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E-LEARNING OPPORTUNITY IN HIGH EDUCATION FOR ENGINEERS

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ABSTRACT
The primary goal of this paper is to present a system for support of distance education that has been develop and used within the web based e-platform implemented at the Faculty of Mechanical Engineering in Skopje. The system has been develop in order to enable different new forms of learning methods for students enrolled to the Faculty and also, to the second group of students; graduates and professionals from SMEs and industry that use continuing forms of education, such as: life-long learning courses, specialisation courses or postgraduate studies. That distance education system enables different forms of interaction among participants in the learning process and supports different active learning forms in order to adapt to the labour market needs, to propose different modes of delivery and promote contemporary types of skills (ICT, advanced technologies, entrepreneurship, communication, flexibility). The implementation of such a system for distance education represents an attempt for transferring the infrastructure of traditional education system (classroom, library, project work) into the digital word, as a form useful for both groups of students, especially employees that don't have time for classroom but need continuing increase of the knowledge and skills.
Keywords
e-Learning, Distant Education, Entrepreneurship, Engineering, SMEs.

1. INTRODUCTION

The countries in the Western Balkan are facing major challenges in terms of economical and social regeneration, mass education, limits of public funding, changing technologies, with increasing the role of Small and Medium sized Enterprises (SMEs) and multinational enterprises. In accordance to this situation, the intensive process of collaboration between universities and SMEs must be built.

Partnership between universities and enterprises can take various forms in the education and in Research & Development (R&D) area. In education, the following forms are important: enable students to be ready for labour market, introduce life-long learning courses and various types of postgraduate studies as a continuing education, using the feedback from employers, guest professorships and shadow manager projects. In R&D, in the form of contract research, the technology transfer and commercialization of research results are important. Expected results of a partnership are improved image of enterprises in Western Balkan, a faster development of economy, new diversified resources and better ways to meet market needs.

Universities need to cooperate with the industry and build relationships to develop joint actions. Particular attention should be paid to SMEs as they contribute significantly to the economic growth. Universities need to demonstrate their willingness to play the key role, together with industrialists and local authorities. In numerous contacts with representatives from industry and small local enterprises we have concluded that increased interest to involve information technologies in the production systems and to introduce the economic based approach in the engineering decisions do exist (Fig.1).

The cooperation between the Universities and the enterprises should bring mutual benefits and better outcomes for all partners, in terms of improving the quality of graduated students, in terms of their preparation for today's and tomorrow's market. The cooperation should enable development of high quality training materials in advanced technologies areas, adapting to the changing needs of the society/economy and ensuring a more effective link between the fundamental and applied research and its transfer into enterprises.

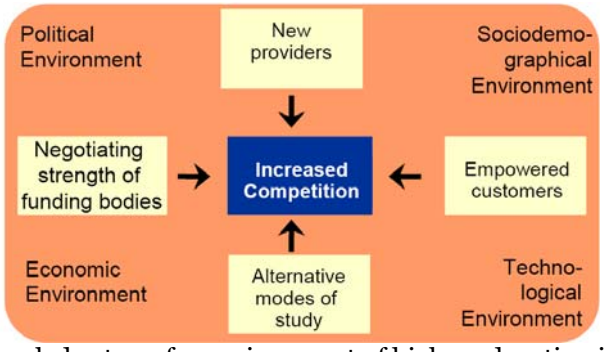

Figure 1. Knowledge transfer environment of higher education institutions

The traditional attitude to learning needs has to be changed. New modes of learning (distance education, web-based education, e-learning, part-time education) need to be further developed. Changes in the courses are necessary to adapt to the needs of labour market, to propose different modes of delivery and promote different types of skills (ICT, entrepreneurship, business, advanced technologies, communication, and flexibility). Those concepts have evolved from simple educational material exchange to more sophisticated interaction between the user and the distributed resources.

2. DISTANCE EDUCATION PRINCIPLES

The term "Distance Education" has many definitions in the literature [1,2,7]. One of the most complete definitions for distance education is provided by Keegan [6]: The instructor and the student are separated throughout the educational process, the educational curriculum is controlled by a certain educational institution, educational materials are exchanged via different media for the purpose of overcoming the physical distance between the instructor and the students, and different forms two-way communication between the participants of educational process are supported". As can be seen from this definition, remarkable attention is given to the interaction (communication) within the distance education process. The Internet technologies enable different kinds of synchronous and asynchronous communications to be incorporated into the distance education support systems.

The way in which the Internet "stepped" into our society implies dramatic changes in the way people learn and interact in society. Students in the system of higher education are especially familiar with using the resources the Internet offers in their studies and research. This fact opens the opportunity of creating an effective education environment, using the Internet as a medium of human interaction. The idea of creating such environment is a challenge to redesigning the user interface systems in order to improve the classical educational environment as well as a challenge to improving the education process by implementing options and techniques that are hard to implement in the traditional teaching systems. Although all these tasks are hard to achieve, it is feasible to implement most of the assumed options and teaching characteristics using opportunities offered by current technology.

Distance education is based on human behavioural educational theories. One of the basic educational theories of this type is the Constructivist educational theory. According to this theory, learning is an active process, in which the students construct new ideas or concepts based on their current knowledge. Education is a student-centred active process. The teacher's role is to canalize and enable the learning process. Students should take initiative in the learning process whenever possible. In that way, the general concepts which are the subject of learning become part of students' experiences. Learning is a natural process which can take different patterns depending on students' affinities, backgrounds and interests. Also, learning is social process and thus different form of communication and cooperation among students should be encouraged. Students should find their own facts related to the educational subject. The knowledge is created through the real world activities rather then merely reproduced.

3. EDUCATIONAL MATERIALS

Similar to the educational materials aimed for traditional education, the educational materials for distance education have to contain expert's knowledge. Additionally, since there might be a lack of direct communication, that knowledge has to be organized in a way that enables the autonomous learning process. For that purpose, an additional expert has to be consulted when creating such materials. Finally, the technical staff should transfer the materials produced as a result from previous collaboration into the distribution medium. The creation of educational materials for distance

education undergoes the following phases: analyses of target students' needs, common goals and social background, creation of educational material, upgrade of the way the material is presented depending on students' evaluation and changes in the student target group [4,8].

Any educational material should state in a very clear way "what the main contribution to the student is", what kind of students it is intended to, and what kind of examples it contains. The examples given should be familiar to the student target group. Graphical symbols for different contents (definition, example, related work etc) should be defined at the beginning of the material and used within it. Cooperative work and different form of communication between the actors of the educational process should be stimulated by providing discussion groups, chat facilities, virtual tables and other more sophisticated support tools.

4. Distance Education System Components

Distance education systems are complex systems. They should support different form of active learning. They should keep track of educational materials content and history, student history and enable easy access to that content. The system is developed modularly and different system modules can be used.

There are three general groups of activities that should be supported by this kind of system: institutional administrative activities, student service activities and student activities. Institutional administrative activities are administrative activities of the educational institution. Such are payroll, archive support, legal support and general ledger. Student service activities are related to the educational process by supporting it. Examples of such activities are: lecture scheduling, general information about the subjects, course enrolling, exam enrolling and administrative library services. Student activities are represented through access to educational materials, consultation activities, discussion activities, laboratory work, project work, self testing. Although not directly related to student activities, instructor supported activities should be included in the distance education support systems. Examples of such activities are: publishing of exam results, different kinds of student notifications, educational material creation guide.

5. WebLab e-Platform as a Model of Distance Education System

The paper presents real developed and introduced e-learning education methods in engineering and management courses into the developed education network. The network has been organized between the faculties at four universities in the Macedonia with main server point at the Faculty of Mechanical Engineering (FME) in Skopje. Via the network, it is used model of distance education system trough unique created WebLab e-platform (Fig.2), funded by financial support from European Commission and based of the experience from two European universities: Politecnico di Torino and University of Maribor. That introduction of new education methods, implementation of new information and communication technologies in order to develop better conditions in the education process enable to FME to promote life-long learning and link to industry and SMEs in order to offer different types of skills necessary for the labour market and for continuing improvement of knowledge to the professionals.

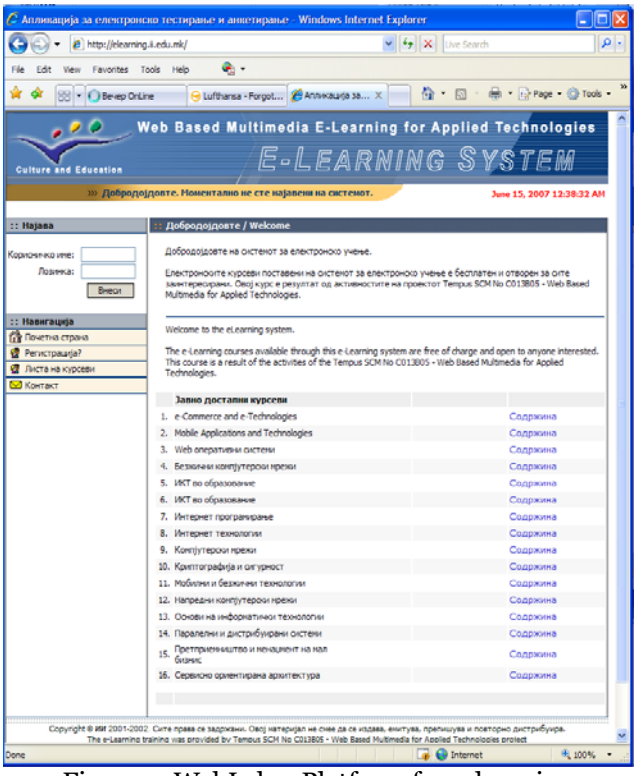

Figure 2. WebLab e-Platform for e-learning

On the e-learning platform as a web based learning environment, there are offered several courses from engineering, entrepreneurship, business and ICT fields. Development of this environment has been based on Contents Management System which means system oriented to the specific methodology with several rules for designing of the course contents:

- The course structure: overall duration, related with the ECTS rating of the course [5];
- The organization of contents: technical contents are responsibility of authors, but their organization and presentation come from a cooperative effort of authors and instructional designer;
- The preparation of support material (slides, external clips, simulators, active drawings, test and exercises);
- The final test and assessment.

6. COURSEWARE STRUCTURE

The tool used for course assembly generates HTML pages, suitable for delivery through the internet. The presentation of contents is structured in a few general pages, index pages (table of content, with links to single lessons), content pages, (at each page links to clips, slides if any), self-testing (each lesson has a quick multiple choice test at the end, related with lesson contents) and additional materials. The global structure is shown in Fig.3.

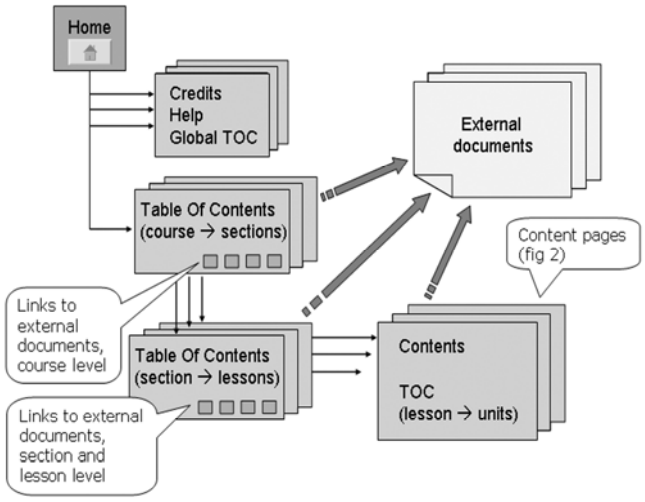

Figure 3. Courseware global structure

From the TOC the learner can access the lesson contents pages, which follow the structure outlined in Fig.4. The content presentation window is divided in five areas, as:

- Top: section, title of the course, section, lesson, unit;
- Bottom right: position information: navigation, link to the list of units in current lesson;
- Bottom left: links to documents related to the unit (clip, slides, text);
- Left: main presentation area, pictures related to the slide;
- Right: main text area for slide.

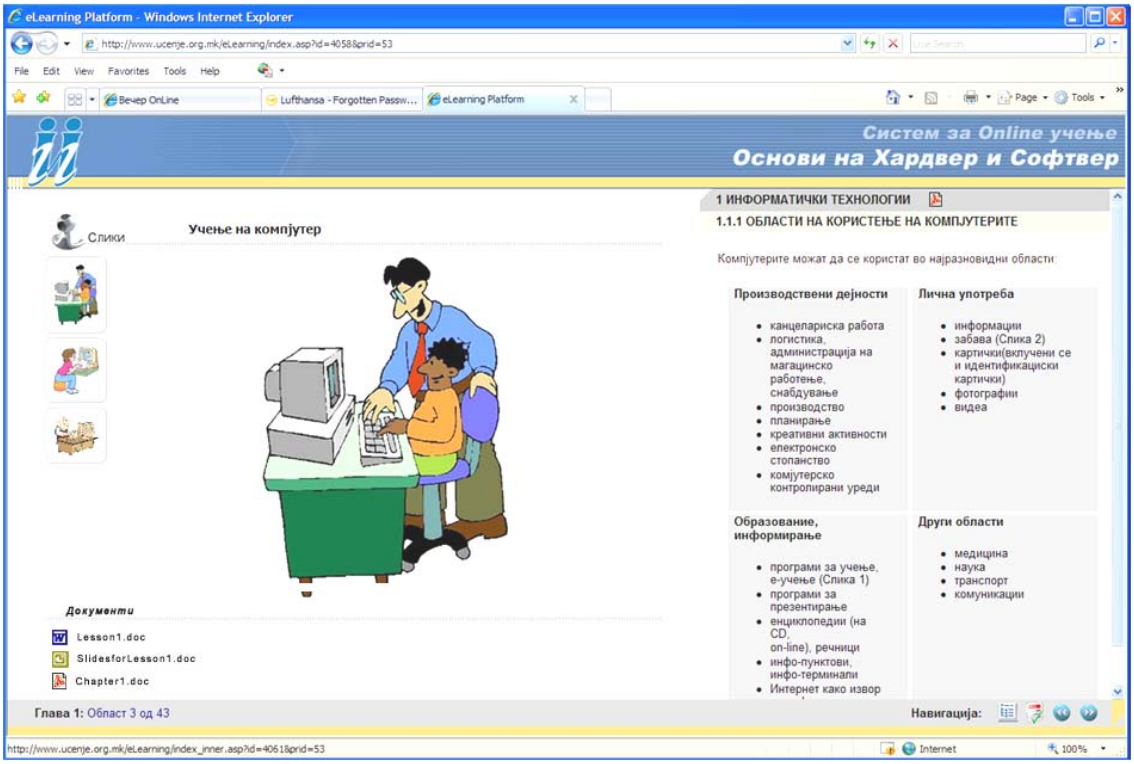

Figure 4. Content page structure

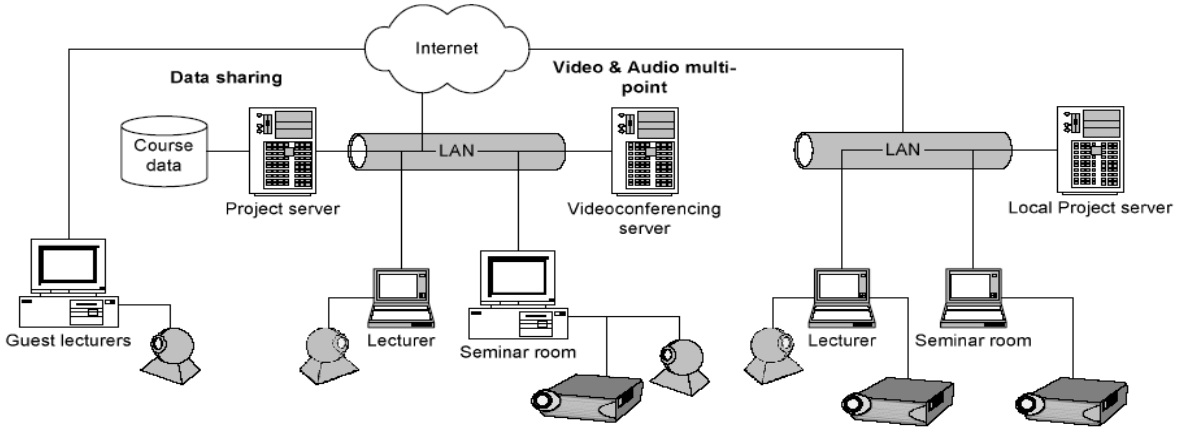

Figure 5: Example of the "Virtual classroom"

Slides displayed in the main window are synchronized with the clip flow. Synchronization is maintained with slide (next/previous buttons) and clip navigation (slider control). The slide may include active areas with external documents that linked a new window. External documents can be anything suitable for presentation through a browser (.pdf, .ppt, .doc, html, flash object). This "external document" capability allows to show the learner text or graphics too complex for a slide (e.g. a datasheet) and to include interactive simulators or short movies. These additional documents can be opened directly from the slides. A procedure which addresses all phases for the design production of e-courses has been developed and tested with the development of several courses. About teen courses have been designed and developed with this procedure (in Macedonian) and they are on the WebLab e-platform which can be seen from [9]. Working on generated network in WebLab e-platform environment between partners institution from Macedonia, Slovenia and Italy is based on a "virtual classroom", showed on the Figure 5.

7. E-LEARNING ENVIRONMENT LINK WITHIN THE INDUSTRY

Presented e-learning environment with WebLab platform has been managed and co-ordinated by staff from the Faculty of Mechanical Engineering in Skopje – Weblab e-Learning Training Centre in collaboration with the representatives of the Institute of Informatics at the Faculty of Natural Sciences, at University Ss. Cyril and Methodius in Skopje. This environment describes model of technology and change in higher education in line to establish a framework for collaborative networking between universities and industry, all based of experience from European countries. This environment is an initiative for creating a network able to support the development of the cooperation between universities and industries to promote best practices with intention to provide increasing of the level of qualification through offering of life-long learning courses for employees in different areas of interest ICT, entrepreneurship, applied technologies etc.

8. CONCLUSION

The main challenge facing both institutions and governments now is to develop more strategic policies on how important skills such: ICT and entrepreneurship can be used for the different target groups (traditional learners, lifelong learners, graduates, non-ICT engineers). Higher education is expected to serve the knowledge economy of the 21st century and should consider corresponding technical environment, tools and functionalities.

The need for a fruitful collaboration between university and industry is a necessity. Universities are currently facing a deep restructuring process, as a result of the European integration, with the goal of creating the European Higher Education Area. On the other hand, enterprises need knowledge for immediate use in practice, for the purpose of meeting the market needs, increasing the competitiveness and generating the profit.

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