AN HYPERMEDIA UNIVERSITY COURSE IN THE EDUCANARIAS E-LEARNING SYSTEM

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ABSTRACT

This paper describes an University course in the Educanarias e-learning system. Educanarias provides through the "Canarias Digital" initiative virtual classrooms for e-learning to all the members of the educative community in the Canary Islands. We describe our experience as the first University course in the system and propose several guidelines for course design and creation that are followed by our course and may be used in other virtual classrooms. Course material is described and the benefits of complementing presential formation are discussed.

Keywords: E-LEARNING, HYPERMEDIA, EDUCANARIAS, VIRTUAL CLASSROOM, PATTERN RECOGNITION.

RESUMEN

Este artículo describe un curso de educación universitaria en el sistema de formación a distancia Educanarias. Uno de los servicios que este sistema proporciona a los miembros de la comunidad educativa canaria es posibilidad de tener "aulas virtuales" que complementen la enseñanza presencial tradicional. En este trabajo se describe nuestra experiencia como primer curso universitario en Educanarias y proponemos una guía para la creación y diseño de cursos que hemos aplicado y puede ser de interés para otras iniciativas similares. También se describe el material del curso y se discuten los beneficios de apoyar la enseñanza tradicional universitaria mediante esta nuevas tecnologías.

Palabras claves: TELEFORMACIÓN, HIPERMEDIA, EDUCANARIAS, CLASE VIRTUAL, RECONOCIMIENTO DE PATRONES.

INTRODUCTION

Distance education is, despite of an existence of more than a century, a modern formative modality in permanent evolution, incorporating to the traditional didactic material the latest technological advances to help the students and facilitate their learning.

The importance of distance education in the world is evident. The distance education industry is set to mature further over the next few years, as the number of colleges and universities offering these courses increases from 1,500 in 1999 to over 3,300 in 2004. A new report [1] from the International Data Corporation (IDC), 'Distance Learning in Higher Education: Market Forecast and Analysis' states that the number of students enrolling in distance learning courses will jump by 33 percent per annum over the next four years.

Traditional distance education uses different means to provide content (mail, telephone, recorded tapes, videos, etc.), but Internet has introduced in this field the facility of the interaction with the student, multiplying the effectiveness of previous approaches and creating the new field of electronic learning or e-learning [2]. Now it is possible to offer a great amount of information in systems thorough the WWW (World Wide Web) over IP (Internet Protocol) based networks. This information can be updated very easily and, in addition, it is possible to maintain an easy relation with the student through electronic mail, debate forums, chat systems or electronic conferences. Moreover all this can be done with very reasonable costs due to different tools that Internet offers [3].

Some characteristics that describe the facilities and advantages of distance learning are the following:

> It guarantees an effective equality of opportunities for those who, by personal or social circumstances, have greater difficulties in adapting to ordinary education.

> It renders less need for physical proximity of learners to learning materials, other students, and teachers. This is of special importance in a fragmented territory like the Canary Islands.

> It fills the need for continuos learning in the knowledge-based society.

Within the University, e-learning can offer a very interesting complement to the actual lessons or increase the possibilities of selection of courses in a new university system. And from a wider point of view, it can be used to satisfy the cultural necessities that have groups of people who have interest in diverse formative aspects.

Virtual education in the University is mainly based on the Virtual Campus paradigm. This allows by means of computers and telematic networks, to surpass the barriers of space and time and facilitates the individualised and interactive contact among all the members of the university community: students, professors and management personnel. It is a powerful space of communication and transmission of knowledge

and a clear place of academic and personal relation, where diverse services are offered.

In this paper we will present an hypermedia university course that has been developed in the Department of Estadística, Investigación Operativa y Computación at the University of La Laguna. It uses the Educanarias e-learning system to provide learning content and support for the students in the course. We discuss the basic guidelines in the design of the course, its main features and tools. We also describe the integration in the Educanarias system and finally we present the conclusions of our work.

THE EDUCANARIAS E-LEARNING SYSTEM

It is now widely accepted that education is essential to assure competitiveness in the knowledge economy, each time more global and interconnected. This is of special importance in the Canary Islands where economy is mainly based on the services sector. This has been recognised by the Canary Islands Government that promotes through the "Canarias Digital" plan the creation and use of new technologies. Due to the fragmentation of our territory and the formative needs of its habitants the use of distance education through Internet may be a valid solution to increase the competitiveness of our workers and companies and also the cultural and formative demands of our society.

Educanarias http://www.canarias-digital.org/educanarias is an integrated online learning environment system designed to provide means for the creation and management of online learning. It comprises a set of tools for content creation, communication and management. Moreover, Educanarias provides "virtual classrooms" for all the members of the educative community in the Canary Islands and all the necessary infrastructure and technical support.

The Educanarias initiative is now an e-learning system comparable [4] to the leading internet based learning systems such as:

Web Educational Support Tools (WEST), http://www.west.ie/

World-Wide Web Course Tool (WebCT), http://homebrew.cs.ubc.ca/webct/

Web course in a Box (WCB), http://madduck.mmd.vcu.edu/wcb/wcb.html

The Educanarias system provides a set of tools (see Figure 1) that support the main features in e-learning:

Development tools

WWW content publishing subsystem that comes in the form of a Web based HTML (Hypertext mark-up language) editor that permits content to be authored from any platform.

Course menu creation.

Created content can be transferred to other mediums like CD-ROM or other e-learning platforms.

Automated test system that permits test taking and scoring with true/false or multiresponse items.

Creation of final qualifications from combinations of on-line and off-line tests.

Support of testing stage for courses before making them live for students.

Threaded discussion lists that generates asynchronous communication for learners and instructor.

Chat systems that provides synchronous communication between learners and instructor.

Statistics of visited content pages that gives information about the use of content by learners.

Instructor tools

Course planning and managing.

On-line testing and grading.

Student record managing.

Course preview as a student.

Student tools

On line registration and payment.

Authentication.

Platform independent content access.

Private e-mail.

File submissions.

Access to threaded discussion lists and chat system.

Qualifications tracking through the course (certain qualifications may be continuously being updated).

Technical support

External communication support, currently at the ITC (Instituto Tecnológico de Canarias).

External administration of the system.

External support for information backups.

External course administrative support (course creation, instructor and student addition).

Security features that assigns different roles to administrators, instructors and learners.

Administrator tools

        Security access.

        Client/Web interface.

        Authorisation tools.

        Crash recovery tools.

        Administrator, student and instructor support tools.

        Resources management.

Therefore, the Educanarias system allows the instructor to concentrate on course definition and creation while other administrative and technical questions are solved externally.

Figure 1 The Educanarias e-learning portal (left) and its on-line publishing tool (right)

AN UNIVERSITY HYPERMEDIA COURSE IN EDUCANARIAS

In this section we describe an University course in the Educanarias system and the basic guidelines of its creation and design. An extensive list of the learning materials is also provided with a detailed description of its sources and uses.

3.1 VIRTUAL UNIVERSITIES

Universities almost everywhere in the world have started to offer courses and services over the internet. There are several reasons [5] for a traditional university to create an alternative environment for teaching and learning outside the walls of the university:

Outside the academic area multi-media and electronic networks are rapidly gaining an increasing impact on a great many services (also in the training departments of enterprises and other organisations).

Students to a huge extend enter university education with a solid and sometimes

very elaborated knowledge about computers and the benefit of Internet: they are accustomed to take advantage of these technologies. This is specially important in Computer Science studies.

Some experts announce a strong competition between universities and private companies in the communication sector in the area of education, training and human resource development in the near future. So strategic planning of universities has to take into account this challenge.

As the Educanarias system shows, there are funds spent especially for the development of multi-media and telematics aiming a vision of over-all modernisation of the formative sector.

Some universities or colleges intend to disseminate their courses and study programs.

There is a growing number of instructors that believes that technology can significatively improve the quality of teaching. Most often the benefits of new technologies are evident in science or engineering disciplines.

3.2 WEB BASED COURSES (WBC)

There are several guidelines for the purpose of creation of effective on-line, web based courses [6], [7]. The literature indicates that there are several critical factors to the success of WBC:

Course content must describe what technical (browser ,etc.) or academic prerequisites are needed to be successful in the course.

Course learning objectives must be clearly stated and the expected effort of the student (hours per week, etc.) must be described.

Content must be presented in a logical progression of difficulty and built on an existing knowledge base.

Course content must take advantage of the new medium capabilities. Porting of material from one medium to another must be done considering the new design issues.

Courses should use internet capabilities to encourage interaction between learner-content, learner-instruction, and learner-learner.

User interfaces must be attractive and easy to use, no new skills should be needed. This is of special importance when course is directed to the general public.

Course content must be easily accessible. Course menus and concept or word search capabilities should be provided.

To increase the quality of teaching new information and experiences have to be offered. The objective is to replicate the best of classroom environment but

taking advantage of the new medium capabilities.

Course content should be downloadable for offline use. This reduces the communication costs of the learner when working at home.

We have followed these guidelines to build an university course that exploits the internet capabilities to provide the learners an integrated site to interact. Classical content is complemented with simulations and real applications of course content are shown.

3.3 A "*PATTERN RECOGNITION*" UNIVERSITY COURSE IN EDUCANARIAS

This WBC offers a formative complement to the course "Introduction to Pattern Recognition (PR)" that is offered by the Centro Superior de Informática at La Laguna University. This course is part of the formation in Artificial Intelligence that receives the students of the Computer Science Engineering in the University.

The PR discipline studies how machines perceives its environment, learn to distinguish patterns of interest from an assembly of observations and make reasonable decisions about the categories of these patterns. The PR solves important problems in a great variety of disciplines like: Biology, psychology, medicine, marketing, computer vision, artificial intelligence and its applications vary from the analysis of DNA sequences, search of Internet documents, or biometric people identification.

There are also applications in e-learning like intelligent tutoring systems that infers learner knowledge from test responses and automatically proposes the student new exercises or to reinforce the content of selected lessons.

We have chosen the field of *Pattern Recognition* to build the WBC for several reasons:

It is an important and well-defined part of Artificial Intelligence with a great number of applications

Teaching quality can be enhanced since several abstract concepts can be easily understood with visualisation and simulations tools that are difficult to implement in a traditional classroom.

The continuos availability of teaching material makes easier several tasks. For example, when a student is making its computer practices he/she may have simultaneously on his/her monitor: a window for the practice statement, a window for the course content related to the practice, a window for the compiler and a window for the documentation of the library functions to link with the program.

There was some previous material in digitised form (documents, slides) that could easily be adapted to the course.

There is limited teaching material for the discipline in Spanish. Therefore links

to the material of other spanish-speaking Universities greatly enhances content.

3.3.1 Course Components

The first step in the creation of the WBC has been the making of the Course Syllabus. This syllabus lists all the necessary information and prerequisites for taking the course as shown below:

Course syllabus

A concise introduction to the field.

Technical requirements for taking the course (browser, document viewers).

Academic requirements for taking the course (currently to attend the presential course in the University).

Prerequisites to be successful in the course (mathematics skills, knowledge of programming languages).

Academic requirements to be successful in the course (tests, assignments, practices, percentage of passed practices).

Alternate methods to contact the instructor (phone, e-mail address, physical location, presential tutorial hours).

The second step in the creation of the WBC has been the making of the Course Design. This helps the student to understand easily the relations between the different topics as shown below.

Course design

Learning objectives that describe from the beginning what the student is expected to know at the conclusion of the course.

Course division in units.

Learning goals for each unit in the course that express what has to been learned.

List of assignments for each unit.

Basic bibliography and the University Libraries where these texts can be found.

The last step in the creation of the WBC has been the compilation of learning material that builds the different units of the course. Material components are shown below:

Course material

Course slides (more than 150). These are the digital version of the

course slides. These slides can be accessed on-line through internet or can be downloaded in postscript format for off-line access or printing purposes (Figure 2).

Course textbooks and slides from other Universities. As mentioned before this is of particular importance due to the lack of spanish-based material in the field. Whenever possible an effort is taken to provide off-line access to this material

Simulations (about 30 in Java) that allows to visualise results and experiment with the concepts explained in class. A Pattern Recognition course that introduces abstract models to solve real problems improves its quality if these concepts are linked to applications. There are several of Java-based simulations of excellent quality that illustrate all basic concepts in the PR field [8],[9] or introduce applications.

Problems and exercises can be downloaded for each unit. Some of them are linked to simulations that let the learner to test the results.

Previous written exams from preceding years can be also downloaded to help the student to prepare his/her final exam.

Programming problems. This part is of particular relevance for a Computer Science student. Problem definition and programming material like auxiliary routines can be easily downloaded.

Libraries for programming. We currently use the SPRLIB/ANNLIB [10] library from Delft University of Technology. This library supports the easy construction and simulation of pattern classifiers. It consist of more than 150 functions written in C. Most of the well-known classifiers are present as well as error estimation and dataset generation routines. The library can be compiled for various platforms: SUN (SunOS, Solaris), SGI (Irix), HP (HPUX) and PC (Linux, MS-DOS + Turbo-C/Borland-C, MS-DOS + DJGPP (GNU C), Windows 95/NT). Documentation is available on-line and off-line.

A collection of links related to the field that help the students to go

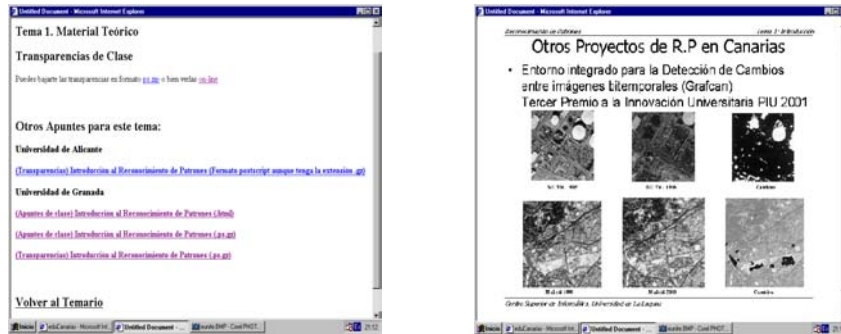deeper in several aspects or applications.

Figure 2 Course web page (left) and on-line course slide (right).

The method for online course preparation has been done by collecting scientific material from various sources (textbooks, articles). This material is consulted, condensed and translated to produce the material that is available to students. As this course has been given before we have reused a lot of material that was in digital form with minor modifications to keep up-to-date.

In the process of WBC creation we have found that producing a hypermedia courseware for a complex field like Pattern Recognition that goes beyond what traditional education offers is very difficult if everything, in particular animations and simulations have to be developed from scratch. Therefore we systematically started to collect all kind of material either offline and online to either download it or use it as an interactive text (see Figure 3). This generates the problem of the integration of such diverse material and of course the copyright issues that is of great importance.

3.3.2 Course Administration

Besides Course Content instructors have to face with course administration and management. Fortunately, Educanarias simplifies for the instructor all the management issues in traditional course administration. Students can be permanently contacted through a database of student records. This database can be used to notify students modifications of course content or incidences in traditional or virtual classes. In the PR course where student qualifications are modified each week when computer practices are done, the WBC simplifies the instructor the qualifications tasks and allows the students to know their results continuously. This generates a feedback for students and allows them to modulate the effort in the different units.
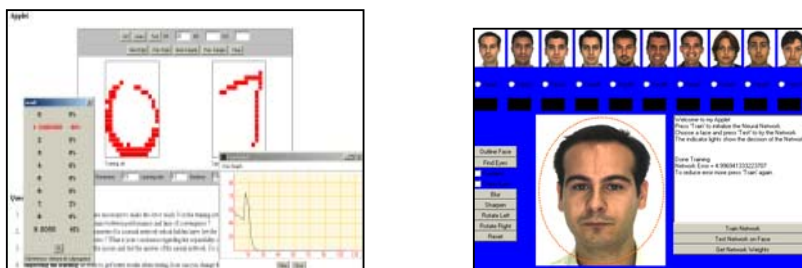
Figure 3 Hypermedia simulations. Character Recognition [8] (left) and Face Recognition [9](right).

4. CONCLUSIONS

On-line learning can supply a number of significant advantages over traditional teaching methods. An efficient use of e-learning requires an integrated system that supports the interaction between all the learning actors in the educational process. Educanarias is such a system that is designed as a central point that distributes the information between all the elements that interact in the educational process. This system offers "virtual classrooms" to the members of the educative community in the Canary Islands where e-learning can take place. An example for a University course is provided that shows the benefits of e-learning to complement traditional learning. This course design is based on a set of guidelines that may be used to put other university courses within the e-learning framework. The result of course creation is a centralised place for *Pattern Recognition* that makes easier for the students to obtain teaching materials with a decrease in the time, energy and cost involved in education. Moreover the use of on-line learning increase the student/student and student/teacher communication which is of crucial importance on their success and satisfaction.

REFERENCES

1   Burger J.; Booges J.; Webber S., 2000, Distance Learning in Higher Education: Market forecast and analysis 1999-   2004 IDC Report #23539.

2   Jensen, B. ; Sandlin, B., 1997, Electronic Teaching and Learning: Trends in adapting to hypertext, hypermedia, and networks in higher education, http://www.trinity.edu/~rjensen/245cont.htm

3   McCormack, C., Jones, D., 1997. Building a Web-based Education System. New York, John Wiley & Sons.

4   Mioduser, D., Nachmias, R., Oren A., Lahav, O. ,1999. Web-Based Learning Environments (WBLE): Current State and Emerging Trends. Ed-Media, Seattle, Washington.

5   Wagner, E. Creating a Virtual University in a Traditional Environment, 1998 EDEN Conference, Proceedings of the 7th European Distance Education Network,University of Bologna, Italy

6   Bacher C., Müller R. Ottmann T. Will M., 1999, Open hypermedia Educational Environments: A feasible approach to overcome some difficulties, Technical report 91, Institut für Informatik, Universität Freiburg

7Henke H. Evaluating web-based instruction design, http://www.scis.nova.edu/~henkeh/story1.htm

8   Gerstner W. Supervised learning with neural networks: Atutorial with Java exercises, http://diwww.ep.fl.ch/mantra

9   Shorey J. Neural networks for face recognition, http://www.ee.duke.edu/~jshorey/Face/FaceIndex.html

10 Hoekstra, A., Kraaijveld, M.A., Ridder, D. de and Schmidt, W.F., The Complete SPRLIB & ANNLIB, 1996, Pattern   Recognition Group, Delft University of Technology