

CD/Web Hybrids: Delivering Multimedia to the Online Learner

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The World Wide Web (WWW) represents an exciting and potent force for educational content delivery. There are numerous multimedia technologies that can facilitate self-directed, practice-centered learning and meet the challenges of educational delivery to the adult learner. However, delivering content via the WWW has been plagued by unreliability and inconsistency of information transfer, resulting in unacceptable delays and the inability to effectively deliver complex multimedia elements including audio, video, and animation. This article describes how a CD/Web hybrid, essentially a web site on a compact disc (CD), combines the strengths of the CD-ROM and the WWW, and facilitates the delivery of multimedia elements while preserving connectivity. Pressing a web site onto a CD-ROM can reduce the amount of time that students spend interacting with a given technology, and can increase the amount of time they spend learning.

One of the long-standing problems in delivering educational content via the World Wide Web (WWW) has been the unreliability and inconsistency of information transfer via Internet connections. Whether connection to the WWW is established over conventional telephone lines or higher speed networks, often communication is delayed or terminated because of bottlenecks at the server level, or because of congestion at any point in the line of transmission. Further, the current state of technology does not allow for the optimal delivery of multimedia elements including audio, video and animation. Larger multimedia files require lengthy download times which means that students have to wait too long to view or hear these files. Even simple graphics can cause unacceptable delays. A CD/Web hybrid, essentially a web site on a compact disc (CD), can serve as a workable solution to these problems.

In this article, the author presents a brief review of the strengths and weaknesses of the WWW as a tool for delivering educational content to the online learner. The author also presents a rationale for the use of CD/Web hybrids in concert with the WWW to utilize the advantages inherent in both technologies.

WEB TECHNOLOGY AND ADULT LEARNING THEORY

It is becoming increasingly clear that learning takes place in a complex internal and external environment. Knowles theory of *andragogy* (as cited in Blackmore, 1996) is an attempt to explain the differences between the way adults learn from the way children learn. Blackmore lists the assumptions inherent in this adult learning theory:

1. Adults are goal oriented.
2. Adults are relevancy oriented (problem-centered), that is, they need to know why they are learning something.
3. Adults are practical and problem solvers.
4. Adults have accumulated life experiences.
5. Adults are autonomous and self-directed.

An important part of andragogy is the notion of self-directed learning, which suggests that the instructional design process needs to involve the learner. Mutual planning, evaluation of delivery and instruction, and needs-based instruction should be hallmarks of adult education (Wratcher, Morrison, Riley, & Scheirton, 1997).

At the present time, the adult learning theory paradigm has shifted from a teaching environment to a learning environment (Berge & Collins, 1995; Schuyler, 1997). Students are not to be filled up as if they were passive, empty vessels. Instead of being the passive recipients of knowledge, students are capable of constructing their own knowledge with guidance from their teacher—a theory referred to as “practice-centered learning (Berge & Collins, 1995).” Students can become lifelong learners by being enabled to locate the resources necessary to continue learning.

If adult learners are autonomous, and prefer self-directed study, they should respond well to the independent nature of distance education via the WWW. Further, the vast resources of the WWW should enable students to acquire the information necessary to construct their own knowledge. However, the distance education classroom must be rendered interactive in order to promote participation and independence without isolation. The educator must learn how to construct a learning environment that stimulates student motivation and promotes skills that encourage self-directed and independent learning.

There are several technologies within the realm of distance learning and the WWW that can facilitate self-directed, practice-centered learning, and meet the challenges of educational delivery to the adult learner. Several forms of synchronous (real time) and asynchronous (delayed time) technology can provide communication between teacher and learner that is stimulating and that meets the needs of the learner. Information can be delivered in a variety of forms. Real-time “chat”, “threaded” discussion areas, hypermedia such as audio, video and graphics, Shockwave, Virtual Reality Modeling Language (VRML) and Java applets, are just some of the new and/or emerging technologies that promise to make the WWW compelling and interactive while delivering rich content. Together, these multimedia technologies represent an innovative and potent force for educational delivery over the Web (Kaplan, 1997).

McKeachie noted that student interest and curiosity can provide intrinsic motivation and aid student learning (1994, p.349). Poor students are not necessarily poor learners; nor are they unmotivated. According to McKeachie, students are constantly learning and are highly motivated about a great number of things. However, the things they are motivated to learn are not necessarily those that will help them to attain the goals of a given course. Therefore, one of the tasks of the teacher is to nurture curiosity and use it as a motive for learning. A compelling and interactive web site can stimulate student interest and curiosity. Several multimedia technologies available to the distance educator might be useful in creating such an environment. Hypertext and hypermedia, such as audio, video and graphics, can be delivered over the WWW and engage both the interest and the various learning styles of adult learners (Kaplan, 1997).

In higher education, there exists rationale for (Kilian, 1997) and examples of (Collins, 1997; Vishwanatham, Wilkins & Jevic, 1997) the use of the WWW as an effective medium for instruction. There is a new paradigm for using interactive multimedia technologies for teaching and learning via the WWW (Kaplan, 1997). There exists sufficient rationale and standards of good practice for the use of multimedia technology in education (The Academic Senate for California Community Colleges [ASCCC], 1997), and for use in employee training (Merrill, 1997; Black & Goldstein, 1998).

Web Technology Limitations

Guenette and Gustavson (1996) observed that today’s web sites are following the same path as early CD-ROMs. Most early CDs were text-only, and gradually became reliant on complex multimedia. So too, today’s web sites, which began as text-only, now are moving increasingly towards the use of more complex multimedia. Multimedia technologies can be built into an educational web site, but not without a “cost”. Delays attendant to file transfers on the WWW make it difficult to incorporate multimedia technologies (Carman & Boynton, 1997). Technological barriers to delivering effective educational content via the WWW include the unreliability of network connections, insufficient bandwidth, problems at the server level and congestion over the data transmission lines, each of which serves to delay transmission of data. This means that the WWW often becomes the “World Wide Wait”, causing students to waste valuable time. Worse yet, students spend more time interacting with the technology rather than learning from the technology.

Haring (1998) noted that "streaming media" has become the latest rage in the delivery of online audio and video. Streaming is a video and audio compression technology that allows for more immediate playback of multimedia elements on a web page. Companies like Broadcast.com, and Real-Networks, are setting the standard for today's web streaming systems (Harm, 1998). RealNetworks estimates that 6.7 million viewers go to its hub site for streaming media each month. Even though streaming media has become increasingly popular, the price of increasing Web complexity continues to be the reduction of transfer speeds. Though bandwidth restrictions are likely to lessen in the next few years due to the roll out of cable modems and digital subscriber telephone lines throughout the country, for the near future, internet speed gains will be neither ubiquitous nor cheap (Hallett, 1998).

Several delivery options have been suggested (Carman & Boynton, 1997) to address the current bandwidth restrictions of the WWW. CD-ROM, computer hard drive, local and wide-area networks, and hybrid systems (either from a CD or a computer hard drive) can be used to deliver large multimedia files while also providing access to the extended content of the WWW. The choice of delivery medium would be dependent on the types of media to be used, the accessibility of content to the users, and the life-cycle of course content.

CD/WEB HYBRID

How is an instructor to provide a multimedia rich web site that is compelling and stimulates student interest, and at the same time is able to deliver large data files without the attendant wait that is still characteristic of the WWW? A partial solution is to utilize CD/Web hybrid technology, which merges the strengths of the CD-ROM and the WWW (Andrews, 1996; Hallett, 1998; Heid, 1997).

Both CD-ROM drives and computer processors are considerably faster than the common data transmission hardware (modem) of the typical web connection. Holsinger (1994, p. 151) noted that early CD-ROM drives "oozed" information at a rate of 150K/second. At that sustained rate, the first-generation, 1-speed, CD-ROM drives would take about seven seconds to transfer a megabyte (1024K) of data, making them roughly as fast as a TI connection (Hallett, 1998). Standard equipment in many newer computers includes a 24 or even 32-speed CD-ROM drive, catapulting the delivery speed exponentially. By comparison, today's typical modem, a 28.8 Kbps modem, takes about five minutes to transfer a megabyte of data. Hallett noted that standard PC processor speeds have doubled over the past 18 months while CD-ROM speeds have quadrupled. This represents a remarkable speed advantage for the CD-ROM drive over the modem, especially considering that analysts expect two-thirds of all Web users will be "surfing" with 28.8 Kbps modems through the year 2000 (Hallett, 1998).

The CD/Web hybrid can aid and abet the delivery of educational content in innovative ways. Wratcher, Morrison, Riley, and Scheirton (1997) indicated that multimedia and hypertext elements commonly incorporated into web sites hold great promise in that they enable instructional content to be presented "in ways that provide the continual stimulation and reward that rival computer games (p.73). They further noted that distance education is able to bring all of the multimedia technologies together to provide variety in teaching (p.74). Given the current data transfer limitations of the inter-net, pressing a multimedia web site onto a CD-ROM, may prove to be one of the most efficient and effective ways of delivering educational content via the WWW. Creating a web site that could be played off of a CD-ROM drive would enable an instructor to include rich audio and video content since the delivery would not be restricted to the slow transfer speeds of the modem. Hyperlinks on the CD-ROM would take a student from the CD-ROM out to the Internet, and back again, seamlessly. Further, with the ability to integrate more multimedia resources into the web site, the instructor could increase student interactivity, curiosity, and interest in the hopes of increasing student motivation.

One of the drawbacks of using the CD/Web hybrid is that information can not be included that is likely to change in the short term. Heid (1997) pointed out that updates to a CD-ROM are not as convenient, nor as immediate as updates to a traditional web site. Data becomes frozen and can't be updated. According to Heid, integration of information requires a companion web site where "users download updates, read current information, and interact on discussion boards."

The private sector and the federal government have increased their use of CD/Web hybrids. Nicholls (1997) pointed out that TFPL Multimedia's *Multimedia and CD-ROM Directory* listed 600 hybrid CD-ROMs at the end of 1997, an increase of 160 percent since the beginning of the year. The reason for this increase seems clear: a publisher can provide complex multimedia files on a CD-ROM as well as add access to expanded content via the WWW (Andrews, 1996; Heid, 1997).

PLUG-IN ARCHITECTURE

There are two main delivery methods for multimedia elements via the WWW. One way is to use *helper applications*, which are programs that allow you to view multimedia files that your browser cannot handle internally. The files must first be downloaded and then played using a helper application. Downloading large multimedia files is very time-consuming and thus helper applications have given way to a second method of multimedia delivery: the *plug-in*. A plug-in is a small application that extends the built-in capabilities of the web browser. In contrast to helper applications, plug-ins often do not require files to be downloaded in order to be played, and allow for significant compression and more immediate playback of multimedia files—a concept referred to as streaming.

Audio and video streaming is becoming more popular as a means for delivering complex multimedia files because it relies on compression schemes that reduce the time it takes to view or hear multimedia files. Real-Networks delivers both audio and video through the use of Real Audio and Real Video plug-in architectures that extend the browser support for video and audio streaming (Haring, 1998).

However, until all browser software includes built-in support for various audio and video compression schemes, it will be prudent for the educator to select plug-in software that supports multiple platforms and various file formats. Using multimedia files that require proprietary plug-ins can force the user to install numerous pieces of software in order to access multimedia elements. Horton and Lynch (1997) have warned that requiring too many plug-ins would risk “losing students and other site visitors [by requiring them] to jump through hoops in order to view your content (p.16).”

Apple Computer’s Quick Time technology is a cross-platform product that has the largest installed base of any digital audiovisual format (Horton & Lynch, 1997). QuickTime is a multiplatform standard used by multimedia software tool vendors and content creators to store, edit, and play synchronized graphics, sound, video, text, and music. QuickTime playback options transcend a wide range of media from the Internet to CD-ROM titles to professional broadcasting. QuickTime is useful in playing multiple file formats including graphic, audio and video files. There are over 20 file formats supported directly by the QuickTime 2.0 Plug-in. This alleviates the need to download and install dozens of proprietary products that only support a single media type, or to use and configure the helper applications that go with them.

On a web page, the QuickTime plug-in allows for progressive download, or “fast start.” The Fast Start feature presents the first frame of a movie/video file almost immediately and can begin as soon as enough playable frames have been downloaded. Further, the plug-in allows the user to play movies linearly or browse through them using the built-in VCR-like controllers.

Since Apple’s QuickTime 2.0 plug-in architecture has a large installed base, supports multiple platforms and file types, installing it as the main plug-in of choice may obviate the need to install multiple products to playback multimedia elements in a web site. The teacher would simply need to create multimedia elements in the QuickTime format, or in one of the formats supported by the QuickTime plug-in. More information about QuickTime can be found at the Apple web site at <http://www.apple.com/quicktime>.

SUMMARY

There are numerous multimedia technologies within the realm of the WWW that can facilitate self-directed, practice-centered learning and meet the challenges of educational delivery to the adult learner. These multimedia technologies, if adequately delivered over the WWW, can engage both the interest and the various learning styles of the adult learner and represent an innovative, potent force for the delivery of educational content. There are many types of helper applications and plug-ins used to deliver multimedia elements. However, it would be wise for faculty to use a cross-platform plug-in architecture like QuickTime, which provides support for up to 20 different file formats.

There are strengths inherent in the hybrid approach over stand-alone educational CD-ROMs or web sites. Delays associated with current communication technologies make it difficult to incorporate multimedia technologies over the WWW. The CD/Web hybrid can be a partial solution to this problem as it takes advantage of the strengths of both the CD-ROM and the WWW to facilitate educational delivery.

IMPLICATIONS

In an online distance education class, where students spend considerable time navigating the Web, delays mean that students spend an inordinate amount of time interacting with the technology rather than learning. To ensure good student performance and to meet student expectations for a high quality education, educators will need to address student success in terms of the efficiency of time spent online.

It is crucial to the future of distance learning in higher education that attempts at online instructional delivery be successful from the vantage points of the students, the faculty and the administration. Some assurance must be provided that distance learning will meet the expectations of students for a high quality education, provide the same level of academic excellence as courses taught in traditional modes, and successfully meet the challenge of delivering education to an ever-burgeoning student population. Instruction of any kind, using any delivery system, must establish and maintain high standards of performance (ASCCC, 1997). As increasing numbers of classes make use of online delivery methods they will also encounter increasing scrutiny from sources outside the campus boundaries. The integrity of course outlines and articulation agreements must be maintained to ensure course transferability, and accreditation commissions will require standards of good practice in an attempt to ensure the quality of distance education (McCollum, 1998).

New and emerging multimedia technologies have important potential for enhancing the teaching and learning process. These technologies can be delivered via the WWW and add to the acknowledged wealth of content available on the Web. However, delivery of interactive multimedia content via the WWW has been shown to be less than acceptable. Lengthy download times and the need for several software plug-ins to facilitate delivery of multimedia reduces the efficiency and effectiveness of educational content delivery via the WWW.

Too much emphasis has been placed on the fact that a technology can be delivered at all (e.g., streamed video over the Web), rather than if said delivery is effective and efficient for the purpose of teaching and learning. The reality of the current state of technology is that bandwidth restrictions limit the ability to deliver interactive, multimedia content via the WWW. In order for multimedia content to serve a useful purpose in the educational setting, the question of how it is to be delivered must first be addressed. Until bandwidth restrictions have been alleviated, the CD/Web hybrid can provide a useful delivery system for class content while providing access to the expanded content of the WWW.

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