning environments are furthermore characterized by a greater *content-related flexibility*. Learning contents can be centrally (by a tutor) modified, updated or adjusted to the learning capacities of the students. However, it is common again to both web- and computer based learning environments that they can be used *independent of time and place*. Learning can take place in a self-regulated way, i.e. at a self-chosen place, at any time and at the respective adequate learning pace (Astleitner, 2000, p. 17).

A perspective on e-learning under networking conditions that has lately received substantial attention can be described with the term 'microlearning.' Even though this term has not yet been clearly outlined, it is becoming apparent that it represents comparatively short-lasting, in daily routines (subtly) embedded learning processes, which are initiated by highly modularized contents (also called micro content) (Hug, 2005, pp. 2-8). Unlike web-learning, whose learning processes and learning materials can be located equally on a macro level (e.g., as curricula or an entire course), on a meso level (e.g., as lessons or topics), and on a micro level (as a singular learning matter), microlearning focuses on the interaction between learner and highly modularized contents, whose technical distribution can not only be carried out by Internet-capable PCs, but also – and that differentiates microlearning from traditional web-learning – by mobile end devices like cell phones.

Should the potentials of web-learning, and its subform, microlearning, be used for teaching in universities; should thus high quality learning environments emerge, that initiate efficient learning processes – then the question emerges of what quality with regard to learning environments means, and how it can be ensured.

Quality

In everyday speech, the term "quality" describes the "property," the "excellence," or the "value" of an object (cp. Bruhn, 2003, p. 27). It would, however, be too narrow to define quality as being merely product-oriented within the realms of web-learning – namely as the property of a courseware – and in the process to apply established product standards, that are most often defined by producers or instructors.[3] Since learning environments are developed for students, it is useful to complement the product-related definition of quality with a consumer-related one. This perception, rooted in business marketing studies (e.g., Bruhn 2003, p. 29-30), has, in the meantime, expanded to pedagogical research, which deals with the various forms of e-learning (e.g., Astleitner, 2002; Carstensen, 2006; Astleitner, 2006; Ehlers, 2006). Carstensen even talks about a *"paradigm shift from teaching towards learning"* (2006, p. 13). Expec-

3 A summary of the central quality criteria for web-based learning can be found in Astleitner & Sindler (1999, pp. 121-38), a summary of principles of good teaching in Astleitner (2005).

tations that students have of teaching or web-based learning environments, their perception of the provided learning offerings, and finally, their evaluation of the initiated learning process should equally be considered. *"Quality in the context of e-learning is a co production between the learner and the learning arrangement"* (Ehlers, 2006, p. 34). Quality can therefore be defined as the property of a learning product or a learning process with the ability to fulfill the attributes, that have been agreed on between web-learning-providers and web-learning-customers (Astleitner, 2002).[4]

Quality Management

To meet the manifold expectations of both providers and users of web-learning as best as possible, measures to ensure quality have to be implemented. However, they do not only start with the final product, the learning environment. The 'philosophy' of quality management, especially of Total Quality Management[5], rather assumes that the entirety of all objectives and activities of an organization should be related to quality (Bruhn, 2003, p. 54; Zollondz, 2002, pp. 192-3). All planning, controlling and organizational activities, that arise with the implementation of various quality assuring measures, are consequently referred to as 'quality management.' So quality management constitutes an extremely complex process, in which a series of different quality assuring methods – e.g., situation analyses, employee trainings and product evaluations – are employed, combined with each other and coordinated.

Especially in business studies, there is a vibrant debate about different forms of quality management (Zollondz, 2002). This microeconomic discussion will not be reproduced here. It should be mentioned, however, that with the implementation of learning environments particularly three approaches of quality management become increasingly relevant: Total Quality Management, Knowledge Management[6], and Benchmarking[7] (Astleitner, 2002).

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4 Astleitner (2002) derives, as does currently Ehlers (2006, p. 39), this definition from the quality and quality management concept that is defined in the concept standard DIN EN ISO 9000:2000-12. This standard defines quality as the property configuration of units regarding quality requirements (Zollondz, 2002, p. 192).

5 Total Quality Management is conceived of as all structures, procedures, directions, regulations, instructions, and measures, that serve to ensure and continuously improve the quality of products and services of an organization in all functions and at all levels through the participation of all employees in due time and at low costs, in order to allow an optimal satisfaction of needs of the consumers and the society (Oess, 1993, p. 89). The holistic approach of Total Quality Management thus aims at the check and reformation of organizational structures with the objective of achieving customer- and with it competition-oriented quality improvements. The three constituent factors are customer, process, and employee orientation (Astleitner, 2002).

6 Knowledge Management can here be understood as a frame that encompasses all plans and activities, to permit individuals and organizations to act intelligently. It is to be seen as a cyclical, on single learning processes based process, that concerns the finding, organization, distribution, application and evaluation of knowledge (Astleitner, 2002).

3 Quality Management Approaches Regarding Web-Learning

In the following, the process of quality management has to be structured and related to the implementation of web-based learning environments. Although, from a pedagogical perspective, there is still a lot of research necessary concerning the production, implementation, and evaluation of Internet-based learning systems in universities (cp. summarizing Astleitner, 2000), a few quality management strategies, especially for web-learning-projects, have already been developed (cp. e.g., Koring, 2001, specified by Baeßler et al., 2003; Niegemann, 2001, pp. 157-72; Astleitner, 2002; Astleitner, 2004, pp.128-147; Glowalla, Glowalla & Kohnert 2002; Euler, Seufert & Wirth, 2005, as well as the contributions in Sindler et al., 2006).

In essence, three pedagogical approaches to quality management have been synthesized for the following cycle: (1) the system theory inspired approach by Astleitner and Sindler (1999), (2) the chronologically structured phase model by Niegemann (2001), and (3) the stage model by Koring (2001), which is chronological and cyclic at the same time.[8]

Approach by Astleitner and Sindler 1999

Analyzing where quality assuring measures can start, according to Astleitner and Sindler (1999, p. 119; cp. also Astleitner, 2004, p. 128), three realms regarding the production and implementation of web-based learning offerings have to be differentiated:

- Inputs
- Management Processes
- Outputs

Inputs are the general framework in which a web-based learning environment is developed. These inputs, or requirements, are, for example, determined by political decisions or temporal, technical, and financial demands. They are not under control of the organization that intends to create and implement a learning environment.

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7 Benchmarks are reference values, against which products, services, or even their single components can be measured. Benchmarks give content and goals for quality management measures, in which "Learning from the best" (best practices) is aspired to. Empirically tested benchmarks for the success of web-learning have been presented by the Institute for Higher Education Policy (2000). Quality seals and certifications for web-learning offerings can in some way perform the function of benchmarks, as proper criteria are specified, that an offering has to meet to be certified as high quality. Comparisons to quality seals and certifications in the area of e-learning are summarized in Euler, Seufert & Wirth (2005) and Balli, Krekel & Sauter (2005) and exemplarily in Abt, Ehlers & Pawlowski (2006), Bruder et al. (2006), Berger & Eilert-Ebke (2006) and Wirth, Euler & Seufert (2006).

8 These three models constitute the basis of our phase model, which is, however, compatible with other currently published phase models – e.g., with Ehler's "4-Phase-Cycle" (2006, pp. 40-50), Pächter's six stage "Quality Circle" (2006, pp. 58) and Bremer's "4-Level-Model" for quality assurance (2006, pp. 185-6.).

Outputs, in turn, are regarded as the consequences of the development, production and implementation of a web-based learning offering. This means that the actual Net-based course (its content-related, didactical, and technical realization) on the one hand, and its success on the other, both count as 'output.' Success includes all the changes regarding the knowledge and competencies of the course participants, the experiences the course organizers have gained, and the appreciation of the course by others.

Finally, the term 'management processes' embraces all measures that correspond to the implementation of learning systems, to the information flow within the (educational) institution and between project participants, and finally to the production process. Quality management is part of the management processes and tries to ensure an optimal output via mediation processes and continuous quality checks,.

This quite rudimentary differentiation is helpful to identify the focus of quality management: as inputs have to be seen as largely fixed parameters, they can hardly be influenced by measures of quality management. Thus, it is essential to analyze the inputs and then to produce high quality outputs through the use of existing organizational structures and the skills of involved individuals (Astleitner, 2002).

Starting Points and Contexts of Quality Management for Web-Learning

Inputs	**Management Processes** Coordination of internal and external employees of organizations	**Outputs**
- Legal, contractual, etc. regulations - Budget - Timing - Technical equipment - Employee training - Customers/ target group - Teaching materials - Organizational structure	- Instruction designers - Media designers - Technicians - Tutors - Administrators - Programmers - Librarians - Evaluators	- Courses - Achievements of the students - Satisfaction of the students - Number of dropouts - Reputation/admission of the learning environment in international programs - Satisfaction of the employees - Transferability - Revenues/ Profits - Demand

Figure 1. Starting points and contexts of quality management for Web-learning (table according to Astleitner, 2002)

Phase Models

Niegemann (2001, p. 17) and Koring (2001, specified by Baeßler et al., 2003, pp. 15-6) have identified phases or steps that should be carried out chronologically during the development of web-based learning environments. Within each step, different strategies of quality management apply. If – starting from Astleitner's three components – Niegemann's four phases[9] and the eight stages of Koring's quality management cycle[10] are synthesized, the following exemplary process of the development and implementation of a web-based learning environment emerges:

1. Input analysis
2. Specification of didactics and learning contents
3. Specification of the technology to be used
4. Development of a test lesson
5. Pretest
6. Production of the learning environment
7. Implementation
8. Evaluation of the output and further advancement

These steps shall be specified in the following. In the process it is explicated where quality assuring measures can be employed.

4 Developing an Eight-Phase-Model of Quality Management

Phase I: Input Analysis

In a first step, the general framework for the development and implementation of the new learning environment has to be analyzed. We distinguish between six goals of analysis:

1. Knowledge, tasks and target analysis
2. Analysis of the resources
3. Analysis of the target group

9 Niegemann distinguishes between 1. Analysis, 2. Design, 3. Production, and 4. Implementation. In the first phase the general framework (or according to Astleitner the "Inputs") has to be analyzed. Niegemann here again differentiates between problem and target analyses respectively, needs assessments, target group analysis, analysis of the learning matter, analysis of available resources, and analysis of the application context (Niegemann, 2001, pp. 69-96).

10 Koring distinguishes between 1. Problem and task definition, 2. Survey of the relevant didactic information (learning contents), 3. Development of a lesson-like (receptive) and problem-oriented (creative) didactic design, 4. Development of a test lesson, 5. Pretest, 6. Production, 7. Implementation, and 8. Evaluation and advancement (Baeßler et al., 2003, pp. 15-6). Comparing Niegemann's and Koring's work stages, obviously – despite all parallelism of procedure – Koring's eight stage cycle puts a stronger emphasis on quality checks (especially in the form of the phases "Pretest" and "Evaluation").

4. Technology analysis
5. Analysis of the subsequent application context
6. Analysis of the legal and contractual regulations

The *knowledge, tasks, and target analysis* can be perceived as the central analysis task which should be performed first. The already existing contents (professional knowledge stocks and especially teaching materials) are contrasted with the aspired knowledge or competencies of the addressees. This analysis activity cannot be carried out independently of the overall mission statement of the educational institution, of the existing curriculum, nor of the embedding of professional competence in the form of human resources at the respective institute. This means that the (quality) goals of different administrative levels, from the university administration to the institute, should be incorporated into the analysis (Bremer, 2006, pp. 185-9).

Subsequently, the analysis of the available *resources* includes possibilities and limits, which are set by *budget* and *timing*, and also the technical accoutrement of the project or the involved organizational units. The specific *equipment with hard- and software* should be accurately collected (so e.g., the availability of devices for video recording and editing, but also the configuration of university computers, provided that the future web-learning user is supposed to work with them, and the personal equipment of future users with computers and mobile end devices), because only the knowledge about the available technical infrastructure allows the conception of a learning environment that can actually be realized by the project team and used by the students. Web-learning initiatives are generally cooperative projects. Usually, several institutions cooperate, and even within one institution there are often several organizational units involved – e.g., besides the project team, the institute, the department, the computer center, centers for teaching or examination offices, and – if existing – e-learning centers. Therefore, the *structure of the involved organizational units* should be carefully analyzed with respect to what support can be realistically expected. Last, but not least, the *employee situation* has to be clarified during the resource analysis. Which employees are available for the web-learning project? On how many people can the project count? Which knowledge, competencies, and personal characteristics will they bring in?

Besides the collection of these various resources, the *addressees* or the *target group* has to be *analyzed*. How much previous knowledge and which competencies does the targeted student group already possess? On what can be built, what has to be taught from scratch? When answering these questions, it matters, of course, on which semester level the potential students are, whether the subject is their major or minor, and whether a homogeneous or a heterogeneous group can be expected. Taking the didactics of microlearning into account, daily routines and possible time slots for using the learning environment should be analyzed.

Also, the students' technical competences and their technical equipment play an important role. Knowledge about that not only facilitates the conception of adequate introductory tutorials, but also enables the adjustment of the learning environment to be designed to the currently common computer and cell phone equipment of the target group. Obviously, the most sophisticated learning system makes no sense if the software does not run on the 'outdated' computers of the target group.

As stated in our introduction, a multitude of web-based learning programs already exists. Their solutions for the creation of a learning environment can sometimes be of help as an inspirational source – or through the purchase of a licence. During the analysis phase, thus, an *analysis of existing web-learning technologies* is necessary. What are their advantages and disadvantages? Can they be used – and above all, on what terms? Or is a new production on the basis of the collected analysis outcomes advised?

Web-learning projects are, however, not only bound to commitments that involve the purchase of licences. They equally have to consider *legal and contractual regulations* which their investor imposes on them. Depending on the project proposal and the financier, different regulations regarding the production, distribution, and patent rights may apply. The analysis of those regulations should take place early enough in order to design a learning environment which both fulfils all product requirements and whose application and (further) distribution is ensured in the long run, as well (Euler, Seufert & Zellweger 2006).

The *analysis of the subsequent application context* of the learning system also is of essential importance. Given the situation in most German study programs, teaching usually takes place in the traditional classroom setting and the courses are often crowded. The high number of students is, for the most part, disproportionate to the equipment of the institutes, whose human, but also (computer) technical resources are often insufficient.

From the outcomes of the application context analysis arise new questions about the conception of the learning environment. If web-learning is only employed complementary to the classroom teaching as "blended learning," it can typically be replaced by traditional courses at any time. That is why the question of how comprehensive and sustainable the application of web-learning is going to be needs to be clarified from the outset. Should merely one course (or even only a thematic complex within a course) be developed, or is a multi-course platform planned? Should the learning environment be applied once (only as an experiment), repeatedly or even continuously?

Phase II: Specification of Didactics and Learning Contents

Based on the results of the analysis, in particular on the findings from knowledge, tasks and target analysis, as well as the addressee analysis, the didactic design and the concrete learning contents are determined in a next step.

In principle, diverse didactic designs are imaginable. For the distribution of knowledge contents, e.g., a classical, 'direct' instruction design according to Gagné (1985) can be applied.[11] As introductory courses, first and foremost, convey basic knowledge, a traditional instruction design was chosen for the conception of the learning environment CLIC in Erfurt. For other courses, however, completely different instruction designs may be appropriate, depending on the knowledge to be conveyed and the aspired competencies. For example, a Goal-Based-Scenario (Niegemann, 2001, p. 57) was positively evaluated in an academic context. It aims at the advancement of skills by not only offering a participant factual knowledge in the context of possible applications, but also by giving them practical assignments. During the completion of these assignments, students are to deepen the conveyed knowledge in scenario-actions (Schank, 1998).[12]

Once a decision for an instructional design has been made, the learning contents can be specified. In the beginning of this task, as many academics of the relevant organization as possible should be integrated. Despite different understandings of the subject, the sustainable implementation of a learning system needs to represent the contents of the curriculum, based on a consensus within the organization that the learning environment covers central parts of the course of study.

Phase III: Specification of the Technology to be Used

Beyond didactics and content, a decision about the appropriate technology needs to be taken. The decision for a technology is deliberately placed third, because it should result from the decisions about didactics and learning contents. For certain instruction designs and subject matters (e.g., the simulation of scenarios) numerous technical options are required, while others get by with a more rudimentary technology. The outcomes of the analysis of existing web-learning technologies (phase I) should facilitate the decision about which authoring and/or course management systems can be used, and to which extent (partial) reprogrammings are necessary.

The conceptual considerations made in the previous three phases are initially to be placed on the so-called macro level, because the entire organizational requirements and content-related objectives on the part of the university, the faculty, the department and the institute are taken into account. The specification of contents, didactics, and technology leads to the development of an overall design for a learning environment. The development of this overall design is, according to Euler, Seufert & Wirth (2005,

11 The instruction design, according to Gagné, contains the teaching steps: attracting attention, informing about learning targets, activating previous knowledge, presentation of the learning matter with the characteristic features, guiding learning, letting perform, giving informative feedback, controlling and evaluating achievement, assuring retention and transfer (cp. Niegemann, 2001, pp. 25-32).

12 At this point it would be going too far to list and present the established instruction designs in detail. Hence, reference is made to the highly instructive summary outline by Niegemann (2001, pp. 21-68).

p. 518), already located on the so-called meso level, while Hug (2005, p. 3) still puts these activities on the macro level. It shall only be stated at this point, that not until the next step, the development of a test lesson, do principles of microlearning apply, as it is about developing modularized contents and testing their effects on the learning process.

Phase IV: Development of a Test Lesson

Following the most important conceptual decisions (didactics, content, technology), the entire learning system should not be immediately produced. Rather, a test lesson should be developed that represents the chosen didactic instruction design. At this point, considerations may influence the process of microlearning. For example, a (preliminary) decision is made about the extent to which the learning material is to be modularized, which can by all means affect the time periods of learning. The more modularized a learning material is, the more options are created for the learners to handle the learning matter in small portions and, at the same time, to access the contents of their choice.[13] Moreover, on the production side, experiences can be made during the creation of a test lesson that help to specify the expenditure of time, work, and costs more precisely.

Phase V: Pretest

Beyond testing the technical operability, a pretest can help to assess the evaluations of the potential users of the learning environment. For this purpose, students are usually confronted with the test lesson, then they have to work with it and are surveyed afterwards. The pretest results can lead to the conclusion that the first three work phases (input analysis, specification of didactics and contents, as well as technology specification) have to be carried out again. Obviously, our phase model includes a feedback loop: mainly data collected on the micro level (from survey results of learners about their learning processes) provide for conclusions with regard to problems on the meso level (didactic, content-related, and technological design), and with regard to the achievement of objectives on the macro level (i.e. specification of quality goals).

Some results of our pretest (which was conducted twice before implementation of the system) can be interpreted more precisely with the didactics of microlearning in mind. Clickstream records, for example, have shown that machine-interactive modules were predominantly used in the beginning. These modules, that complied to a great extent with the principles of microlearning, are apparently relevant for the determination of learning success, on the one hand, and could be handled in a short time, on the other

13 Although the choice of the learning module can apparently become a burden. At least the results from three evaluations of the Erfurt CLIC project indicate that indeed the modularization of the subject matter was very appreciated (every aspect as regards content is described with, at most, 400 words and one lesson is typically composed of 30 modules), the possibility, however, to determine ones-self the sequence of the modules, was rarely used.

hand. We developed interactive animations and so-called 'checks,' i.e. batteries of up to 10 test questions with automated feedback, whose processing took normally between two and five minutes. These small interactive learning bits were evaluated very positively in the beginning and were regarded to be very motivating to learning. Once the students, however, completed the entire learning course, they especially assessed the checks still as being motivating, though ultimately not as promoting knowledge. Rather, they evaluated the traditional 'guiding questions' (which generally corresponded to larger topical realms that were established through a multitude of modules or entire lessons) as very helpful. These results indicate a constructive information processing on the students' part which can be initiated by small motivating learning modules (or microlearning). The importance of the didactics of microlearning seems to decrease, however, with the increasing number and integration of knowledge stocks.

Phase VI: Production

After the pretest, the learning environment is produced. In this phase, many coordinating management tasks arise, especially if the technical realization of the learning system is produced within the organization, but programmed from externals, due to outsourcing.

Phase VII: Implementation

It would be illusionary to believe that a web-learning project is completed when the learning environment is readily produced. A sustainable learning environment on the web has to be temporally, factually, and socially incorporated into the entire teaching process. Otherwise, there is a risk that the extensively produced learning environment is never, or only once, applied. The implementation phase is thus crucial to the success and the sustainability of web-learning. Essentially, the four addressees of implementation activities need to be integrated carefully: the organization members, the computing personnel, the tutors, and the students.

1. Implementation Tasks on the Part of the Institute and its Employees

Usually, only part of the academic staff of a university institute already has experiences with e-learning, while doubts about one's own technological competence, and scepticism about the new learning form, are widespread (cp. Issing, 2002, p. 14; Encarnação, 2002, p. 95). That is why it is all the more important to introduce the learning environment – with its advantages and disadvantages – to the members of the institute. For a sustained implementation of web-learning, institute-wide consensus to cover certain courses with web-learning and a close tie to the curriculum should already be established at the beginning of the project. In addition, a continuous implementation of a web-learning environment is supported if one institute member is assigned the responsibility for web-learning in the long run.

2. Implementation Tasks on the Part of the Computing Personnel

For proper operation of the learning environment, several technological requirements have to be met. This can, for example, be the installation of the learning environment on the university server, the installation of additional programs (e.g., for the playback of videos and animations) on university computers, or the setup of a technology hotline for the users of the learning environment. Very often, these tasks are in the field of responsibility of university computer centers. They should be integrated into the development of the project from a very early point in time. After an initial inquiry concerning the extent to which resources can be made available, an active contact should be maintained during the implementation to coordinate solutions for technological concerns.

3. Training of Tutors

An efficient communication – be it within the student body or between the students and instructors – is still a prerequisite for the acceptance of a learning system and the learning success (e.g., Astleitner & Baumgartner, 2000, pp. 167-69; Kinnebrock, Koschel & Rössler, 2004, p. 38). Therefore tutors need to be trained for their tasks and responsibilities. Tutorial responsibilities are, for example, the maintenance of discussion forums, the administration of chats, the support of the students via e-mails, as well as the explanation of learning checks and their results. To enhance the motivation of the students, it is extremely important to answer e-mails in a timely manner and to keep the feedback constructive (Astleitner, 2000, pp. 26-27). During the training of tutors this should be emphasized.

4. Preparing the Students for Web-Learning

E-learning encounters reservations from students, as well (cp. exemplarily Baeßler, Wünsch & Kinnebrock 2004, p. 28-37; Kinnebrock, Koschel & Rössler 2004, p. 33-34). Therefore, the application of web-learning requires further justification. Furthermore, students have to be carefully introduced to the learning environment. Both electronic tutorials and introductory courses in university computer rooms are appropriate for this purpose. Within the scope of introductory courses, the handling of the technical tools of the learning environment should be practiced, and students should also be encouraged to use the possibilities for online communication inherent to the system. The extent of social contact – with instructors, but also with fellow students – remains the decisive factor that determines motivation and dropout for web-learning (Astleitner & Schinagl, 2000, p. 63).

Phase VIII: Evaluation and Advancement

After the output, the web-based learning course, has been run once, important findings for the improvement and advancement of the learning environment can be drawn from different evaluations. Basically, we may distinguish between *internal and external evaluations*.

A common form of internal evaluation is a *student survey*. In standardized surveys, or with the help of guided interviews, the satisfaction of the web-learning user, common usage patterns, and especially criticism on the learning offerings can be collected. These data allow inferences on how learning processes work on a micro level. Beyond the subjective satisfaction of students the learning success, measured by grades, is a central objective of teaching. Thus we strongly suggest including the *results of achievement inquiries* in the overall evaluation.

As the academic staff is confronted with the application of e-learning, too, a survey of those who designed the learning environment and conducted the learning course should be interviewed about their experiences. How satisfied were the *contributors* with the progression of the course, the virtual course administration, and with the achievements of the students? What is the proportion of results achieved and the effort that has been expended for the establishment of the learning environment? The contributors should make a *summary objective-outcome comparison* after the first completed application of the learning environment, whose starting point should be the results of the knowledge, task and target analysis (phase I).

In addition, other *data material* is available that can be used for internal evaluation: *indices* that help to describe the success of web-learning (e.g., dropout rates, grade point averages, etc.) can be calculated. *Messages of students*, that are accumulated during use of the learning environment (e.g., e-mails, entries on discussion forums), can also be collected and evaluated with a content analysis.

Apart from the results of internal evaluations, the outcomes of *external evaluations* are instructive, too. External evaluations can be carried out by experts, on the one hand, or through the collection of reference data, on the other hand. Expert judgments are, for example, relevant, when the content of the learning system has to be evaluated, or when the question of whether the latest subject matter has been displayed adequately has to be clarified. Here, *external academics* can be consulted and asked for their expertise. The didactic design, in turn, should be evaluated by *external pedagogues*.

Furthermore, a comparison with reference data is useful within the framework of the external evaluation, because the internally calculated indices (e.g., dropout rates) have few explanatory powers concerning the quality of the created learning environment as long as no reference data is given. Empirically tested *Benchmarks* for the success of web-learning or the establishment of *seals of quality*, as well as the passing through a *certification process* might be of relevance here. Through the participation at *competitions*, i.e. the direct comparison with competing learning environments, an evaluation of the quality of one's own product can be obtained. The reasons for the jury's judgments should provide important clues here (also for the improvement of the learning environment).

We want to emphasize that only a combination of different forms of evaluation allows a quality judgement about the created web-learning environment. Whether, for exam-

ple, a learning matter is out of date, or contains factual mistakes might not be adequately judged by a student who is confronted with it for the first time. Here, the expertise of an accounted expert is needed. But only the students, in turn, can provide information about motivation problems during learning. The evaluation thus should be perceived as a process, in which sources of different origin are collected, evaluated and balanced.

After combining the different evaluation results, it might eventually be useful to get back to previous phases of the quality management cycle – e.g., to go back again to the first stage, the analysis, to modify the objectives. Consequently, a circular model of quality management for the implementation of web-based learning environments (see figure 2) can be developed from our experiences.

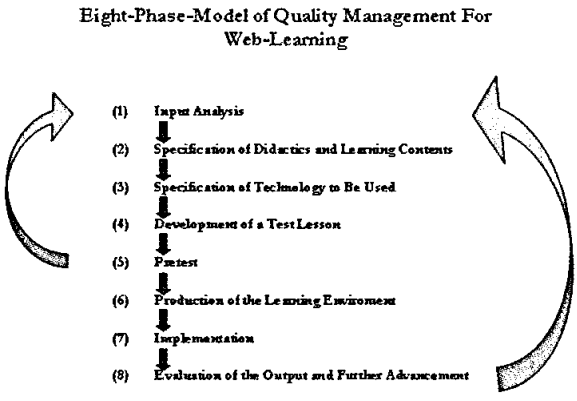

Figure 2. Circular model of quality management for the implementation of web-based learning environments

5 Conclusion

Web-based learning environments are indeed used for university teaching, but up to now sustainable changes in teaching can only exceptionally be recognized. Often, the end of project promotion also means the end of efforts to establish web-based learning environments in the long term (Kerres, 2002, p. 58; Ehlers, 2006, p. 37). From our perspective, this is a distressing development, because not only resources are wasted, but also important potentials of web-learning are not used. The free choice of the place and time of learning, the self-determined study time, motivational multimedia-based and machine-interactive editing of contents, a comprehension-promoting modularization of the learning matter – all these are opportunities provided by web-learning, which – ideally – lead to a greater learning success.

The planning and realization of such learning environments, however, is a highly complex process. To structure the progress of web-learning projects and to establish continuous quality checks, an Eight-Phase-Model of quality management was suggested. The different levels on which learning or coordination processes take place were addressed during the elaboration of the individual phases.

A main characteristic of web-learning, and especially microlearning, is that it can be used independent of places. A learning environment is potentially available everywhere, through Internet/WWW or cellular phone networks. Moreover, the extreme modularization of content allows the students to determine not only the places where they learn, but also the time periods they dedicate to learning. Our evaluations indicate a dynamic interplay between small, motivating microlearning modules (that are especially important to initiate learning processes), on the one hand, and larger learning units that allow a deeper integration of knowledge stocks on the other. These dynamic relations should be further investigated – and this is particularly true from a quality management perspective. Among all the different goals that are to be defined and achieved within the process of quality management, the improvement of learning processes is still crucial – and to a great extent, controllable. As a consequence, quality management in the field of web-learning must respect the didactics of microlearning.

References

Abbey, B. (2000) *Instructional and Cognitive Iimpacts of Web-Based Education.* Hershey, PA: Idea Group Publishing.

Abt, M., Ehlers U-D. & Pawlowsiki, J. (2006) Qualitätssiegel E-Learning bei der RAG Aktiengesellschaft in Essen. In: Sindler, A., Bremer, C., Dittler, U., Hennecke, P., Sengstag, C. & Wedekind, J. ed. *Qualitätssicherung im E-Learning.* Münster: Waxmann, pp. 21–32.

Astleitner, H. (2000) Qualität von web-basierter Instruktion. Was wissen wir aus der experimentellen Forschung? In: Scheuermann, F. ed. *Campus 2000. Lernen in neuen Organisationsformen.* Münster: Waxmann, pp. 15–39.

Astleitner, H. (2002) *Qualitätsmanagement von E-Learning. Research Report.* Institut für Erziehungswissenschaft der Universität Salzburg. Available from: <http://www.sbg.ac.at/erz/as/AS_QUAL2.DOC > [Accessed 19 August 2004].

Astleitner, H. (2004) *Qualität des Lernens im Internet. Virtuelle Schulen und Universitäten auf dem Prüfstand.* 2nd ed. Frankfurt M.: Lang.

Astleitner, H. (2005) Principles of effective instruction. General standards for teachers and instructional designers. In: *Journal of Instructional Psychology*, 32, March, pp. 3–8.

Astleitner, H. (2006) Standard-basiertes E-Lehren und selbstreguliertes Lernen. Selbstreguliertes Lernen als Voraussetzung für Qualitätsinnovationen im E-Learning. In: Sindler, A. et al., eds. *Qualitätssicherung im E-Learning.* Münster: Waxmann, pp. 21-32.

Astleitner, H. & Baumgartner, A. (2000) Dropout bei web-basiertem Fernunterricht. In: Kammerl, R. & Astleitner, H. eds. *Computerunterstütztes Lernen.* München/Wien: Oldenbourg, pp. 166–187.

Astleitner, H. & Schinagl, W. (2000) *High-level Telelernen und Wissensmanagement.* Frankfurt a.M.: Peter Lang.

Astleitner, H. & Sindler, A. (1999) *Pädagogische Grundlagen virtueller Ausbildung. Telelernen im Fachhochschulbereich.* Wien: Universitätsverlag.

Baeßler, B. et al. (2003) E-Learning-Systeme. Theoriegeleitete Konzeption, Qualitätsmanagement, Implementierung. In: *Zeitschrift für Medienpsychologie,* 15 (1), pp. 13–23.

Baeßler, B., Wünsch, J. & Kinnebrock, S. (2004) Innovation in der kommunikationswissenschaftlichen Lehre? Evaluation eines internetbasierten Lernsystems zur Einführung in die Kommunikationswissenschaft. In: Neubert, K. & Scherer, H. eds. *Die Zukunft der Kommunikationsberufe – Ausbildung, Berufsfelder, Arbeitsweisen.* Konstanz: UVK medien, pp. 19–39.

Balli, C., Krekel E.M., Sauter, E. (2005) Qualitätsentwicklung in der Weiterbildung aus der Sicht von Bildungsanbietern – Diskussionsstand, Verfahren, Entwicklungstendenzen. In: Balli, C., Krekel E.M. & Sauter, E. eds. *Qualitätsentwicklung in der Weiterbildung. Zum Stand der Anwendung von Qualitätssicherungs- und Qualitätsmanagementsystemen bei Weiterbildungsanbietern.* Bonn: Schriftenreihe des Bundesinstituts für Berufsbildung [Wissenschaftliche Diskussionspapiere Heft 62], pp. 5–24.

Berger, N. & Eilert-Ebke, G. (2006) Corporate Communication and Language Trainer Certificate (CLTC) als Werkzeug zur Qualitätssicherung. In: Sindler, A. et al., eds. *Qualitätssicherung im E-Learning.* Münster: Waxmann, pp. 125–34.

Bremer, C. (2006) Qualitätssicherung und E-Learning. Implementierungsansätze für die Hochschule. In: Sindler, A. et al., eds. *Qualitätssicherung im E-Learning.* Münster: Waxmann, pp. 185–202.

Bruder, R. et al. (2006) Qualitätssicherung mit einem E-Learining-Label für universitäre Lehre und einem Gütesiegel. In: Sindler, A. et al., eds. *Qualitätssicherung im E-Learning.* Münster: Waxmann, pp. 87–98.

Bruhn, M. (2003) *Qualitätsmanagement für Dienstleistungen. Grundlagen, Konzepte, Methoden.* Berlin: Springer.

Carstensen, D. (2006) Studierende im Mittelpunkt. Qualitätsperspektiven in multimedialen Lehr- und Lernsettings an Hochschulen. In: Sindler, A. et al., eds. *Qualitätssicherung im E-Learning.* Münster: Waxmann, pp. 13–20.

Ehlers, U.-D. (2006) Bildungsrelevante Qualitätsentwicklung. Qualitätskompetenz als Grundlage für Partizipation im Qualitätsprozess. In: Sindler, A. et al. eds. *Qualitätssicherung im E-Learning.* Münster: Waxmann, pp. 33–54.

Encarnação, J.L. (2002) Entwicklung multimedialer Software für das Studium. In: Issing, L.J. & Stärk, G. eds. *Studieren mit Multimedia und Internet. Ende der traditionellen Hochschule oder Innovationsschub?* Münster: Waxmann, pp. 91–112.

Euler, D., Seufert, S. & Zellweger, F. (2006) Geschäftsmodelle zur nachhaltigen Implementierung von eLearning an Hochschulen. In: *Zeitschrift für Betriebswirtschaft. Special Issue 2* [E-Learning Geschäftsmodelle und Einsatzkonzepte], pp. 85–104.

Euler, D., Seufert, S. & Wirth, M. (2005) Gestaltung des Qualitätsmanagements zur Zertifizierung von E-Learning-Programmen. In: Euler, D. & Seufert S. eds. *E-Learning in Hochschulen und Bildungszentren.* München/Wien: Oldenbourg, pp. 513–28.

Horton, W. (2000) *Designing Web-Based Training.* New York: Wiley.

Hug, T. (2005) *Microlearning and narration. Exploring possibilities of unitilization of narrations and storytelling for the designing of "micro units" and didactical microlearning*

arrangements. Paper presented at the forth Media in Transition conference. May 6-8, Massachusetts Institute of Technology, Cambridge (MA), USA. Available from: <http://web.mit.edu/comm-forum/mit4/papers/hug.pdf> [Accessed 19 November 2005].

Gagné, R.M. (1985) *The Conditions of Learning and Theory of Instruction.* New York: Holt, Rinehart & Winston.

Garrett, R. (2005) *E-Learning in Tertiary Education. Where Do We stand?* Center of Educational Research and Innovation. Paris: OECD Publications.

Gerpott, T.J. & Schlegel, M. (2000) Online-Zeitungen. Charakteristika und Anwendungspotenziale eines neuen Medienangebotes. In: *Medien & Kommunikationswissenschaft,* 48 (3), pp. 335–353.

Glowalla, U., Glowalla, G. & Kohnert, A. (2002) Qualitätsmanagement interaktiver Studienangebote. In: Issing, L.J. & Stärk, G. eds. *Studieren mit Multimedia und Internet. Ende der traditionellen Hochschule oder Innovationsschub?* Münster: Waxmann, pp. 113–28.

Horton, W. (2000) *Designing Web-Based Training.* New York: Wiley.

Issing, L.J. (2002) Neue Medien – Herausforderung und Chance für die Hochschule. In: Issing, L.J. & Stärk, G. eds. *Studieren mit Multimedia und Internet. Ende der traditionellen Hochschule oder Innovationsschub?* Münster: Waxmann, pp. 9–17.

Kerres, M. (2002) Medien und Hochschule. Strategien zur Erneuerung der Hochschullehre. In: Issing, L.J. & Stärk, G. eds. *Studieren mit Multimedia und Internet. Ende der traditionellen Hochschule oder Innovationsschub?* Münster: Waxmann, pp. 57–70.

Kinnebrock, S. & Baeßler, B. (2004) Qualitätsmanagement bei der Implementierung von webbasierten Lernumgebungen in die kommunikationswissenschaftliche Lehre. In: Neubert, K. & Scherer, H. eds. *Die Zukunft der Kommunikationsberufe – Ausbildung, Berufsfelder, Arbeitsweisen.* Konstanz: UVK medien, pp. 41–60.

Kinnebrock, S., Koschel, F. & Rössler, P. (2004) Web-Learning. Konzeption und Evaluation des Lernsystems CLIC. In: *Medien Journal,* 28 (4), pp. 31–9.

Koring, B. (2001) *Qualitätsmanagement bei der Entwicklung von Tele-Learning-Kursen für die Universität.* Paper presented at the University of Erfurt. Feb. 4.

Niegemann, H.M. (2001) *Neue Lernmedien – Konzipieren, Entwickeln, Einsetzen.* Göttingen/ Bern: H. Huber.

Oess, A. (1993) *Total Quality Management. Die ganzheitliche Qualitätsstrategie.* Wiesbaden: Gabler.

Pächter, M. (2006) Von der didaktischen Vision zum messbaren Indikator. Entwicklung eines Qualitätssystems für medienbasierte Lehre. In: Sindler, A. et al., eds. *Qualitätssicherung im E-Learning.* Münster: Waxmann, pp. 55–72.

Schank, R.C. (1998) *Tell Me a Story. Narrative and intelligence.* 2nd ed.. Evanston: Northwestern University Press.

Sindler, A. et al., eds. (2006) *Qualitätssicherung im E-Learning.* Münster: Waxmann.

Wirth, M., Euler, D. & Seufert, S. (2006) Qualität von E-Learning beurteilen, sichern, verbessern. Herausforderungen in der Umsetzung und Erfahrungen mit dem neuen Qualitätszertifikat "CEL" von EFMD. In: Sindler, A. et al., eds. *Qualitätssicherung im E-Learning.* Münster: Waxmann, pp. 153–68.

Zollondz, H.-D. (2002) Grundlagen Qualitätsmanagement. Einführung in Geschichte, Begriffe, Systeme und Konzepte. München/Wien: Oldenbourg.