Work in Progress - Interactive multimedia contents and synchronous graphical communication tools for distance learning in Engineering Degrees

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Abstract - The curricula design in distance universities has been influenced by the fast development of communications, and web based learning has become generalized. Typical contents are based on hypertext, with communication models between students and lecturers being based on e-mail, text-based forums, and text-based chats. These tools alone do not seem to be good enough for engineering distance education, where formulae and graphics are necessary. Therefore, a new LCMS (learning content management system) is presented in this paper. Contents are based on web guides, short videos and e-labs or simulators, and graphical communication (synchronous and asynchronous) is possible, by means of e-boards and videoconference web (e-classroom).

Index Terms – Distance Engineering Education, LCMS, LMS, E-labs, Virtual Classroom

INTRODUCTION

Computer Engineering and Electrical Engineering degrees are usually studied online (or blended way) by people with jobs, who cannot attend classes. Hence, the instructional design of the curricula is very important, taking both contents and communication tools into account.

Contents should be easy to read (or observe or use interactively) and very understandable. Similarly, these should be attractive enough to connect students to the LMS (learning management system [1]) and thereby get them in touch with fellow students and lecturers. On the other hand, in engineering disciplines where formulae and graphics are fundamental tools for the representation of concepts, the existence of easy and fast to use graphical tools in the LMS is essential. In this paper, we present a new LCMS used in Electrical and Computer Engineering online education, including several ways of delivering contents, and synchronous and asynchronous graphical communication tools.

Some experiences of this nature can be seen in [2], but nowadays, most of the LMS’s like Moodle, WebCT or ATutor do not offer these functions.

The paper is structured in three sections: the first one deals with the antecedents of this project, the second one with the new kind of contents and the third one with the new communication tools.

ANTECEDENTS

La Salle (Ramon Llull University), has been offering Computer and Electrical Engineering degrees in a blended format since 2001 [3]. The development of its own platform (eCampus) made this possible. In the original LMS, the communication tools were e-mail, forum and folders where documents were shared. The contents were structured in web guides based on hypertext. These were short explanations of concepts with references to books, articles or webs, where details could be found. At the end of each chapter there were self-evaluative questions in order for students to check their learning process. Of course, professors could track the student’s progress in a report table.

This model worked well for very motivated students, but some problems were detected. Text-based guides with references to books or articles are not practical for the students, because they must spend a lot of time searching for the information. Besides, guides are not attractive enough to connect students to the LMS, who generally prefer reading on paper to reading on screen.

In consequence, research in the e-learning field led us to design a more interactive and multimedia guide in order to make studying more attractive, making the understanding of difficult scientific or technical concepts easier, and motivating students to access the LMS [4]. Now, we are delivering different modalities of contents: web guides, PDF documents, short videos and e-labs [5] or simulators.

(INTERACTIVE) MULTIMEDIA CONTENTS

I. Multimedia Contents. Short Videos.

Short videos are used to explain concepts which are difficult to understand autonomously. We can distinguish between two kinds of videos, demos or classes. The former are multimedia creations which can represent some physical or technical problem, i.e. an electromagnetic wave propagation. The latter are videos of computer screen captures with audio recorded by the lecturer. On the computer screen the image of a webcam,
some technical software, a slide show, or an e-board where
professor can write and draw can be shown.

II. Interactive Multimedia Contents. E-labs and simulators

E-labs (remotely controlled laboratories) and simulators
/software representing some real process) add a new feature to
e-learning: interactivity, allowing the student to control the
execution of some processes. These kinds of contents are very
interesting since most technical concepts should be better
understood through practice, the classical “learning by doing”
[6]. When students are working on signal and image
processing [7], antenna theory, or electronics, for example,
comprehension is easier if they can vary the parameters and
see the effects (Figure 1.A). Multimedia allows the creation of
interactive animations of technical processes or scientific
phenomena. Nevertheless, these manipulations must be
guided, so textual explanations and references to bibliography
are attached to these multimedia contents.

Nowadays we are developing an authoring tool for all
these kinds of contents allowing professors to generate and
upload demos or short interactive practices without the need of
web technology knowledge.

SYNCHRONOUS GRAPHICAL COMMUNICATION

Typical communications in a LMS like e-mail and text-based
forum or chat are insufficient for the representation of
technical or scientific concepts. In the same way, we cannot
underestimate the power of attendance in classical education,
where dialogs in front of the board are so efficient in the
learning process. If we provide LMS with the virtues of this
education model, such as its synchronous character, or board’s
graphical capacities, we improve the quality of distance
education.

In technical and scientific education, the professor’s task
is very important in order to explain difficult concepts.
Engineering subjects are not easy to understand, even with
text book explanations. But how could a professor teach in an
online context?

On one hand, scientific explanations are traditionally done
on blackboards, on the other hand classical chats, forums and
e-mail, cannot offer graphical capabilities.

Thus, two graphical tools have been developed: the
/graphical forum and the e-classroom. The former is an
asynchronous forum where students and professors can write
or draw by hand on a small white window. It is easier and
faster to use than an equation editor and it allows the drawing
of any figure. The latter is a synchronous communication tool
with four fundamental parts: an e-board, videoconference
many to many, textual chat, and slides show (Figure 1.B).
Users can select which components of the e-classroom they
want to see at any moment. It is possible, for example, to only
see the e-board, and listen to the professor’s comments.

In order to write and draw on the e-boards, a graphics
tablet will become very useful, and webcam and microphones
are necessary for videoconferences.

In this environment, a classical school classroom has been emulated. With these functions, professors
can establish timetables for synchronous classes or collaborative work classes, and students feel more integrated in the community.

Fig. 1. (A) E-LAB OF IMAGE PROCESSING (B) E-CLASSROOM.

EVALUATION, CONCLUSIONS AND FURTHER WORK

During the academic year 2004-2005, we have been
evaluating the feasibility of these tools in the LMS in several
ways: improvement of the learning (by comparing the results
of students using different contents modalities), students and
professor’s participation and satisfaction levels. From the
conclusions of this analysis we will make the necessary
modifications to the system.

At the moment, we can already assert that the delivery of
different contents modalities seems to make the
comprehension of many concepts easier and to motivate
students to access the LMS. The use of graphical tools
facilitates scientific and technical writing, and the e-classroom
allows the development of some competences like oral
communication or teamwork in an online environment,
enhancing the relations within the university community and
facilitating discussions among students and lecturers.

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