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Important Criteria for Web-Based Educational Tools

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ABSTRACT

The rapid development of distance education technologies introduces new educational methods challenging traditional learning. World Wide Web offers immeasurable opportunities for educators. New software tools are being developed to facilitate the development, the management and the delivery of Web-based educational courses worldwide. It is important to define criteria for assessing these tools. In this paper we analyze the functionalities of educational tools, propose important criteria for evaluating the tools and classify the criteria into appropriate categories.

INTRODUCTION

The World Wide Web has been considered by many as the fourth global medium, integrating print, radio and television. Indeed it has surpassed all other forms of media in terms of its speed in reaching a critical number of households worldwide [9]. The use of technology in the area of education is expanding in a very rapid rate. Tele-education over the World Wide Web can offer new learning experiences to the trainees. It comes to the front to fill in the gaps of the traditional educational systems and deal with the problems that arise in the traditional ways of teaching [2].

The application of technology in education produced a number of questions; how well a formal education can be applied over the WWW; will there be any human contact or communication; which functions facilitate the navigation through the course material; what are the benefits from the implementation of Web-based education; how complete and accurate is the information and the links; how valuable is the information provided on the Web Pages' of the courses;

Those questions are reasonable if we take into consideration the fact that there is a luck of awareness about the technological educational tools. It is important to understand the possibilities that we have in our disposal finding ways to exploit them and to achieve our educational goals.

There is a widespread belief that we are driven through an era where many organizations, universities and institutes try to simulate a traditional classroom via Internet. Universities and companies have realized that Tele-Education is the spearhead of the educational system to spread the knowledge and experiences all over the world [1]. There are many Web-based educational tools that meet the instructors' needs in a satisfactory level and offer a variety of functions to simulate an educational environment. In another paper [10], we have compared software tools for distance education over the Web to conclude to the five products; WebCT [12], TopClass [13], Learning Space [14], Virtual-U [15] and LearnLinc [16]. Of course, they do not comprise an optimal solution for everyone. Different opinions [7] exist, regarding the choice of a proper tool and it is worth to remind that neither tool provides an integrated solution.

Provided that we are at the beginning of this technological explosion, companies are not so mature to create an integrated tool, quite flexible and powerful to overcome particular problems, resulting to underestimate the Tele-Education's advantages.

SYSTEMS OF DISTANCE EDUCATION

Depending on their functionality, interactivity and communication abilities, we classify the educational tools in three types: Authoring tools, Integrated tools and Conferencing tools. Having examined these tools thoroughly we realized that the best solution can be reached by establishing a combination of these tools (e.g. integrated and conferencing tools, or authoring and conferencing tools) [11]. There is a vital need to combine the different types of educational tools and provide an integrated solution. Until now few researchers have compared the Web-based educational tools [5], [6], [7]. Defining the most important criteria for evaluating educational tools, we must have in mind the necessary, fundamental and appropriate functions that they should support. We also have to consider that some of the integrated tools are notoriously rigid in the face of change. Furthermore, conventional techniques of software development are used to produce stable rather than flexible information systems for distance learning. In this paper, we recommend the most important criteria and functions for a reliable evaluation of educational tools. After experimentation with these tools, we suggest a combination of programs for creation, continuous development, delivery and communication of an educational class over the Web.

Most of the products have a user-friendly environment and no need for programming knowledge. The user friendliness is important for stimulating the student's participation. The no need for programming is important for helping the instructor to control and change the design of the educational program according to students' responses and current trends. We can use an HTML composer to configure impressive pages, supported by frames and multimedia applications. Furthermore, we can use Java to create more complex pages and cgi-scripts to provide more secure environments. Most of the tools are very flexible so that the user can design the environment according to his preferences. It is amazing the way we can modify pages, backgrounds, frames and course content without complicated functions and by event-driven buttons.

In the era of end user programming it is important to define our roles precisely and to protect the information systems from undesirable attacks. It is advisable to control students' access, to know how to react when an invasion takes place and to confront successfully the bugs that might appear. Although we have been turned away from programming it is sometimes recommended to use some modules that helps the system to be more defendable. A number of security methods are available. We have examined three different methods for the educational tools to authenticate users and to forbid unauthorized users; i) the security system that is being provided by the programmer of the tool, ii) the operating system used and finally iii) the web server and the browser that have been installed on the server where the course material is located. To make it clear not all of the tools provide all three methods of security simultaneously. Additionally to these security methods, some educational tools protect files by placing them into inaccessible Web locations. On Windows this means that the files are put in two separate locations. On other platforms this is achieved through the use of aliases. Also users' passwords in the database must be encrypted for further security.

Another important criterion is the ability for the delivery of testing for evaluation of student's progress. Testing is important in a complete environment for distant examination and automatic correction. It is recommended for quizzes and short tests, especially when we want to permit students to practice. Auto-correction helps teachers to examine students in a rapid and accurate way. The results have been predefined to facilitate the procedures of marking. Auto-correction is a function that depends on the questions' type. Having mentioned some important criteria that we must have in mind when we examine the Web-based tools, it is preferable to classify them in categories [4], [8]: technology features, administration features, student features, communication features and instructor features. After extensive experimentation with Web-based educational tools and taking into consideration the experience of other researchers, we conclude to the most important criteria for evaluating the tools. Someone may select the Web-based educational tool using these criteria to meet his needs.

TECHNOLOGY FEATURES

Criteria that are related to the technology of the tools include the size of the RAM (what are the demands in megabytes to handle with the tools), the Operating System (Windows, Macintosh or UNIX environment), and the Access from Internet or LAN (helpful for remote users). Most of the tools require 32 MB as a minimum size for the RAM, except LearningSpace, which requires 64 MB RAM. We examined these tools on Windows NT and in some cases Windows 95. We have designed the course content under Windows NT and we have tested the educational tools under Windows 95. The ability to have access from Internet is important, as most of the registered students will be in remote locations. Nevertheless, we can also use these tools in LANs.

HTML programming is essential for professional design, which is supported from all the integrated Web-Based educational tools we have worked out. Browsers are another factor we must take into account. Depending on the Web Browser we will be able to retrieve anything written in HTML (Web sites), as well as text in Gopher files, Usenet articles, and archived files found in FTP sites. During the tests we found some problems concerning the upload of the Web pages. Not all of the browsers are being supported by the tools equally well. For example WebCT supports better Microsoft Internet Explorer 4.0 rather than Netscape Navigator 4.5. The opposite happens with TopClass Server.

Another ability is the communication with other sites on the Web using the Universal Resource Locator. It is useful to provide further information concerning the course material using links. In this way, the educational tools are not isolated without external ports to the rest of the network. In addition, they can cooperate with other applications and help students to navigate easily according to the course content and instructor's guidance.

Support of Video or Audio can influence the flow of the course material and help the students to be educated effectively. Furthermore, a well-organized Database could help the administrator to structure the courses properly and to keep important information for users. Some of these tools can communicate in a successful manner with external more powerful databases. For example, TopClass Server can communicate successfully with database Oracle. The educational tools' database operates using object classification. This means that an appropriate object classifies every information into the program. This function is useful especially when we want to maintain the program or fix a bug that may appear. An external database is recommended only when the internal one is not so powerful as we would prefer or in cases we want to insert external information from other database. Sometimes it is necessary to exchange information, which have been worked out in other databases or by other applications. The ability to export or import raw data for further process is an advantage.

ADMINISTRATION'S FEATURES

An important feature that facilitates the administration of the course on the Web is the security. We can distinguished two types of security: the security dealing with the protection of the course material from users, so that no one can modify the contents and the security concerning the access control which is being defined by the administrator. Regarding the first type of security, files are located in different directories. One directory contains files for access by users and another directory contains files for the functions of the program. This method ensures that nobody could interfere to unauthorized files by accident or in purpose. The second type of security relates to the access control, either remote or local. We have discussed it above.

Other important criteria include Automate Index and Remote Access. Automate Index provides the ability to create an index automatically. During the design of the course framework, we only have to define the chapters, the topics and the catalogs, the so called units, where the course material will be placed. The program automatically will present us the index according to these units. Remote Access helps the developers to build up the material easily from distant locations (e.g. their homes, or offices). This useful utility facilitates the remote construction of the educational environment. In addition, the administrator is permitted to interfere with the program whenever a problem occurs and to fix it. Remote access gives the right to the pertinent users to correct, to check and to change the procedures they want and furthermore, to adapt the course content according to the classroom's needs anytime. Also there may be defined Restrictions for the course material or the access time. We can modify the time a student can hold the connection with the server without moving and working on the course material. As a result of this, new users have the opportunity to login into the educational environment. Besides this we can set restrictions on the access and the display of specific course content depending on the time or day or even the year. This is useful when we want to hide a test or a set of transparencies or even a document and to present them in a specific future time. So the access time utility can control effectively and quite strictly the time horizon of a test or a final exam.

Crash recovery tools restore the database or even the course content from communication or server hardware failure without loss of data.

STUDENT'S FEATURES

Features helping the students include Submission and Auto-Correction of tests, Report of student's progress, and Presentation Area. A student takes tests that have been provided and managed by the instructor through controlled services of the software tool. The instructor submits tests and controls them defining the time horizon of the questions' display. In other words, the instructor can predetermine the start and the end period of the exam. He can also determine whether a test will be corrected automatically or not. Auto-Correction has four types of choices. In the first type the instructor writes down the answers together with questions and the program will match automatically the correct answers and will display the results without the instructor's interference. In the second type, the above way of testing is used but the results will be displayed after the instructor views the questions and answers. In the third type, in addition to auto-correcting some questions, there are other questions accepting a document or an attached file as an answer. Finally, the instructor has the choice to correct the test directly without the program's interference. When a test is submitted, it is accessible only for specified time limits. Concerning Students' Progress Report and Analysis most tools prefer to export any progress information to other applications for further process. Though it is advisable to export the result of students' progress in an appropriate software tool in order to create diagrams, pies and histograms or to work them out in a statistical tool (e.g. SPSS, Minitab, SAS) the opportunity is not always available. So we have to be very careful in our choices and to examine whether it is possible to work out the result of students' progress or not.

Additionally, most of the tools provide a number of Question Types to build up tests or quizzes. Usually the integrated tools support 5 to 8 different types of questions. Instructors can build up questions whether inside the educational tools or outside with the use of external independent tools like QuestionMark. TopClass program has a utility called TopClass Testing Assistant that helps us to create tests and to import them into TopClass Server. It guides the designer with event-driven buttons to build up various types of questions like, Multiple Choice, Multiple Answers, Image Map, Boolean, Pick-one, Text, Upload, List Matching.

Another criterion is the ability to use Annotations. Annotations help students to keep notes near the course material. Private annotations concerning the course or other remarks are accessible only to the owner using his password. WebCT provides such kind of facility and we could say that during our testing appeared to be very useful.

A last criterion in this category is the Presentation Area. All the participants have the right to create an Area which can be accessible by the others and to present important information about themselves, announcements, and to publish their homework or other files for common share.

COMMUNICATION FEATURES

Communication Features is another category of important functions for online or offline communication. Criteria that belong to this category are Discussion Area, real time Audio and Video Conference, Bulletin Board (downloading and updating/posting files over the Web), Chat (exchange of text in real time), Whiteboard (shared window that may also support shared drawing) and Application Sharing (run an application on one machine and share the window view across the Web). Discussion Area permits users to have an asynchronous communication by threads or a classification of the messages according to the author. Similar function to Discussion Area is the Class Announcement, which helps instructors and administrators to make announcements concerning the virtual classes. Students have the right only to read and not to interfere with the announcements. We can either search for an author of a thread or navigate through messages. Audio and Videoconference are very important functions especially for interactivity. LearnLinc is such a powerful tool. Whiteboard opens a window where we can draw and share our schedules with others that are being connected. Chat helps the online communication by text. It is useful when we want to have a quick discussion without any further demands. Application Sharing helps participants to share applications and work in-groups regardless of distance locations. Another important function is the ability to use Internal and External e-mail (to facilitate the communication among the participants in a course and external users).

It can be predefined to either prevent students to communicate with each other, or with external users of Internet or to provide both Internal and External communication.

INSTRUCTOR'S FEATURES

Features for assisting the Instructor include Remote Authoring, Customization features for the Welcome Page and the courses, Syllabus, Creating Actions (provide the student with extra material depending on tests' results), Language for advanced options to enhance the course content, Questions Pools (repositories for questions to help the professor choose randomly), Import/Export Courses, import a course with a .doc format, import a course with a .ppt format. We can build up questions to deposit them in a "repository" called Question Pool and to recall them either randomly or by declaring them. These questions can be recalled anytime for future needs. Importing a course is a new sense to the Web-based educational environment. We can import a course content, which has been made in another software tool like MS Word or MS PowerPoint and has been transformed in an appropriate form. Moreover we can export a course content and submit it to users' personal computers for offline viewing. TopClass Player is a utility that facilitates users enough by helping them to view the course material offline avoiding the costs of being connected. The only cost is to download the file and take part to the exams.

It is necessary to mention that not all of the educational tools provide all the above criteria. Most of the educational tools provide the fundamental ability to import or export the course material in a desirable form. This is important especially when we want to process the contents or a part of them and to import them finally in the course material.

CONCLUSIONS

Currently, instructional designers have developed a number of educational environments taking advantage of Information Technology's explosion, adjusted to the learner characteristics and needs. The role of the instructor is changing to a "facilitator of learning rather than a communicator of a fixed body of information" [3]. In this paper, we have presented the most important criteria for the evaluation of Web-based educational tools. When comparing educational tools, it is essential to define the instructor and student needs and then evaluate the most recent versions of these tools, since many upgrades and new features are continuously introduced. This is expected, due to the rapid technological development. Every day, each educational tool becomes more powerful and optimizes its performance. Each criterion covers an important part of the educational needs and the choice will depend on the accurate analysis of the educational goals.

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