PROMOTING THE USE OF ICT FOR EDUCATION IN A TRADITIONAL UNIVERSITY: THE CASE OF THE VIRTUAL LEARNING CENTER OF THE UNIVERSITY OF GRANADA

Keywords: Internet-based Instruction, E-learning, Institutional Policy, Teachers' IS Skills and IT Competency, Instructional Design, Undergraduate and Postgraduate Education, Case Study

EXECUTIVE SUMMARY

This case describes the Virtual Learning Center of the University of Granada in Spain. It relates the creation of a specific service structure to manage the promotion of the use of ICT and e-learning in the educational processes of a large, traditional, five century-old university. With just the base of a few previous pilot experiences, this Center, created in February 2001, had to address the training of the teaching staff of the University in ICT competences and the creation of both graduate and post-graduate virtual courses.

Four years later, all the proposed goals have been achieved and, currently, the University of Granada has more than 4,000 virtual students and more than one third of its academic staff (around 1,200 teachers) have proper e-learning skills, with some of them being able to create their own digital materials for face-to-face teaching support and blended learning.

ORGANIZATION BACKGROUND

The University of Granada in Spain was founded in 1531, under the initiative of the Emperor Carlos V, by means of a Papal Bull from Pope Clemente VII. In this way, Granada asserted its vocation as a university city which was open to different cultures, people and beliefs. With more than 470 years of tradition, the University of Granada has been an exceptional witness to history. Its influence in the city's social and cultural environment grew until it was to become, over a period of almost five centuries, an intellectual and cultural nucleus in Southern Spain in its own right.

At present, it has 24 university centers and 4 associates, 69,811 Degree and diploma students (year 2004), 10,000 students of Spanish as a foreign language, 3,000 doctorate students, 3,423 lecturers, 1,729 Administration and Service Staff, and more than 3,300 professors in 108 Departments. The University of Granada currently runs 50 degree courses, 22 diploma courses, 132 doctorate programs and a wide range of courses (of varying length) related to almost every area of knowledge.

The University of Granada takes an active part in the European Union university programs, both in the mobility of teachers and students as well as research. The programs are coordinated by the Office of International Relations and aimed at EU countries and other geographical areas (Latin America, Eastern Europe, North Africa, etc.).

By way of bilateral or specific agreements between groups of universities, it has traditionally collaborated with universities from these geographical areas as well as with the USA, Japan, China, Israel, Canada, Australia, Benin, Asian countries from the former USSR, Palestine, etc., university associations such as the Coimbra Group, the AUIP, ISTEC, ATEI, etc. All these are some examples of collaborative initiatives.

Although the three most intense areas of cooperation, as might be expected for a country such as Spain and a university with the tradition of Granada, are the European Union, Latin America and the Magreb, of no lesser importance are the lines of collaboration which exist with the remaining countries mentioned above. As a result of this cooperation, the University of Granada receives more than 8,000 lecturers, students and university administrators each year from all over the world, who attend Spanish classes, regular courses (around 5% of registration numbers), teach, and collaborate with research groups.

The University of Granada has made a strong commitment to its future by means of the development of quality research. The criteria behind its research activity are to stress traditional lines of research in order to support those which, although less developed, may be interesting to a changing society, and

to forge bonds with firms and institutions. These ideas offer advantages which have enabled to increase funds allocated to research and to open real future perspectives that never existed before.

As a result of the growth in scientific production, the University of Granada is among the top three Spanish universities. The growing relations with private and public companies in the country, through research contracts and provision of services, are the guarantee for the future. Besides, the same commitment is made in the quality control of teaching processes. A classical, old university such as ours must offer the best formation programs. With this aim, a specific Vice-Rectorate is in charge of all the aspects related to quality in education.

The application of ICT to science, economy, educational institutions, culture, etc. implies a wide variety of transformations in both aspects: in the way people behave and interact and in how services are provided. The University, as an institution that generates knowledge, is also responsible for the use of these new technologies with academic goals. Since 1995, the University of Granada has encouraged the application of ICT in its curricula. The daily use of technology requires an essential change in the way of training, teaching, and learning. If this were not the case, we run the risk of giving way to the so-called "digital breach". For that reason, the University of Granada is aimed at promoting the application of the ICT for the improvement of the teaching and learning system and the academic community at large.

At the University of Granada, the Vice-Rectorate of New Technologies promotes a progressive and continuing expansion of the use of ICT into the field of learning, knowledge and technology through its different services areas (Library Services, Computer Services and ICT Services). On this line, the Virtual Learning Center, embedded in this Vice-Rectorate, emerges in order to channel and promote the changes issued from the introduction of ICT in the academic and educational framework. It provides adequate training for the teaching staff in issues related to virtual teaching, introducing teachers to the virtual learning environment tools and e-learning methodology. The CEVUG also promotes the consolidation of a virtual academic structure developed from on line training pilot experiences, as a way to improve educational quality and research activities of the University of Granada. Finally, the Center means to strengthen international relations with other partner universities in the field of e-learning, participating in various e-learning projects and groups.

SETTING THE STAGE

The experience of the University of Granada (UGR) in e-learning started in 1995 and included both an external and an internal side (Cabrera and Cordón, 2002)(Cordón, 2002). Whereas the former refers to the participation in several international projects, the latter alludes to a series of teaching staff training programs on the use of ICT and the development of virtual authoring tools.

Summing up, between 1995 and 2000 the UGR was involved, among others, in the following international projects:

- *Humanities I and II* (1995-96). European Community (EC) and Coimbra Group project for the creation of courses in Literature and Law using videoconferences.
- *Euroliterature* (1996-97). EC program (continuation of *Humanities*) for the shared creation of virtual courses between European universities.
- *Patagonia* (1998). Alfa Project, Coimbra Group and Argentina and Chile universities. The goal was the development of an e-learning exchange framework from Spain to Latin America. The UGR provided technical support and participated in the creation of different courses.
- *HECTIC* (2000). European project supported by the Coimbra Group for the sharing of European experts experiences on e-learning in order to establish future policies in this area.

Almost all the previous projects were developed under the umbrella of the Coimbra Group of Universities (http://www.coimbra-group.be/). This collaborative group is composed of 39 European Universities which are characterized by being long-established and not located in capitals of countries (so known Universities such as Barcelona, Cambridge, Coimbra, Oxford, Poitiers, are members). It was created 20 years ago in order to promote internationalization, academic collaboration, excellence in learning and research, and service to society. Currently, the activities developed by the group are managed by different Task Forces, being the e-learning activities put into effect by a specific Task Force of the same name.

On the other hand, the UGR is a founder member of EUNITE (http://www.eunite-online.org/), a strategic alliance of 8 European universities to create a common Virtual Campus for sharing on-line courses as well as developing e-learning programs. As a first step, this partnership has the aim of the production of several common pilot courses. Some of them, related to areas such as Law and Literature, have already been distributed since 2002.

As for methodological aspects of virtual education, our university was involved in the MULTIPALIO Project, a European training program for specialists in design, development an evaluation of e-learning programs with new technologies.

All these initiatives connected to international projects came from the Vice-Rectorate of Research as well as from the International Relations Office, and they were an important precedent for the future establishment of e-learning in the UGR teaching policies.

Related to the internal perspective, the UGR Computer Services organized technical courses between 1999 and 2000. This teaching staff training program of 20 hours length was focused on the use of computer-based tools to design on-line contents for the support of their face-to-face subjects. The main topics of these courses were an introduction to computer science, Internet, Microsoft Word, Microsoft PowerPoint, an Automatic Virtual Course Generator (an authoring tool developed by the UGR Computer Services), web design and image processing.

Throughout this program, the UGR encouraged teachers to develop web-based materials and to use them to support their daily teaching. In addition, in order to support face-to-face teaching, students and teachers used a digital platform, developed by the University that provided authenticated access and allowed teachers to serve web materials for the students.

This identified access, linked at the main portal of the university, allowed teachers to fill in and check the school records of the students enrolled in their subjects. They could also attach materials for supporting their face-to-face classes. On the other hand, the students could (see Figure 1):

1. check their school records
2. check the list of their subjects
3. check the material of a specific subject
4. fill in an application for a student card
5. check scholarship information

Figure 1: Student view of the UGR digital platform

The UGR initiatives on e-learning before 2001 were the beginning of a strong commitment with the promotion of the use of ICT in education. However, these experiences showed the lack of a common nexus on the virtual learning development. They were much decentralized, as many different actors from different Vice-Rectorates participated, and no specific staff existed in the University to support them.

As we will see in the following sections, the creation of the Virtual Learning Center of the University of Granada (CEVUG) meant not only the centralization of all the e-learning activities of the UGR but also the setting of specialized staff focused on teaching staff training programs on the use of ICT and on the development of undergraduate and postgraduate on-line courses.

CASE DESCRIPTION

As seen in the previous section, although the UGR had developed some activities to promote the use of ICT in education, those were a few pilot experiences completely decentralized. By the beginning of 2001, just a couple of pilot courses with a small number of students had been put into practice and the UGR teaching staff did not have a proper technical and methodological background on the use of ICT in their teaching.

From that moment on, the UGR tried to support the growth of e-learning on its regular teaching. To do so, the Secretariat for Information Technologies in Education (STAD, in Spanish) was created within the Vice-Rectorate of Services to the University Community (the previous name of the Vice-Rectorate of New Technologies) in February 2001, with the following goals:

- To promote the use of ICT to improve educational and research activities in the UGR.
- To provide an appropriate teaching staff training (at several levels) on the use of ICT in their teaching ("teachers' technoliteracy").
- To support the adaptation of educational contents for its digitalization and to facilitate teachers' familiarization with the different existing tools in virtual learning environments.

- To manage the e-learning international relations, specifically with the Coimbra Group and the EUNITE alliance, as well as to participate in other international experiences in order to consolidate knowledge and liaisons in this field.
- To promote the creation of a virtual academic structure developing from on-line training pilot experiences to a Virtual Center (the CEVUG).

Nowadays, the Virtual Learning Center of the University of Granada (CEVUG) (Cordón, 2002)(Cordón et al., 2003) has become a reality (http://cevug.ugr.es), with a well defined structure (supported by the STAD). Moreover, within a short period of time, we will have our own physical building.

As we will see below, during the last four years the CEVUG has grown successfully, achieving and surpassing the originally planned goals. Up to present, it has organized 69 virtual courses (7 in 2002, 21 in 2003 and 41 in 2004), with the participation of 4,115 virtual students (214 in 2002, 1,132 in 2003 and 2,769 in 2004).

In addition to the teaching staff training programs and several undergraduate and postgraduate on-line courses in the UGR, the CEVUG has also developed different courses for prestigious external institutions like the University of Jaén, the University of Almería, the University of Alcalá (Madrid), the University Carlos III (Madrid), the MADOC (the Spanish Army Training Center), as well as the *Diputación de Granada* (County Council of Granada) and *Caja Granada* (a Spanish savings bank group).

The CEVUG also has an active role in the international sphere. It is a member of different international projects funded by the European Commission, as well as being a participant in the EUNITE alliance and Coimbra Group e-learning Task Force,

The remainder of this section is focused on the description and justification of the main tasks developed to achieve the goals we have mentioned before:

- To define a coherent structure of the CEVUG.
- To design a teaching staff program for UGR teachers.
- To create a workflow for the production of e-learning courses (see Figure 2).

The following three subsections are focused on the analysis of the decisions taken to develop each of these tasks. We will describe not only *what* but also *why* we have acted in that way in each case. Finally, the fourth subsection describes some of the results accomplished such as several virtual postgraduate courses developed by the CEVUG.

Structure of the CEVUG

The structure of the CEVUG has been increased in the last few years, adapting the number and skills of its members to new requirements. At the beginning, our staff was composed of 6 members but currently we have 12 people taking part in a heterogeneous team:

- A Director.
- An International e-learning Networks Coordinator needed to fulfill the UGR active participation in international e-learning programs (see Section “Organization Background”).
- A multidisciplinary support and development team of 8 permanent and 2 granted technicians, whose skills and tasks are as follows:

- A Journalism graduate: instructional design for web contents.
- Four Computer Science graduates: WebCT Learning Management System (LMS) and web server administration, evaluation and self-evaluation exercises design, HTML design, databases management, etc.
- Four Librarianship graduates: HTML design, usability, resource search, quality control.
- An Arts graduate: graphic design and development of additional educational resources.

The multidisciplinary team develops different functions across a planned program. The harmonic integration of functions and activities put into effect by diverse specialists allows us to adequately generate high quality virtual materials. In the third subsection we will describe the applied workflow with the aim of showing the functions of each member of this multidisciplinary team.

Nowadays, the CEVUG staff must develop the following tasks:

- Generation of virtual courses from authors' rough educational materials by applying an appropriate instructional design process.
- Maintenance of our own computer system structure.
- Handbook writing: guides for content authors, on-line tutors, evaluation, LMS use, etc.
- Methodological and technical formation for content authors and on-line tutors.
- Hotline: e-learning technical and methodological problem solving service for the UGR staff.
- Promotion of International Relations in e-learning, taking part in various projects, especially within the European framework.

The promotion of ICT among UGR teachers

As said, the CEVUG manages both the undergraduate and postgraduate on-line courses in the UGR. On one hand, the web-based materials for undergraduate courses are developed by the teachers themselves, with the support of the CEVUG staff. Teachers receive a specific training program and get some rewards (e.g., reduction in face-to-face teaching time) for their work. On the other hand, on-line materials for postgraduate courses are usually developed by our team from the rough materials provided by content authors who get paid for them.
In the remainder of this subsection and in the next one, we will state the key aspects of the IT case: the UGR teaching staff training program on ICT and the promotion of e-learning course creation by the teachers at the Virtual Free Credit Choice and Optional Subject Program, as well as the description of the technology used to do so. Later, in the fourth subsection, we will devote some lines to the creation of postgraduate courses by the CEVUG staff.

Academic Staff Formation Program

The CEVUG has always made a bet for the UGR teacher training in order to promote the use of ICT in education in our university. Since the creation of the STAD in 2001, more than 1.200 teachers have received these teaching staff training courses. Moreover, this program has evolved from a 20 hours technical course to a complete methodological and technical program composed of four consecutive levels and 110 hours of face-to-face and blended teaching. This evolution has been a consequence of the observation of teachers' requirements and the increase of the CEVUG staff and resources.

In June 2001, after the creation of the STAD, 60 teachers followed a course created with the same one-level 20 hours structure used previously. This course was taught by the Computer Services staff because the CEVUG had not its own employees yet.

After a survey made among the teachers enrolled in the course, the Director of the CEVUG realized that the contents were too heavy and that the teachers required more teaching materials and later support to apply their acquirements to their own subjects.

That was the reason why, in the 2001-02 academic year, the CEVUG started a new program with a two-level structure (20 face-to-face hours each course):

- Level 1: Microsoft Word, Microsoft PowerPoint and e-mail (basis for the Automatic Virtual Course Generator).
- Level 2: on-line materials generation tools: Macromedia Dreamweaver, Macromedia Flash, Virtual Course Generator; and the basics of the methodological aspects of digital materials creation.

In addition to giving those courses, the CEVUG staff started to offer technical support to answer the teachers' inquiries.

Till May 2002, several face-to-face editions of both level courses were done in Granada, Ceuta and Melilla[1]. In June and July 2002, the Level 2 course was offered in a blended modality: 3 face-to-face and 17 on-line hours. This way, teachers acquired the on-line student perspective, experiencing the usual existing problems.

This program, focused on face-to-face teaching support, was not enough for teachers to create on-line courses. Immediately, the CEVUG began to develop a new plan and, in the 2002-03 academic year, the formation program became a four level structure with both methodological and technical sides, performed by 210 teachers:

- Basic Level: 20 face-to-face hours. Microsoft Windows, e-mail, Internet and file transfer (ftp).
- Medium level: 20 face-to-face hours. Microsoft Word, Microsoft PowerPoint, basics of HTML, and Automatic Virtual Course Generator.
- Advanced Level: blended model: 3 face-to-face and 17 on-line hours. Macromedia Flash, Macromedia Dreamweaver and e-learning methodological basis.
- Pedagogical Level: blended model: 3 face-to-face and 27 on-line hours. E-learning methodology: instructional design, IPR, virtual tutoring, on-line evaluations design, etc.

The last stage of these courses included important changes to take into account new teachers' necessities. The CEVUG focused its new offer on increasing the quality of contents and on methodological aspects instead of on technological ones, and tried to simplify the process of courses generation. To do so, the order of levels was changed, Macromedia Flash was removed from the program and templates and Cascading Style Sheets (CSS) were included into the Level 4 course. The current offer is designed with the following structure:

- Level 1: face-to-face course for beginners. 20 hours. Windows Explorer, e-mail, basics of Internet and ftp.
- Level 2: face-to-face basic course on on-line materials generation. 20 hours. Microsoft Word, Microsoft PowerPoint, basics of HTML, Automatic Virtual Course Generator, UGR LMS (see Section "Setting the Stage").

[1] Ceuta and Melilla are Spanish cities in the north of Africa that administratively belong to the UGR, thus owning their respective Campus.

- Level 3: blended model. 8 face-to-face and 42 on-line hours. Instructional design of educational materials on virtual environments: characteristics of e-learning, how to write materials for the Internet, on-line tutoring, on-line evaluations design.
- Level 4: face-to-face. 20 hours. Macromedia Dreamweaver, templates, CSS, and image optimization.

During 2004, 512 UGR teachers followed our courses. The formation program structure is thought to incorporate two different kinds of teachers to the UGR e-learning project:

- Those receiving the two/three first levels and developing ICT-based materials to support their face-to-face classes, accessible by the UGR LMS (see the next subsection).
- Those receiving the upper two levels and creating on-line courses in WebCT promoted by the CEVUG institutional projects (Virtual Free Choice Credit and Optional Subjects, postgraduate courses, etc.).

As said, apart from the training teaching staff program, the CEVUG provides technological support service for content authors and teachers initiating on on-line teaching. This service was created to advise the authors on preparing contents according to their technological possibilities, as well as to give technical support and assistance to the partakers of the virtual courses.

Virtual Free Credit Choice and Optional Subject Program

After receiving some teaching staff training courses, teachers would be able to apply what they have learned through the UGR Virtual Free Credit Choice and Optional Subject Program. First of all, the subject digitalization projects have to pass an evaluation process, and afterwards, teachers themselves prepare the course materials: they do content instructional design and even the HTML design. The CEVUG staff offers both specific training and technical support, and finally makes the developed materials available by the LMS through a virtual course (see more details about the CEVUG operation mode in the next subsection).

After the production phase, there is an internal evaluation, developed by the CEVUG staff, and an external one, carried out by Virtual Learning Centers of other Spanish Universities. In case the subject does not pass the evaluation, it is offered in the usual face-to-face modality. In case the evaluation is positive, a blended teaching modality is applied where the teacher structures the subject syllabus into two different parts: face-to-face and on-line. The on-line subject percentage can be up to a 75%.

In order to maintain its quality standards, the UGR also coordinates other initiatives like the e-learning Quality Evaluation Project, funded by the UCUA (Quality Unit for Andalusian Universities), as well as the MASSIVE Project (Modeling Advice and Support Services to Integrate Virtual Components in Higher Education), funded by the European Commission to design a model of necessary support services for European traditional universities in order to successfully implement the virtual component of teaching.

During the 2002-03 academic year, the CEVUG started up the Virtual Free Credit Choice Subject Program (LiCEvI in Spanish) with seven virtual subjects. They were followed by 250 students. Ten more subjects were added during the 2003-04 edition. Throughout the current course, the undergraduate e-learning offer has been enlarged with new courses. For the first time, optional subjects have been considered in the program, now called Subject Virtualization Program, and eight subjects of this kind, as well as six more free credit choice ones have been implemented. Currently, the CEVUG runs 31 virtual subjects from different studies and 2 free credit choice courses within the EUNITE alliance.

Technology components of the Virtual Learning Center

Since the CEVUG got involved into the process of creating a Virtual Learning Center for the University, there was a need of some technological components to develop and deploy digital contents somehow. Apart from the people required for the tasks involved, a digital platform (LMS) and some client products were also necessary to interact with this platform, so that the CEVUG staff could create the resources that eventually would be offered to the student community. The main objective was that all these parts should come together to a common end: to blend pedagogy and technology in a suitable way (Moreno and Santiago, 2003).

Undoubtedly, at the moment of the initial decision, it was not easy to determine which deficiencies of the LMS could eventually affect us. This was due to the fact that e-learning technology is still changing these days and the requirements of the organization can evolve too. After a deep evaluation of some commercial products, the CEVUG decided to invest in *WebCT* (Rehberg et al., 2002), the most known software by the time of the decision.

WebCT is a global market-leading course management system that enables the efficient delivery of high quality on-line education. It provides some of the elements that a learning institution would need (WebCT, 2005):

1. Personalized *learning paths* for the students.
2. Best on-line *assessments* (self-tests, surveys, quizzes).
3. *Student tracking* (collecting and tracking data of students across the platform, analyzing their use of the learning modules).
4. Efficient *course management* (file management, discussion forum monitoring, assignment submission and grades management).
5. *Easy deployment and scalability*.
6. *Reliability, security and performance.*

WebCT provides three main roles for the actors: *student role* for the students, *designer role* for the authors of the material and teachers, and *teacher assistant role* for those who give support to the main teachers, but have less permission than them. These roles were enough to our organization when we started delivering the courses.

Its software and hardware requirements fitted all the CEVUG needs at that time. The Center firstly started with the 3.6 release, and currently, after some migration processes and security patches applied, the 4.1.2 release is the one available.

WebCT Campus Edition was distributed under two different licenses:

1. *WebCT Campus "focus" Edition*: It had a limit of 3000 signed-up students; it did not provide the WebCT API for accessing internal data, neither provided the LDAP integration.
2. *WebCT Campus "institution" Edition*: It provided all the functionality available, besides unlimited number of users.

The CEVUG chose the former, essentially because the cost of the second option entailed a great expense for the available budget. However, in 2004, having an increasing number of students, around 4,000, the Center had to migrate to the institution license. As we will comment on afterwards in Section "Current Challenges/Problems Facing the Organization", migrating to this license was not an easy decision to make, mainly because there were some serious, weird problems at the beginning of that period with the software.

In order to get the rest of the system up and running, the CEVUG needed to set up a server with some network services running on it. That would be the base for the management and maintenance of the

general service offered. At that time, Linux operating system was growing up as an option on the server part and fulfilled all our requirements. It was mainly a cheap, robust and scalable option. RedHat 7.3 was the first release used and, over the years, we have upgraded to new ones. In February 2004, the CEVUG acquired a 2.2Ghz Xeon bi-processor server with 2GB RAM and seven 72GB SCSI hard disks using a RAID-5 setup for primary storage, where RedHat Enterprise Edition 3.0 AS was installed.

In an institution that needs to expand its knowledge over the World Wide Web, it becomes essential to deploy a web server. So, the CEVUG staff configured Apache 1.3 for serving web pages, sign-up procedures for the on-line courses, management of internal work group using some collaborative tools (forums, tasks manager), surveys for the students, access statistics, etc.

Besides this, a DBMS was needed to store the organization and customers' data. The CEVUG staff decided to use the most popular open source database server, MySQL 4.0, which guaranteed a great performance and easy management, backup procedures and maintenance, with the background support of a big community of users. With zero cost, the CEVUG got its main infrastructure prepared.

Why WebCT?

By that time, most LMS vendors offered good products that could match the CEVUG needs at the starting of the process, but that could come to a wrong and incomplete development as well, as the project grew up. However, these inconsistencies could be solved by the vendor consultants if they had a good support service, so we identified here one of the concepts that should matter in an evolving technology like e-learning.

Many factors affected the chosen platform. Some of them were:

- *Target Audience:* A lot of differences could exist between higher education students and secondary schools students. The LMS should be focused on the sort of students that would sign up for a course.
- *Costs and Benefits Rate*. Almost all of the evaluated LMS costs entailed an important percentage of our budget.
- *License*. It was important to identify the constraints associated to the product license, such as the number of users that could sign up for the LMS, the concurrent clients allowed, etc.
- *Hardware requirements.* It was needed to purchase an adequate server for the service.
- *Use of the product on similar institutions.* While it was not a decisive factor, it helped to investigate which LMS was being used at that moment by other educational organizations.
- *Suitability of the product to the subjects* that would be taught through the LMS. The pedagogy and methodology could change a lot with Arts, Science, Language or Mathematics materials.
- *Communication Tools*. The way the teachers and students communicate depends on the LMS.
- *Localization of the product*. It was essential to have different languages support for the LMS, as foreign students could eventually sign up for a course.
- *Standards support*. As e-learning is an evolving technology, the LMS contents should be easily migrated to other systems.

All these factors were taken into account in order to decide which platform would be better. A study made in 2001 by a local company in collaboration with the "Training and Employment Foundation" (Fundación, 2001) showed that WebCT was the best scored LMS among several evaluated systems (Virtual-U, FirstClass, IntraLearn, TopClass, WebCT, Blackboard, LUVIT, TLM and Netcampus).

The Distance Learning Office (also known as GATE) of the Universidad Politécnica de Madrid in Spain, wrote a deep comparison analyzing a lot of commercial e-learning platforms, which also helped us in the decision. Furthermore, WebCT was being used at that moment in other national universities that we contacted with, in order to get some feedback about how their decisions were made and how satisfactory their experience with WebCT was. This initial feedback from other organizations related to the university activity was decisive for the final decision.

Finally, we analyzed two products in depth, Blackboard and WebCT, as they both were well scored in the studies observed. WebCT presented a better structure and ease of use than Blackboard. It had the "plug & play" concept that the CEVUG staff was searching for, and it was demonstrated in some practical cases that setting up the virtual center would be easier using WebCT as the e-learning engine. Moreover, WebCT could also be installed in Linux and Solaris operating systems. We had to have this in mind as well, as the Computer Services of the UGR used this kind of systems to offer most of their services.

Technological aspects of the CEVUG multidisciplinary team operation mode

As mentioned in the first subsection of Section "Case Description", the CEVUG multidisciplinary team follows a common procedure for producing resources, in which all members of the team participate. The staff works under this methodology because the creation of virtual courses needs specialists in concrete areas. When it comes to create virtual courses, the design generally involves two principal tasks:

1. Instructional design (process to convert a simple electronic text into an organized hypertextual resource): text, graphical and resources.
2. HTML design: hypertext, animations and self-tests.

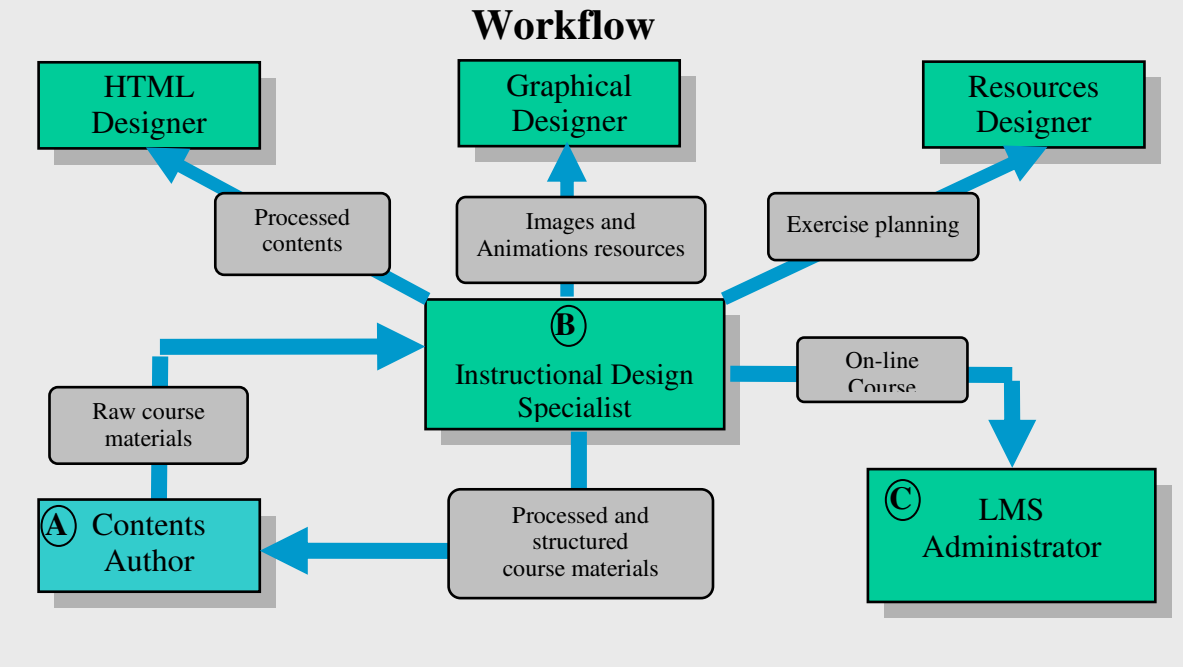

Figure 2: Graphical representation of the multidisciplinary team members' operation mode to build up virtual courses

From a technological point of view, the CEVUG production system takes place as shown in the workflow at Figure 2:

1. The teachers or content authors prepare the rough resources (usually in Word format, or in the best case directly in HTML format following a CSS style sheet provided by our team). The Center staff provides technological support for the content authors and the teachers that want to initiate their teaching activity through the Internet **(A)**.

2. Then, the instructional designers review those resources and make the page layout of the material prepared to be browsed through the Web. The graphic designer reviews the multimedia content of the resources and modifies, adapts and optimizes what is needed. Besides this, some information related to those media objects, which would be shown later on the course content, is added (file size, transfer time, dimensions, etc.) **(B)**.

3. The system administrator creates a course within WebCT, using a predetermined identifier, and the librarianship graduates, after a pedagogical quality evaluation of the virtual contents and an external evaluation by qualified consultants, make a table of contents within the course and organize all of the tools that would be used (calendar, activities, periods, exams, or whatever it would be needed). The course material, packed in a folder of HTML files and multimedia files, is then uploaded to the server through the Samba network file system that allows the interaction with Microsoft Windows, being finally stored at the Linux server.

   When the course is about to start, the administrator will insert a file with the sign-up data for that course (students and teachers login identifiers and passwords) through the WebCT administration interface and the course is made available to the students through a personal homearea called 'MyWebct', where the courses are listed **(C)**.

WebCT 4 was somehow easier to personalize than previous versions, but, nevertheless, it had strict restrictions for doing so. In our installation we changed some icons, but the color template remained the same as originally.

We used to have the left menu where the course content was placed activated: communication tools, calendar, course syllabus, self-evaluation and activities. However, you can also navigate most of these items through icons on the central frame.

As we mentioned before, the CEVUG staff normally uses some client tools for the creation and optimization of resources:

- Microsoft Office.
- Macromedia Studio MX Edition.
- Adobe PhotoShop CS Edition.
- CourseGenie (convert Microsoft Word documents to e-learning units on XML and HTML WebCT compliant format).
- Reload Editor (creation of SCORM content).
- Turbodemo Professional Edition (for creating animations and tutorials).

Postgraduate courses developed by the CEVUG

Virtual Certificate of Pedagogic Proficiency (CAP):

The CAP is a Certificate of Pedagogic Proficiency that postgraduates need to become Secondary Education (High School) teachers in Spain. This year, we are applying again the experience started three courses ago with a blended modality for the three obligatory subjects required to obtain it:

- The School, the Syllabus and the Teacher.
- Learning and Development in Adolescence.
- Theories, Institutions and Contemporary Problems in Education.

This on-line modality is offered to graduates with problems to follow the usual face-to-face instruction. It is composed of 7.5 credits of the total 18 credits program. The first year, it was done by 180 students and more than 300 enrolled in last year edition. This academic course we have a new subject: Teaching English.

Virtual Master in Forensic Anthropology and Genetics:

Master Course of 500 on-line hours composed of two different parts, forensic anthropology and genetics identification, with a common block of 100 hours. Content authors are recognized researchers in both areas, as well as FBI and Israel Police staff. The academic directors, Drs. J.A. Lorente and M. Botella, are UGR teachers chairing labs in our university.

This Master contains diverse on-line support materials: original images, virtual skeletons, lab practice videos, web resources, self-evaluation, etc. (see Figure 3). Tutors are experts in the area, belonging to the labs of the academic directors.

This year, the third edition of the Virtual Master in Forensic Anthropology and Genetics, the third Virtual Expert Course in Forensic Anthropology, and the second edition of the Virtual Expert Course in Forensic Genetics are being followed by 32 students from several parts of Spain and Latin America countries. Moreover, we have developed two short related courses with 70 virtual hours: Anthropological Techniques of Identification and Investigation of Paternity with DNA Analysis, followed by 60 more students. The former editions of the Master and Expert Courses were followed by around 70 students.

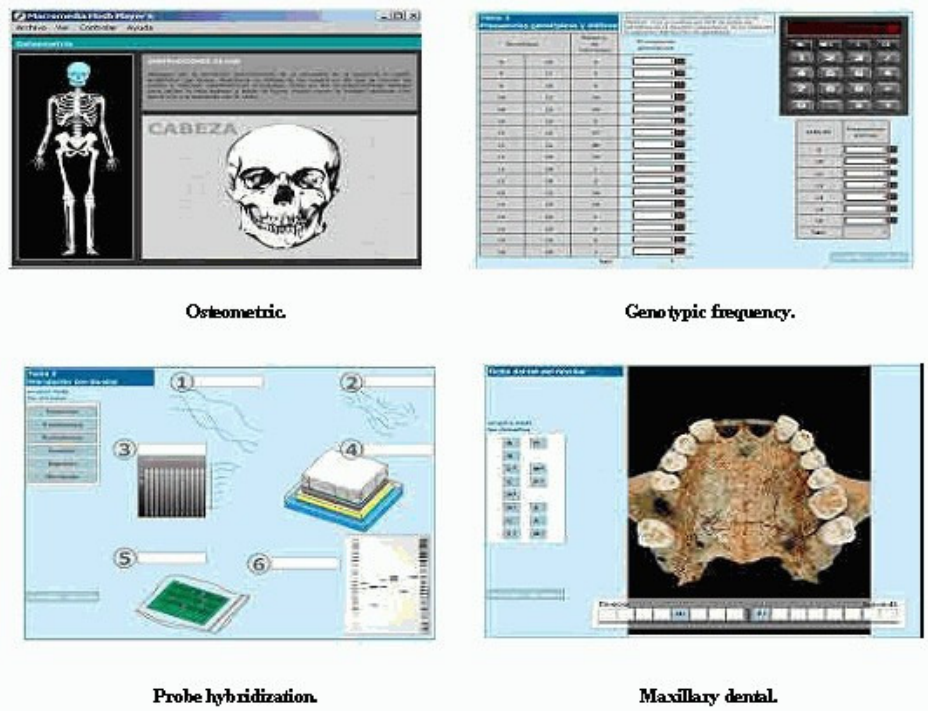

Figure 3: Screen shots of the Virtual Master in Forensic Anthropology and Genetics offered by the CEVUG

E-learning Methodology Course for Teaching Staff Training

Blended learning course organized by the STAD-CEVUG for more than 400 teachers of the University of Alcalá de Henares (Madrid, Spain) and 26 teachers of the University Carlos III (Madrid, Spain). This program, called "Learning through the Internet: Instructional Design of on-line didactic materials", has the goal of training these teachers in the creation and administration of e-learning materials, in both the methodological and technical aspects.

Previous Instructional Design courses organized by the CEVUG have also been performed for some other prestigious institutions like the University of Jaén (blended course for 230 teachers), the University of Almería (180 teachers), as well as the MADOC, the Spanish Army Training Center (15 Training Centers representatives).

Instructional Design and On-line Tutoring on e-learning Environments:

This is a 100 hours virtual course on Instructional Design and On-line Tutoring on e-learning Environments, completely developed by our staff, to give a complete, methodological and technological training in e-learning. It is mainly addressed to undergraduate or graduate students in Computer Science, Pedagogy, Education, Journalism and Information Sciences.

The first edition began in 2004 with 48 students and the second one has just finished with 31 new students.

Experimenting with Animals for Researchers:

Blended expert course directed to teachers and trainers who work in scientific experimentation with animals. Last year, 13 students took part in the first edition with 65 hours of teaching (53 on-line and 12 face-to-face practices in laboratory).

Internet Languages, HTML and XML:

Blended course addressed to Caja Granada employees (a Spanish savings bank) and held during November 2004. This 24 hours course has been completely created by our technical staff and was followed by 26 Computer Science graduates.

CURRENT CHALLENGES/PROBLEMS FACING THE ORGANIZATION

One of the first problems the CEVUG staff had with WebCT was the *small customization capabilities* it owned. It was impossible to add our own functionalities to the LMS and the aspect (colors, styles) of the web pages within the LMS was not easy to modify either. As it was distributed under a proprietary license, the modification of the source code in order to develop our own functionality within the platform was both difficult and risky and we surely would be infringing the license. It would be difficult to modify it because WebCT has been developed in PERL, a structured programming language that could be not so easy to understand. Besides, it would be dangerous (and surely illegal) to modify some parts of the code, because *it did not use a relational Database Management System* (DBMS), but it is based on Berkeley DB and it did not provide any documentation at all about how to access the whole internal data.

Among others, one of the most important problems was the absence of really standard ways of importing learning resources in the LMS. WebCT used to have IMS support, a standard specification made by a global consortium of vendors, institutions, technical developers and others, to enable

learning technology to be interoperable. However, WebCT modified some parts of this standard, making their own IMS format that could be incompatible somehow with some external authoring tools. Besides this, another specification called *SCORM* seems to be the most promising at present, and *it is not supported by WebCT yet*. We need to turn to external tools, as CourseGenie, that makes possible to create WebCT compliant modules from Microsoft Word, but this option keeps increasing the expense every year.

One of the main functionalities absent in WebCT currently, is the chance to see *who's online* inside the LMS when you are logged in. So, you are not able to know if your teacher or any student is already in the platform. You also need to use external tools like MSN or ICQ to talk to other people, once you have obtained the contact information of all your students or teachers.

Besides, we should mention that the *cost of WebCT licenses*, both campus focus edition and institution edition, *is really expensive*, mainly because it depends on the number of students your educational organization could manage as maximum. So, if our university had 60.000 students, even though the CEVUG only had 2.500 students that applied for online courses, the cost for our organization would be calculated by the total number of students for the University. After some period of negotiation with our national vendor, we finally came to an agreement for a reduction of the price on the institution license, but yet we would prefer to spend our budget in increasing the technical staff in the CEVUG or in investing in the training program.

Another very important problem associated to licenses is that we could *only have one server running on an IP and port by license*, so we could not have a backup server for failure situations or set it to another IP/port without contacting with WebCT support. In February 2004 we had a failure on our main server and, as some courses were running at that moment, we needed to restore the online courses as soon as possible in another backup server; WebCT allows you to export the courses as encrypted zip files and, as we made backup copies every day, we followed the restore procedure. But, as it managed two internal databases (global DB and students DB), when we needed to restore those compressed backups on another recent installation, *only some data were really restored.* When making WebCT support service aware on this fact, their answer was that they could help us just in case we pay them an amount of money proportional to the number of courses that had to be restored, what in fact was actually unacceptable.

Another point where WebCT fails is that it has not got the option to be installed in a *Fault Tolerant* way without turning to external software again. As we mentioned before, this is a strong requirement when you have to provide your service to national and foreign customers, mainly because you could have almost the same traffic at day (i.e. in Europe) or at night (i.e. in South America). It would be perhaps necessary to look into WebCT Vista (WebCT Vista, 2005), an Academic Enterprise System, which is specifically built to address the mission-critical challenges of enterprise-scale deployment, but that would highly exceed the price for the institution license.

Besides all these problems, a current challenge for our institution is to deploy the LMS inside the computer *farm* available at the Computer Services of the UGR. With this feature, which is strongly needed in our organization, the CEVUG could have a 24h/7days active LMS, with the advantage that we would have it available even if an error occurs in one of the eight computers that compose the farm. This would also improve the response time to HTTP requests.

WebCT does not provide an option for this, as you need to use again external software called Lifekeeper, from Steeleye Technology Inc. (Linux, 2005), setting up a cluster. For this reason, in 2002, we started to look into an open source LMS called ILIAS (ILIAS, 2005), which is based in Apache, PHP and MySQL, and has already some experience being deployed in clusters and computer farms.

ILIAS started as a project at the University of Cologne (Germany) in 1998, and at the moment it maintains a cooperation network with some other universities and companies (ILIAS Cooperation Network, Databay Inc., Novell Inc.). They organize annual sessions about the LMS and developer conferences that help to make the project successful.

The main features of ILIAS are:

- Personal desktop for each user with information about last visited courses, new mail or forum entries.
- Learning environment with personal annotations, test, glossary, print function, search engine and download.
- SCORM 1.2 and AICC compliance.
- Course management system.
- Communication features like mail system, forums and chat.
- Group system for collaborative work and organizing users and resources.
- Integrated authoring environment (Editor) to create courses even without any HTML knowledge.
- Support of metadata for all levels of learning objects.
- Context-sensitive help system for learners and authors.
- User and system administration interface.
- System languages: Chinese, Czech, Danish, Dutch, English, French, German, Greek, Indonesian, Italian, Lithuanian, Norwegian, Polish, Portuguese, Russian, Spanish, Swedish and Ukrainian.

ILIAS solves some of the problems mentioned above about WebCT. As it has been developed in a common platform as LAMP (Linux, Apache, MySQL, PHP), it is easy to add new features or improve the existing ones. We have been installing it on the computer farm under Solaris operating system where its performance and adaptation to our requirements would be evaluated. Our main purpose is to open ILIAS to all the teachers of the University, so that they can slowly and progressively get involved in the e-learning process by themselves. At first, we would use it for face-to-face teaching support and blended learning and not for whole virtual courses.

Besides, it already supports the new system of credits ECTS that is being developed in European Education and it will help us promote the mobility for students and teachers with an embedded translation system for learning modules, as was established at the Declaration of Bologna of 1999 (Bologna Declaration, 2005).

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