

ENGINEERING COURSES ON LINE: INTERNATIONAL COLLABORATIVE PROJECT

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Abstract

The purpose of this paper is to describe the experience and results obtained by the Grupo Multimedia of EHU (Basque Country University) teaching on line a set of Engineering courses. The group has developed a teaching environment including the following elements: a) video/multimedia as a basic component for the teaching-learning process, b) teacher-student collaborative methodology, c) Internet-based pedagogical and communication tools.

The international collaborative project involves professors of three universities from USA, France and Spain with a total of 15 Engineering courses, both at the undergraduate and graduate level [1]. The delivery of these courses has allowed the faculty to gain experience in the areas of video/multimedia creation, use of e-learning platforms, and online course delivery which in turn has produced successful results in student satisfaction and student academic performance.

Keywords: Online education, international collaboration, multimedia, academic infrastructure, engineering education.

1. VIDEO LECTURES

The Grupo Multimedia of EHU has been working in the area of on line higher education for the last seven years, focusing in the creation of video/multimedia as an integral element of the teaching process. The Grupo Multimedia has developed several types of models for multimedia courses. These models include in different arrangements the video presentation of the professor and/or the computer activity used during the lectures [2]. Each multimedia model provides the faculty and the students a set of characteristics in the areas of time required to record the classes, ability to organize the content in modules, and ability to record the activity on the computer. According with the type of methodology used to lecture and the time and resources available, different faculty can select an appropriate model for their courses.

In areas such as architecture, medicine, biology, engineering, etc., where the use of the computer as a pedagogical tool is increasingly more important, the multimedia lecture model of computer activity is providing the best academic results as well as student satisfaction.

This paper describes some of the multimedia and academic characteristics of a set of courses for which the faculty and the students reside in three engineering universities (EHU, in Spain: www.ehu.es; ESIGELEC, in France: www.esigelec.fr; and CBU, in the US: www.cbu.edu). For the reasons detailed before, the majority of the courses of this project use the multimedia lecture model of recording the computer activity and the audio of the professor.

There are several additional benefits of using this model. Some of these benefits have an academic impact. The faculty can create the content in a modular form, which allows for a structured organization of the content. This structured and modular organization is optimally suited for a continuous update of the content, where only some of the modules need to be revised or added. Other methods where the recording is done in a live class have the benefit of fast content creation, but do not allow easy content update.

The fact of having only one video source also helps direct the attention of the students to the target objective in the lecture, be that a computer program, and mathematical explanation, a simulation, etc.

Technically, this model has very low hardware and software requirements, and therefore can be easily deployed and implemented with little front end investment. Other models, in addition to higher cost equipment requirements, also include the need for technical personnel for the recording of the lectures and more involved post processing tasks, which also increases their economic constraints.

The video is compressed with a lossless compression algorithm which generates a final video signal with a quality equal to the original, and with a substantial reduction in bandwidth requirements. This in turn allows the access of content from students in different countries and continents to the same materials and with the same time response.

The format selected is Flash, which includes progressive downloading. Flash is the video format most widely used currently on the web, and it does not require a dedicated video server for its delivery. In addition progressive downloading allows immediate access to the lectures, and easy review of the content due to the fact that a temporary copy of the file is downloaded into the student's computer at a speed faster than real time delivery of the lecture. Traditional streaming techniques are not well suited for the selective review of the content since they must first buffer several seconds of content before displaying it.

The combination of these advantages has made this model the fastest and most widely adopted by faculty, as well as accessed and accepted by students. Figure 1 shows an example of a module based on this model.

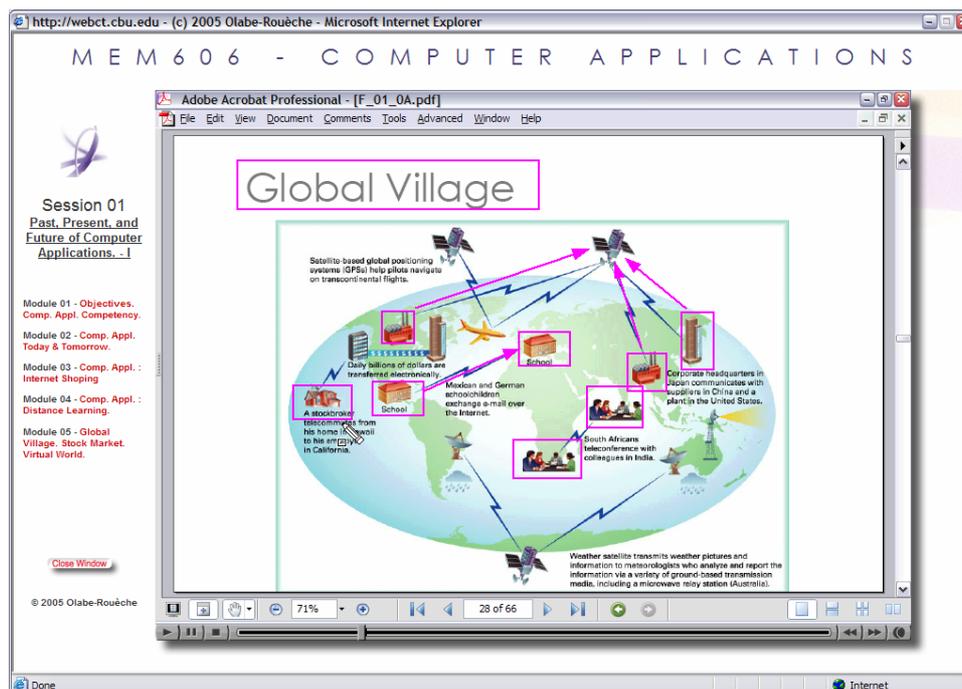


Figure 1. Example of Video Lecture

2. TEACHER-STUDENT COLLABORATIVE ENVIRONMENT

The academic success of on line courses depends not only on the quality of the lectures, but also very importantly on the existence of an academic infrastructure that will sustain the teaching-learning process. In this section we present the main components of the academic infrastructure used in our project. Part of this methodology has been extended to the cases of studies implemented in the VideoAktiv Project [3], a Socrates/Minerva European project in which Grupo Multimedia participates.

The main web based elements of this infrastructure are illustrated in Figure 2, which shows the homepage of one of the courses in the project. From this home page the professor and the students have access to a group of tools that include the video lectures, class notes, weekly assignments, response of the professor to the students' questions, as well a communication via email. An additional benefit of this infrastructure is that all the academic activity of course is recorded and time stamped, which allows a systematic evaluation and assessment of all the elements of the course, including faculty activity and students performance. This information is critical if new online courses and programs need to be formally evaluated of accredited by accrediting agencies.

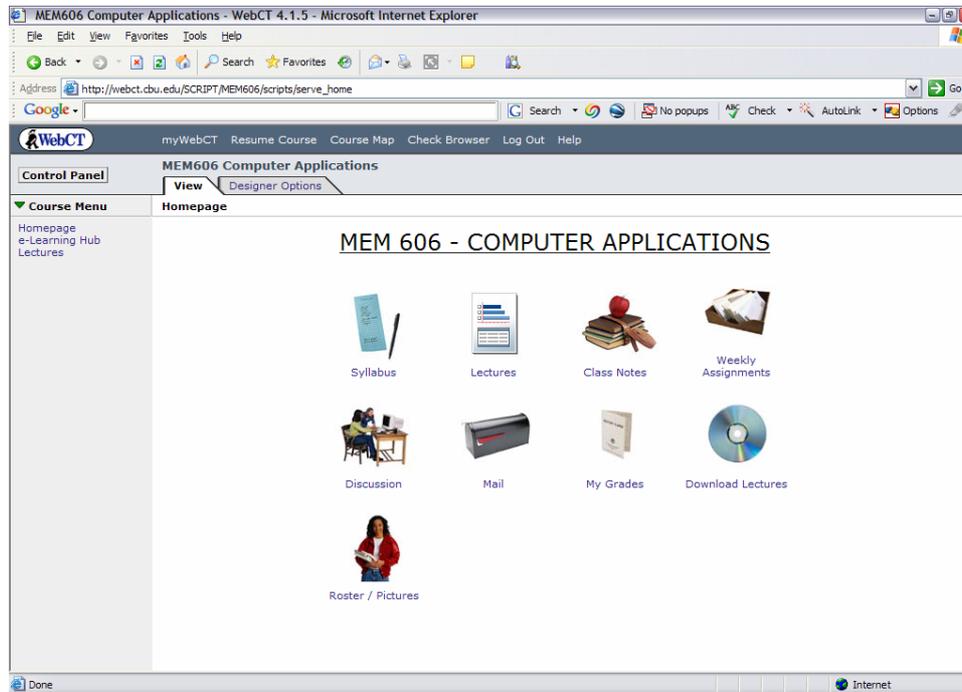


Figure 2. Academic Infrastructure

The video recording and the indexing of the lectures, allows the structured and systematic access to any segment of any lecture, as well as selective access to past segments. This structure provides the students, from the first day of class a clear road map of the course, their goals, and the expected performance from the students.

The students are required – among other tasks – to submit a comprehensive summary of each lecture, in which they will include questions on parts they did not completely understand the concepts, or parts they would like to have further expanded. This allows the professor to evaluate, week by week, the level of assimilation of the content by the students, and his or her ability to present the material clearly.

The number of question, their nature, as well as the corresponding answers of the professor, all parts of the permanent record of the course, provide a tool to assess and evaluate the depth and quality of the communication between students and faculty.

The students are required to view the questions and answers of everyone in class each week. This provides individual students access to the level of participation and depth of understanding of the materials of the other members of the class. This tool has proved to have been critical as an incentive to promote good performance among students as they were witness to high performance in others through the quality and depth of their work.

The students are also provided with the class notes corresponding to the lectures – which include all the relevant work, annotations during the class, etc. The class notes represent minute by minute documentation of the course content, and allow the student to have a visual summary of the course, lecture by lecture.

Some additional benefits of the international cooperation include the ability of faculty to cooperate in the creation and delivery of common courses. The modular format of the model has allowed two faculty to develop complementary modules of a course, and integrate them finally into a single course. Also, since currently the academic systems differ from country to country, and the number of lectures for similar courses varies, this model has allowed tailoring each course to the requirements of each university. In addition, in some cases some lectures have been complemented with laboratory-related lectures for those programs which require them.

Accreditation requirements demanded that when modules created by a faculty from another university were used, that faculty had to be register as visiting faculty in the university of the enrolled students.

The process now allows using the content created by one university, and having an instructor of the local university interface with the local students. In this sense, the overall tasks of the course, lecture design and delivery, and communication with students are divided among faculty.

These courses are in some cases used as part of a bilingual program, where English taught courses have enrolled students in France or Spain, or vice versa.

Finally, in a movement which is gaining strength rapidly, initially in the US, a large number of universities provide their students with portable and mobile devices where they can download specially formatted versions of lectures. In this sense, the Grupo Multimedia has added to other mobile initiatives and is developing the Mediamovil Project [4] in the areas of content generation, .3gp files, compatible codec, encoding settings, streaming server, internet browser and plug-in based on Java applications.

3.- CONCLUSION

This paper describes some technical and academic details of an international project of collaboration among universities in Spain, France and US, using engineering online courses. It describes the academic, technical and economic advantages of the multimedia format selected for the video lectures, and it details the academic infrastructure developed to sustain an efficient teaching-learning environment that will guarantee successful performance of the students.

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