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A WebQuest Framework to Improve the Study of Deadlock and Process Synchronization

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Abstract: The impact of the Internet on Society also affects learning at University. Students use not only printed books and their own notes, but also the information available on the Net. WebQuests are learning tools that help the students use the Internet, but under the supervision of the lecturer, who has previously selected the most interesting sites to visit. An experience of using WebQuests with first year Computer Science students is shown, as well as the good results obtained both in the improvement of examination results and in the positive attitude of the students when using WebQuests.
Key Words: WebQuests, e-learning, Education Technologies
Category: H.3.5, K.3.1, K.3.2

1 Introduction

WebQuests are defined as learning tools developed through Internet resources previously selected by the teacher [Eduteca 2005]. After that selection, students may use those resources to find and analyze the specific information they contain in order to improve their skills in various areas. One important objective consists of helping the students to manage properly their time, without wasting time browsing the Internet. Therefore, at lower levels, teachers should provide students with the addresses of all the websites needed to find the information, whereas at upper levels only basic sites should be provided so that the students can look for complementary sites [Adell 1997, Moran 1995].

WebQuests were first designed by Bernie Dodge [Dodge 1995] and are composed of six main parts: introduction, homework, process, resources, evaluation and conclusions. The main part is the definition of the work that the students must accomplish, and it must be defined in a way that keeps their interest in the work until the end of the learning process [Yoder 1999, Barack 2005].

Several authors have reported their experiences using WebQuests as approaches to help the integration of the Spanish University System into the European Higher Education Area [Herranz et al. 2004], as a form of interactive learning [Perrone et al. 1996], or as a co-operative venture among teachers [Yamagata-Lynch 2003].

The project reported here aimed to improve Computer Science students' motivation and learning in one topic related to Operating Systems, by leading them towards a proper use of Internet resources as well as stimulating group work under the supervision of a tutor [Reinhart 1999]. In [section 2], the particular methodology used and the WebQuest are described; [section 3] shows the impact on the students and on the learning; in the last part, some conclusions and possibilities for future work are mentioned.

2 Methodology

This project was chosen in order to help students to improve their understanding [Zheng et al. 2005, Gaskill et al. 2006] of *Deadlock and Process Synchronization*, which is a lesson related to *Operating Systems*, a compulsory subject in the second semester of the Computer Science degree. Since this lesson requires students to have high abstraction skills, it is frequently overlooked thus yielding an insufficient training in the area and making it difficult for students to pass the subject. At the beginning of the semester, the students were informed of the possibility of passing those contents by submitting supervised homework following the rules described in the departmental website [Interbloqueo 2005] (see [figure 1]).

WebQuest tries to help the students use the Internet to acquire knowledge by visiting web sites previously selected by the professor. Therefore the instructions include the following information [Dodge 2001, McGregor and Yiping 2004]:

- Introduction. A presentation of the problem of deadlock and the need of process synchronization.
- Aim of the work. In this case, the students should make groups of no more than four people, and develop a web site explaining, with their own words, the concept of deadlocks, how to detect and avoid them.
- An enumeration of the several parts which the work should cover. In this very case, the website should include the following sections:
  1. Definition of deadlocks
  2. Conditions required for deadlocks to happen
  3. Graphic tools available to detect deadlocks
  4. Deadlock avoidance: the Banker's algorithm

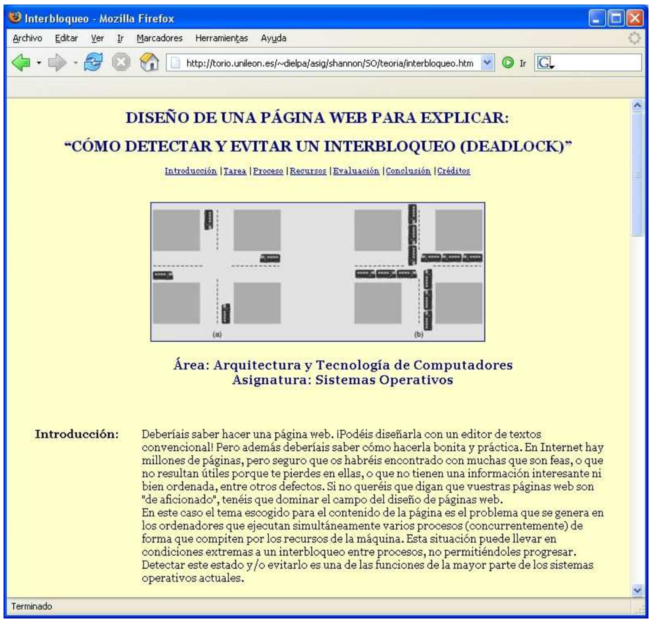

Figure 1: Web site with the instructions to accomplish the WebQuest

5. Deadlock prevention and recovery

6. Solved exercises

– A list of selected Internet resources that the students should visit in order to get proper information to do the work without wasting time.

– Information about the evaluation scheme, which involves not only the quality and clarity of the contents, but also the quality of the whole web site. In this case, writing was considered very important as it is a key ability for every engineer and scientist. In addition, all the groups should do an oral presentation of their work for the rest of the students.

– At the end of the process, the best pieces of work are shown as examples of good practice so that the other students can use them to improve their learning [Interbloqueo 2005] ([figure 2]).

3 Experimental results

After the students had finished their WebQuest, they gave their own opinions by means of an anonymous survey after their final examination. They were asked

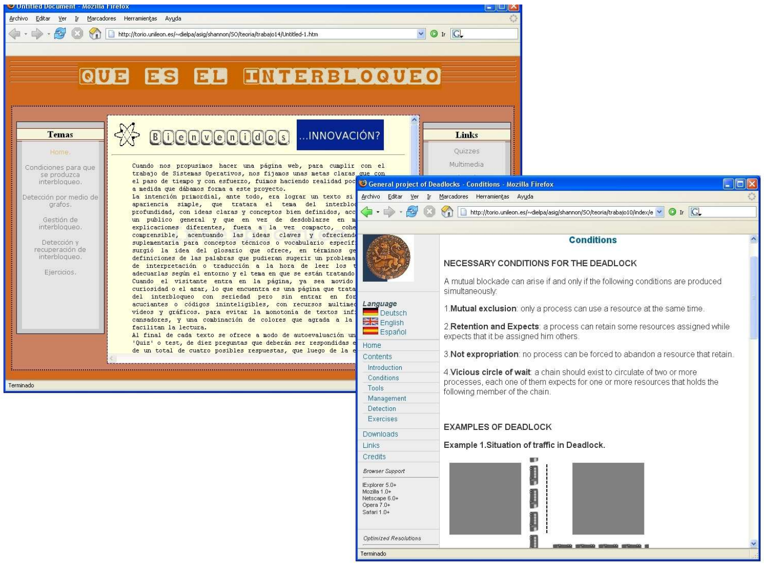

Figure 2: Example of websites developed by the students

to rate from 1 point (disagree) to 5 (agree) to the following assertions, except for the last one, which was to be answered yes or no:

1. The WebQuest helped me learn *Deadlock and Process Synchronization*
2. The definition of the problem was sufficiently clear
3. The project was very difficult to accomplish
4. The evaluation system was fair
5. I would recommend Webquests for other subjects/topics (if so, propose two subjects/topics)

As it can be seen in table 1, most of the students confirmed that the experience had been quite positive, and even asked for a new WebQuest oriented towards helping them with the topic *Memory Organizations and Management*.

As regards the learning oucomes of the WebQuest, it was observed that before using it, only 20% of the students had passed the questions related to *Deadlock and Process Synchronization*, while after completing it, 33% succeeded in the final examination, which means an increase of 65%. These data have also been checked by the institutional evaluation procedure that the University of Leon has carried out for the degree in Computer Science [Evaluación y Calidad ULE 2005].

Table 1: Results of the survey in the use of the WebQuest to learn *Deadlock and Process Synchronization*

	Degree of agreement (% responses)				
Assertion	1	2	3	4	5
1. Webquest was useful	9.6	8.4	15.7	20.5	45.8
2. Problem was stated clearly	12.0	15.7	18.1	32.5	21.7
3. Project was difficult	7.2	21.7	31.3	24.1	15.7
4. The evaluation was fair	14.5	12.0	18.1	36.1	19.3
		yes		no	
5. Recommend Webquests		86.7		13.3	

As a result, an increase of the students competence was observed through their marks in the examinations before and after using WebQuests.

4 Conclusions and future work

We can conclude that a WebQuest has been developed to improve the learning of *Deadlock and Process Synchronization*, a particularly difficult topic inside Operating Systems. When the students carry out the work involved in the WebQuest, they acquire not only knowledge and abilities on Computer Science, but they are also trained in group work strategies and in technical writing and speaking. In addition, students learn how to create simple web sites as a preparation for future subjects. Finally, other students can learn using the websites developed by their own peers, as they all use the same kind of language, and here they emphasize the concepts which they really find difficult. *There appears to be a positive relationship between students' self-efficacy for web-based instruction and motivation to learn from web-based instruction [Reinhart 1999].*

Future work includes using WebQuests to help students learn other topics related to Operating Systems (as suggested by our students, the next one will be devoted to the learning of *Memory Organizations and Management*).

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