Innovation in engineering education through computer assisted learning and virtual university model

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Abstract. The paper presents the most important aspects of innovation in Engineering Education using Computer Assisted Learning. The authors propose to increase the quality of Engineering Education programs of study at European standards. The use of computer assisted learning methodologies in all studies is becoming an important resource in Higher Education. We intend to improve the concept of e-Learning using virtual terminals, online support and assisting special training through live seminars and interactive labs to develop a virtual university model. We intend to encourage computer assisted learning and innovation as sources of competitive advantage, to permit vision and learning analysis, identifies new sources of technology and ideas. Our work is based on our university datasets collected during last fifteen years using several e-Learning systems. In Constanta Maritime University (CMU), using e-Learning and Knowledge Management Services (KMS) is very important and we apply it effectively to achieve strategic objectives, such as collaboration, sharing and good practice. We have experience in this field since 2000 year using Moodle as KMS in our university. The term KMS can be associated to Open Source Software, Open Standards, Open Protocols and Open Knowledge licenses, initiatives and policies. In CMU Virtual Campus we have today over 12500 active users. Another experience of the authors is the implementation of MariTrainer Wiki educational platform based on Dokeos and DekiWiki under MARICOMP and MEP Leonardo da Vinci Project. We’ll also present in this paper a case study under EU funded project POSDRU, where the authors implemented other educational platform in Technological High Schools from Romania used over 1000 teachers. Based on large datasets the study tries to improve the concept of e-Learning teaching using the revolutionary technologies. The new concept present in this paper is that the teaching and learning will be interactive and live. The new and modern techniques are the flexible learning courses, the production of learning demonstrators and testing. All the information from the virtual educational platform remain open space, communication between participants and continued after graduation, so we can talk about creating and maintaining a community of graduates, a partnership with them. Every European University must have a department which aims to provide computer assisted learning using knowledge creation through learning, capture and explication, sharing and collaborative communication, access, use and reuse and knowledge archiving.
1. Introduction

Nowadays is particularly important to identify correctly all of modern teaching technologies used for development in university education. Learning concept has evolved over time leading to advanced forms currently based on knowledge engineering and artificial intelligence technologies.

Evolution of the communication technologies and especially the Internet technologies has initiated the concept of Virtual University development. A number of other advanced resources of collaborative information type (e.g. wiki concepts) may be useful as developing tools to platforms and software solutions to increase the quality of education using computerized assistive technologies. The new approach of education system is in a continuous learning process and changing globally and rapidly now, [1]. A Learning Management System (LMS) means a collection of dedicated software tools designed to manage user learning activity. Also, the term of Knowledge Management Services (KMS) can be associated to a plenty of meanings in Open Domain (e.g. Software, Standards, Protocols, Knowledge licenses, initiatives and policies).

Over the past fifteen years Constanta Maritime University initiated a series of experiments based on educational information technologies which have enabled new advanced statistics that can be important elements for infrastructure design in a virtual university concept.

Collaborations have been achieved in the framework of EU funded projects with partners from several maritime universities in countries such as Netherland, Germany, Norway, Ireland, Denmark, Finland, Estonia, Greece, Italy and Spain. We are jointly developed a series of specialized courses in maritime field designed from the start to use e-learning platform based on open source technologies such as Moodle, ATutor, Dokeos, ILIAS etc.

Use of the modern techniques as e-learning education, combined with classical teaching methods, represents the optimum solution for better and standing quality learning system inside of the lifelong learning concept.

2. Computer assisted learning in Constanta Maritime University

In Constanta Maritime University, applying computer assisted learning is important and we apply it effectively to achieve important and global objectives. We encourage learning and innovation in engineering education as sources of competitive concern, to allow vision and analysis, identifies new sources of technology and ideas. Using computer assisted learning in our university we explore creativity, communication between participants of the learning system and innovation, [2, 3].

You can see the practical Constanta Maritime University Campus approach, link: http://campus.e-shipping.ro. As Knowledge Management System in Constanta Maritime University we use Moodle as Open Source Software. We have today over 12500 active users in CMU Virtual Campus. In the meantime, we developed a new dedicated virtual education space, an upgrade one, link: http://campus.cmu-edu.eu/ using also Moodle. In the figure 1 is presented the main interface of the Constanta Maritime University Virtual Campus.

![Constanta Maritime University Virtual Campus](image)

**Figure 1.** Constanta Maritime University Virtual Campus.
Using Moodle for our Virtual Campus we achieve strategic objectives as collaboration, encourage learning, sharing, creativity and innovation, through a free web application that teachers and instructors can use it for online learning. Moodle is a Course Management System (CMS), as well known as a Learning Management System (LMS) or a Virtual Learning Environment (VLE).

In Constanta Maritime University has introduced the concept of e-learning since 2000 years and from 2004 we made important investments in IT tool. An important approach that can make major contributions in increasing the overall quality of general education is based on the continuous process of improvement of teachers in high school using long life learning methods. In this regard were carried out a series of projects aimed to develop tools to increase the capacities for teaching of technical subjects using modern learning systems, computer aided type. Using classical capabilities of e-learning technologies in conjunction with a plenty of e-activities subsystems creates the premise of achieving a complete training using the most advanced learning techniques, [4].

The first e-learning EU project developed in CMU in 2007 achieved a Web based IMO Tanker Courses for distant simulation and tutorial systems on board. The developed Campus had the main goal to coordinate the development of a maritime flexible learning system.

Course management system ILIAS as knowledge management services was developed to support and enhance intensive knowledge processes, tasks or projects, creation, identification, organization, transfer, visualization, capturing, maintenance, distribution, evolution. You can see the practical approach using the link: http://training.e-shipping.ro, figure 2.

Another EU project that we developed in CMU was MariComp. The partner groups in this project consist of six MET institutions from different countries: Denmark, The Netherlands, Estonia, Ireland, Romania and Norway. The main objective of the project was to develop a European virtual learning space for maritime educational institutions and to create and evaluate a pilot e-learning course for maritime lecturers. In the figure 3, you can see the MariTrainer Wiki based on Dokeos and DekiWiki under MARICOMP Leonardo da Vinci Project, link: http://maricomp-web.eu.

Figure 2. Web based IMO Tanker Courses.

Figure 3. MariTrainer Wiki.

The course developed under the project was a virtual learning space for maritime lecturers. The main objective of this platform was that European maritime lecturers with expert knowledge have better opportunities of developing their competencies and creating an international network of colleagues within the same maritime discipline. For the platform where lecturers inside and outside the partnership can seek and share knowledge was CMS Dokeos. The MariTrainer Wiki allowed us to gain access to a greater range of teaching and learning materials and methods, made us more prepared to enhance our skills, helped us to encourage a greater European dimension in the work of our organizations and met our continuing professional development needs.

Other EU project that we developed in Constanta Maritime University was Maritime Education Platform, you can see the link: http://mep.stc-r.nl. The main objective of this EU project was to
improve the level of maritime education for lecturers in the EU, by producing and sharing the high quality educational material. The partners developed a virtual learning space called MEP, where they organised seminars, had a great cooperation between maritime educational institutions. That virtual dedicated space, MEP was an innovative virtual learning space filled with high quality e-learning courses, [5].

In 2011 we developed another large and important project under CMU using EU funds, with a target group of 1,000 teachers who are mainly focused on technological disciplines in training and development activities for the improvement of curriculum and professional development capabilities over several months. They address the complex issues being used in the LCMS software solutions, ERP/CRM and Knowledge Management Systems. The impact of information was high, being adapted to the needs of multidisciplinary training. Trends to use mobile terminals to change main aspects presentation of information in the educational activities generated virtualization premises of the educational process on the entire educational path, link: http://ciatm.forcon.cmu.edu/moodle/login/index.php. You can see in the figure 4 screenshots of project portal.

Figure 4. A new assisted e-learning approach: integrating LCMS, ERP/CRM & KMS.

3. Virtual University Model

During last decades there have been numerous attempts to develop some working models for adapting university education activities to new trends like e-learning and ICT technologies.

For a while it was possible to operate with mixed traditional learning models and e-learning methods. The emergence of new educational technologies and large scale adoption of mobile intelligent devices with high autonomy, permanently connected to the Internet, require reconsideration of the entire educational process, [6, 7].
Coexistence between traditional ways of teaching and learning and modern generated educational capabilities complement each other. Although any of the systems do not exclude other one, there was always one or the other pleadings regarding one of them. While narrowing is observed as the separation of the two ways of doing education, as technology becomes more mature - providing a high degree of naturalness in presenting information. Obviously, the difference between the two approaches is reduced by widespread acceptance of these mobile terminals in all sectors of social life.

The validity of the concept of true Virtual University has to rely on natural principles of evolution in the current ICT environment as education and classical techniques have made it in the natural environment before the appearance of information technologies.

The basic principle of Virtual University must derive from “naturalness” of interactions in virtual environment: advanced technologies for presentation and cognition, unrestricted access to knowledge, integrating social media, reputation and feedback. In almost every aspect the common principle preserve the concepts of classical education adding some specific elements of the virtual environment: responsiveness, widespread interaction, almost instantly feedback.

In a Virtual University all the materials, courses, information have to be open space, collaboration between participants and continued after graduation, to preserve a community of graduates, a partnership with them. Every European University must have a department to implement computer assisted learning using knowledge creation through learning, dissemination, preservation, capture and explication, sharing and collaborative communication, access, use and reuse and knowledge archiving, as you can see in the figure 5.

![Virtual University abstraction layers](image)

**Figure 5.** Virtual University abstraction layers.

4. **Conclusions**
This paper and discussions are based on our university datasets collected during last fifteen years using several e-learning systems. The quality of education will be improve day by day by various number of computer assisted learning software and tools.
Adapting of the educational process to the demands of virtual universities will raise discussions of specialists in education, which will help to define new advanced methods of education. It is obvious that the future will impose major changes in the educational system beyond the current imaginary limits and the degree of integration of new technologies transforming the methods since become classics, in educational systems adapted to the needs of the age. The next evolutionary step in virtual education research is to offer a technical framework to negotiate between old fashion and new learning technologies in such a manner to obtain the best results of the both worlds.

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