AN ELEARNING EXPERIENCE USING THE SAKAI ENVIRONMENT

A Case-Study for Online Courses in Operating Systems

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Abstract: In the context of the Bologna process, e-learning experiences are being promoted in many European universities. Recently, the Universidad Politécnica of Valencia (UPV) has implemented the Poliformat platform that is based on the Sakai environment. Last year, a pilot experience was developed to test this environment for undergraduate courses in a Computer Engineering degree. The current work describes an e-learning application of the Poliformat platform in an Operating Systems online course. The experience has been evaluated using survey techniques that analyse online learning issues and also technical aspects related to the Poliformat platform. Globally, the experience was rather positive although some problems were detected in the evaluation process that revealed that e-learning methods and tools have to be improved.

1 INTRODUCTION

E-learning platforms are "shaping" the future of higher education in the context of the Bologna process. Many European universities have promoted in the last years several actions to introduce these platforms in their academic activities through virtual campuses and online courses. Recently, the Universidad Politécnica of Valencia (UPV) has implemented the Poliformat platform that is based on the Sakai environment (Mengod, 2006).

During the 2005-2006 academic year, a pilot experience was developed to test the Poliformat platform for undergraduate courses in a Computer Engineering degree. The current work describes such experience and the e-learning application of the Poliformat platform in an Operating Systems online course. The experience shows interesting aspects of online learning and some problems that occur when e-learning courses are delivered through the Poliformat platform.

The rest of the paper is structured as follows. Section 2 describes the Sakai environment used to implement the Poliformat platform. Section 3 illustrates the current e-learning experience under the Poliformat platform and section 4 reports the evaluation of this experience. Finally, Section 5 gives some concluding remarks.

2 SAKAI DESCRIPTION

Sakai is a consortium of universities, colleges and commercial affiliates working in open partnership with standards organizations and other open-source initiatives to develop "community-source enterprise-scale software applications to enhance collaboration, research and teaching within higher education" (White, 2005). The core members include MIT, University of Michigan, Stanford, Indiana University, and uPortal.

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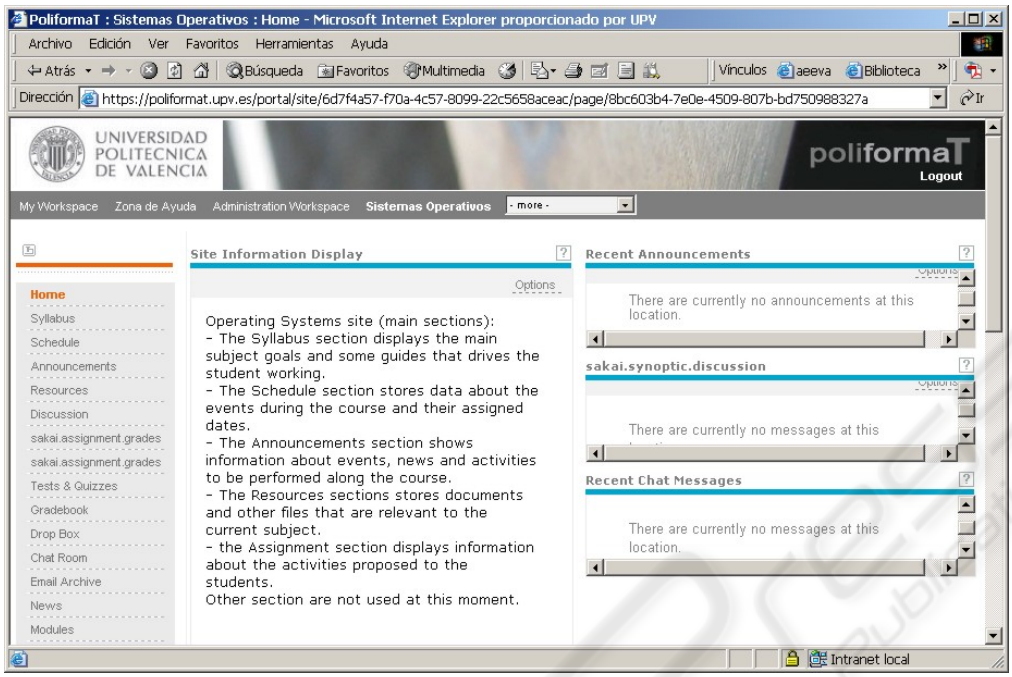

Figure 1: Poliformat main screen.

The Sakai environment is based on an extensible service-oriented architecture for building and deploying enterprise-scale collaboration, teaching and research tools and services. Sakai uses Java-based technologies that enable teaching tools such as a complete course management system, support for collaborative activities and a services-based portal.

The UPV became a Sakai partner in 2005 and adapted its environment to produce the Poliformat platform. Some of the Poliformat contributions are the integration within the corporate systems and applications, the customization of appearance and the internationalization, including the translation to Spanish language.

Figure 1 shows an example of Poliformat screenshot that displays the main window in the Operating Systems course. The Poliformat window is structured into several areas:

- The head area displays the available course sites (e.g. Operating Systems).
- The left area shows the main subject options such as Syllabus or Schedule.
- The central area displays the subject information.
- The right area displays other site sections such as announcements, forums or chat messages.

3 E-LEARNING EXPERIENCE

3.1 Teaching Context

"Operating Systems" is present in most of the computing curricula of both undergraduate and Master's programs. At the Computer Engineering Department of the UPV more than twenty instructors teach Operating Systems courses to about a thousand students. Table 1 shows the organization of the Operating Systems courses.

Table 1: Operating System courses.

Course name	*Type*	*#Students*
Operating Systems I (SO1)	Introductory	567
Operating Systems II (SO2)	Intermediate	650
System Administration (ADS)	Advanced	187
Operating System Study (ESO)	Advanced	84

Each course involves both a theoretical and a practical part. The percentage of the practical part varies depending on the learning goals of each course. Introductory courses such as SO1 require students to acquire a solid theoretical foundation, thus the teaching methodology favors the theoretical part. Intermediate and advances courses (i.e., SO2,

ADS, or ESO), try to balance this percentage by covering new conceptual topics and performing some practical activities. This methodology allows students to learn how operating systems are designed and how to use their services.

Unfortunately, this teaching methodology becomes inefficient in mass courses because when the student/teacher ratio increases, the traditional relationship between the students and the instructor becomes affected so that it is more difficult to provide right feedback and to monitor students' progress.

In order to alleviate the problem of mass courses and to study the requirements and benefits of distance learning, the Computer School at the UPV started in 2002 an innovative experience providing students with distance learning for some Operating Systems courses, including SO1 and SO2.

Web repositories and e-mail tools were used to provide remote assistance and automatic assessment. These courses were aimed at students who were not able to attend traditional courses for any reason whatsoever. During the 2005-2006 academic year, the Poliformat platform was used to support a SO2 course that was taught to 48 students (about 650 in classroom-based courses). The students joined voluntary the course and they knew the general conditions (e.g. the assessment system was the same for all students either in classroom-based or in online courses)

3.2 Online Learning Method

The current e-learning experience is based on an online learning method to organize the course items and control its delivery (Anderson and Elloumi, 2003). This method must be independent from the e-learning platform that supports the specific course. In this case, the proposed method combines several techniques from self-paced autonomous learning for theoretical issues to programmed instruction used in practical activities. Figure 2 shows a flow chart that displays the main steps in the course organization.

In the current approach, a preliminary evaluation step is required to test the students' goals and to check if they are able to meet the course conditions. If the stated conditions are accepted then the student is enabled to join the online course (a kind of "learning contract") but if students do not "sign" the contract they are recommended to join the alternative class-room based course.

The next step consists of scheduling the course items using agenda services and assigning a calendar of recommended tasks and activities by weeks. From this step, online learning issues are planned according to two different "parallel paths":

- The acquisition of theoretical knowledge (concepts, facts…) is based on a self-paced learning in which the student decides what concepts are interested in and the way and time to get them. A collection of resources and material about the target subject are available in the *Resource repository*.
- The practical skills are obtained by performing activities that involve the working with real systems or simulations (Buendia and Cano, 2006) in the case of technical subjects (e.g. Operating Systems). These activities also require some theoretical fundamentals but they have to be acquired under the student responsibility. Nevertheless, the achievement of practical activities is based on a paradigm of programmed instruction. Students receive assignment information about the proposed activities and they have to deliver results in a tightly scheduled way.

After theoretical concepts have been acquired and practical activities performed, a formative assessment is performed in order to evaluate the student's knowledge and skills. This evaluation is only informative and it has not a grading purpose.

Once learning activities have been finished, the next step is a post-course evaluation that queries students their point of view about the course delivery. Finally, all students either in online or classroom-based courses perform the final examination for getting their grades.

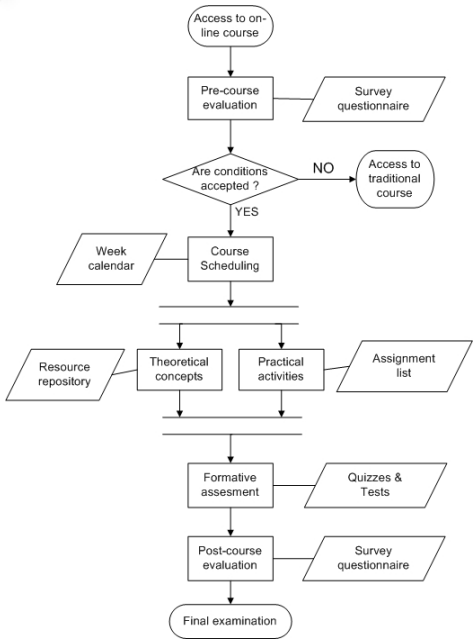

Figure 2: OS Course flow chart.

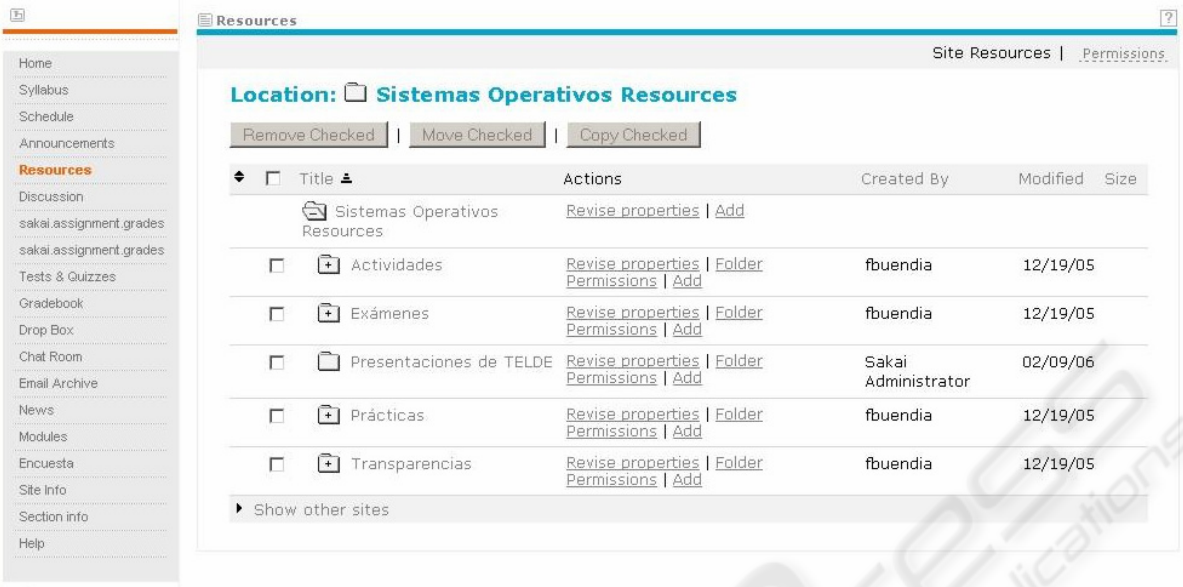

Figure 3: Example of Poliformat repository.

3.3 Implementation Details

The previous online learning method has been applied to the course of Operating Systems using the Poliformat platform. After the student accesses the platform, he or she views the course site as displays. The course site provides information about the course items although a specific learning path is not forced to the student.

From this point, the student can select the different items that compose the course. The Poliformat platform provides a *Schedule* service that allows instructors or site organizers to post items in a calendar format. The calendar has day, week, month, year, and flat list views.

The information about events, notifications or programmed activities is organized by means of the *Announcement* service that is used to inform site participants about current items of interest. Other kinds of information related to the course subject are provided by the *Resources* service. Different types of resources include documents (e.g., word processing documents, spreadsheets, slide presentations, plain text), links to websites, and simple text documents. Figure 3 shows a screenshot that displays a repository of resources related to the Operating Systems course.

There are other services mainly addressed to provide communication facilities such as *Discussion*, *Email*, *Chat* or *News*, or to manage learning information such as *Modules*, *Quizzes*, *Assigments* or *Gradebooks*. In the context of the current experience, the next services are of particular interest:

- The *Assignment* service that implements the practical activities provided in the course. This service allows instructors to create, distribute, collect, and grade online assignments. Assignments are private; student submissions are not visible to other users of the site. Figure 4 shows a screenshot that displays some settings about a practical activity in the course example
- The *Tests & Quizzes* section that allows the instructor to create online assessments for delivery via a web interface to the course students. They are used in the formative assessment of the course (see Figure 2).

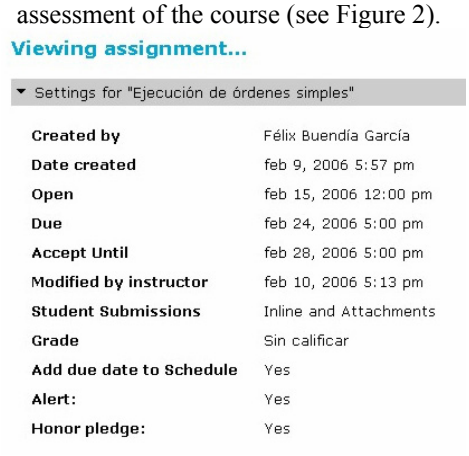

Figure 4: Example of assignment features.

4 EXPERIENCE EVALUATION

This section describes how the current e-learning experience has been evaluated in the context of the Poliformat platform. This evaluation is based on subjective methods such as surveys and checklists. In this experience, two different evaluation processes were performed as Figure 2 shows.

A pre-course evaluation reviewed the students' profiles (e.g. how the student was reported about the online course or if he/she joined the course voluntarily) and asked them if they are able to carry out the proposed course activities. The *Survey* tool was not available in the Poliformat platform at the beginning of the course and a (quiz) questionnaire was proposed to the students. The evaluation questionnaire was based on "true/false" questions and most of the student answers agreed with the course conditions.

A more detailed evaluation was performed at the end of the course and the Survey tool developed at the UPV was used to elaborate the proposed questionnaire. The evaluation questionnaire was based on "Likert-scale" questions (from strongly disagree-0 valued to strongly agree-10 value). Table 2 shows a set or questions related to general issues of the course evaluation (independent from the e-learning platform) that were submitted to the students.

Table 2: Post-course general issues.

Issue	*Question*
Prerequisites	Do you think that the online course would need some prerequisite to join it?
Expectations	Does the course address your expectations?
Scheduling	Has the course scheduling been met?
Goals	Are the course goals adequately stated?
Resources	Are the available resources adequate for the course?
Expected activities	Do you think that programmed activities are the expected one?
Timing	Is the time assigned to activities enough?
Academic level	Is the academic level of activities adequate?
Assessment	Is the assessment system adequate to the course activities?
Methodology	Do you think that the course methodology is adequate?
Assistance	Is the teacher assistance adequate?
Satisfaction	Do you think that the course experience has been satisfactory?

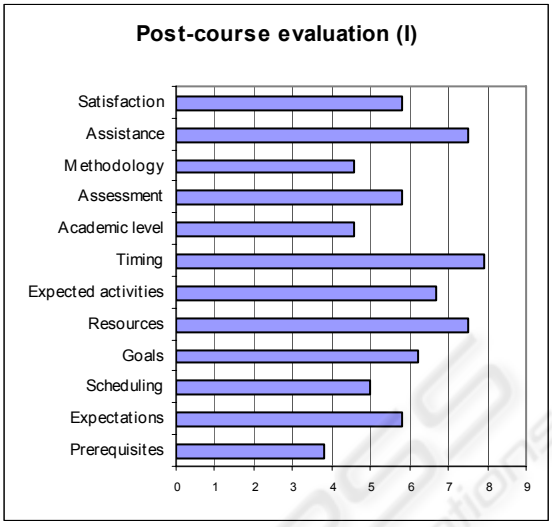

Figure 5: Evaluation of general issues.

The obtained results are displayed on Figure 5 that provides a view of the weak aspects detected by students. The evaluation shows that prerequisites were not mainly considered by students as a crucial aspect and some complaints were stated about the online e-learning methodology and the academic level of practical activities. Globally, the degree of satisfaction with the course was acceptable.

Table 3: Post-course technical issues.

Issue	*Question*
Handiness	Is it easy to interact with the platform?
Interface	Is the user interface of the platform friendly?
Help	Are help options in the platform useful?
Operation	Does the platform operate as expected?
Reliability	Are serious platform errors happened?
Communication effectiveness	Are communication tools effective?
Additional tools	Do you think that the platform would need other tools?
Activity support	Is the platform support enough for practical activities?
Assessment support	Is the platform support enough for assessment?

Table 3 shows some technical aspects about the Poliformat platform that were asked to students. The proposed questionnaire was also based on "Likert-scale" questions that checked the effect of the e-learning platform in the course example.

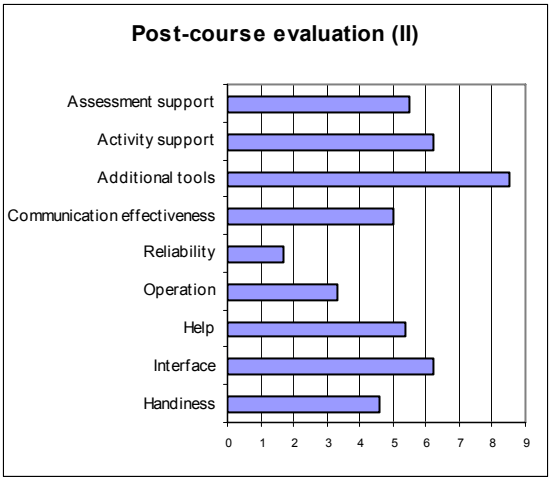

Figure 6: Evaluation of technical issues.

The results about the evaluation of technical aspects are displayed on Figure 6. Students were particularly critical with operation and reliability issues. In the first year of the Poliformat application, there were several system crashes and login failures that were noticed by students. Another complaint was focused on the handiness to interact with the platform. A common student point of view was the demand of additional tools for communication purposes.

5 CONCLUSIONS

The current work has described an e-learning experience under the Poliformat platform that is based on the Sakai environment. The experience has been focused on a technical subject (Operating Systems) that is part of a Computer Engineering degree. An online learning method has been used to drive the e-learning experience and some implementation details about the role of the Poliformat platform in the experience have been reported.

Finally, the experience has been evaluated using a two phase approach (before and after the learning activities) and considering, on the one hand, the general issues about the online learning method and, on the other hand, the technical issues introduced by the Poliformat platform. The obtained results reveal that methodology aspects have to be improved in the course delivery, mainly, the lack of support for teaching theoretical issues, and special attention must be given to system maintenance, avoiding the platform failures and improving the user interaction.

Further works are addressed to take advantage of the evaluation results in the management and delivery of future courses. Another aspect to improve is the systematization of evaluation procedures that will help the generation of survey questionnaires. In this context, the use of learning standards such as IMS Learning Design will contribute to facilitate the evaluation of online courses in e-learning platforms.

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