USING MOODLE FOR AN AUTOMATIC INDIVIDUAL EVALUATION OF STUDENT'S LEARNING

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Abstract: This paper presents several strategies and actions which improve the education process by using a platform of learning such as Moodle. In particular, a set of resources and an evaluation system have been created using this blended leaning platform with three basic objectives: to stimulate the autonomous learning by providing interactivity between students to make flexible the way how the students study, and to facilitate the implantation and beginning of subjects in the new European Space of Higher Education system by using tools which offer collaborative surroundings. This work has been developed for the subject of Computer Networks taught in the Computer Science Engineering degree at the University of Alicante, in Spain.

1 INTRODUCTION

In the next years, Spain and the rest of member states of the European Union (UE) must adapt their educational structure and curricula to achieve a same objective without losing the specific features of every educational system. This process of convergence is called European Space of Higher Education (ESHE). The pedagogical methodology for the process of convergence to the ESHE considers the student's learning the principal aim. This assumption means that the students have to develop a more active function in the education process, and consequently the student must be the main person in the learning process. This pedagogical methodology has to be near to the constructivist educational model where the learning process is based on resolution of questions, problems, projects and real situations. The constructivist educational model is different from the traditional education model because it considers new aspects such as horizontal relations between professor and student (between equals), the interaction among the students' groups and the exchange of opinions during the solution of tasks. The courses and subjects based on ESHE have been structured with the European Credit Transfer System (ECTS) to recognize the studies degrees in the same way in all UE. ECTS considers the hours the student studies on his own in addition to class time in college.

The work presented in this paper is based on the pedagogical methodology used to adapt the subject of Computer Networks taught in the Computer Science Engineering degree at University of Alicante, in Spain, to the process of convergence to ESHE using ECTS. In previous works, virtual laboratories, such as KivaNS (Candelas, 2008) have been implemented and used in that subject. As support in this adaptation towards ECTS, a b-learning ('blended learning') methodology has been employed with the help of a Learning Content Management System (LCMS) such as Moodle. A LCMS represents the fusion of a Content Management System (CMS), which is used to generate, broadcast and administrate informational resources, with a Learning Management System (LMS), which is mainly focused on the administration of courses and learning contents (Romero, 2008-Koohang, 2009-Martin-Blas, 2009).

The b-learning methodology can be defined as a model for learning that combines face to face education with the web technology applied to e-learning ('electronic learning') (Falconer, 2007) for distance education. In contrast, the concept of e-learning is used to define a learning model where the students rarely or never meet face to face, that is, the students are only supported by online courses based on web technology. Furthermore, the LMS are considered management platforms which permit to integrate or create a virtual learning environment (VLE). Some popular VLEs to be emphasized are

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BlackBoard, WebCT or CyberExtension. Moreover, the LMS organize the classroom activities, sources, questionnaires, etc. At this moment, there are not only commercial LMS such as Cogno or Pegasus but also free and open source systems such as Dokeos, Caroline, ILIAS or Moodle (Romero, 2008-Chapman, 2009).

In the work described in this paper, Moodle has been used as LCMS for the learning of Computer Networks taught in the Computer Science Engineering degree at the University of Alicante in the academic year 2008. This subject is structured in 75 hours of which only 45 have been taught and evaluated using the help of Moodle. Furthermore, 115 students have participated, attended the course and have been evaluated by means of Moodle. Although, only 64 students have freely and voluntarily participated in the opinion survey presented in this paper. This paper has been structured as follows. Section 2 describes the learning methodology using digital documents, resources like questionnaires, and web based guides which have been published in Moodle as SCORM (Sharable Content Object Reference Model) packages (Scorm, 2009). In Section 3, the results of the surveys of students' opinion are shown. These interviews have been developed to evaluate the satisfaction degree of the students with regard to the evaluation modality, the educational resources, provided material and documents as well as the attitude of the professor with the new form of interaction with the students.

2 EDUCATIONAL METHODOLOGIES FOR AN AUTONOMOUS LEARNING

2.1 Using Moodle as LCMS

Among the different available CMS/LMS options, Moodle was chosen to develop the educational strategy presented here because it offers many features in comparison with other systems. The most important characteristics for this work are described below.

First, Moodle (Moodle, 2009) is a very popular free and open-source software (under the GNU Public License), and this fact enables Moodle to be regularly updated with new features and bug corrections. Moreover, any person with programming skills can develop modules with new features for Moodle. For example, a research group has developed a new module for including remote laboratories as activities in Moodle courses (Uran, 2007).

Secondly, Moodle provides teachers with many activities and resources for the courses (Martin-Blas, 2009), and it is even possible to include modules from third parties with new activities and resources which are not included in the official version. More specifically, the following activities and resources have had an especial use in this work: quizzes, forums, and SCORM as activities, as well as web pages, files, and directories as resources.

At this point, the SCORM activity must be pointed out. This module enables Moodle to include learning objects that meet the SCORM standard, which makes possible to transform documentation developed with other software tools, like different office software, into Moodle hypertext web pages which also can include questionnaires in addition to the static information. This process is better described in Section 2.2

Third, the University of Alicante facilitates the use of Moodle by supplying community servers, although it has its own official LMS called "Virtual Campus", which offers powerful tools for administrative tasks, documentation managing, evaluation questionnaires and electronic communications among the university community.

Finally, it should be mentioned that the questionnaires of Moodle offer many kinds of questions and possibilities which facilitates the creation of self-assessment, polls and qualification questionnaires for the topics covered in our courses, as explained in Section 2.3. Moreover, more kinds of questions can be added to Moodle by installing optional or third party modules.

2.2 SCORM Web based Guides and Other Resources

Two principal types of digital documents have been used as educative resources to teach topics about the subject Computer Networks: a guide in PDF (Portable Document Format, from Adobe) and SCORM packages. A SCORM is a collection of standards and specifications for web-based e-learning. SCORM defines how to package into a transferable ZIP file a set of web documents linked according to a format of a course where it is possible to learn by following an educative training material.

Specific software called 'Wimba Create', from Wimba (Wimba, 2009), has been used to create SCORM package. This commercial software, which is only distributed with campus-wide licenses, is a

plug-in for Microsoft Word which permits user to convert Word documents into web documents with interactive HTML contents. Furthermore, this plug-in can export the HTML content such as a SCORM package saved like ZIP file to be used in LMS platforms. Once the SCORM package has been created, it is easily exportable to Moodle.

The exported SCORM package has a runtime API and a data model used for communication between content objects and Moodle. In addition, the SCORM package provides a sequence to navigate during the learning activities. This kind of package can include documents such as HMTL, graphs, Javascript code, Adobe Flash presentations and other sources which can be played in a modern web browser. Therefore, SCORM is very useful to import and reuse educational material and learning contents with LMS platforms.

In Figure 1, the main view of a Moodle course is shown on the left side. On the right side of Figure 1, the reader can see the HTML content of a SCORM package generated from an original guide in a PDF file.

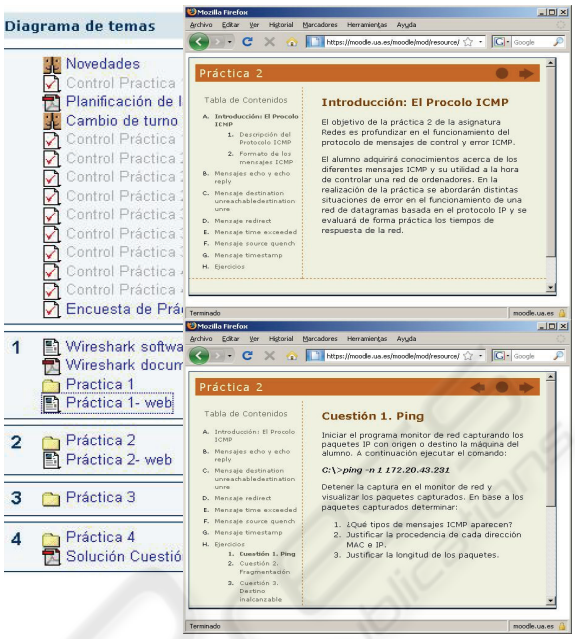

Figure 1: Main course view with documents and resources such as links to SCORM guides (see the right side), forums, polls and assessments. (The images are in Spanish because the subject is taught in Spanish).

2.3 Self-assessment and Qualification Questionnaires

As previously said in Section 2.2, it has been commented that the target subject for this work is structured in 75 hours of which only 45 have been taught and evaluated with the help of Moodle. The qualification of these student work-study hours has been accomplished by designing questionnaires for the Quiz activity of Moodle. In Figure 1, several links called "Control Practica *N*" lead to the questionnaires which are used to evaluate the student work for four practical experiments in the Computers Network laboratory. Each experiment approaches and comments several concepts related with the same thematic and topics. There are also different models of questionnaires for each experiment. In this way, a qualification questionnaire is used for each 9 student work-study hours, including 1 hour that the student dedicates to solve it. Considering the four experiments, there are 36 hours of work-study in total. During this time, the teacher only participates solving doubts and problems in two ways: an electronic support through forums and in person in the laboratory. In addition, 5 hours of lecture are used to teach the handling of specific software tools and commands which are used in the Computer Networks subject.

According to the topic, an average of 10 questions and/or exercises have been designed and implemented in each one of 10 available categories, distributed in 4 experiments. In each category, there are questions related to a same concept which has been previously seen in the experiments. Thus, there are about 100 questions in total available for designing questionnaires. Furthermore, each questionnaire of 10 questions is designed among 25 possible questions. The remaining questions can be used to design self-assessment questionnaires so that students can know their level of learning before the final qualification.

Moodle, by means of the Quiz module, offers a random selection of one o several questions from each category for each final qualification questionnaire. This procedure guarantees questions of all categories in a qualification questionnaire. Therefore, the final questionnaires not only are different for each student but they also keep a same level of difficulty. Although, Moodle defines ten different types of standard questions, only three types have been considered in this work (Figure 2): short answer, multiple choice and embedded answers (also called cloze test). A short answer represents a question which has several possible correct answers in form of different numbers, words or phrases. The multiple choice is a question where the teacher can define multiple answers and the student has to choose one or more answer by means of check boxes. An embedded question consists of a

paragraph which has various answers embedded within it, including multiple choice answers, short answers or numerical answers.

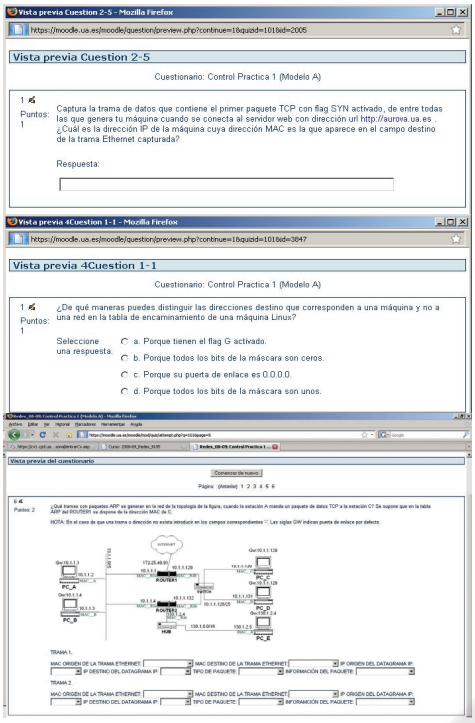

Figure 2: Some questions implemented with Moodle Quiz for final qualification questionnaires.

3 STUDENTS' OPINION

A survey has been arranged to determine the degree of satisfaction of the students in relation to the teaching methodology and the learning process. This survey was made the last day of class using Moodle. Thereby, the students could express their global opinion on the education process once finalized. Among 115 students (41 new students and 74 students which have attended this subject before with another methodology but with the same teachers and same contents), only 64 (55.7%) decided to make the voluntary survey. The survey consisted of four different types of questions as follows. a) Questions about the teacher as facilitator of the learning process. b) The educational resources and documents provided to understand the concepts and the work-study of those. c) The student opinion about the degree of knowledge and skills acquired, in comparison with those that they knew before attending the subject; d) the evaluation methodology based on qualification questionnaires implemented with Moodle. However, due to restrictions on length, only the results related to the educational resources and the evaluation modality are commented in this paper (Table 1 shows these questions).

Table 1: Questions which have been answered about Education Resources and Documentation (R) and Learning Evaluation Process (L).

Nº	Question	T.
1	The resources provided by the teacher in Moodle to pass the subject are:	R
2	The most suitable format to develop the study, is:	R
3	The satisfaction degree in handling resources using Moodle from home is:	R
4	The satisfaction degree in handling resources using Moodle from the University's laboratory is:	R
5	What LMS with document repository do you prefer for an interactive education?	R
6	What is the student's opinion about forums, different documents, questionnaires and other resources provided by the teacher in Moodle for the Computer Network subject?	R
7	The evaluation methodology using questionnaires via Moodle has been:	L
8	The understanding and clarity of exposition of evaluation questions have been:	L
9	The understanding and clarity of exposition of schemes and figures shown in the evaluation questions have been:	L
10	The opinion about evaluation with test questions is:	L
11	The opinion about evaluation with short answers is	L
12	The opinion about evaluation with multiple choice with embedded answers is:	L

3.1 Educational Resources and Moodle

A part of the survey looked for the rating of the degree of utility of the educational resources provided in order to understand and learn concepts and topics, to acquire skills and pass the evaluation of the Computer Network subject. Analyzing the students' answers (Figure 3, see question 1), it can be affirmed that the 73% of students consider that the teacher supplied very good notes and documents for self-learning. Nevertheless, a considerable group of students also considered that the same resources are insufficient or just right to pass the final questionnaires. This fact demonstrates that the supplied notes and documents are valid for the majority of students but they must also be improved with more clarifying and comprehensible examples for the students with assimilation problems of concepts. Furthermore, in question 2 (Figure 3) students show a great diversity of opinion with respect to the useful format for notes and documents. For this reason, it would be recommendable to facilitate notes and documents in different formats

so that each student can choose the format more suitable for him. On the one hand, the 65% of students consider LMS-Moodle the more suitable education platform (Figure 3, see question 5) but on the other hand, the 25% of students think that LMS-Moodle can be improved and contribute little more than the virtual campus (Figure 3, see questions 3-4). The virtual campus is an institutional repository of documents that includes such as simple forums, announcements and permits to solve doubts about the subject remotely.

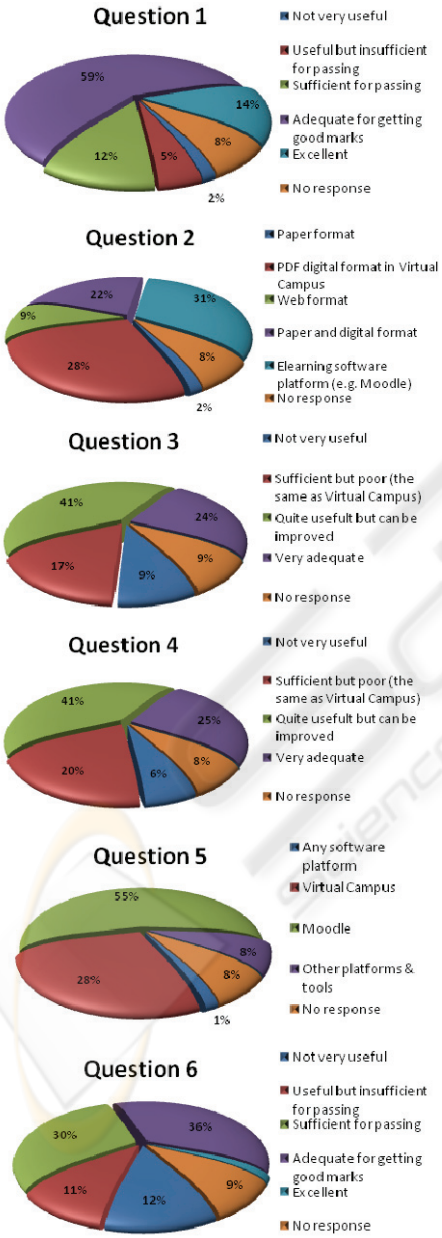

Figure 3: Student answers for the questions of Table 1 about education resources and documentation (R).

3.2 Learning Evaluation Process

In this part of the survey, the questions tried to evaluate: the degree of acceptance of LMS-Moodle for creating the qualification questionnaires and the chosen method of qualification based on questionnaires designed with the quiz module of Moodle (Figure 4, see question 7). In general, the great majority of students, 85%, consider good the

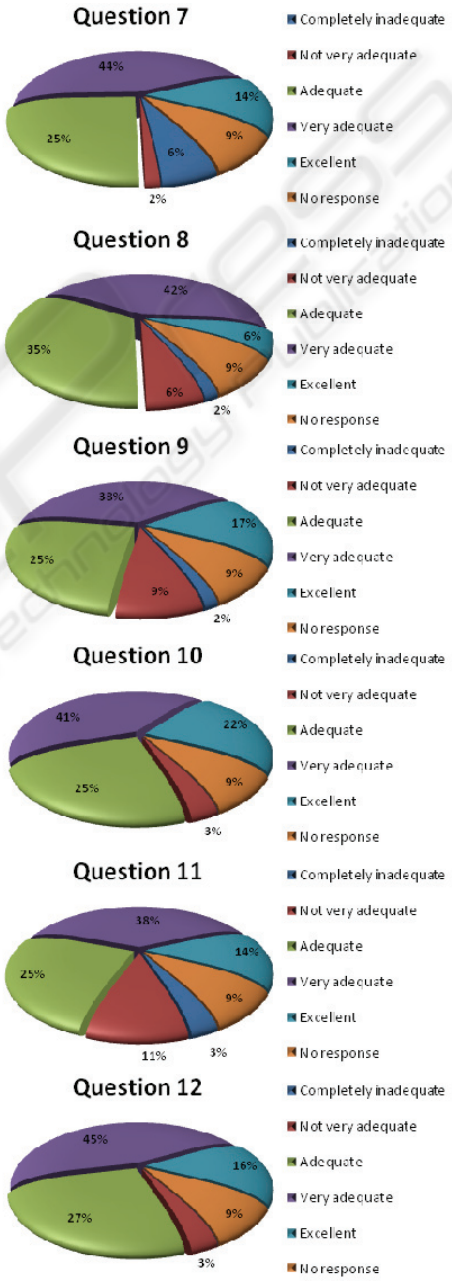

Figure 4: Student answers for the questions of Table 1 about the learning process (L) in the work-study to pass the Computer Network subject.

design of qualification questionnaires created. Among the 85% of students, there are 44% of students that consider it as a very good solution and 19% as an excellent solution. But once the student's opinions to make questionnaires with Moodle are favourable, it is needed to know the student's opinion about the way in which the teacher designed the questions. Thereby, they are adapted and useful to evaluate the student's knowledge of Computer Network subject. Near 80% of students judge positively this aspect while a group of students, below 10%, the contrary (Figure 4, see question 8-9). Therefore, we have to do a small effort to improve the clarity of questions, with more figures and schemes and better language. Finally, the last questions try to determine what type of qualification questions have been more acceptable. In general, the three types of questions selected by the teacher have been considered as (Fig 4, see question 12) good. Only the 3% of students think that the test and the embedded questions with multiple choice are little adapted.

4 CONCLUSIONS

A b-learning methodology has been introduced as a novel teaching method for the Computer Network subject during the last course. To perform this methodological change, in comparison with classical teaching and learning, a learning support based on educational resources as digital documents, web packages, interaction tools, etc. has been used to provide flexibility and autonomy to the learning process. This support is based on the LCMS platform Moodle, which is accessible from the institutional LMS of the University of Alicante. Moreover, a survey has been carried out to determine the degree of satisfaction and the opinion of students about the innovations introduced in the subject, changes that have mainly influenced in the evaluation and qualification mechanisms (quiz module of Moodle) of concepts, topics and skills for Computer Network subject. In future works, new resources based on simulations and training questionnaires will be designed and implemented so that the students can test and practice concepts and thus, they can measure the acquired skills, before facing the qualification questionnaires necessary to pass the subject.

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