The Digital Textbook:  
A Look at the Next Generation of Educational Materials

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The rapid advancements in digital technology is creating a whole new arena of educational opportunities. Now that multimedia is emerging as the next revolution in personal computers, there are abilities to author creative educational materials and frameworks that would not have been possible several years ago. Some of the common concerns that educators and administrators of computing share are: (1) the form that educational materials will take with the advent of multimedia, (2) the format that education will take to exploit the new technology and (3) the computer technology infrastructure necessary to support new educational environments. This presentation will address these concerns by demonstrating a prototype of future educational materials called "The Digital Textbook" followed by a presentation of how these new materials will allow for different educational formats and the necessary technology to support future settings in education.
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Introduction

The acceleration of PC technology has created an environment of both opportunity and confusion. The latest PC technology, with multimedia ability, has provided educational institutions and publishers with a new set of tools that can be used to reengineer the educational process. With the multimedia elements including audio, video, pictures being produced using PCs in a digital form instead of the traditional analog form that used expensive analog equipment, virtually anyone can be a multimedia content producer. Recents trends indicate that the additional hardware that was necessary to bring multimedia to the desktop has been being replaced by software solutions (QuickTime) and/or with hardware in the machine out of the box (i.e. Quadra av). The continuance of this trend would suggest that in the future all machines will have full multimedia resources built in at a affordable price. With all these changes in technology there is a new playing field for everyone. The following sections will discuss: (1) some of the technology developments that help enhance the technology tool box, (2) the impacts that new technology is having on educational materials, (3) how educational formats might change and (4) technology infrastructures that can embrace new technology and accessibility.

Multimedia on the PC

New technological developments have been the driving force in the creation of new PC technology. These developments are evidenced by the new PCs using RISC processors, increases in disk space and speed and the floppies that have much larger storage space that is necessary to store multimedia work. The recent developments in RISC processors such as the DEC alpha chip and the IBM 601 will allow for an entirely new generation of computers to be built at lower prices. These processors provide the needed processing power to support multimedia. The processors that follow (IBM 603, 604, and 620) will continue to push the envelope with staggering performance at relatively low prices. Parallel to the move in processors is the enhancements in disk technology. Disks are becoming smaller, faster and with more capacity. This can be seen in magnetic disks by the move from 5.25 to 3.5 inch disks. In fact, many of the new generation magnetic disks will have performance that rivals that of some disk arrays. Other developments have centered around the development of the 3.5 inch magneto optical disk. This would be the logical replacement for the current 3.5 inch floppies (capacity 1.44 MB) since the magneto optical floppy can hold approximately 128MB. This and even larger spaces would be needed to hold multimedia work and make it easily transportable. Another version of removeable disk is the optical disk. This type is not as popular as the magneto optical but could become popular if certain technological advancements are achieved. What is quickly become the most popular media for distributing multimedia and other content is CD-ROM. Today's CD-ROMs can hold about 650MB of information and costs about $1 per disc to reproduce in quantity. Many of the newer computers come with a CD-ROM drive built in. This trend will continue until all computers come equipped with CD-ROM. Additionally, recent developments have produced a CD-ROM with five time the capacity of today's CD-ROM. We should also expect that CD-ROMs will become smaller. One of the
limitations of CD-ROMs have been their speed (access time and bandwidth). CD-ROM drives have changed from having a throughput of 150KB/sec to 300KB/sec and this fall NEC has announced a 450KB/sec and 600KB/sec drive to be available by the beginning of the year. Within a few years all machines will have much faster CD-ROM drives with much larger capacities. Again, this is necessary to hold the new multimedia creations that are forthcoming. We can expect to see the impact of all of these technological developments in the form that future educational materials will take.

Educational Materials and Educational Formats

Educations materials that take advantage of the new technology will all use multimedia components to produce a package for self study or as a audio/video support in the class room. Most developments today include basic textbook content, exercises and testing augmented by some video and/or audio. These materials are presently available on CD-ROMs but with advancements in networking will soon be accessible over networks. The content of the educational material may be reorganized so that the student explores topics in a random fashion or may be organized like today's textbooks where there is a sequence to covering the material. Both of these formats can be housed on a CD-ROM or be played back over a network. The main difference between using a network or a CD-ROM is in logistics. With future PC notebooks and personal digital assistants (PDAs) likely to have RISC processors and CD-ROM drives having materials packaged on a CD-ROM will allow much more mobility due to it's portability. Networks can only be accessed from designated locations whereas PC notebooks and PDAs can be carried anywhere and played anytime. Examining the different arrangements for experiencing learning yields the following possibilities.

1. Same time same place (today's classroom)
2. Same time different place (teleconference)
3. Different time same place (lab use at the discretion of the student)
4. Different time different place (portable materials or ISDN networks from home computers)
5. Anytime any place (portable computer with portable materials or wireless communications)

The trend will probably produce future scenarios that include more different time different place and anytime any place activities than the traditional same time same place style of learning currently used. As industry is currently undergoing much reorganization to stay competitive, education is addressing similar conditions. It will become imperative to use innovation with new technology to stay competitive as the educational market continues to tighten. As with industry, computer technology can be a strategic weapon for educational institutions.

Networking will continue to advance both on campus and nationally. Just recently several vendors were advertising FastEther boards which boost the data transfer rate to 100Mb/sec. This speed can make video over the wire much more feasible. Currently the IEEE standards committee is reviewing some proposed standards for FastEther. In
another effort Internet is being investigated as a possible medium for high speed transfer over long distances. This network coupled with ISDN that is surfacing in some parts of the country would provide a viable method for linking society up over a global network structure. All of these efforts will move rapidly to achieve a high capacity networked society by the turn of the century.

Campuses are now moving toward a more networked environment to support the innovative use of computers in education. Dorms, offices, classrooms, libraries and more are all becoming networked. With the feasibility of multimedia only well planned infrastructures will be able to take advantage of the latest technology. The technology base at every campus is vital to the institution being able to be innovative and to achieve more efficient and effective educational environments. A campus with leading edge technology is needed even before the faculty and staff think of ways of fully utilizing it. It is the technology rich campus which serves to motivate members of the campus to try new methods. Only through providing the right atmosphere will people think to try new ideas.