Innovation in teaching based on Web-based educational environment: Tutor, a case study from Higher Education

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New Information and Communication Technologies (ICT) and the Internet have contributed to the modification of teaching methods. Web-based educational environments can incorporate student-centered tools in order to introduce more interaction than the traditional teaching approach and they can help to achieve innovation in teaching and learning activities. One of the major obstacles in using Web-based systems is the unavailability of software specifically appropriate for teachers' needs. This paper presents TUTOR, a web-based educational environment with a user-friendly interface which is designed to help teachers to incorporate a computer-based technology into their teaching practices. This system is currently used for more than five thousand students at the University of Granada in Spain.

Keywords web-based educational environment; virtual learning communities

1. Introduction

The rapid development of *Information and Communication Technologies* (ICT) and the *World Wide Web* (WWW) has impact on today's teaching means as well. Web-based educational environments have become an actual revolution for innovation in teaching and learning activities. This kind of on-line environment should incorporate student-centred tools to provide an active and authentic learning environment. Therefore this kind of software offers new possibilities for attaining knowledge, where time and distance are not issues any more. In this way, web-based educational environments should be equipped with technologies enabling multiple forms of communication in order to enrich dialog and interaction between students and teachers, and between peers, such as *Computer-Mediated Communication* (CMC) and *Computer-Supported Collaborative Argumentation* (CSCA). It is also necessary that this on-line educational environment allows students to download documents and files, freely explore information about courses, teaching staff and interesting related matters, access quality-assured information resources on Internet, consult test marks under authenticated access, etc.

There are web-based environments for education which include some tools such as *Course Management System* (CMS), e-learning and CMC/CSCA. However, one of the major obstacles in using Web-based systems is the lack of free software specifically appropriate for teachers' needs. Without adequate technologies and tools, teachers would have no possibilities to translate educational principles into educational practices.

In this paper we present the main functionalities and the most important services offered by a web-based educational environment, called Tutor (http://tutor.ugr.es), used for collaborative work and we also illustrate some kind of activities and tasks. Collaboration and cooperation is not only student-focused but also teacher-focused. Tutor is a flexible and intuitive software environment, designed to streamline the innovation processes of managing and tracking information relating to different courses, as required by the European Space of Higher Education [6]. Furthermore, the platform provides two types of CMC/CSCA channels (synchronous and asynchronous).Nowadays, courses taught by members of

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different departments at the University of Granada belonging to several academic programs benefit from the mentioned system and it is used for more than five thousand students. In order to characterize the participants in this research and find out user acceptance a survey was conducted. Results show that the proposed web-based educational environment achieves high satisfaction levels. Ease of use and preference comparing with the traditional educational method are identified as two main advantages of it.

The rest of the paper is organized as follows. Section 2 provides a background about web-based educational environments and their implications for the current innovation in teaching and learning activities. Section 3 presents the main characteristics and the most important services offered by the system we have developed. In order to know how the project has been accepted by users, Section 4 shows the results of a survey about Tutor. Finally, some conclusions and future works are presented.

2. Web-based educational environments: implications for innovation in teaching and learning activities

According to studies of teaching and learning [5] [7] [2] it seems to be a good idea the use of the web technology because, as they argued, learning and teaching via web have significant advantages such as interactivity, flexibility, interoperability and elimination of the spatial and temporal barriers. For instance, web technology allows teachers to reorganize and adapt the material given to their students at any time. The contents of their subjects, which are on-line supplied by the system, are therefore more up-to-date than in any printed textbook or didactic material.

The use of this technology in both teaching and learning strategies is vital in the new educational context because:

1. It improves the opportunity to find knowledge for oneself according to the constructivist approach. The constructivist view of learning maintains that individuals create knowledge via active involvement with content rather than through imitation or repetition [4]. The role of teacher is to assist the learners in constructing their own knowledge. Moreover, a learner-centered model produce greater internalization and application of knowledge compared to the traditional teacher-centred or to the transmission-oriented approach.
2. It contrasts differences in understanding of that knowledge by different individuals by mean of new on-line communication channels which increase learner-to-learner interaction and facilitate critical thinking in online group discussions. On-line communication channels provide students the opportunity to practice argumentation through writing and discussion simultaneously using text-based communication tools [1]. The electronic asynchronous communications offer new forms of discourse and increase their opportunity for reflection. Discussion and collaborative argumentation in educational environment is one of the most common strategies promoting *active learning*.

However, for a web-based educational system to be really useful, analysis and hence development must be oriented by the teacher staff and students [3]. Because teaching the same course it can strongly differ depending on the teacher, this kind of software must be flexible and adaptable to different learning theories, which at the end are on the basis of different teaching/learning activities. With the aim of accomplishing this objective, we have developed the platform called Tutor.

3. What is Tutor and why is it important?

In this section, we point out the main characteristics and the main important services offered by Tutor. This platform is the result of a Teaching Innovation Project we are developing at the University of Granada (Spain). Tutor has a set of utilities related with management of repositories to store and share information, course registration and course material management, management of registered students, communication between faculties and students, free-access and restricted-access bulletin boards and a group awareness mechanism.

Making use of these utilities, Tutor is intended to achieve the following main objectives:

- To access interesting and complementary information related with the contents of the different subjects it manages.
- To guarantee the confidentiality and security of our information system.
- To establish new communication between faculties and interaction channels between students themselves and between students and their respective lecturers.

With the aim of accomplishing the previous objectives, Tutor offers a series of quality services, which are offered through dynamic rather than static web pages, which are automatically generated from the contents of the relational database that constitutes the core element of our information system. For this purpose, Tutor has been implemented using the language PHP, with embedded queries to our MySQL database. The database management system allows all the information to be maintained in a centralized way. Moreover, redundancy is controlled, inconsistencies avoided, and confidentiality, security, and data integrity requirements can be automatically checked. In the current implementation the main services offered by the system are outlined in the following subsections:

3.1 Main free-access information services

This set of services provides interesting and complementary information related with the contents of the corresponding subjects through some information sections such as:

- *Introduction*. This section outlines motivations for the system creation and the main objectives pursued and it indicates rules for the different users to operate with the system.
- *Members.* Data about each participant in the development team and each lecturer who uses it.
- *Courses.* For all the university courses included in our system, we want their students to be able to access the most exhaustive and precise information about them, especially the particular characteristics concerning the teaching, the learning and the evaluation system of each course.
- *Links.* This section provides a series of hyperlinks which lead to other web sites containing either complementary information to the courses included in the system or interesting information for students.
- *Bulletin board.* Used to publish news about the courses or with general information for all the students, as well as to publish updates and improvements made in the system.

3.2 Main restricted-access services

Depending on the kind of user accessing this restricted section a menu of different options is shown, which reflects the different functionalities and services offered for each user profile. Services included in each restricted section are offered through protocol *https*.

Main services restricted for lecturers are:

- *Courses:* it allows tasks relating to course registration and course material management. Lecturers for example can create and update their groups, introduce all the information related to each group, they can also control the attendance of students to practical (laboratory) classes and register what each student has carried out in each session. It is possible to introduce exam marks, to upload materials so that students can download them and to propose tasks/works so that their students carry out them.
- *Registered student management* which allows management of data about students enrolled in a group.
- *Management of personal data,* used to introduce and update him/her personal data.
- *Administration of notices and links,* used to add, modify or eliminate news or links.
- *Electronic communication channels*: the services offered are described in section 3.3.

Some of the most important services restricted for students are:

- *Laboratory group registering*. Students can choose the practical timetable of their laboratory group that best suits them online. Thanks to this service a rigorous chronological criterion will be used to accept the maximum number of students allowed in the computer laboratory.

- *Marks query*. Each student can only access his/her individual marks, so confidentiality of this type of information is guaranteed. Additional statistical information is offered too.
- Electronic student cards
- *Download zone*, which enables students to obtain didactic materials left by the corresponding lecturers.
- *Upload tasks*, which allows students to hand over electronically the resulting files of some work that they have carried out at the request of one of their lecturers.

3.3 Communication Services

Tutor has CMC and CSCA channels (such as instant messaging, discussion forums, chat rooms, IP telephone…), which allow interaction, cooperation and collaboration between users. Main services are:

- *Virtual tutorials*. Students can also electronically contact each lecturer synchronously, at the time established, and use the channel (chat, instant messaging or IP telephone) indicated by the lecturer for virtual tutorials.
- *Complementary virtual classes or scheduled tutorials* which can even be organised on different topics according to a pre-established schedule, so that the students will know when they should access the system depending on their interest.
- *Internal messaging*. Asynchronous communication channel between registered users of the system that allows to send messages without knowing any mail address and send some information directly to part of (or to all) users.
- *Discussion Forums*. Working groups can be created on specific topics of interest related with a subject, a course, practical classes, etc. In this way, students will always find a lecturer or fellow student willing to help them answer their questions and solve their doubts.
- *Suggestions.* Users can electronically submit suggestions, complaints and comments about the system and the subjects included in it

4. Users' opinions in the Faculty of Economics in Granada (Spain)

After a semester using Tutor, an anonymous and voluntary survey was conducted to gauge the opinion of the platform's users in the Faculty of Economics at the University of Granada, Spain. Two hundred and fifty-one valid questionnaires were collected. The statistical package SPSS, was used to obtain the distribution of frequencies of every response and to compare the averages (t-test) in gender and academic program. Statistical significance was established at 0.05. The average age of the students was 21.5 (Min 18-Max 38; Standard Deviation = 2,69 ; Median = 21). They were studying Management (58.6 %) or Business (41.4 %) and more than half (57.8 %) were women. In figure 1, the percentage of users who possess new technology equipment is significant. Considering that 53 % have daily internet access, we can conclude that they are moderate ICT users.

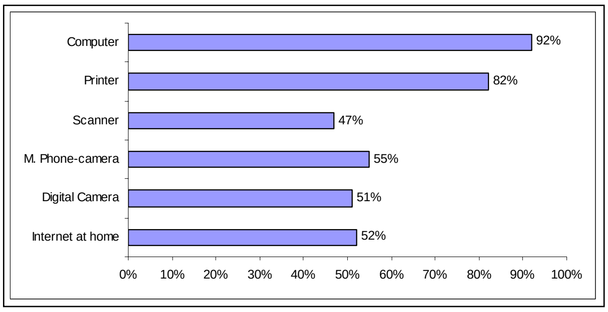

Fig. 1 Owners of equipments of new technology (%)

There is approximately 32 % students of Management more than of Business having Internet at home.

This is a significant difference (p-value = 0.025). With regards to gender, no statistically-valid differences could be determined except for the percentage of users who own digital cameras (p-value = 0.04).

As for the use of the Tutor's tools, we can state that a proportionate 64% used it on average. Out of all the tools, a whopping 99% used the *Student Card* while 97% used *Practice Registration*. Furthermore, *Teacher information* was utilized by 77% of users while *Syllabus or Bibliography* and *Download zone* have percentages of utilization between 60 % and 70 %, respectively. Finally, 51 % of users consulted the *Marks* in the platform. Though *Notice Board* (43%), *Links* (31%) and *Communication channels* (18%) were services used less by students, they were still considered useful by more than 90 % of the users. Male students obtained only significantly higher scores than female students in the *Download zone* (p-value = 0.025). For the rest of tools, no differences could be found.

We used the survey to determine if users found it more comfortable realizing and accomplishing diverse academic tasks with or without Tutor. For the set of activities, 71 % declared it more comfortable to use than the platform. Students usually accomplished simple tasks such as: choosing the schedule of practices, knowing the results of examinations, fulfilling the student card, obtaining didactic materials, knowing information about teachers or subjects, or even having a tutorial. Only this last activity was considered less comfortable with Tutor than in the traditional form.

Significant differences were found in gender and in academic program for a couple of activities. For instance men consider it more comfortable than women to be able to know information about teachers (p-value = 0.002), or the subjects (p-value = 0.001). Management students found it more comfortable than their companions of Business to be able to obtain materials (p-value = 0.001) and to fulfill the student card (p-value = 0.001). Besides these, no other differences were found.

In conclusion, based on the observed results, the platform shows itself as a useful and comfortable tool for students that could ultimately help in the teaching-learning process.

5. Conclusions and future works

We have presented a web-based educational environment which can be used to innovation learning and teaching strategies. The most important objectives and the services offered are outlined. The use of a several web services allows establishing new communication channels which improve the user's interaction. The system can be extended with new services. For instance, we intend to provide a collaborative system where the teacher proposes a challenge and the students must collaborate online in order to solve it.

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References

[1] A. L. Barile and F.T. Durso "Computer-mediated communication in collaborative writing. Computer in Behaviour (2002) **18**(2) pp.173-190.

[2] B. Ligorio, and M. Veermans Perspectives and patterns in developing and implementing web-based technology. Computers & Education (2005) **45**(3), pp.271-275.

[3] G. Zafeiriou, J.M.B. Nunes, N. For "Using Student's Perceptions of Participation in Collaborative Learning Activities in the Design of Online Learning Environments". Education for Information (2001) **19** pp.83-106.

[4] L. R Kroll and V.K. LaBosky, "Practicing what we preach: Constructivism in a teacher education program. Action in Teacher Education (1996) **18**, pp. 63–72.

[5] L. Lipponen, and J. Lallimo "Form collaborative technology to collaborative use of technology. Designing learning oriented infrastructures. Educational Media International (2004) **41**(2), pp.111-116.

[6] UNESCO "Information and communication technology in education". Division of Higher Education. (2002) France

[7] W. Rubens, B. Emans, T. Leinonen, A. G. Skarmeta, R.J. Simons "Design of web-based collaborative learning environments. Translating the pedagogical learning principles to human computer interface" Computers & Education, (2005) **45**(3), pp. 276-294.