ANALYSIS AND COMPARISON OF DISTANCE EDUCATION ENVIRONMENTS

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Abstract — *Distance education allows people from far regions of the country to access technology available in the best educational institutions in big cities. LARC, Computer Networks and Architecture Laboratory, is a research institution belonging to the Computer Engineering and Digital System Department of Polytechnic School at University of Sao Paulo, Brazil. We have developed, on the last three years, on-line courses using media like audio, video and animation and we have developed a Web education system, called Col (On-Line Courses). We are planning Col evolution and for this reason we made a study of commercial and non–commercial distance education environments. This paper presents a comparison among the studied system where it is possible to know the best there is in each system.*

Index Terms ¾ course content, on-line courses, distance education system, interactive tool

INTRODUCTION

Distance education allows people from far countries to access technology available in the best educational institutions in big cities. Web has been brought some facilities for students and teachers and in result of this the Web education research has been increasing in the world. An important question is how the course content and the resources must be organized. Is it necessary for schools, universities or companies to adopt a Web education system? This is a very difficult question to answer because each institution has its own features. What is the best system? Does it exist? How can many courses be controlled without a Web education manager system? LARC (Architecture and Networks Computers Laboratory) - USP (University of São Paulo) - Brazil decided to study some commercial and academic Web education systems to know their environments and to try to answer these questions. The analyzed systems were:

- Webct (version 3.1): developed by British Columbia University- Canada.
- Intralearn (version 2.5): developed by Intralearn Corporation – USA.
- AulaNet (version 1.2): developed by PUC – Brazil (Catholic Pontific University – Rio de Janeiro – Brazil) – Private University.
- UniverSite: developed by MHW – USA.
- Col (version 1.0): developed by LARC – USP – Brazil – Public University.

The study goal was to analyze the system features and to verify their similarities and differences. Consequently, it was possible to do a comparison among the studied systems and to know what the best system for a particular environment is.

WEB-BASED DISTANCE EDUCATION SYSTEM ANALYSES ASPECTS

The aspects analyzed in this research include some important features of Web-based distance education system such as interactive tools, management of course content, system organization, management of students and course and knowledge assessment.

System's workplace organization

The main goal in a distance course is the development skills about new subject. For example, if the course is about History, students should strive in topics about it, then an easy logic navigation is an important point in any Web-based distance education system. Students and teachers cannot be annoyed by the logic of the system, they cannot lose much time learning how operate the system. Organizing tools with same functionality together in the screen, it is a nice idea because when a learner is looking for a chat he can find it in the interactive tools set and he will associate it when he needs to use a forum, for example.

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The system should lead learners and teachers through its tools and always inform where they are in the system to avoid getting lost.

System Management

Generally, Web-based distance education systems need an administrator to organize the system functions, but it is not a good practice to have dependence on him to much. The development of the course might present problems when the system administrator concentrates a lot of tasks on him leading this to a work overload.

Course aspects are the teacher's responsibility, because nobody will know better than him how to solve the course problems. The best distribution of the tasks in the system happens when the tasks have been done by the user related with these tasks. For example, the teacher must control the students registration, because he knows if a student has requisites to follow the course.

Security access

The distance education system must manage the users access it and this is not easy; the information security is essential to any kind of system. Therefore, the system must have a rigorous access control avoiding illegal copies of the course content to be acquired by others, for example.

Management of course content

Normally, the teacher develops course material in html pages with video, audio and images, organizing them in modules (or lessons) which are divided in topics. The Web-based distance education system must be able to store and to manage the course contents.

The pages stored and their maintenance must be easy in the system because with this the teacher may waste time producing the course material. Furthermore, if the system supports a lot of file types like html, ppt, pdf, etc the teacher may safe time in the material development; he might use a material that had already been done.

An important system function is the possibility to reuse a module content that had already been saved in the system in a different course. However, this feature is not found in all the studied Web-based distance education system, but it is fundamental to reduce the work's teacher avoiding the duplication of the same material.

Interactive tools

In a live class, the communication between teacher and learners is fundamental and the experience may be more interesting when the students exchange knowledge. But this is not easy in a virtual class, because students and teachers are very far and in most cases they have to formulate precisely their ideas in a text format which is not a simple task.

Interactive tools should provide a good communication way between students and teachers. Their interface must be intuitive and the principal feature is the facility to be used, because the student must only think about organizing his ideas and writing them.

Some Web-based distance education systems have a lot of interactive tools, but some of these tools may not be necessary in a course. However, two interactive tools are fundamental in a virtual class: discussion list and chat. Chat is a synchronous communication tool that provides a immediate feedback to the student about a theme and it enables group reflection. It is ideal to develop new skills in learners and help students that need information and cannot wait for it. Forum is an asynchronous communication tool where people can post messages, share solutions about a subject, debate ideas and read about topics of interest. An important aspect is to divide the forum in different themes and the learner reads only what is interesting for him and besides this, forum system saves all topics that are put in it allowing for the learner access information later. This tool can develop synthesis and evaluation skills in learners because they don't need to answer immediately, he can have more time to think about a subject and express his ideas about it.

Tracking student performance

Tracking student evolution in a traditional class is not a problem for the teacher, although this should be a matter of concern in an on-line class.

Statistics can minimize this problem because the system can save information about students access and transform this in reports to know facts such as the number of and what pages were more accessed by the student, what pages were more accessed in the course, how many questions had a wrong answer in a test and so on. Based in the statistics, the teacher may change his teaching strategy as when he verifies that there were a great number of wrong answer in a test about a particular topic.

Knowledge assessment

Knowledge assessment is essential for teachers and learners because it is a way to know if there was knowledge acquisition. Applying tests in a live class is not a problem but the same doesn't happen in a virtual class where the teacher cannot be sure whether it is the student who is on the other side. Normally, Web-based distance education system uses self test to verify how much knowledge was acquired about a topic.

Test is a kind of knowledge assessment that can be implemented by computer in such way that the student can answer the questions which is automatically verified according a template prepared by the teacher .

Different question types help teachers to decide how he may evaluate the students, especially if the teacher is using Bloom's [2] [4] category in his evaluation where it is possible to check what kind of assimilation there has been: knowledge, comprehension, application, analysis, synthesis and evaluation .

The systems should have test tools that provide to check all the Bloom's categories and to identify the student learning problems. Sometimes, the learner failure in the assessment doesn't mean a lack in his learning but a deficiency in the material of the course and in this case the teacher can change the course content.

STUDIED SYSTEM FEATURES

Aulanet

Aulanet's main function is to help teachers in traditional class or in virtual class. This system has three principal user types: administrator, teacher and student. The administrator is the system manager and has some responsibilities like: publish courses, accept student and teachers registration, statistics control and so on. The teacher (called author in Aulanet) is the course developer that puts the course contents (unit modules), knowledge self tests, module exercises, etc in the system. If necessary, the course may have a teaching assistant whose objective is to help the teacher in course tasks like chat management, answering discussion lists and so on. The student registration is made by student himself and the administrator can accept or not the student registration.

Webct

Webct is a Web-based distance education system with many teaching resources and with a simple user hierarchy. The system administrator has only some basic and essential tasks like initial course and teacher registration. Consequently, there is not an excessive administrator dependence. Course management tasks, like registering students and course contents, checking test and statistics, are done by the teacher, called designer in Webct. The system allows the teacher to change the pages layout, colors, font types, etc and he can choose texts or icon links.

Intralearn

Intralearn has a user hierarchy like Webct and AulaNet, but the administrator has more responsibilities like registering teachers and students, controlling statistics and so on.

The system navigation in Intralearn is very simple, because the similar tools are grouped together and the linked words indicate their real function.

Col (On-Line Courses)

Col is not different in user hierarchy from other studied systems. The administrator responsibility is to give the teacher permission for a registered person to access the teacher resources like the course content or the registered students. The teacher may define two registration course forms: with or without approval, but in both, the students do their own registration. In the first type, the teacher must accept or not a student registration and in another, the registration is free for any student.

FIGURE 1
AULANET, WEBCT, INTRALEARN AND COL USER ORGANIZATION
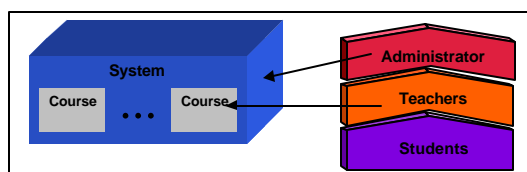
UniverSite

In relation to other analyzed systems, UniverSite is a different Web distance education system because it simulates a real University environment. Actually, it is a virtual University with principal, head of the department, course co-ordinator, teacher and students. User registration is made based in the user dependence once the principal can register the head of the department and departments, who can register the course co-ordinator and courses, who can register classes, students and teachers and so on and each user must access the environments related with him as it is show in Figure 2.

FIGURE 2
UNIVERSITE USER ORGANIZATION
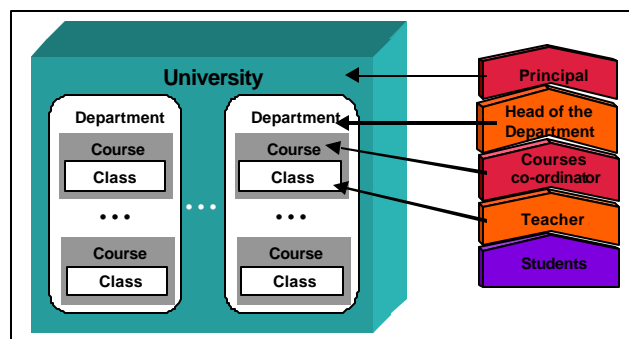
The system is organized by different kinds of environment like classroom, administrative department and principal administration, and the tools are distributed

in these environments. The access to these environments are controlled by user hierarchy where a user that is above another in the hierarchy can access different rooms. For example, the principal access all the rooms but students access only the classroom. This organization can be seen in Figure 3.

FIGURE 3
UNIVERSITE ENVIRONMENTS ORGANIZATION
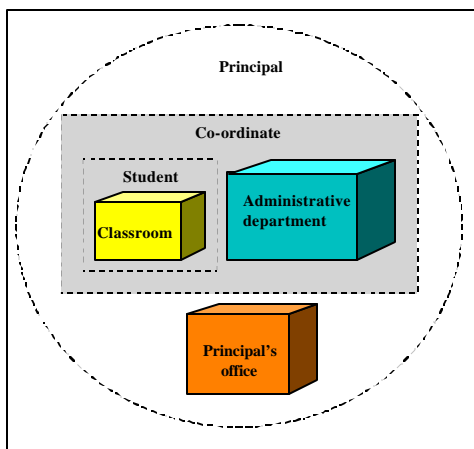
SYSTEMS COMPARISON

As a result of the study, it was possible to compare the system aspects based in the presented features. The punctuation in Table I was used to make the comparison that is shown in Table II. Some characteristics are common to all the analyzed systems, but there are details that were not found in all the systems.

TABLE I
PUNCTUATION

Grade	Correspond
0	Don't exist in the system
1	Exist a little difficult to use it
2	Good implementation
3	Excellent implementation

TABLE II
COMPARISON AMONG RESEARCHED SYSTEMS

	Webct	Col	Intralearn	UniverSite	Aulanet
System's workplace organization					
Facility of navigation	3	1	3	1	3
Grouping of tools with the same functionality	2	1	2	1	0
System Management					
Student registration facility	3	2	1	1	2
Good distribution of the system functions	3	3	2	2	2
System security					
Access control	1	3	3	3	2
Content Management					
Content Uploaded	3	3	1	0	1
Module Maintenance	3	3	3	3	3
Modules Reused	3	3	2	0	0
Interactive tools					
Different tools	3	3	0	0	0
Can create new forum themes	3	3	0	2	0
Statistics					
Presentation form	2	3	2	3	2
Who can access	3	3	1	3	1
Knowledge Assessment					
Different question types	3	1	3	3	0
Automatic correction	2	3	2	2	0

All the systems have a good interface and only in Col, UniverSite and Intralearn the tools with the same function are grouped together and this occurs in some situations in Webct. Nevertheless, UniverSite has a complex user hierarchy that delays the learning for the use of the system, because a user like a co-ordinator has the functions distributed in a lot of different environments. Intralearn has a Wizard that leads the teacher through the

course registration making his work easier and avoiding mistakes in the system navigation.

Depending too much on the administrator is not good, because the more tasks the administrator has to control in the system, the more work he will have, and if there are a lot of courses this can cause an overload. Webct has an efficient way to do the student data registration where the teacher may put, in the system, the student information by a batch file.

The user roles must be defined to facilitate the work in the system. Some system functions should be done by the teacher like analysis of the course statistics, control of student registration and material course, etc. Intralearn and Aulanet don't allow the student registration control by the teacher. Nevertheless, this control is made by the administrator. It is complicated when the system has many courses with a lot of students. The tasks are divided among the users in UniverSite, but this cannot be ideal in cases where many tasks are made by the same user like when the co-ordinator and the head department are the same person.

Although, the control access by a password is implement in all the studied system, a problem was found in Webct. This system finishes a user session only when the user close the browser. If a teacher makes a login in the system and goes to another site after to have used the Webct, without close the browser, the session will not be finished. For instance, a teacher connects in the system and does some tasks, then he goes to another site without close the browser; if the teacher goes back to Webct after navigate in another site, he doesn't need to do his login again, because the system will not check the teacher password again. Another problem has been found in Aulanet allowing users may open different sessions at the same time for the same user.

Col has a system security that controls how much time a user stays in the same course page. If the user stays more than 30 minutes in the same page, the system disconnects him avoiding that the user stays connected in the system while he goes out to drink a coffee, for instance.

All the studied systems work and store the content in modules, but only Webct and Col permit the teacher to make the upload of a file's group that composes a course. In Intralearn and Aulanet, it is necessary to do the upload file by file because it is not possible to use a compressed file such as a Winzip file in these systems. UniverSite doesn't store the module files, instead of this, the teacher must inform the page URL and save the Web pages manually in an internet server. Intralearn and Aulanet may store other file types like ppt (Ms-Power Point) and pdf (Acrobat Reader). The use of multimedia resources had been had success in all the studied systems.

Webct has a tool like Windows Explorer where teachers and learners can work with their files, making copies and deletions of file, for instance. This is a good

option for users that are skilled in the use of computers. In addiction of this, the teacher can edit html files inside the system with this tool.

The material reuse of another course that has already been saved in the system, it is possible in Col and Webct. The teacher might create module files, use them in a course and reuse them in another course. Intralearn allows the teacher to duplicate a course when the teacher needs to use all the same content, but doesn't permit to do the same with only one module.

The material maintenance may occur when the teacher decides to modify his lectures. In this case, the system must not allow the student to access the course content. All the analyzed system disable the student access in this situation.

The fundamental interactive tools like chat and forum were found in all studied system, but there are several tools that make difference in a virtual communication. Whiteboard was found only in Webct and it facilitates the exchange of files between teachers and learners. Col has a similar tool where teacher may use a presentation file like Power Point during a chat to help him to teach about a topic, and at the same time, the students might send chat messages for the teacher or for other learners. Moreover, the teacher may send questions about a topic to all the students in the chat and the tool saves the student answers allowing the teacher to see the answers later. Whiteboard and "chat-presentation" make easier the virtual interaction because teachers and learners may explain his ideas by a visual way and in real time.

In UniverSite and Intralearn, forum themes are created based in title lessons (Intralearn) or only can be created by co-ordinator (UniverSite). Students don't have freedom to create forum themes. In other studied systems, the creation of forum themes are free and the students might have initiative to start new discussions.

Another important point is the number of chat rooms enabled in a course. It is not a good practice to have a lot of students in the same room in a virtual conversation because the same students may lead the discussion all the time while others cannot have change to express their ideas. Webct has four chat rooms and one general room per course. Sometimes, the development of new skills occur in an informal conversation and this might happen with students of different courses. Webct and Col has free chat rooms where students of all the courses of the system can exchange their ideas.

Normally, in a Web-based distance education system, the learner doubt is registered by the teacher in a FAQ and this can concentrate the registration responsibility in the teacher. Col uses a different way to control the students questions: it has a Web Doubt tool where the student does the question registration in the system, and the teacher can answer it later.

There are two ways to analyze the student evaluations: by statistics or by knowledge assessment. The statistics

permit to verify student assiduity and to know when a student spend lot of time in the same course page. The studied systems have statistics, but in Col and UniverSite they are shown in a graphic format whose is a good form to understand what the information presents. Intralearn and Aulanet enable the statistics only to the system administrator.

Automated self tests are found in almost of studied system unless in Aulanet where the teacher should create a text file with the test questions putting it in the system. After the student solve the test, the teacher must check the test and does the grade registration. Different test types like lacuna, multiple choice, column association (objective type) and discursive question are found in Webct, Intralearn and UniverSite.

Col has only multiple choice test type. The teacher might register a question set and to relate it with a module and decide how many question the self test will have. When a module has more questions than the limit registered by the teacher the system choose randomly the question set which the student has to solve. Besides this, the system changes the order of the alternative answers avoiding that the student keeps the alternative sequence in his mind. When the student finish the module test the system shows to him what he answered right or wrong. If he doesn't get the minimum grade, he must do the module test again.

It is possible to define questions with different weights during the test registration in Intralearn, because the teacher might use normalized or weighted evaluation.

UniverSite allows the teacher makes question registration with three different difficulty degrees: easy, intermediate or difficult and the teacher decides what questions will be included in the test. In addition, he may construct a test with questions of different modules, thus a test may or not be linked to only one module. A question may have a different degree in Col, too. But the teacher may or not may use it.

The objective question type has automatic correction in all the analysis systems. But in Intralearn and Webct, the teacher must access the student test to effective the correction. The discursive question type needs to be checked by the teacher in all the systems that have this question type.

5. Conclusion

There are several Web education distance environments and each one is organized and works in a different way. However, the university or the company, which business is the distance education, must consider its needs and course organization before choosing a distance education environment.

This study indicates fundamental points that we will be implementing in new Col version like more chat rooms, other types of self test and so on. We know that our system has the main functions implemented and the system has

some different tools like "chat-presentation" and doubt tool that can help the teacher to organize his course.

It was clear to us that an easy logic navigation is essential to allow a good use of the system. The system must lead the user through it, so the teacher may spend more time in the lecture preparation and the student in the acquisition of new skills. Nowadays, we have an interface group that studies forms to implement an ideal interface to a distance education system whose goal is to present a good interface where the user will not need to worry about learning the system logic.

Automated self tests can not be a good solution to verify the knowledge acquisition, but they may help teachers and learners to have immediately answers about the student comprehension. We need to study and to implement new ways to check the student knowledge like a test using a discussion in a chat or implement other test types.

Tracking the student evolution is other point that we are taking care. We study new statistics implementation to help the teacher to find problems in his course. Col has more different statistics types than other studied system, and we believe it is essencial to the teacher to organize his course.

We conclude that the research goal was successful, as by the studies of different systems for distance education we can see that we are going in the right way.

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