New Teaching Resources to adapt Mathematics to the new European Area of Higher Education

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Abstract

In this study a new experience for teaching mathematics to engineering students, is presented. The aim is to provide the students a better understanding of maths algorithms and basic concepts by using specific software, in a graduate-level course. In this paper we discuss how to structure, define, and implement a web-based course as a part of the traditional classes, according to the convergence of the European Higher Education Project. The proposed course facilitates the use of new Information and Communication Technologies.

Key words: Implementation, Information and Communication Technologies, European Area of Higher Education.

1 Introduction

The creation of an European Area of Higher Education (EAHE) was proposed by the Bologna declaration in 1999, to unify university studies in Europe. The declaration emphasizes the creation of the European Area of Higher Education as a key to promote citizens’ mobility and employability and the Continent’s overall development [2]. Spain is one of the 46 countries involved in the Bologna Process. The corner stones of such an open space are mutual recognition of degrees and other higher education qualifications, transparency (readable and comparable degrees organised in a three-cycle structure), and European cooperation in quality assessment. University studies must be adapted to the international European context and technology development, facilitating new strategies of communication. This new situation forces Universities to renew some situations that until now seemed stable as teaching methodologies, and change their degrees and studies programmes. The use of Information and Communication Technologies (ICT) become more and more important in the higher education process, and
it is considered a pre-requisite for the adaptation to the EAHE, claiming new spaces and conditions of learning, and new professional roles for lecturers [3].

Linear Algebra is a branch of Mathematics, and, in general, it is a part of the curriculum in the first course of Industrial Engineering students. The algebra course taught at the Escuela in the University of Salamanca is divided into 6 modules, concerned with the study of vector spaces, invertible linear maps or matrices, determinants or representation of a matrix in terms of its eigenvalues and eigenvectors, systems of linear equations, and a brief introduction to linear constant-coefficient systems of differential equations. In this paper, we present some educational tools to learn about Linear Algebra with Moodle environment. Moodle is an open source package, designed under pedagogical principles, in order to help educators to create effective online learning communities.

The rest of the paper is organized as follows: In section 2, we will comment the changes that are happening in the Spanish Universities to reach the European Area of Higher Education. In section 3 we will present the Moodle tools used in the University of Salamanca (http://www.usal.es) and how to combine them with traditional algebra classes, and finally, the conclusions will be shown in section 4.

2 Changes in higher education

The knowledge society depends for its growth on the production of new knowledge, its transmission through education and training, and its dissemination through Information and Communication Technologies [1]. As it was mentioned in the Introduction, one of the means to get the convergence of European higher education and the common goal of the Bologna Declaration is the use of the ICT in higher education. Universities face an imperative necessity to adapt and adjust to a whole series of profound changes, including increased demand, internationalisation and links with business.

Online education also refers to learning methods that, at least, partly utilize the ICT available through the Internet. What we propose to the students is to use the online methods to get a more complete education in specific subjects. The online education is a new method of education, very different from traditional education, that take advantage of new media, new ways to communicate, and the design of new educational experiences. Educators are thus utilizing the Internet for professional networking, regionally and globally, they learn from one another about the new media and their applications to education [7], and renew their knowledge in virtually fields of enquiry.

ICT have changed from being considered as a mere object of use towards an instrument of support in the educational innovation [6]. They affect to different aspects in relation to traditional education, as the change in the role of the teacher, who has changed from a simple transmitter of knowledge to be a mediator in the construction of the knowledge of the students; the role of the student has changed as the traditional educative models do not adjust to the processes of learning by means of the use of the ICT [5]. Finally, it is important to take into account that the use of new technologies does not require the invention of new methodologies, but it requires a modification in
the strategies for the continuous learning of the student [4].

3 New working environment

The University of Salamanca has a virtual environment, available for students and teachers, to incorporate new educative technologies to the development of educational tasks. The virtual campus, (http://www.usal.es/eudored), is based on a web platform called Moodle (Modular Object Oriented Distance Learning Environment), a course management system designed to help educators for creating quality online courses.

Moodle is a virtual environment for education which allows to place contents and tasks in the web and provides online communication tools. The design and development of Moodle is guided by a particular philosophy of learning: social constructionist Philosophy. With this learning philosophy people actively construct new knowledge as they interact with their environment, under the hypothesis that learning is more effective when you are constructing something.

One of the most important advantages of Moodle environment is that it has implemented all the useful tools and activities needed for online classes and e-Learning in general. The following features are part of the learning environment: The Chat module allows participants to have a real-time synchronous discussion via the web; in forums most discussion takes place, and they can be structured in different ways, and can include peer rating of each posting. Another activity are glossaries, that allows participants to create and maintain a list of definitions, like a dictionary. A module called Hotpot allows teachers to create multiple-choice, short-answer, jumbled-sentence, crossword, matching/ordering and gap-fill quizzes using Hot Potatoes software (http://hotpot.uvic.ca/). In Moodle platform resources can be prepared files uploaded to the course server; pages edited directly in Moodle; or external web pages made to appear part of this course. As part of web 2.0 learning tools, a wiki is a web site where anyone can add new contents or edit the existing ones, it enables documents to be authored collectively and supports collaborative learning.

4 Course activities: Training in Linear Algebra

We have used Moodle to create a new interactive educational teacher-student context. Students need to construct their own understanding of each algebraic concept, so that the primary role of teacher is not to explain, or attempt to ‘transfer’ knowledge, but to create situations for students that allow them to make the necessary mental constructions. In 21st century students are familiarized with the Internet and with the new technologies. They usually use them to chat with friends, to send and receive e-mails, to meet people or to organize holidays, but they are not conscious that it is a useful tool in the daily classes. Sometimes they do not see possible that personal computers and the Internet could be used effectively for classes about Mathematics.

With the purpose of obtaining a suitable training of the students, in each module we will give the students access to some interesting and introductory documentation,
and we will create a forum to discuss about the current module. For example, with Systems of Linear Equations module we start a new Moodle activity which is a questionnaire with different items related to the right methods of solving systems of linear equations using matrices, or solving systems with some parameters. Other exercises will be proposed to the students so that they will be able to comment and debate them in the forums created for that goal. Moreover, some theoretical questions or Hot Potatoes exercises, that enable the creation of interactive tests, will be proposed for the students assessment.

Another interesting and practical exercise that we are planning is to propose the students to solve some problems as soon as possible. Each monday we will upload one problem and the first student who solve it will have an extra in their final assessment.

5 Conclusions

We have designed a new experience for teaching Linear Algebra in the University of Salamanca. The aim is to give the students a better understanding of that specific branch of Mathematics. In this paper we have proposed a web-based course according to the convergence of European Higher Education Project, to increase the use of new Information and Communication Technologies. This course will be available, for the students of the university, in the virtual environment, which is based on the Moodle platform, and offers a reachable environment easy to work with.

References


