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A Virtual Campus for E-learning Inclusion: The Case of SVC-G9

Daniel Perez-Gonzalez
(University of Cantabria, Cantabria, Spain
daniel.perez@unican.es)

Pedro Soto-Acosta
(University of Murcia, Murcia, Spain
psoto@um.es)

Simona Popa
(University of Murcia, Murcia, Spain
sp.popa@um.es)

Abstract: Academics and professionals agree that, to adapt higher education institutions to the XXI century, it is imperative to extend the use of ICT as well as the virtualization of many human-interaction activities. There is therefore a need to move from the use of ICT as support tools to e-learning instruments based on virtual environments. These environments can be used for e-inclusion. That is, systems can be used to remove communication and interaction barriers that people with disabilities may face in the real world. This paper presents a project which implies the implementation of a virtual interuniversity campus where nine Spanish higher education institutions took part. To enhance Web accessibility as the usability of the system by users with disabilities is one of the main project's objectives. In addition, the paper analyses the teen-year experience of an e-business course for engineers offered simultaneously by the nine universities through this platform. The main conclusions of this work can be valuable to higher education institutions which have implemented or intend to implement a virtual interuniversity campus.

Keywords: E-learning, e-inclusion, accessibility, higher education, usability, teaching innovation
Categories: L.2.3, L.2.5, L.2.7, L.3.0, L.3.1

1 Introduction

The degree of development of certain domains is considered to be linked to the level of implementation of ICT ([Lucio-Nieto et al., 12]; [Soto-Acosta et al., 13]. However, the adoption of ICT has followed different patterns depending on the environment. Thus, although the business context has reached high levels of ICT adoption, other important contexts for the future of generations such as higher education remain certainly laggard in comparison ([Bernard et al., 04]; [Jones et al., 10]; [Park, 09]; [Tallent-Runnels et al., 06]). Despite of this, e-learning has become increasingly common in higher education institutions all over the world. The existing literature considers e-learning as an advanced pedagogy that makes use of digital technology ([Nichols, 08]; [Rosenberg, 01]), and is related to the use of the Internet and other

information-related ICT to create experiences that foster and support the learning process ([Bose, 03]; [Macgregor and Turner, 09]).

Public institutions and international reports (e.g. [Institute for Higher Education Policy, 00]; [European Commission, 04]; [OECD, 11]) suggest the need to deepen in the application and study of e-learning within the higher education as means for achieving flexible, dynamic and personalized e-learning initiatives. This means equal opportunities for everyone within higher education regardless their physical capacities. However, reports point out that the implementation of ICT within the higher education system is still very basic, with high levels of resources underutilization considering its potential ([OECD, 05]; [UNESCO, 11]). Therefore, it is necessary to move from the use of ICT as a support tools to an e-learning inclusive instrument based on collaborative virtual environments ([Guri-Rosenblit, 05]; [Park, 09]).

To address these issues, there is therefore a need for further works that show how to cope with problems and answer practical questions with regard to the development of inclusive higher education virtual environments ([Epper and Gran, 04]; [González, 10]; [Ossiannilsson et al., 12]; [Stanchev et al., 14]). The point of contact between the user and the computer is defined as the human–computer interface [Chou et al., 07]. System accessibility is related to its usability to all users, including users with disabilities. Disabilities can be cognitive, visual, mobility, auditory or neurological related [Loiacono et al., 05]. Thus, ensuring that websites are accessible to everyone is an ethical legal imperative. Virtual higher education should be a learning methodology for all and it must consider the specific needs of all students, adapting the processes in order to cover their necessities. Although today there are still a lot of usability limitations between humans and computers, the correct design of e-learning initiatives can be an opportunity to remove communication and interaction barriers that people with disabilities face in the real world.

So far, universities have used e-learning technologies for supporting their own traditional courses and very rarely for co-operating with other universities. This is critical for e-inclusion as cooperation among universities may allow students with disabilities to attend a large amount of courses both from their university and other universities as well. Thus, the implementation of e-learning interuniversity cooperation programmes can provide equal opportunities to people with disabilities and, at the same time, reduce costs and enhance synergies through cooperation.

To adress the above mentioned issues, this paper presents a project which embraces the implementation of the first virtual interuniversity campus in Spain, called the Shared Virtual Campus (SVC-G9), which since 2001 integrates nine higher Spanish education institutions (G9) and represents the largest online university campus in Spain. To enhance Web accessibility as the usability of the system by users with disabilities is one of the main project's objectives. More specifically, this work analyses the context, previous scenario and development of the project, paying attention to the implementation of the whole learning process virtually. In this sense, technologies used, design, resources and course management issues such as communication, follow up and assessment are explained. Also, this paper analyses the teen-year experience of an e-business course for engineers offered simultaneously by the nine universities through the SVC-G9 platform. The rest of our work is organized as follows. First, the next section presents the context in which the project is

implemented. Second, the characteristics of the project and its implementation are depicted. Third, lessons learned from the project and the e-business course for engineers are outlined and, finally, conclusions, limitations and future research guidelines are presented.

2 The context: interuniversity virtual campus

In May 1997, 9 Spanish public universities (University of Cantabria, University of Castilla-La Mancha, University of Extremadura, University of Illes Balears, University of La Rioja, University of Oviedo, University of País Vasco, University of Navarra and University of Zaragoza) decided to create a group named the G9. The group was characterized by including universities geographically disperse and with less resources in comparison to the largest universities in the country. The aim of the group was to develop a joint collaboration strategy to share resources and generate synergies. To achieve this main goal, the G9 established the following objectives:

- To incorporate new technologies and innovative teaching practices within their universities.
- To develop a high quality flexible virtual e-learning system tailored to students' needs.
- To foster interdisciplinary students by allowing them not only to choose courses from different degrees but also from distinct universities.
- To facilitate learning opportunities to students with time constrains through the use of ICT.
- To share and exchange valued resources and experiences through virtual means.
- To enhance accessibility to users with disabilities

Consequently, in 1999, the G9 developed an innovative project by creating the first virtual interuniversity campus in Spain called Shared Virtual Campus (SVC-G9) through which G9 members could offer e-learning courses virtually and simultaneously taught by the 9 universities. These courses could therefore be attended virtually by any students of the participating universities and would be recognized as official courses with the same value as those attended in person.

The SVC-G9 started its academic activity in 2001 with 9 courses, one for each university and, since that date, has maintained a continued and positive progression with regard to the number of students as well as the number of courses. Currently, the SVC-G9 is the largest online university campus in Spain regarding the number of courses offered and number of students with 79 and 6429, respectively.

3 The Project

This section begins describing the scenario before the project started and, following that, the project development and its outcomes are depicted.

3.1 Previous scenario and methodology.

Universities pertaining to the G9 in order to received proposals about courses to be taught through the SCV-G9, in 2001, published a call for courses. From all the received proposals, an expert committee selected those that would be part of an innovative learning project. We, the authors, considered this an interesting and enriching experience and proposed a course denominated "introduction to the e-organization", with a multidisciplinary approach and the objective of teaching engineers the basic notions of business management through ICT. Moreover, in line with G9 objectives, our course aimed to be accessible to students with disabilities. Finally, our course was selected to take part in the project.

Prior to the project development, the use of ICT by the G9 members was merely as a complement to lectures. More specifically, ICT were used principally as document repositories of course materials. In this sense, a website in html and java script was usually employed to provide documents of interest to students. This way of applying ICT can be considered as the first step toward the virtualization of teaching and, in fact, is still the most frequent use within the higher education context ([Jones et al., 10]; [Biasutti, 11]; [UNESCO, 11]). However, this way of virtualization presents important limitations with respect to the possibilities that ICT offer to higher education. These limitations include one-way interaction -only lecturers introduce information- and unsynchronized communication often by email.

The aim of the new Project was to overcome passed stages and enable to conduct the whole learning process virtually, including the providing of course materials, the interaction among students, the development of assignments and exams as well as the offering of support to students during all processes by multidirectional communication. In addition, as mentioned earlier, enhancing Web accessibility for users with disabilities was also one of the main project's goals.

In order to achieve these objectives, in-depth interviews were conducted with a number of individuals from other online courses and participating universities. In total, 20 interviews were conducted (10 face-to-face interviews with students with physical disabilities and 10 telephone interviews with lecturers). These interviews were about difficulties found by disabled people when attending online university courses.

- More specifically, the main difficulties pointed out by lecturers during the interviews were:
  - The lack of awareness about the problems that disabled people face when working on computers.
  - The unawareness about the technical solutions that may reduce that problems
  - The lack of examples which may be used as a reference for specific experiences related to courses pursuing e-inclusion.
- Students highlighted during the interviews the following issues:
  - The complexity of the course website regarding its structure and required plug-ins as well as the lack of alternative text/font for icons and images.
  - Limitations with regard to course materials format, since they were only available in text or ppt.
  - Similar to offline courses, only a specific day and hour for examination was offered to students.

- The focus seemed to be on lecturers' convenience rather than on students' needs.

Opinions from lecturers, especially those concerning the lack of previous experiences and the unawareness about the problems that disabled people face when working on computers, encouraged us to carry on with this experience in order to provide the research and teaching community with further knowledge and practical experiences to achieve e-inclusion. Moreover, student's opinions were considered during the whole project. Thus, for instance, the W3C guidelines on web accessibility were followed to make web browsing easier for people with disabilities, in particular for users of common assistive technologies like screen readers, mouse or keyboard emulators. A screen reader is software which identifies and interprets what is displayed on the screen. This interpretation is then re-presented to the user with text-to-speech, sound icons, or a Braille output device. Screen readers are useful to people who are blind, visually impaired, illiterate or learning disabled. Mouse or keyboard emulators are used when individuals do not have sufficient fine motor control to successfully use a keyboard or mouse. This devices offer cursor control on the screen using a button or switch for item selection. Combined with an on-screen keyboard they serve as a keyboard alternative.

3.2 Project development

Many authors in the literature indicate the high failure rates of this type of initiatives (e.g. [Romiszowski, 04]; [Aggarwal and Makkonen, 09]; [Reeves, 09]; [Chih-Cheng et al., 11]) because developing high quality fully virtual university courses is often more complex than initially expected ([Guri-Rosenblit, 05]; [Park, 09]). From our previous experience using e-learning, and comments from the interviews, we realized that developing a website to facilitate the same course material provided through a traditional lecture was not enough, but a complete virtualization of teaching was necessary. This virtualization requires following a systematic and structured process which must analyze, before conducting the course, how to cover the teaching objectives, that is, establishing a course design that permits the development and implementation of the course with enough guarantee of success. Thus, we analyzed existing initiatives at that time and reviewed the literature, identifying the following key issues ([Institute for Higher Education Policy, 00]; [Alexander, 01]; [Cloete, 01]; [Kendall, 01]):

- Technological platform and ICT tools to be used.
- Work environment appearance.
- Type of course materials for students, software and format.
- Course management characteristics.

In the next sections, we address all these issues following our experience with the course "Introduction to the e-organization", which is being offered nonstop since 2002 within the SVC-G9 virtual campus and has the objective of being accessible for people with disabilities.

3.3 Technological platform and ICT tools

Technology is one of the key factors for the success of an e-learning initiative ([Debande, 04]; [Romiszowski, 04]; [Guri-Rosenblit, 05]; [Tallent-Runnels et al., 06]; [Nawaz et al., 11]; [Ossiannilsson et al., 12]). However, the decision regarding what technology to use is difficult because of the many options available, which include the building of a platform with client/server technology (PHP, ASP, JavaScript, VbScript) or the use of a specific commercial software -Learning Management Systems (LMS) - for the development and management of online courses, being the best known software in 2001 WebCT and Moodle.

The LMS software facilitates the creation and design of the website by offering predefined settings as well as its implementation and management. These systems incorporate a set of tools which make possible that lecturers without advance computer skills can use it. Moreover, the LMS software facilitates content distribution, course management and communication between and among different users: lecturer-student, student-student and student-lecturer.

In our particular case, universities decided to implement the Webct LMS software for the virtual shared campus to avoid problems regarding technology incompatibility between institutions and achieve homogeneity. As a result, all the courses used the same technological platform. In addition, the W3C guidelines on web accessibility were followed to make web browsing easier for people with disabilities, in particular for users of common assistive technologies like screen readers, mouse or keyboard emulators.

3.4 Design and materials

With respect to the response of students during interviews, we consider that the design of the virtual environment must adopt a perspective from the students' point of view in order to create a simple and intuitive work environment. In our case, the structure of the portal has a first page access available for all the participating universities where students introduce their user name and password to get access. The first thing they find when they access a course is a simple and technically light site which loads quickly. This first page has a banner in its up part, which shows the course name. Below it, a set of icons, all with alternative text formats and the possibility to change their font size, give access to the main elements of the course: materials, communication tools and evaluations.

Regarding the development of course materials, it is essential to take into account two aspects: software and format. In our particular case, for each course unit we hand in three different type of documents: 1) text materials in PDF format with detailed content, which can be displayed online and offline; 2) slides in ppt that summarize each unit content; and 3) multimedia stuff – subtitled videos with audio material to enhance interactivity with students and complementary links to other websites related to the content of each specific unit.

3.5 Course management: communication, follow up and evaluation

Course management is achieved through: 1) a two-way communication between and among the different users: lecturer-student, student-student and student-lecturer; 2) a

thorough follow up of what happens in the course; and 3) a correct evaluation of students' learning.

Next we present the main tools for communication and course management:

Communication

The communication process with students starts one week before the official commencement of the course. The contact is made by email. Lectures welcome students, explain the course functioning and attach one file (in different subtitled video formats, audio and ppt), which explains in detail the steps to access the course, course contents, assessment methods, etc.

Once in the course, the first element shown is a guide in multiple subtitled video formats, which describes in detail the functioning of each element of the course. Students have for each unit a direct access to the lecturer in charge, who facilitates contact for the resolution of any doubts.

The course's main page has an icon called communication. When students click on it, they access a site in which the following communication tools can be selected:

- Internal email. This feature permits to send private emails to lecturers or the rest of students within the platform.
- Forum. This application allows students to exchange their opinion or debate in public about questions raised by lecturers or any theme related to the course.
- Chat (IRC). This element is used for real-time interaction between students and between them and lecturers, this replaces the traditional offline office support hours between students and lecturers.
- Wiki. This tool is used for knowledge creation and sharing among participants.

Follow up

The LMS system gives information about the number of times students access the course, contents visited, time connected to the platform and activity during connection. This way, statistics are obtained on use of contents and the level of interaction using communication.

It is important to notice that communication and course management are influenced by the number of students. The number of students is exponentially associated with the required time for communications, evaluation and course management.

Evaluation

Evaluation is based on the student performance in different type of online activities:

a) A multiple-choice test exam per unit to assess students learning. These exams can be attended during 48 hours, although once started the exam last 30 minutes. Thus, students choose the best time for them to do the exam within those 48 hours. The exam is recorded in the system, indicating not only students' answers but also the time to answer each question.

b) Continuous assessment through case studies suggested by the lecturers and the student participation through the distinct communication tools (forum, chat, e-mail).

3.6 Output

The evolution of the number of students, since the course started in 2002, has been very positive (see table 1). A total of 788 students from 9 different universities have already taken the course. However, it is important to remark that from 2008 the maximum number of students was limited to 90, even though more than 100 students were interested in the course. The reason why is because we consider that a large number of students may constrain interaction and follow up.

Year	2002	2003	2004	2005	2006	2007
N. Students	34	42	47	59	68	88

Table 1: Students per year (2002-2007)

Year	2008	2009	2010	2011	2012	Total
N. Students	90	90	90	90	90	788

Table 2: Students per year (2008-2012)

The average number of students who pass the course is 71%, being very similar to that of offline courses, which is between 61% and 84% [OECD, 11]. Every year students fill in a questionnaire to assess the course and suggest possible improvements. The average value obtained, in a scale that goes from 1 to 5, is 4.1. This result is above the average value of 2.9 that traditional offline courses receive ([Buesa et al., 09]; [ANECA, 07]). In the following section, lessons learned from the project are explored.

4 Lessons learned

The lessons learned during the different phases of the Project can be classified into three categories: 1) Technology and design; 2) Management: communication, follow up and assessment and 3) e-course process.

4.1 Design, technology and materials

The design of the course website is one of the key elements for the success of an e-learning activity. The website must be designed considering the characteristics of students. The website works as the "classroom", so besides a proper design, it should meet the following characteristics:

- Simplicity. That is, a website without too much technological artifacts such as flash presentations or plug-ins to load is not appropriate. The main page should load fast. In the beginning of our project, the website started with a

flash presentation as a commencement guide. Students through their suggestions argued that they had to wait for elements to load. Moreover, contents from flash presentations can be best presented in other formats such as ppt or videos inside the course.

- Structure. It should include merely the strictly necessary functions without incorporating elements or tools that are not essential, website organization must be perfect.
- Accessibility. Students access the course for learning not for playing –In the beginning the site included animated gifs or active buttons with java script, which were criticized by students. Internet users' tastes have changed and now users demand for clarity and simplicity.
- Usability. It is important to meet the W3C guidelines on web accessibility, for instance, having alternative text for images and icons, the possibility to change font size, color contrast and the format of information in order to make web browsing easier for people with disabilities [W3C, 08]. Assistive technologies like screen readers, mouse or keyboard emulators must be incorporated.

It is of interest that the system allows the incorporation of new technological developments such as the Web 2.0 and wikis in order to create and share knowledge among the members of the course. In this sense, lessons learned indicate that the creation of a social network or a wiki within the course's website may be interesting, although it must be moderated by lecturers ad accessed by students and lecturers only, since as stated by the students "it is essential to avoid confusion between private and academic life" and, also, it is important to keep control about who access the course.

With regard to the use of webcams, it is no recommended because lecturers cannot guarantee that students have the appropriate equipments, internet speed, etc. Moreover, we have experienced that when students cannot use it satisfactorily, for instance, during office support hours or work discussion, this technology generates a high level of frustration.

Regarding the virtual shared campus or the virtual campus, if only one university is adopting it, the same technological platform for all the community members must be used in order to have a corporative image and guarantee the interoperability of the rest of technologies used within the campus. Moreover, the course should work nonstop 24 hours with security access and information privacy.

With respect to the course materials, they must be more carefully developed than those from a traditional class where lecturers have visual support. Materials must be available in multiple formats in order to guarantee they satisfy all students regardless their physical capacities. Also, when virtual lectures take part, questions can be made to lecturers using the chat or the forum. In sum, course materials must be developed in a way that students can understand them and, at the same time, achieve the learning objectives.

4.2 Management: Communication, follow up and assessment

Course Management is considered the key element for the correct functioning of e-learning. This management process implies a correct multidirectional communication, with various communication tools, an adequate follow up and learning assessment.

Communication

From our experience during the last years and the feedback from the students, we recommend that the communication should start before the commencement of the course, facilitating potential students a guide of the course and a contact email to solve questions before enrollment (this has been valued by students). Once the course starts, we recommend indicating students with clarity how the communication process works and the specific uses of each available communication tool. We suggest the following uses:

- E-mail to ask punctual and private questions.
- Chat to conduct individual or group office support hours in real time and follow up of assignments. This tool should be activated by lecturers only.
- Forum for solving collective doubts through a collaborative way.
- Private social networks and Wikis to share experiences and create knowledge collectively.

Students highly value that answers are received within 48 hours. In this sense, it is important that lecturers check course's communication tools every one or two days, since leaving the course unattended lead to the project failure. A lesson learned, in relation to this, is the need to limit the number of students. We found that the number of students is exponentially associated with the required time for communications, evaluation and course management. In our particular case, the maximum number of students is set at 90.

Follow up

LMS systems, such as the one used in our case (WebCT), enable to obtain statistics by student, indicating when he or she has accessed the course, contents visited, time connected to the platform... The lesson learned in this particular case is that showing publicly data and statistics about students helps them to be aware that there is a serious control and course management so that they take the course seriously.

Assessment

A calendar for each assessment activity must be established. Our experience indicates that it is adequate to assess learning through partial exams for each unit together with various individual work assignments and group solving case studies during the course. In virtual higher education learning, students have different time constrains, which implies that doing a certain activity one specific day at certain time may limit the performance of several students. Thus, we recommend that certain assessment activities such as exams can be taken during a period of time, though with a specific deadline. Flexibility is one of the main advantages of these learning initiatives.

4.3 E-course process

Another important aspect that is necessary to highlight refers to particular context in which the course is taught. Thus, it is necessary to take into account that the course is delivered through a virtual shared campus, which requires the course to be taught simultaneously under the same conditions for the 9 universities that integrate the campus. This forced us to consider several issues related to faculty staff and course

materials in order to make the course more functional. With regard to faculty staff, the participation of various lecturers is enriching, but sometime it may be the source of conflict because they may not share the same criteria. This issue can put at risk the success of a virtual course simultaneously taught in various campuses. To avoid this, we agreed to name one course coordinator out of the 5 lecturers, who was in charge of transmitting the same guidelines to all and monitoring whether the course was functioning properly. Regarding course material, it is usually delivered all at the beginning of the course or on a regular basis, but with no fixed dates. In our particular, we decided to establish a calendar of materials delivery. Thus, students knew that every 15 days a new unit started and that course material were available to download. This way, we align course planning and structure with the required flexibility to adjust contents and activities in response to the performance of students in previous units.

5 Conclusions

This paper presents a project which analyzes the implementation of the first virtual interuniversity campus, called the Shared Virtual Campus (SVC-G9), which integrates nine higher Spanish education institutions. To enhance Web accessibility as the usability of the system by users with disabilities is one of the main project's objectives. In this sense, the W3C guidelines on web accessibility were followed to make web browsing easier for people with disabilities, in particular for users of common assistive technologies like screen readers, mouse or keyboard emulators. More specifically, this work analyses the project's context, previous scenario and development, paying attention to the implementation of the whole learning process virtually. In addition, this paper analyses the teen-year experience of an e-business course for engineers offered simultaneously by the nine universities through the SVC-G9 platform. Findings from this experience revealed different conclusions discussed below.

Technological tools are key elements, although it is essential to consider whether the course is a single activity or takes part within a campus. In the second case, we recommend using a homogeneous platform for the whole campus, which favors interoperability and institutional image. Also, it is important to have a LMS system which helps lecturers with: 1) course design; 2) course management; and 3) multidirectional and multichannel communications. In any case, it is recommended to design the course as being student-centered and adapted for people with disabilities.

Furthermore, to achieve success in these initiatives, students must receive constant support through ICT tools. In this sense, it is necessary to demystify the general thought about the less effort required for lecturers when courses are conducted online. In fact, exactly the opposite can occur, since an online course implies an additional effort with regard to the correct design of the course structure and materials as well as the continued and personalized attention to students. Indeed, it can be recommended to limit the number of students to ensure quality of attention, participation of all the students and a continuous follow up of the course.

Students' opinions and our experience gained after ten years of teaching enabled us to verify that e-learning in the context of higher education facilitates the creation of interdisciplinary flexible and personalized learning environments characterized by the

elimination of distance and time barriers for students and, also, the creation of benefits for universities such as synergy and the sharing of resources.

However, it is necessary to highlight that there are several weaknesses and threats to overcome in this type of projects. For instance, lecturers should be better prepared for managing situations with regard to the problems that people with disabilities may face when working on computers. Moreover, it is important to reward and recognize the effort of lecturers participating voluntarily on educational initiates which encourage e-inclusion. Thus, it is a must to create and maintain stable and sustainable educational environments which guarantee the continuity of these initiatives regardless of whether changes in higher education policies occur.

As a concluding remark, we must indicate that this work shows an experience that must be considered in a context of institutional support with regard to resource availability. The extrapolation or generalization of the results of this experience should be done with caution and considering the context. In this sense, as future research lines, it could be interesting to analyze 100% virtual higher education initiatives and develop several indicators which, based on the opinions of students and lecturers, enable to assess these initiatives.

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