NEW REVOLUTION IN EDUCATION– DIGITAL CLASSROOM

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INTRODUCTION

Teachers can no longer afford to embrace the motto "This, too, shall pass!" when viewing technology's role in education. Research has shown that appropriate applications of technology greatly enhance learning. As long ago as 1995, a U.S. Department of Education forum reported, "Through the use of advanced computing and telecommunications technology, learning can also be qualitatively different. The process of learning in the classroom can become significantly richer as students have access to new and different types of information, can manipulate it on the computer through graphic displays or controlled experiments in ways never before possible, and can communicate their results and conclusions in a variety of media to their teacher, students in the next classroom, or students around the world. A more recent study found that online learning allows individual student needs to be more effectively met and instructors have more time to address individual student learning issues.

The Digital Classroom courses are not about learning isolated technology skills or using any particular application. While we will do those things, the more important issue is integrating those skills and applications into real-world projects useful to improving a student's understanding of any curricular area while learning the necessary objectives for life-long success. In addition, technology lets educators unite students with students, classrooms with stakeholders, parents with teachers. When everyone is informed, real progress can take place. That is the real power of technology. It allows teachers to accomplish what Susan Patrick, the new head of the federal Office of Educational Technology, said was the necessary use of educational technology. "Technology is becoming the adhesive that unites formerly disparate parts of the education enterprise." (*eSchool News*, May 2004) Technology is that place to stand that Aristotle was looking for so many years ago; it allows us and our students to "move the world."

CURRENT DEVELOPMENT OBJECTIVES

Currently lectures for all remote courses are available on video and delivered via cable TV, satellite transmission, or tapes that are sent by conventional mail. As bandwidth to the home increases, videos will be made available on-line. As an immediate step, to conserve the bandwidth we design lectures as a combination of picture slides and audio files. Rather than watching talking heads, students can view the slides (equivalent to a blackboard in the traditional classroom) and optionally hear the teacher's voice. The students are sent electronic forms of the slides that are used in the lectures so that they may amend these notes provided by the lecturer with their own notes, utilizing a word processor of their choice.
The authoring activity of the current Digital Classroom allows faculty and teachers to publish assignments, exams and lectures. An author can use almost any word processor and can include reference to multimedia objects on the INTERNET or on local systems. The back end of the authoring agent is a combination of various software tools which produce data in file formats recognized by the front end (X tools and Mosaic). Common image file formats can include GIF, JPEG and Postscript, which all can be displayed by Mosaic along with text (HTML format) in a hyper-media environment.

Requirements

Multimedia Requirements

Computer aided interactive multimedia courseware is being developed at NJIT (Bengu, 1994) to introduce an early and comprehensive understanding of interdisciplinary applications of engineering systems, with a focus on manufacturing. The manufacturing engineering multimedia courseware will include on-line lectures, audio-video education tools, interactive computer software (process and equipment design, simulation and animation software). It will also make access available to related academic, industry, and government research and education information through the World Wide Web.

The initial course material is being prepared by faculty, with the modules referred to as topics. Each topic contains illustrations in various media such as text, still pictures and slides, video, and interactive software. The students will invoke the courseware through an activity link in the Virtual Classroom or though a World Wide Web interface. An "electronic blackboard" serves as the current interface metaphor.

The power of multimedia technology can be used to assemble course materials in various media forms such as text, slides, full motion audio-video, live video and interactive software on a single powerful interactive

platform, referred to as simply "courseware." The introduction of multimedia into courseware allows the instructor complete freedom to incorporate into a remote course those learning situations that previously could only be accomplished in a face-to-face environment. An example would be, the manipulation of complicated machinery by simulation, animation and multimedia presentations.

The integration of Virtual Classroom[and multimedia on the Information Superhighway is also underway at NJIT (Kushwaha & Whitescarver, 1994, Deek & Kimmel, 1994). Current work is the enhancing the media richness of the Virtual Classroom using the standard protocols of the Internet (e.g., HTML and Mosaic). World Wide Web client software is utilized to integrate the virtual library resources of the information highway as well as the group communication facilities of EIES to provide a comprehensive fully interactive collaborative learning multimedia environment.

The multimedia digital Classroom courseware can be viewed as a computer-mediated application, where the computer acts as a mediator between the application author, who publishes the on-line classroom courseware or "encyclopedia", and the user, who browses the available information and contributes to the authoring as a participant. The author is not just restricted to publish his original work, but has capabilities to reference, include and publish all the relevant information available on the Internet in a multimedia environment.

In similar fashion, users of the courseware, in addition to their innovative contributions, have access to abundant information which can be easily referenced in the courseware discussions. The instructor has to have the ability to integrate new material generated by the current class for the benefit of future classes. The underlying semantic structure for the effective incorporation of material is still a research issue. The ultimate objective for the instructor is the evolution of a knowledge base with a learning oriented semantic and pragmatic topic structure oriented to the given subject matter. This synergetic paradigm creates an information garden for the subject topic under discussion and the author takes the role of a moderator, who communicates with the users in a group communication environment, to manage and organize the information.

The software architecture of the multimedia courseware may be viewed as having three components: the authoring agent, the user agent and the distributed database or group agent. The authoring agent consists of various tools which allow authors, such as instructors, to publish the course material in a manner which is easy and comprehensive. The text material from various sources which have multimedia objects can be submitted using a user friendly authoring environment. For this environment an extremely easy to use and integrated authoring and submitting tool needs to be developed. We cannot expect most educators to master the current hodgepodge of protocols and software. Finally the educator must have the ability to efficiently manage the growing volume of information and communications resulting from the collaborative learning process.

There is a great deal of work still to be accomplished to make this distributed system appear to be completely transparent to both the educators and the students. Currently there is no comprehensive authoring system and no integration between the authoring tools that do exist and the browser type capabilities. In addition, a clearly missing piece is the ability of the educators to develop their courseware on their personal computers and to turn their machines into personal servers to control and regulate the communications environment with their students.

Hypertext Requirements

In rich hypertext systems (Nanard 1991) all the nodes have types. The type of a node may reflect its role in the Hypertext, e.g., its syntactic category. In the use of Hypertext to support learning applications we see the requirement for semantic typing of both nodes and links. We cannot add any form of intelligence to the course materials unless there is some standardized semantic typing of nodes and links.

CONCLUSION

While one can conceptualize most of the functionality that would make up an advanced learning system and even point to ways to implement it, the integration into a single interface that is easy to learn is still a key challenge. An interesting and appropriate interface metaphor adds to the usability and user acceptance of software. That is one reason why we have viewed this as an evolutionary process that must be tied into an evaluation program that provides feedback to the design process. Furthermore, the objective of doing better than the standard approach to education requires that we evaluate effectiveness.

The resulting system must be viewed as a toolkit that gives the instructor full control of what aids and techniques to employ in delivering their course. That is one reason we have focused on the metaphor of "activities" that can be chosen and integrated dynamically into a given class conference. The key expansion of the conference database to incorporate a full collaborative Hypertext approach will provide complete freedom for the instructor

to facilitate or "weave" the conference discussion. We are beginning to refer to our advanced system as the "ABC" (Activity Based Conference) system to further reflect the idea of tailoring and the idea of simplicity in structuring communications around the learning objectives of a group.

Currently many of us use the technology to integrate our face-to-face classes with our remote students so they are all one class. In addition, there are opportunities for the use of the technology to facilitate multiple instructors, multiple courses, material used across different course sequences, training on the job, and numerous other requirements that in themselves can add to the requirements for software functionality. For example, a management game might involve a sequence of management courses where the more advanced students are assigned higher level management positions in the game.

Once we free ourselves from the mental limits of viewing this technology as a weak sister to face-to-face synchronous education, the potentials to revolutionize education and learning become readily apparent.

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