E-LEARNING IMPLEMENTATION IN HIGHER EDUCATION

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ABSTRACT

In this paper, the phases of institutional implementation of e-learning technologies are presented. They include rigorous analysis and planning, ensuring the management support including corresponding financial resources, selection of appropriate technologies and courses, ensuring e-learning acceptation through whole institution, and evaluation of e-learning contribution. Finally, the paper focuses on the case study of institutional development of e-learning at the Technical University of Kosice and on the recommendations ensuring successful e-learning implementation.

Keywords: *e-learning, human resource, learning management system, methodology, portal, platform, quality of services, virtual university.*

1. INTRODUCTION

Drivers of the European Higher Education Area (EHEA) include mobility, support of knowledge-driven economy, attention for social inclusion and equity, efficient investment in human capital, and last but not least, response to the rapidly changing knowledge society with particular attention to the rising information and communication technologies.

With regard to the contribution of non-classical learning and teaching forms to the emerging EHEA, the Report of the *International Seminar „Bologna and the Challenges of e-Learning and Distance Education"* [13] demonstrated that e-learning and distance education are to be considered an integrated part of the regular activities alongside mainstream higher education. E-learning as part of a well balanced blend can facilitate self-directed learning, can easily match individual needs and provides sufficient flexibility. Integration of lifelong learning and collaborative networking between institutions, both conventional and distance teaching ones, and even including the corporate world through private-public partnerships can help to build transparent, high quality, efficient, and socially inclusive EHEA.

Moreover, according to independent studies confirming this European Union intention, it is expected that 70 - 80 % growth of economics and competitive strength in the nearest decade will be based on the „knowledge industry". This fact follows especially from corporate environment changes, globalization, sharpening competition, accelerating innovation, etc.

It is evident, that the educational institutions face challenge in this transition and complex environment where they have to exploit all available opportunities and competencies. From the point of technological support, they can exploit extremely fast development and efficiency of information and communication technologies, in education field known as e-learning.

Generally, e-learning technologies can create multimedia databases of knowledge of an institution in the form of electronic courses available on arbitrary computers connected to Internet, they provide remote communication with teacher and the possibility to obtain a certificate in a such form of study. *As a consequence, e-learning can be defined as the ICT applications for education development, distribution, and management.*

It is possible to list the following *six steps* to ensure successful e-learning implementation [14]:

1. No matter how good e-learning benefits look, they can only be obtained with *careful analysis* and *planning* regarding to business drivers, content, learners, didactics, technology, tracking, etc.
2. The second critical step is to secure *executive sponsorship* and *financial funding* (or who is going to pay for this?).
3. After that it is possible to *select technology* and *content*. Careful evaluation of potential Learning Management Systems is serious because of the high investment cost and long-term impact.
4. The fourth step is to *gain acceptance* – from both employees and their managers.
5. The fifth step to success is to *ensure enterprise-wide* e-learning that is system-wide implementation of e-learning aimed at making a significant impact.
6. Finally, the last step is to evaluate and measure benefits resulting from e-learning implementation at a particular institution.

In next sections, the above mentioned critical phases of e-learning implementation at the institution of university type are discussed.

2. SWOT ANALYSIS AND DIDACTICS

The answers to questions like „what kind of benefits the institution can get by e-learning implementations" or „what kind of strengths, weaknesses, opportunities and threats can follow from e-learning application in every-day university life" can be a basis for the following SWOT analysis [10].

The strengths of e-learning (S1, S2) follow especially from technological architecture of e-learning systems:

- *S1: Databases of e-learning materials and study results*. On-line available on Internet, plentiful

interactive and multimedia resources, learning with own study style, independence on place and time, standard and interoperability support, thematic exchange networks.

- S2: *Internet communication tools.* Possibility to create new educational models combining face-to-face teaching with on-line individual study and collaborative learning (so-called blended learning), building the student motivation by team projects on Internet, national and international exchange of teacher experiences.

Not only strengths, but also the weaknesses of e-learning (W1, W2) follow from technological keystone of e-learning systems:

- W1: *It is „just" technology.* It means, it is an additional tool of teacher (like book, blackboard, etc.) that should be managed in a proper way. The teacher personality, his or her personal approach to students, remains dominant for the overall success of study and education.
- W2: *Time and financial expenses.* The workload of teachers does not usually contain duties following from e-learning, no technical and/or organizational structures are available many times, institutional budget is not able to cover new expenses, etc. These problems can be solved by the change of institutional strategy, moreover, the expenses can decrease by building up thematic exchange networks. Generally, e-learning is going to be profitable only at the high repeatability of e-learning courses. On the other hand, with regard to competitive strength of institution the e-learning activities should not be neglected.

A proper implementation of e-learning can provide especially these opportunities (O1, O2):

- O1: *Increase of study efficiency.* More creative education and improved personal approach of teachers to students, study individualization, broad spectrum of multimedia databases, independence on place and time, automation of teacher routine activities (e.g. testing), possibility to enlarge the creativity and humanity of all participants.
- O2: *Improvement of institutional transparency.* Better transparency for students, teachers, faculty and university management as well as for the third party through user-friendly educational web-portals including *Learning Management System* (LMS)/ *Learning Content Management System* (LCMS) filled up with standardized educational modules and transferable study results.

At the end of this analysis, we should note that each technology has also some potential threats (T1, T2):

- T1: *Unilateral development of students.* Intention only on knowledge without any development on ethics and culture, on-line courses without personal contacts between students and teacher, locking into virtual world, decrease of social competency, elitism and humanity suppressing.
- T2: *Replacing teachers by intelligent machines.* Elimination of personal contacts between students and teachers, decreasing importance of educative impact of

teachers on students, teacher as a tutor with possibility to replace him by intelligent machine.

Generally, the successful implementation of e-learning technologies at the particular educational institution can provide us with several benefits given in Table 1.

Table 1 Benefits of successful e-learning implementation

Technology	Students	Teachers
Study Results Database	Comparison Motivation	Testing Transparency
Study Materials Database	Rich multimedia Learning-styles	Methodology Fast Adaptation
Communication Tools	Collaboration Creativity	Blended Learning Availability

Technology	Management	The Third Party
Study Results Database	Student analyses Quality System	Availability of Study Results
Study Materials Database	Teacher Analyses Quality System	Transparent Institution
Communication Tools	Exchange Networks Standardization	Lifelong Learning

From the *didactics* point of view, according to Jan Amos Comenius, world-wide teacher of nations, schools should be „*humanity manufactories"* that should not only teach human being, but also put forward him or her to such values as truth, justice, diligence, prudence, wisdom, respect to people and matters as well as faith, hope and love. Consequently, a right personal example of teacher to students is necessary. He thought of dialogue as the most naturalistic method of education, especially that one not prepared in advanced. On the other hand, he supported to include into education the prepared short performances. Moreover, he proposed to implement into education the methods making school like a play that enhance and vitalize educational process (up-to-date constructive approach). He talked that a teacher should not present the theory prosily and in a dry atmosphere staying „above" students (traditional instructive approach).

As a consequence, the technology must not replace the personal relationship between teacher and student, but on the contrary, it has to develop this relationship as well as creativity and humanity of all participants in education.

With regard to practical implementation of e-learning technologies, the following three models can be used: *technology supported learning* (large part of face-to-face learning with support of different e-learning solutions, e.g. multimedia CD presentations in conventional classroom), *on-line learning* (small or no part of face-to-face learning, e.g. on-line courses in LMS/LCMS, video conferences, etc.) and *blended learning* (combination of face-to-face and on-line learning and/or collaborative work on Internet).

Blended learning as a learning model has been successfully used in enterprise training as well as in case of lifelong learning provided by universities. For the

correct and efficient application of blended learning it is necessary to identify subject parts that are better to provide by face-to-face form and the others to be taught by on-line courses or collaborative work on Internet. Generally, *the most important knowledge should be presented to students with personal explanation*. It should be noted that the share of face-to-face learning and on-line courses depends on the student age and subject under consideration. In case of children and adolescents the personal contact and teacher attendance is necessary. Therefore, the technology supported learning can be a proper model of education here. On the other hand, in case of adult students the larger share of on-line self study can be applied. [11]

3. MANAGEMENT AND TECHNOLOGY

For the success of any project the management support of particular institution including corresponding financial resources is absolutely necessary. [9] This is valid especially in case of e-learning implementation affecting the organizational structure and strategy of entire institution. As a consequence, a failure risk of institutional implementation of e-learning based on effort of individual e-learning fans not clearly supported by the institutional management is considerable high.

It should be noted that the e-learning implementation is a very cost-consuming process. It requires not only a purchase of some LMS/LCMS system (including license costs per year), but it is necessary all the time to cover the development or purchase of e-learning courses, teachers training, users support, etc. As the first implementation step can be useful to test some open-source solutions or to make mutually profitable agreement with a provider of commercial e-learning solution that has usually own implementation strategy.

At present time, the following e-learning solutions are frequently applied: simple informational solutions (on-line documents, web pages, etc.), e-books and e-textbooks, streaming media and presentations, virtual classrooms for live e-learning events, interactivity and testing, games and simulations, on-line courses and tutorials, learning by e-mail including e-mail games, collaborative learning (chat, discussion groups, social networks, wiki), blogging, mobile wireless learning (so called m-learning), etc. Games and simulations can take a special importance for enterprise training. Cost expenses and time to develop the particular e-learning solutions are illustrated in Fig.1.

From the point of e-learning content development, the following strategies are available: *purchase of courses* (low effort, low or medium expenses, low risk), *development of own courses* (high effort, medium expenses, high risk) or course development through *outsourcing* (low effort, high expenses, low risk).

From the technological point of view, an appropriate *LMS* should be available to students. The LMS system provides on-line courses to students including basic or advanced communication tools, it monitors particular user activities, etc. If the system supports the development of e-learning courses, it is so-called *LCMS*. The great advantage of LMS/LCMS systems is the interoperability of e-learning courses and study results, i.e., the

standardized learning modules are transferable between different systems. In past, the standards for LMS/LCMS architecture, for content and personal information exchange, for interfaces, for data models and digital libraries have been proposed. Following, the compatibility of particular LMS/LCMS system with the complex *standard SCORM* (www.adlnet.org) is important when selecting appropriate e-learning technology. The export of e-learning courses and tests into standardized xml schemes (so called imsmanifest.xml corresponding to static SCORM on asset level) should be a minimum requirement for the LMS/LCMS system. At present, there are only few producers providing the full support of SCORM standard.
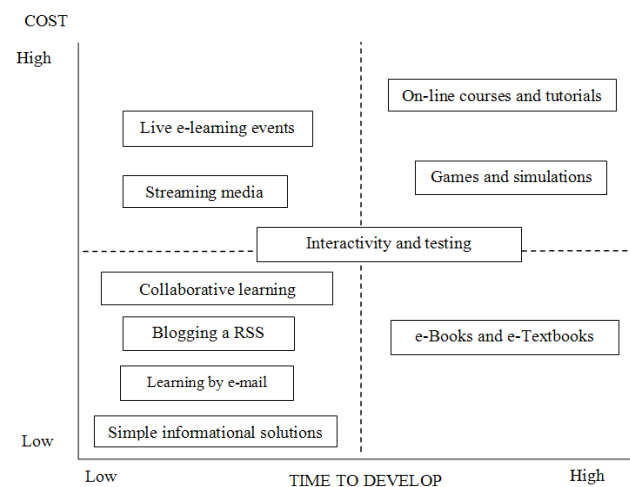

Fig. 1 e-Learning solutions - cost and time to develop.

The *IEEE 1484 LTSA Specification* (ltsc.ieee.org) describes the system design and the components of the *Learning Technology Systems Architecture* (LTSA). The LTSA specification covers a wide range of systems, commonly known as learning technology, computer-based training, computer assisted instruction, intelligent tutoring, education and training technology, etc. The overall flow takes the following form: learning style or strategy is negotiated among the learner and other stakeholders; learner is observed and evaluated; evaluation produces assessments and/or performance information; performance information is stored in the learner history database; system coach reviews the learner's assessment, past performance history, and, possibly, future learning objectives; system coach searches the knowledge library, via query and content indexes, for appropriate learning content; system coach extracts the locator indexes from the available content indexes and passes the locator indexes to the delivery process, e.g., a lesson plan; delivery process extracts the learning content from the knowledge library, based on locator indexes, transforms the learning content to an interactive multimedia presentation to the learner.

To select an appropriate LMS system, the *EduTools* project can be a good resource (www.edutools.org). *EduTools* provides comparisons, reviews, analyses, and automated decision-making tools in areas of course management systems, student services, e-learning

policies, etc. This site reviews each product by researching and describing more than 40 product features, in particular, *Communication tools* (discussion forum, discussion management, file exchange, internal e-mail, on-line journal and notes, real-time chat, whiteboard), *Productivity tools* (bookmarks, calendar and progress review, orientation and help, searching within course, work offline and synchronize), *Student involvement tools* (group-work, community networking, student portfolios), *Administration tools* (authentication, course authorization, hosted services, registration integration), *Course delivery tools* (test types, automated testing management, automated testing support, on-line marking tools, course management, on-line gradebook, student tracking), *Content development tools* (accessibility compliance, content sharing and reuse, course templates, customized look and feel, instructional design tools, instructional standards compliance), *Hardware and software* (client browser required, database requirements, server software), *Company details and licensing* (company profile, costs and licensing, open source, optional extras).

4. ACCEPTATION AND EVALUATION

The next step in institutional e-learning implementation is to *gain acceptance* – from both employees and their managers. There are several strategies for providing a smooth transition: start small to build confidence; involve instructors early on and throughout the implementation; select external skill sets that compliment your own; make training and trial projects, etc. Except above, very important to success is to ensure institution-wide e-learning that is system-wide implementation of e-learning aimed at making a significant impact.

Finally, the last step is to *evaluate and measure* your benefits [15, 16, 17]. To achieve these aims a *Quality Assurance System* [12, 8] for e-learning developers/users including the development of proper organization structures should be established. It should address the areas of *Strategic Planning* (market analysis, target group requirements, resources planning), *Framework or Program* (program planning, learning methods and materials, evaluation), *Cooperation* (establishing network of content providers, teachers, sponsors, etc.), *Course Development* (infra-structure, design, didactics, motivation, learning materials, assessments, student support, and evaluation), *Marketing* (strategy, test studies, evaluation), *Starting an Educational Activity* (prerequisites regarding certificates and technology, costs, support), *Introduction* (explaining objectives, test, feedback, rules and support, training of learning methods), *Realization* (interactions through e-mails, chat, etc., feedback system, evaluation), *Student Support* (technical and content support, improving motivation, monitoring performance, evaluation), *Teacher Support* (technological and didactical support, quality assurance by continuous training and evaluation, improving motivation by adequate resources, teamwork, teachers' feedback and common decisions), *Central Database* (collecting students' data and documentation from all

mentioned areas), and *Evaluation* (assessment of all phases including quality assurance approaches, controlling).

Important issue is the *transparency of learning environments* for the learner. From this point of view, the information for learner can be identified through *General Information* (title, description, prerequisites for participation, technical requirements, guidelines and standards, update interval, language, student involvement, security and privacy), *Content* (objective, curriculum subjects, structure, classification), *Educational Concepts* (context, target group, typical learning time, teaching methods, learning resource type, collaboration), *Support* (kind and accessibility of support, intervals for delivering of learning materials, technical support), *Presentation* (media and applications used, layout guidelines), *Communication and Interaction* (types of interaction and applications, guidelines for feedback), *Assessment* (types and dates of assessment, certification), and *Administration* (costs and dates, payment methods, expenses for telecommunications, contracts, and place, duration, frequency of accompanying instruction or service).

In next section, an example of the *Quality Assurance System for course development* adopted at the Technical University of Kosice is outlined [5]. The basic idea is that every developed e-learning course has to fulfill the requirements from the content point of view (A1-A3) and from the e-learning point of view as well (B1-B10).

The detailed description of mentioned quality characteristics is following:

A: Content Evaluator
Following three characteristics are checked by independent Content Evaluator.

A1: Course content meets textbook requirements
The lessons include clear objectives, study texts are enhanced with assignments and/or case studies, at the end of lessons are available summaries, check answers, literature, webliography and other sources.

A2: Course content on professional level
The content is evaluated by expert in particular field of study.

A3: Course content for full semester study
The lessons in online course typically correspond to lectures in full-time study, on the other hand, assignments, case studies and tests usually match exercises or practices.

B: e-Learning Evaluator
Following ten characteristics are checked by independent e-Learning Evaluator.

B1: Course general information
The course information should include course title, contact addresses and profiles of course instructors, course code, field of study, number of credits, course syllabus including a clear statement of the roles, responsibilities and expectations of the instructor and students, technical requirements including links to tutorial modules for any additional skills that maybe required, and a statement on relevant institutional policies as late assignment, plagiarism policies, etc.

B2: Course calendar with events and activities
The calendar represents a time schedule of lesson's topics, readings, assignments, tests and exams including all

deadlines. It can inform about course events and activities, e.g., date of virtual classrooms, personnel meetings, consultations, etc.

B3: Course lessons with clear structure and motivational components

The comprehensible lessons with well-defined structure including objectives, keywords and lesson summary, links to self-evaluated tests and assignments, list of literature and resources. Students should be engaged through humor, novelty, game or surprise elements, testing, adventure, etc.

B4: Adequate level of design and aesthetics

The professional templates are recommended (e.g., MS Office). A good, clean layout can greatly increase understanding, i.e., simplicity is the key.

B5: Appropriate multimedia support of lessons

The quality pictures, animations, audio and video files are needed. Note that use of multimedia depends on course nature, i.e., for some courses multimedia files are not required. On the other hand, audio/video streaming of lectures is usually useful.

B6: Keywords and glossary of terms

At least one-two keywords for every slide of lesson are recommended. At the end of lessons a glossary of terms should be provided to support searching.

B8: Assignments and discussion forums

The assignments usually correspond to exercises in full-time study. Discussion forums support communication within e-learning course. Information about assignments and discussions should be defined in course calendar as well.

B8: Evaluation system including self-evaluated, current and final tests

Every lesson should be linked with at least one self-evaluated test to ensure a study feedback. Clear information on how students will be graded on tests, assignments and course participation should be provided. Important feedback represents a student course evaluation form and a student feedback page to take comments during the course.

B9: Additional resources

Additional resources include a list of literature and reading materials, webliography, FAQ, case studies, references and other links to learning resources.

B10: Course text ready to download and print

As many students are still grounded in traditional "paper and pen" methods, a good idea is to have pages available in standard print formats for quick downloading and offline use.

5. CASE STUDY

In order to support e-learning activities at the Technical University of Kosice, a common technological and organizational platform available for all university teachers and students was necessary to develop. In next paragraphs, some important results of e-learning implementation projects are outlined [1-7].

The establishment of the University E-learning Board was the important output of the development project solved in 2004 [2]. Shortly, the E-learning Board is the consultative and advisory body of the university rector in the field of e-learning activities. Its competency is intent on university coordination of e-learning development, management of the e-Learning Portal, support of e-learning courses development including retraining activities, creating opportunity for discussions, consultations and exchange of experiences, etc.

Fig. 2. e-Learning Portal - home page of particular subject.

The important step from the technological point of view was the establishment of the e-Learning Portal (http://ep.tuke.sk, see Fig.2) integrated with the university information systems. The e-Learning Portal provides detailed public information about university study programs and courses. In particular, from February 2007 almost 80% university study programs (exactly 214 programs and 9401 courses) were available on-line. The content of the e-Learning Portal can be upgraded using data import from the university information system Study Programs. The Portal is also connected with the university employee database that enables user-friendly log-in of all university teachers.

Except detailed public course information the e-Learning Portal provides the following support for every university teacher:

1. *Basic e-learning support*. The teacher publishes for students the study materials and the course announcements. All students studying such a subject have access to e-learning materials through one universal login and password provided by the teacher at beginning of the semester.

2. *Medium e-learning support*. It extends basic support in such a way that each student has available own login and password. This approach supports e-mail communication between teacher and students, discussions, tasks and assignments, student's evaluation, etc.

3. *Full e-learning support*. Except basic and medium support the multimedia lessons and electronic tests are available for students. The teachers develop standardized course materials using authoring tool with SCORM support.

Finally, we would like to note that the e-learning implementation at the Technical University of Kosice is just at the starting point. In next years the substantial effort in the area of human resources development, effective online teaching, standardization, and marketing should be done.

6. CONCLUSIONS

From ethical and didactical point of view, teacher's personality including *human contact* is crucial for any educational process and it cannot be replaced by only technology. At the same time, specialized ICT supported services as easy-to-use portal solutions will provide opportunities to build *more transparent* educational institutions with well balanced blended learning supporting creativity, personnel development, and social cohesion of all parties.

In order to reflect the SWOT analysis of e-learning given in the Section 2, especially to empower the strengths of e-learning, to overcome weaknesses, to utilize opportunities and to avoid threats, the following recommendations should be taken into account.

1. To build up *standardized* databases of study materials and study results (see strength S1 in SWOT).
2. To use Internet communication tools in an *effective way* (S2).
3. Not to overrate e-learning, but to perceive it as just another *teacher's tool* (W1).
4. To develop the *institutional strategy* including human sources development, to eliminate expenses by building up thematic *exchange networks* based on standards (W2).
5. To introduce *multi-level* e-learning according to user skills and learning models, i.e., from so-called lite e-learning portals for beginners up to complex LMS/LCMS with virtual classrooms for advanced users (O1).
6. To use simple and *user-friendly* e-learning portals with public information for the third parties (O2).
7. To apply *blended learning* models (T1).
8. Not to replace the personal relationship between teacher and student, but on the contrary, to support the development of this relationship as well as *creativity* and *humanity* of all participants (T2).

Finally, we should promote substantial *research effort* on proper implementation of e-learning technologies in the European Higher Education Area with special emphasis on social and ethical consequences.

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BIOGRAPHIES

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