LEARNING ENVIRONMENTS OF THE FUTURE: NARROW TO BROADBAND VIA DVD

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Abstract

As the Web becomes part of mainstream learning and teaching at Australian universities, changes to online learning include a proliferation in the use of commercial learning environments and in the movement of institutional processes online. These changes indicate that now is an appropriate time to plan for the future. University of Wollongong has established a team to investigate learning technologies of the future. One of the first areas of concern for the group is the widening of the digital divide by broadband, creating the bandwidth rich and poor. A project is proposed to partially address this divide through the provision of media rich content by DVD in a hybrid DVD/WebCT environment.

Keywords

online learning, future technology, broadband, narrowband, DVD, DVD/Web hybrid

Introduction

Online learning has become part of life for most Australian universities. For many Australian institutions online learning has moved, or is moving, out of the aegis of early adopters and into the mainstream. Commercially available online learning packages are now the norm and as well as hosting content and facilitating interactions they provide some course management support. Institutional processes and resources, for example; eReadings, student surveys, enrolment procedures and other administrative tasks, in many institutions are moving online. These factors are changing learning web sites into eLearning portals or eUniversities. These are characteristics of what Taylor refers to as the "Fifth Generation of Distance Education".

> The fifth generation of distance education is essentially a derivation of the fourth generation, which aims to capitalize on the features of the Internet and the Web." (Taylor, J.C., 2001; p. 3).

Taylor's description of the generations of distance education is worth noting as it provides a concise encapsulation of the history of distance education and suggests that flexible and online leaning are later components of it. He describes the generations of distance education and their associated delivery technologies as:

First Generation - The Correspondence Model
- Print

Second Generation - The Multi-media Model
- Print
- Audiotape
- Videotape
- Computer-based learning (e.g. CML/CAL/IMM)
- Interactive video (disk and tape)

Third Generation - The Telelearning Model
- Audioteleconferencing
- Videoconferencing
- Audiographic Communication
- Broadcast TV/Radio and Audioteleconferencing

Fourth Generation - The Flexible Learning Model
- Interactive multimedia (IMM) online
- Internet based access to WWW resources
- Computer mediated communications

Fifth Generation - The Intelligent Flexible Learning Model
- Interactive multimedia (IMM) online
- Internet based access to WWW resources
- Computer mediated communication, using automated response systems
- Campus portal access to institutional processes and resources

(Taylor, J.C., 2001; p. 3).

As institutions and their online courses mature into Taylor's Fifth Generation the roles of instructional designers and educational developers need to change in response to changing needs of teachers. As a greater proportion of academics becomes skilled in developing online learning, instructional designers and educational developers can shift their focus away from training academic staff in the basics of online learning and towards providing finesse and increasing quality. As well they can plan for the future.

Another challenge to online learning is that the majority of students come to university with the expectations that IT will be part of, or even central to, their learning experience. As this expectation is obviously informed by students' prior experience of IT, it is probably safe to assume that the level and type of IT they expect to encounter will be media rich and highly interactive.

Further stress is placed on the role of online learning, as employers require the graduates they employ to have increasing levels of information and computer literacy. Universities need to maintain or enhance students computer and IT skills as well as enhance their online learning skills in preparation for a lifetime of learning.

As both students' expectations and employers' requirements change with new developments in software and hardware and as these changes are often fast and far-reaching it is safe to assume that most universities are hard pressed to keep up with them.

It is appropriate that the change in focus of instructional designers and educational developers comes as the changes mentioned above take place. As both changes impact on, and will alter the very nature of the student IT experience. To facilitate these changes to the student IT experience, University of Wollongong has established a small team:

- to investigate learning technologies of the future
- to assist in the planning of the future of online learning, and
- for the development of the student learning experience, especially their experience with IT.

Establishment of a Future Technologies Team

To facilitate the investigation of future learning technologies the Centre for Educational Development and Interactive Resources (CEDIR) at University of Wollongong has set up a team to investigate future learning technologies. With the working title of LOFT (Learning Online Future Technologies) the core of the team is made up of an academic, educational developer, a video producer, a multimedia programmer and when required draws upon the expertise of other staff such as:

- Technical staff at satellite campuses
- Intranet/network staff
- Other production and technical staff

The aims and objectives of the team are:

- To provide staff development opportunities in the use of current and future technologies in teaching and learning through the development of prototypal products
- To produce prototypes of learning/teaching materials that use digital technology and/or broadband Internet for both content provision and online collaboration (e.g. exemplar subjects that are beyond international benchmarks through their use of digital and broadband technology
- To provide advice on strategic planning for the implementation and adoption of these technologies
- To investigate the use of new technologies in teaching and learning
- To investigate the integration of new technologies with current

One of the specific issues LOFT is considering is the impact that broadband Internet will have (or is having) on online learning.

Broadband Internet

Broadband Internet is here. Telstra and others are advertising high speed Internet connections through, Cable modems, ASDL and satellite (see Table 1). The bold venture proposed by Teledesic (Teledesic, 2001) to launch 288 low orbit satellites for global, broadband, "Internet in the Sky" appears at first to be the work of a science fiction author. However, when one discovers who has invested in the company and their level of investment (see Table 2) it is clear that the IT business sector is clearly preparing for global, or at least widespread, broadband whether provided by Teledesic or others.

Method	Provider	Speed kbps down/up	Recurrent Cost per month	Set up Cost
PSTN modem	Telstra Bigpond	28.8	$24.95	
PSTN modem	Telstra Bigpond	56	$24.95	
ADSL	Telstra Bigpond	256/64	$78	$189 -$399
ADSL	Telstra Bigpond	512/128	$89	$189 -$399
satellite	Telstra Bigpond	64	$70.95	$430 - $1500
satellite	Telstra Bigpond	Up to 400	$92.95*	$430 - $1500
cable modem	Telstra Bigpond	256/64	$67	$189 -$399
cable modem	Telstra Bigpond	512/128	$72.55	$189 -$399
cable modem	Optus	(30 x)**	$69.95	$199 - $399
cable modem	Optus	(100x)**	$74.95	$598

*3GB download limit exists, 26.4 cents per extra MB
** Optus only provides approximate comparisons to 28.8kbps
PSTN = Public Switched Telephone Network

Table 1: Costs and speeds of broadband internet (data collected June 6, 2001)

Investor	Amount ($US millions)
Bill Gates	Undisclosed
Craig McCaw	Undisclosed
His Royal Highness Prince Alwaleed Bin Talal Bin Abdul Aziz Alsaud	200
Abu Dhabi Investment Company	121
The Boeing Company	100
Motorola	750

Table 2: Teledesic investors and amounts

From Table 1 it can be seen that for broadband, communication speeds are significantly higher and hence download times are much shorter. While costs are somewhat higher than for connections to PSTN (Public Switched Telephone Network) modems it is expected that they will fall in the not too distant future. Students with broadband connections to the Internet will be able to access media rich, interactive web sites and enjoy short download times. The files could consist of full screen, full motion video and high quality audio as well as text and still images. No longer will the majority of educational web sites be limited to text and still images or slim multimedia files like Flash.

When online learning is limited to narrowband, a digital divide is apparent between the access rich and the access poor. Students in the one online course could access the same material from networked computers in a range of locations and situations. It is possible that students with access to high speed Internet (such as T1 or LAN) at their place of work could enjoy fast downloads for little or no cost. Other students in the same class might access the material through a slow modem and pay an ISP for the service, while a third group with no personal access might be relegated to joining a queue at the campus computer lab.

It is quite possible that broadband could create another digital divide through creating a gulf between the bandwidth rich and poor. It is conceivable that some students may choose to use broadband while others, for reasons of affordability or access, might be constrained to a slow PSTN modem for access to their course.

One way to address, in part, the digital divide between the bandwidth rich and the bandwidth poor would be to supply students with access options for the course materials. Students with broadband could conveniently download media rich content from the institution's server while students with a narrowband connection could be supplied the media rich content via distributed media. The LOFT team considers that the relatively new medium of DVD has the potential to provide media rich content in a cost-effective manner and hence was worthy of further investigation and evaluation. To test the suitability of DVD to online learning it was decided to create an educational DVD. So that the DVD could be used as an integrated part of online learning it was decided that the prototype the DVD would be integrated with a WebCT subject.

DVD/Web Hybrid Project Description

The DVD/WebCT hybrid, will be an exemplar of one possible future scenario for online learning. As it was proposed to use the product primarily to demonstrate the technology for staff development purposes, a topic, relevant to the target audience was selected: Educational Videoconference Techniques.

The hybrid will provide information and training in several aspects of the educational videoconference, including:

- introductory information on aesthetics of video and the framed image
- on-screen communications
- manual style information on how to operate videoconference equipment
- examples of pedagogical techniques for videoconference.

Writing for DVD is somewhat similar to writing branched scripts for multimedia that traditionally would have been distributed on CD-ROM. However the unique abilities of DVD such as selectable angles and the ability to seamlessly concatenate scenes from different parts of the disc add a third dimension to the script. These attributes of the script structure will allow users to customise their own learning experience to their needs. The hybrid will be used in training:

- to operate videoconference equipment
- to prepare material for screen based presentation
- to teach using videoconference
- about the aesthetics of the framed image
- all of the above

However, as stated above, the primary purpose of the product is to demonstrate the technology and its use in an educational setting. In this way it will be used as a professional development tool to investigate, evaluate and showcase DVD/WebCT hybrid technology in a learning environment. In this way it will be used:

- to emulate learning via broadband Internet through enhancement of a WebCT site by full screen, full motion interactive video,
- to assist in planning for future technologies, as well as the secondary purpose;
- the improvement of videoconferences as a learning technology thus enhancing the learning experience.

Production of the DVD/WebCT hybrid would also provide learning opportunities for the staff involved with it from the scriptwriter, the web programmer, through to the video production staff who would record the disc.

Why DVD?

When the DVD medium was first introduced its primary role was for the storage and distribution of video. From the outset Hollywood's movie studios have had a (some would say heavy) hand in the development and standardisation of the medium and at first the acronym was short for Digital Video Disc as it was thought that their main use would be to replace the VHS distribution of movies. However, as computer files increased in size and as the capacity of CD-ROMs is limited to 650 or 700MB, DVD was proposed as a higher density storage option and many computers started shipping with drives that could read DVD as well as CD-ROM. To reflect this new use of the medium the acronym was changed to Digital Versatile Disc. However, today it is known simply as DVD.

A basic DVD can store up to 4.7GB of information. However, dual-layer and double-sided discs are available which raise storage capacity to 9 and 18GB respectively. Table 3 compares storage size of DVD with CD-ROM. The capacity of DVD in terms of video depends on the compression rate and hence the quality of the pictures.

> "... DVD is much more than CD on steroids. Its increased storage capacity and speed allow it to accommodate high-quality digital video in MPEG2 format. The result is a small shiny disc that holds better-than-TV video and better-than-CD audio. A basic DVD can contain a movie over two hours long. A double-sided, dual-layer DVD can hold about eight hours of near cinema quality video or more than 30 hours of VHS quality video." (Taylor, J. 2001; p. 3).

Media	Storage Capacity
CD-ROM	700MB
DVD single-sided single layer	4.7GB
DVD single-sided dual-layer	9GB
DVD double-sided single layer	9GB
DVD double-sided dual-layer	18GB

Table 3: A comparison of CD-ROM and DVD

While DVD media has many clear advantages over CD-ROM media, it would not be worth considering unless DVD replay hardware was relatively, freely and widely available. The Pioneer Electronics Australia website makes the following claim about the numbers of DVD players.

> "In two years, some 250,000 DVD players have been sold in Australia with 11 to 12 million expected to be in service within 5 years" (Pioneer, 2000).

This does not include the number of DVD drives sold as components of computer hardware. It is reasonable to expect numbers of these drives to increase rapidly as DVD drives typically can read CD-ROMs and hence expand the functionality of the host computer. Some later model playstations (for example Sony's PS2 and Microsoft's XBox) incorporate a DVD drive and read games encoded on DVD or CD-ROM and can be used to replay video and audio from DVDs (Tyson, 2001).

Bandwidth and Learning Experience

The DVD/WebCT hybrid will allow students to choose the method or methods by which they access course content. Students with slow Internet connections will be recommended to use the DVD to access content while students with broadband connections of sufficient speed will be given the option to download the content material. Other material such as the subject outline including the calendar of dates could be included in the DVD. However, material of an ephemeral nature, such as dates that change from one teaching period to the next would be most appropriately accessed from the website.

The ways in which students interact with the media-rich content material will depend on the way in which they are downloaded and the local media on which they are stored. Students could interact with the DVD through selections made from the on-screen menu. They can elect to view an overview or the complete module. Students who download the content material would make their choices before they download each section of the content.

With a broadband connection of sufficient bandwidth it is possible for students to interact with each other through streamed desktop videoconferences as well as the narrowband methods of chat, email, discussion forums and bulletin boards. They could interact with their teachers using the same technologies.

One limitation of narrowband is in the interaction with the teacher and between students. These interactions would be limited by the bandwidth and typically would be confined to text or highly compressed video/audio streaming.

To compare the learning experience between broadband, narrowband and narrowband enhanced through the use of DVD/Web hybrid, the Model Of Learning and Teaching Activities (MOLTA) (Caladine, 1999; p. 24) has been selected (see Table 4). MOLTA arranges the activities of the process of learning and teaching into the categories of:

- Provision of Material,
- Interaction with Material,
- Interaction with the Teacher,
- Interaction between Students, and
- Intra-Action.
  (Intra-Action here refers to those activities that students undertake that are not in the other categories and are to a high degree independent of them.)

MOLTA Categories	Narrowband Internet	Narrowband Internet plus (DVD/WebCT)	Broadband Internet
Provision of Material	Text Stills Limited low quality video	Text Stills High quality full screen from DVD	Text Stills Video streamed from server (quality dependent on bandwidth)
Interaction with Material	Text Stills Low quality video	Text Stills High quality video	Text Stills High quality video
Interaction with Teacher	Email Chat Online discussion Low quality streaming	Email Chat Online discussion Low quality streaming	Email Chat Online discussion Streaming (quality depending on bandwidth)
Interaction between Students	Email Chat Online discussion Low quality streaming	Email Chat Online discussion Low quality streaming	Email Chat Online discussion Streaming (quality depending on bandwidth)
Intra-Action			

Table 4: A comparison of narrowband, enhanced narrowband and broadband

As mentioned above the enhanced narrowband DVD/WebCT hybrid does not have the streaming capability of high bandwidth broadband. However, in most cases it is possible, and usually desirable, to prepare content material beforehand thus allowing sufficient timeframe for the distribution of high quality video material by post or other physical means. In broadband cases where streaming is available and affordable it is more likely that it will be used for interaction as well as the narrowband text based tools.

Conclusion

A DVD/WebCT hybrid has been presented as a means of incorporating high quality video material into online subjects delivered via narrowband connections to the Internet. While the hybrid falls short of the functionality of the broadband example in terms of the interactions with the teacher and between students, it does go part of the way to reduce the digital divide between the bandwidth rich and the bandwidth poor.

As well the DVD/WebCT hybrid provides an appropriate and friendly entry point for the acquiring of online learning skills. Skills that most universities agree are an essential graduate attribute for lifelong learning. Of course it is not anticipated that all online learning should become media rich. However, it is argued that the best introduction to online learning is through an environment rich in the media with which students are familiar through their exposure with computer games, television and other electronic entertainment.

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