Abstract

Web-based learning environments are extensively used nowadays. At the moment of designing, implementing and managing e-learning courses, there have to be defined guidelines that guarantee the quality and excellence of these processes as well as controls of evaluation that assure the above mentioned quality. In this respect, in the LMS (Learning Management Systems) the teacher has not got tools for assessing and measuring the performance of the students in their virtual courses. Therefore, we have developed a Monitoring and Analysis Tool for E-learning Platforms (MATEP) in the University of Cantabria (Spain) which is described in this paper.

1. Introduction

Most universities, colleges and high schools are currently virtualising their teaching process through e-learning platforms, benefiting from their many advantages such as work “any-time, anywhere”, the use of collaborative tools, the support of different styles of learning, etc. Nevertheless, this education model has as main disadvantage the absence of the contact teacher-pupil which is present in the education which takes place in a classroom. So, we can say that these tools do not cover all teaching aspects, since they do not usually provide educators with the necessary information to thoroughly track and assess all the activities performed by all learners, nor to evaluate the structure of the course contents and its effectiveness in the learning process ([8][9]). Consequently, specific tools to help undertake this task must be developed.

Given the fact that most LMS rely on Web servers to provide access to resources and applications, the MATEP tool makes use of the Web server log files [7] in which the activities of the learners are captured. But, unlike other tools (see Section 2), their information is enriched with external information such as academic and demographic data, and with information introduced by professors (page importance, estimated time of study...). This allows professors to extract a more accurate knowledge than can be obtained from the typical log analysis tools.

The paper is organised as follows. In section 2, we briefly present a related work about monitoring and assessment tools for e-learning environments. In section 3, we describe the main characteristics of MATEP showing its differences with respect to other tools. Section 4 offers a brief description of the reports included in MATEP. Finally, in section 5, we present the conclusions and the future work lines.

2. Related work

As far as we know, there are no commercial tools to help professors to get an objective feedback about their virtual courses. However, efforts in this direction are currently being made. CourseVis [5] is a tool that takes student tracking data collected by LMS and generates graphical representations that can be used by instructors to gain an understanding of what is happening in distance learning classes. It directly and exclusively uses web log files without building web sessions. GISMO [3] is another tool similar to CourseVis. It also provides teacher with different reports (the student’s access to the course, all students’ accesses to course resources, etc). Sinergo/ColAT [1] is a tool that offers interpretative views of the activity developed by students in a group learning collaborative environment. Mostow et al. in [6] describe a tool that shows a hierarchical representation of tutor-student interaction taken from log files.

3. Monitoring and Analysis Tool for E-learning Platforms

MATEP is a tool developed according to the general guidelines of design of Business Intelligence applications. It is fed from a data webhouse which, in turn, is fed from different data sources suitably
processed and integrated: data from virtual courses, academic and demographic data from operational systems as well as the e-learning platform log files which register the activity made in this tool.

Currently, MATEP only offers static and dynamic reports, although we are working in the integration of behaviour patterns.

3.1. Main characteristics

Given that MATEP is a tool designed to help instructors to track their learners’ activities online, the instructors told us the questions to answer. These are:

- Regarding the course follow-up: When do students connect to the system? Do they work online? Could the value of a session be measured in relation to learning objectives?
- Regarding the course: How often do they use collaborative tools? What are the sequences of pages visited in each session, in what order, and how long do students stay in each of them? What are the most frequent patterns?
- Regarding students: What are the students’ profiles? Is there any relationship between their behaviour and their qualifications? Who leaves the course and when?

From a technical point of view, MATEP is a Web application built independently from the e-Learning platform that it audits. Besides, it provides updated information with the frequency that the administrator defines. The only one requirement of MATEP is that the logs file needs to follow the W3C specification. The technological platform used to develop the whole system has been BI-SQL Server 2005.

Finally we have to mention that MATEP’s interface and the reports it manages have been designed following the premises “easy-to-use” and “easy-to-interpret”. Instructors only have to click in the link which opens the desired report and select the parameters under which they want to analyse the information that this provides. This means that they can configure the analysis of their course according its characteristics. This interface can be seen in ([10][4]).

3.2. Particularities of our tool

Our tool presents two remarkable differences with respect to other click-stream analysis tools. The first one has to do with the pre-processing of log files; and the second one is about the enrichment of the log file.

3.2.1. Log files pre-processing. As previously mentioned, we use the concept of web session. A web session is assumed as a sequence of requests made to the same site by a single user during a certain time period. This allows us to have the amount of time spent on each web page and the sequence of pages accessed by each individual, besides the date and time in which it happens. The pre-processing task is done according to [2] but, in this case, we adapt it to educational environment. For each virtual course, the professor decides the heuristics with which the student sessions are built according to the organization of his course. These heuristics are: maximum time allowed between two consecutives pages of the same course and how to calculate the spent time in the last page.

3.2.2. Contextual information. Using only the information from log files turns out to be poor to gain sight of what is happening in virtual courses and extract meaningful patterns of the students’ behaviour. Therefore, it is convenient to add contextual information. This information can be categorized in three groups: course structure and content information, student demographic and academic data and learning objectives and results.

4. Reports

The main actors involved in a virtual education process (instructor and student) play roles that are different from those of an attending instructor and student. E-learning makes the pupil the protagonist of the process, and he will need to be capable of building his knowledge establishing his own learning process; whereas the teacher acts like tutor in this process, and will need to know the behaviour of the students both with the pedagogic contents and with the platform of learning.

MATEP tool helps to perform an exhaustive study of this information. It provides educators with a set of reports which answer the questions mentioned in section 3.1.

The set of reports about course follow-up facilitates the information, for a certain period of time, of the behaviour of a pupil or of a group of students with regard to the day of the week, time slot or place of connection to the platform of learning. They also show the number of visits to each page, the average time in minutes that has taken its reading, the number of users who have visited it, etc. MATEP completes this analysis with a report that gives a value to a certain session in relation to the learning objectives that have to be achieved in it.

Using these reports, the teacher can plan tutorship online adapted to the availability of his students and may carry out time adjustments both in the planning and in the distribution of the course tasks, etc.
To carry out the follow-up of the students, the teacher has four reports available in which the time period of the study can be chosen as a parameter. Once one or more students have been chosen, depending on whether an individual or comparative analysis will be performed, it is possible to know the number of sessions carried out per week, the average time for a session, the sequence of visited pages and the duration of the visit for each page.

This information allows the teacher to detect the balance in the duration of the tasks proposed to the students, since it would be enough to select the period that the teacher establishes to perform a work and to see the time used by the students. He might also know the moment in which a pupil leaves the course and analyze if it is a matter of a critical period in case a group of students is in the same situation. This information would allow the teacher to consider alternatives, correcting the initial approaches and defining systems of tutorship to foresee and encourage the individual work of the student.

Once the course is finished, the student behaviour analysis can be complemented with the study of the relationship between the profiles of the students (age, sex, studies, etc.) and the qualification obtained.

From our perspective it is necessary to differentiate the aspects that need to follow a common line (criteria of evaluation, degree of exigency, purpose of the course,...) from those that are proper of the relationship of the instructor with the group (style of communication, procedures of response to doubts raised or to the delivered activities, time to dedicate to each module,...). In this way the teacher would have objective information to establish different itineraries and recommendations according to the different interests and features of the students.

Finally, the last group of reports allows detecting the way in which the different resources of the course (bibliography, video tutorial, etc) have globally been used. His analysis will allow him to take decisions such as whether it is advisable or not to limit the utilization of a resource in a certain period, or the format most demanded to reach a certain goal.

5. Conclusions

This work presents a tool, called MATEP, which helps instructors to track and assess the learning process in LMS. MATEP uses learners tracking data and contextual information to generate relatively simple, predefined-format and parameter-driven reports which also include graphical representations.

According to instructors’ opinion, this tool helps them to gain a more accurate knowledge of what is happening in their courses since it allows them to analyze and visualize data with different level of detail, discovering student behaviour patterns’ and understanding how their courses are used.

As more immediate work, we will tune the tool to work in a real environment, and next, we will select a set of courses designed under different guidelines in order to evaluate, the ability of the tool to gather the course context and the goodness of the reports.

As future work, we will think how to integrate data mining models that allow instructors to build significant student patterns by themselves.

6. References