

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES IN MATHEMATICS STUDIES IN ENGINEER EDUCATION AT THE RIGA TECHNICAL UNIVERSITY

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Further perfection of teaching of mathematics in engineering education is related to integration in the Bologna process: passing to the multilevel departmental teaching, individualization of the teaching programs. The improvement of mathematical teaching programs includes the estimation of existent programs, their maintenance and acquirable skills. Therefore the programs of mathematical teaching and didactics need to be perfected, using information technologies, creating teaching materials by using new technologies and providing access to them in Internet.

Keywords: information and communication technologies, the studies of mathematics in the higher education, e-learning

1. Introduction

The main factor of the competitiveness of a state is an educated and competent person. It has been observed that there is a demand for qualified technologists, who can quickly work with the latest developments of science, modern Technologies and the materials. That is why nowadays in all over the world the most important questions are connected with the development of the educational system and the improvement of the quality. The university has to be able to provide the youth with such knowledge that they would be able to compete in such environment. In these times of change the most important task is the development of the intellectual labour, the improvement of cognitive skills and Information and Communication Technologies (ICT) competence in the fresh blood specialists.

Reacting to these rapid changes it is essential to understand the development tendencies of engineering education in Latvia, Europe and in the world, set the role of mathematics in the engineering education and to find the places of alteration in the study program of mathematics.

The development of the higher education of Latvia goes hand in hand with the convergence process of higher education in Europe, which commenced with the declaration of Sorbonne (25/05/98) and the declaration of Bologna (19/06/98).

Latvia is in the first rows of Bologna's initiated changes. The Bologna's principal theses have been worked in the curricula of the higher education establishments which became effective in December 2000. For example: the possibility of professional bachelor, Professional master, colleges as a short term higher educational establishments, the accreditation of all (state and private) higher education establishments, where the study quality, the propellant and disincentive forces as well as labour market strategies are assessed and evaluated.

It originates a new challenge not only for the engineering education but also for the program of mathematics and the used methods, as well as changes the understanding about teaching and learning and the role of the teacher in the study process.

2. ICT Solutions for the Support of Study Process

The development of programs of mathematics consists of the analysis of the present program extent and content and the understanding of the achievable competences. The programs of mathematics and the didactics have to be changed based on ICT (putting greater emphasis on the application of mathematics (including ICT) by constructing the teaching materials based on the modern Technologies and the availability in the Internet [1].

Including the online teaching technologies in the higher education is of great importance at RTU. We have to be ready to accept the new methods and modules of teaching, which includes multidimensional teaching object and lecture forms, which are supported by the latest technological developments. As in universities is slowly being introduced the credit point system, the programs are formed from block modules, which contributes to flexible approach to studies. For example those who work are able to choose some of the necessary modules, without learning everything. Thus the real time lessons are becoming less and we have to look for new methods in effective learning of mathematics and can be done with the help of e-learning.

What is e-learning? E-learning could be defined as a mixture of learning and the internet. It is not a simple download thing; the students can easily Access their marks, materials as well as discuss important matters with other students. E-learning gives the opportunity to follow each student's needs and wants and provide him with the information which is needed only to him. In fact in the studies is used the combined approach – the work in lectures is combined with e-learning. E-learning will allow the students to plan their time more efficiently and to learn when they can and as fast as they can, as well as communicate with other students and lecturers.

In Riga Technical University there is e-learning environment with Moodle [2] (Modular Object-Oriented Dynamic Learning Environment) which is an open code program and is accessible to anyone who is interested in it. The system is oriented on the interaction of students and teachers as well as suits the organization of far distance courses and real time lectures needs.

The department of engineering mathematics has completed two courses: “Mathematics” (semester 1 and 2), as well as “The Discreet Mathematics”. In the process of development are the higher mathematics special courses.

The students have the ability to revise the theoretical part, test their knowledge with different tests and ask questions to the lecturers. Starting with 2008/09 all lecturers will be working in the system of Moodle.

The advantages of e-learning:

- a) Documents are accessible 24/7 in all the places where there is internet connection
- b) It is possible to use heterogeneous data forms, forming global information blocks
- c) The utilization of Technologies is a motivating factor, as it provides the students with different methods of learning
- d) If the student works then it is easier to solve the time and place conflict
- e) Individual pace of learning

The problems of e-learning:

- The support of individual needs when working and learning in e-environment
- How to provide the students with a qualitative e-learning; efficiently develop cooperation in the internet and to develop new guidelines
- Students don't know the rules of working in e-environment, don't know how to learn, how to discuss things, how to work with study plans and to cooperate with the lecturers.

Suggestions for the improvement of e-learning:

- Start the learning with real time lectures
- the main task would be to form separate study modules which would be easily combined with the specific lecture aims
- modules should be put into lectures and the learning steps which would be separate from the structure of the course

In the online regime the student himself sets his study pace. The theme of the course is put into units. Doing the course step by step the student is involved in the study process – he is explained the conceptions and the main principles, demonstrated practical works, are made to do practical works and answer the required questions. Every unit or course could be done as many times as it is necessary. The students who require structural approach and more active communication during the study process are provided with lecturer's online courses. The study sessions are given by experts in the field and are based on the technology aspects. Courses like this last from 4 weeks up till 8 weeks and each week the lecturer publishes his lecture and the materials in the server. During this week the students logs on whenever he wants, learns the material, sends his questions to the lecturer or discusses his course paper. The student can also participate in planned 'chat' sessions with his course mates or lecturers, as well as join discussion groups, give advice or use some other resources. “The Technologies themselves do not guarantee success. It becomes efficient if both the students and the lecturers can make something useful out of it. ... The content of education and the e-learning ... has to be adapted to the local needs and culture” [3]. In the opening of Learntec forum in 2003 February 4 the commissioner Mrs. Reding spoke about the future of learning in a mixed way: “The modern e-learning solutions acknowledge the importance of learning as a social process and provide the students with cooperation possibilities with other students, the utilization of interactive study process and allow the teachers, lecturers and instructors guide the process. ... The teachers and lecturers again have the main role; they use “the combined approach”, combining the traditional way of learning with the virtual. It is not an approach where they work in pre-designed system but move as editors, authors and participants in context learning scenario.” This quote by Mrs. Reding and her conclusions leads us to think that in the study process the cooperation between students and teachers as well as mutual responsibility is of key importance. Thus, by using ICT in the study process of mathematics we will not only make the lecturer's work easier but will also make it more interesting and efficient; as well we will significantly increase the quality of education and the readiness of the new specialists for the labour market.

The department of Engineering Mathematics (RTU) took part in a Project “The implementation of computers in the study process of the university”. The Project was partly funded by European Social Fund.

The participants of the Project: University of Latvia, Riga Technical University, Latvia Agriculture University, Ventspils University, Rezekne University.

The Project time – 01.11.2006 – 20.08.2008.

The contracting authority means the development agency of Professional education.

The aims of the Project: to prepare for the realization and implement modern mathematical computer software in the study process, such as Matlab, Maple, Mathematica, MathCAD.

The results of the Project: acquired software licenses, developed new methods in working with the software, developed and implemented laboratory works in mathematics with the programs.

Riga Technical University completed two computer classes where they use Mathematica 5 for their laboratory works [4]. The program could be used for simple arithmetical calculations as well as in complicated scientific researches. The program supports work with graphics and sound, including the development of two- and three-dimensional graphics, the drawing of geometrical figures as well as the export and import of images and sound. In great disappointment only two departments use Mathematica 5 in teaching the higher mathematics. The students could later use these practical skills in working with other subjects where the mathematical calculations are required and necessary.

Conclusions

1. The study of mathematics and its didactics have to be improved based on information communication technologies.
2. The materials have to be developed and made available in the Internet.
3. The lecturers have to learn effective combining methods [5], as well as acquire personal motivation in the development of each student, so that the student could acquire many essential competences and be ready for the labour market as high qualified and well educated technical engineering personnel.

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Sarmīte Čerņajeva, Irina Eglīte. INFORMĀCIJAS UN KOMUNIKĀCIJAS TEHNOLOĢIJU IZMANTOŠANA MATEMĀTIKAS STUDIJĀS INŽENIERIZGLĪTĪBĀ RĪGAS TEHNISKAJĀ UNIVERSITĀTĒ

Matemātikas docēšanas tālāka pilnveidošana inženieru izglītībā ir saistīta ar integrāciju Bolonjas procesā: pāreja uz divlīmeņu mācību sistēmu, mācību programmu individualizācija. Matemātikas studiju programmas pilnveide ietver sevī esošās programmas apjoma, satura un iegūstamo kompetenču izvērtēšanu. Matemātikas studiju programmas un didaktika jāpilnveido, balstoties uz informācijas un komunikācijas tehnoloģijām, veltot lielāku vērību matemātikas pielietojumam, izveidojot uz modernām tehnoloģijām balstītu mācību materiālu izveidi un nodrošinot to pieeju internetā. Tiek plānota e-mācību attīstība, kā arī datoru matemātisko sistēmu izmantošana mācību procesā.

Atslēgvārdi: informācijas un komunikācijas tehnoloģijas, matemātikas studijas augstskolās, e-mācības

Черняева Сармите, Эглите Ирина. ОБУЧЕНИЕ МАТЕМАТИКЕ В ИНЖЕНЕРНОМ ОБРАЗОВАНИИ В РИЖСКОМ ТЕХНИЧЕСКОМ УНИВЕРСИТЕТЕ С ИСПОЛЬЗОВАНИЕМ ИНФОРМАЦИОННЫХ И КОММУНИКАЦИОННЫХ ТЕХНОЛОГИЙ

Проблемы преподавания математики в инженерном образовании связаны с необходимостью интеграции в Болонский процесс: переход на систему двухуровневого обучения, программная индивидуализация обучения. Улучшение программы обучения математике включает в себя оценку объема имеющейся программы, содержания и получаемых компетенций. Программы обучения математике и дидактике необходимо постоянно улучшать, основываясь на информационных и коммуникационных технологиях. Необходимо уделять больше внимания применению математики, создавая основанные на современных технологиях учебные материалы и обеспечивая их доступность в Интернете. Кроме того, планируется развитие e-обучения, а также использование в учебном процессе компьютерной математической системы.

Ключевые слова: информационные и коммуникационные технологии, обучение математике в высшей школе, e-обучение