

Teaching with Internet

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Abstract

The Internet promises to be the harbinger of the much talked about paradigm shift in teaching. Many leading Universities and Educational Research Institutions, around the world are sponsoring state-of-the-art Internet based educational projects. These projects take on various names like Virtual classrooms, Computer mediated communication(CMC) and Distributed Tutored Video Instruction(DTVI). Teaching staff too, will have to adapt their teaching methods to incorporate Internet based teaching models. In time to come, newer generations of students will demand technology based learning as they get familiar with the Internet in their high schools. Fortunately the Internet, especially the WWW and the Electronic-mail components, are getting user friendly enough that virtually any lecturer or tutor can use the Internet for teaching without too much effort.

The writer, started developing teaching applications on the Internet a year ago. In this article, he starts by surveying existing as well as emergent Internet based technologies, that are being adapted to become effective teaching platforms. He then proceeds to give a first-person account of some simple teaching related applications that he has developed on the Internet. These applications essentially use Internet platforms such as E-mail, Usenet and the World-Wide-Web(WWW).

Key-words

Internet and Teaching, Teaching with E-mail, Web teaching applications, Technology based Teaching, Computer based Teaching, Multimedia and Teaching, Internet based education.

Introduction

The Internet (or the Net for short), refers to the global network of computers that can be used to perform a variety of applications such as Electronic-mail, Listservs, Bulletin Boards, Remote Login, File Transfer Protocols(FTP), On-line Chat programs(IRC), Multi-user dimension Object Oriented(MOO) applications, to name a few.¹ The Net has been around for more than twenty years and has been extensively used by research establishments and academia. However, the advent of the World Wide Web(WWW or simply the Web) and Graphic User Interface(GUI) based browser software such as 'Mosaic' (in late 1993) and subsequently 'Netscape', 'Internet Explorer' and in recent times 'Hot Java' has sparked a quantum explosion in the popularity of Internet[1]. The WWW is exemplified by Web pages(or Home-pages as they are popularly called), which are hypermedia files into which one can incorporate graphics, text, sound and motion. Each Web page is given a

unique address(URL) and can be linked to other Web pages. Navigation between the pages is by pointing and clicking at key words or phrases or on navigation buttons at the top of the browser software. This process is so simple that anyone can learn to navigate the WWW and gain access to a multitude of files containing valuable information resources in a matter of minutes. The Internet is fast evolving as a huge repository of all kinds of information resources, with many Web sites now incorporating appropriate multimedia features.

Multimedia software and hardware developers, sensing an opportunity are rushing to build plug-ins for their products to work with the Net. There is no doubt that the Net has the potential to displace CD-ROMs' which are currently the most popular medium to distribute large volumes

of multimedia files. If this is not happening right away, it is because of constraints in data transmission (bandwidth), data compression, and security technology. As these technological problems are resolved, the Net will become 'the mother of all CD-ROMs'. In fact, the Internet can be more than a CD-ROM, as one can also write and update Web-site information, virtually at will.

Promising Internet Trends

The WWW is fast becoming the de facto platform for Internet TV, Virtual Reality applications such as MOO, Computer Animation, Video-On-Demand, Video conferencing, Multimedia database systems(Mediabases) and distributed Computer Aided Instruction(CAI) systems[2]. One can now distribute multimedia applications developed on 'Macromedia Director' and 'Authorware' authoring systems using a plug-in named 'Shockwave'. Already announced is the incorporation of Picture-Mail[3]: E-mail with in-line multimedia options. Users will also manipulate the same intuitive GUI browsers to communicate and access information resources from the rest of the world as well as manage their intra-organizational information. The latter aspect, that is using the Internet browser to manage intra-organizational activities, has spawned a new buzz-word, namely 'Intranet'[4]. All these developments provide new opportunities for the teaching profession to design and implement Internet based educational systems.

The Net's impact on teaching

In doing research on this paper, I was amazed by how often it was mentioned that the Net will change the existing paradigms of teaching[5]. The traditional notions of teaching, such as lecturers meticulously preparing lecture notes, photo-copying handouts, and lecturing to large crowds of anxious (and in some cases disinterested), students keeping up with note taking etc., need to be re-evaluated[6]. The Net is rapidly breaking down the barriers associated with the physical boundary of the college or university and even more relevant, time. It is already being used to create virtual classrooms, where students and lecturers do not need to physically gather in a class or

lecture hall at a pre-set time. Instead, they can log into their computers at set times or at their own convenience and discretion, from wherever they are located and carry on with their class work. Detailed discussion of this paradigm shift must certainly be the subject of another paper. Here, I will merely outline a few examples of how Internet technology is used in some leading institutions:

Since 1995, at the University of Pennsylvania, Classical Studies and Language classes have been conducted entirely on the Internet. Students are responsible for posting summaries of discussions on the network. Discussions and assignments are entirely conducted on the Net. Language classes are conducted using On-line Chat sessions, E-mail discussion groups, and virtual classrooms[7].

The Internet has created opportunities for Princeton University students to take a limited number of courses at the University of Pennsylvania and vice-versa, without the need to physically travel between the campuses. Meetings are conducted through Video Conferencing, E-mail and on-line discussion groups[8].

The Polytechnic University, Hawthorne, USA has implemented several teaching modules which are taught completely on the Internet, based on their teaching concept called Internet-Cyberspace Assisted Responsive Education (I-CARE)[9].

The University of Catalonia, in Spain, captions itself as the world's first Virtual Campus. Its first intake of 200 students, in 1995, learn

by using Interactive Multimedia applications, E-mail, a Virtual Library, a Virtual Cafeteria and regular live Video conferences. Face to face study meetings are limited to two times per semester to lessen the feelings of isolation[10].

Several graduate students in the National University of Singapore interact with other students from around the globe in a virtual classroom environment called the BIOMOO[11].

Certainly projects like those mentioned above incur significant investment, while requiring coordinated institutional effort and state-of-the-art technical knowledge. Fortunately, the Net also provides the technological space for individual lecturers with limited time and know-how to implement suitable personal Web applications for targeted students, in tandem with the more sophisticated institutional Net applications. For example, it is becoming increasingly common for teaching staff in many leading universities around the world to operate personal Home-pages, incorporating a range of applications for the benefit of their students.

The Internet challenge for lecturers

Any lecturer who wants to use the Internet effectively must have a proper perspective of the rapidly evolving technological trends and must also be aware of the opportunities and constraints of his own immediate computing environment. This will ensure that he does not go off on a tangent and develop applications that may become obsolete in no time, or dabble in teaching applications that look state-of-the-art, admired for their snazzy capabilities but which are of little practical use. To this end, it makes sense to develop Web based Internet applications, as the direction of technology points to the World Wide Web as the one-stop environment, where most present and future Internet applications will be centered.

Developing Home-pages is getting simpler, with new Web page authoring products being announced by the month. For example, 'Internet Assistant' software, an optional add-on utility to 'Microsoft-Office' products, will make developing Web pages scarcely more difficult than word-processing! Web authoring software, such as 'WebMagic Author' by Silicon Graphics, 'FrontPage' by Microsoft and 'PageMill' from Adobe requires only nominal knowledge of HTML, the hypertext markup language that is otherwise needed to develop Web pages. Such software allows the developer to focus on content rather than HTML commands. Certainly, some structured training can assist a wide spectrum of teaching staff to implement Web based Internet applications. Implementing interactive features in Web pages presently requires programming scripts such as PERL or VISUAL-BASIC or the recently developed JAVA language. More advanced Web authoring software for developing Virtual Reality, namely Virtual Reality Manipulation Language (VRML) software, and 3-Dimensional multimedia and animation software are also becoming relatively cheap to acquire and easy to learn for interested novice web page developers. Fortunately, there are many sites on the Internet, where good advice, as well as free copies of scripts and software, can be downloaded.

Web-site teaching applications

My own interest in developing teaching applications and utilities on the Internet dates back at least a year. Constant press and journal reports on Internet developments certainly sparked my curiosity. I have since utilized the Internet E-mail, Usenet and my Home-page to supplement my teaching. These initial applications have provided me with the requisite skills to experiment with On-line Chat (IRC) systems, CU-SeeMe video conferencing and Multi-user Dimension Object Oriented (MOO) systems. I will first detail on those Internet based

applications I have implemented and then proceed to discuss other potential Internet based applications for teaching and learning.

I have been maintaining a Home-page, since the beginning of this year. My Home-page is intended to be a one stop resource hub, providing my students with additional material to supplement their face-to-face lectures and tutorials. Key applications on my Home-page include:

i) Access to on-line resources on the Internet : In addition to their lecture notes and textbook, students have access to a collection of Web sites as part of their reading and research assignments. Interestingly, some of these sites also provide self paced tutorial materials, which are excellent supplementary learning resources. A search around the globe will reveal that there are many good souls out there who have researched, collated and posted valuable information on virtually any subject of interest. All that is needed is to search on keywords, using one of the numerous search engines that come with the web browser. The Internet also provides links to the thousands of electronic libraries worldwide. What all these developments imply is that the Net offers lecturers the opportunity to cut down on their lecture content and provide students with the educational space to do their own research for the information that they need to assimilate.

ii) On-line lecture notes, tutorials, examination papers etc. : It has now become quite commonplace for teaching staff in many leading universities to post their course materials and research publications on their personal Home-pages. I have emulated them by putting my syllabus, lecture outline, past examination papers, tutorial, project assignments and my time-table on my Home-page. I have found this to be an interesting and effective way to communicate with my students. The marvel about the WWW is that it allows me as a lecturer to create materials for student reference which will involve very little maintenance. I hope to reach a point where I may not need to religiously photocopy my syllabus, lecture materials and project assignments for distribution to my students, as they can readily download these course materials from my Home-page.

iii) Electronic Announcements: The personal Home-page is also an excellent conduit for subject related announcements. My students regularly refer to my page for announcements and notices about course and tutorial schedules.

iv) Slide-On-Demand: I am also building a library of my lecture slides on the Web. By a click of the mouse button, I am able to download my MS-Powerpoint slides at any computer terminal linked to the Internet, within the Polytechnic, or potentially anywhere in the World! Students can review my lecture slides at any time and anywhere.

v) On-line feedback and survey forms: Also available at my Web site is a menu of on-line forms to elicit student feedback or conduct surveys. Students can access or download the forms, from any Internet linked computer on campus or at home, to respond to my queries or provide feedback. The responses are updated in my file quite instantaneously for me to analyze. This particular application of having on-line documents on the Net can be extended to almost all the forms that a lecturer has to handle as part of his teaching and administration. At last count a typical lecturer in Ngee Ann

Polytechnic has to deal with some 80 different types of forms. Certainly many of these forms can be converted from hard-copy to electronic format, saving storage space, printing costs and, perhaps a few trees. Web authoring systems that facilitate designing on-line forms to update Mediabases on servers, and to retrieve and display

multimedia information on clients' terminals, open up a whole range of opportunities for on-line interaction.

vi) Internet Discussion Groups: Many users associate the Internet with Usenet discussion groups, such as 'soc.culture.singapore', where often entertaining gossip and sometimes banal discussions take place. However in reality, most of the approximately four thousand odd classified news-groups, to which the Polytechnic subscribes, can be effective learning fora. My students are encouraged to access and participate in a selection of the business related discussion groups. In addition, I shall be shortly setting up a private Web-based bulletin board for my students. Initially, one or two of my tutorial sessions could be re-designed to be conducted virtually via bulletin board exchanges.

vii) On-line Chat, Internet-Phone and Virtual Reality: Tools like On-line Chat (IRC), Internet-Phone and Virtual Reality certainly hold promise for teaching applications. At the moment, to demonstrate the potential of On-line chat and Virtual Reality to my students, I have links from my Home-page to several of these sites. An example of an On-line chat site on the Web is 'Alamak Chat', where you can access and have on-line discussions with anyone else in the world who may want to have a conversation with you. Better still, you can participate in a virtual tour of Antarctica, take a jungle walk, or transform yourself into an icon and engage in games, or listen to music in a Virtual Cafe. Although these environments are fun, they have serious potential as virtual tutorial and lecture halls. Indeed, several leading universities are beginning to exploit the potential of Virtual Reality for teaching and learning. The advent of Internet compatible Object-Oriented Virtual-Reality-Manipulation-Language(VRML) and 3-Dimensional software hold promise for creating on-line management games and simulation programs. 'CU-SeeMe' and 'FirstClass' are getting to be a popular software tools for implementing PC-based video conferencing applications on the Net[12]. At this point of time, because of bandwidth restrictions, high cost and security considerations in the Polytechnic network, it may not be viable, to implement full-fledged teaching applications based on the software platforms just mentioned. Nevertheless, as I read about Internet based Video Conferencing, Multi-user dimension Object Oriented(MOO) and Distributed Tutored Video Instruction(DTVI) applications, I can perceive the potential and implications of these new systems for teaching. The DTVI system is an interesting new development, sponsored by Sun Micro-systems which is currently undergoing tests in several universities in the USA[13]. Pre-recorded video material of a lecture

is distributed via a high speed network to geographically dispersed group of 8 to 12 students, who will then discuss the lecture via Video Conference, with the aid of a facilitator. The facilitator may not be a content expert but will help to moderate the electronic discussion to encourage group learning. I can see that it may not be too many years before DTVI applications will be feasible on the Internet, using ordinary telephone cables, due to impending advances in data compression technology. The DTVI certainly has implications for current methods of course delivery. I am certain that, at the institutional level, the Polytechnic is already investigating and probably working on prototype educational projects involving these fast evolving technologies.

E-mail for teaching

Whilst there is a lot of excitement about the World Wide Web and its use as a teaching tool, much effective teaching can be accomplished with E-mail. Many of my students interact with me via E-mail. Simple queries about tutorials, lectures and project assignments can be resolved through E-mail. I sense that some of my students who are

usually quiet in face to face tutorial discussions, prefer to use the E-mail to ask me questions. Perhaps they feel more free to express themselves via E-mail!

The E-mail system is the key component of most Computer-Mediated Communication(CMC) teaching platforms. A simple CMC system will consist of a tutor broadcasting questions to his students via E-mail and receiving responses.

For the present, for security reasons, the E-mail system in the Polytechnic is accessed separately from the Web. Two trends, namely secure E-mail communication from within the Web browser, and the incorporation of in-line graphics (a la Picture-mail) will greatly enhance the use of E-mail as a teaching medium.

Teaching on the Web

The experience derived from designing and developing the Home page and using the E-mail and Usenet components of the Internet, has now let me to think about converting a couple of my weekly lecture sessions to be completely on the Net. What I want to do is to create a web page, where my lecture objectives and outlines are clearly displayed. The page will also contain information on reading assignments, and links to electronic library resources and other salient web sites for additional reference. An archive of FAQ's to help students with their lecture related queries, will also be available. In addition, students can also directly E-mail, phone me or come and meet me for additional help. To ensure that students have assimilated the modules, I will have assignments or questions which can be discussed at the regular tutorial sessions.

A future new learning scenario

Imagine this scene. Jack, is at the local McDonald having a burger for lunch. He decides to review his Statistics lecture whilst having his meal. He accesses the Internet through his wireless palm-size computer, and downloads the on-line video on Decision Theory. There is a point discussed in the video that he is not clear about. He freezes the video, and points his pen at the 'FAQ' button to see if the answer to his problem is listed there. It is not there, so he points at the 'Tutor' button for a one-to-one video conference. A window pops up on the screen and his tutor appears on the window. Jack describes the problem to him. The tutor brings up a shared screen with his slides to demonstrate and explain the solution to him. Jack thanks him, and points at the 'Close' button. On his part, the tutor goes into the web editor to add the new query and the suggested solution to the 'FAQ' list.

As I work on my Internet applications, I begin to appreciate that scenarios such as the above may not be far off.

Conclusion

So, what have I learnt so far, in my interaction with the Net? Certainly, I am increasingly convinced that the Net will be the harbinger of the much talked about paradigm shift in teaching. Internet based education models will become more prevalent as educational institutions seek the advantage of such models to enhance teaching productivity. Internet based distance education (or is it distance-less education!)² programs will become increasingly significant as the Net provides cost-effective opportunities for institutions to break out from the confines of their physical boundaries and reach out to students over a larger geographical area^[14]. Educational institutions, including the Polytechnic, will have to adjust or even re-engineer their educational processes in the face of the onslaught of Information

Technology, global competition, and increasing operating costs.

At a personal level, I foresee that in time to come, I may have to adapt my teaching role to one of a facilitator, as students go about packaging their own learning on the Net. Increasingly, newer generations of students are going to demand technology based learning, as they become familiar with the Net in their respective high schools. As new Internet compatible software and hardware teaching platforms flood the market, I shall be forced to invest much time learning new computer based teaching skills. Fortunately, software and hardware platforms to create and use the Internet are becoming very user friendly, and the skills required to create practical teaching applications are within the reach of a wide spectrum of teaching staff. What may be at a premium is the creativity to come up with instructional content that will spur learning interest. But even this

difficulty can be resolved, as with careful search on the Net, you will inevitably come across interesting teaching resources created and made available by someone from another part of the world, adaptable for your own class use. Such is the Net!

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Appendix 1

Some common Internet terms for the non-specialist:

3-Dimension (3-D) - Ability to view objects and models in three dimension. Several software packages are available to create 3-D models. VRML integrates Virtual reality with Internet.

Authoring systems - Usually applied to computer software programs such as Macromedia-Director, Authorware, ToolBook, Icon-Author etc. which are used to develop Interactive multimedia applications.

Bulletin Boards - Electronic notice boards.

Client-Server - Computer network where some computers are designated as server in that they are repositories on data, programs and information and most other computers are clients, i.e. request, retrieve and process data into information.

Computer Aided instruction(CAL) - Software programs that help the user to learn from the computer.

Computer mediated communication(CMC) - Teaching applications using IT tools, such as Internet tools like E-mail, usenet, on-line chat and video conferencing.

Distributed Tutored Video Instruction(DTVI) - A video conference based tutorial project sponsored by Sun Microsystems and at present being tested out at a few universities in the US.

E-mail -or electronic mail - sending and receiving text and data through the network of computers. At present graphic files need to be attached to E-mail text files. This will change with the impending introduction of picturE-mail, when multimedia can be in-line.

FAQ - Frequently asked questions. An Internet related acronym. A list of questions and answers are provided in hypertext form for user reference.

File Transfer Protocols(FTP) - Internet based systems that allow retrieval or delivery of programs and files to or from geographically distant host computers

Graphic User Interface(GUI) - Windows based software, where one can navigate by pointing at text, icons and pictures.

Hypermedia - Computer-based processing of text, graphics, images, audio and animation. These data are held in frames, and authors define links

between frames.

In-line graphics - Incorporation of pictures and graphics along with text within a document.

Internet TV - TV transmission via Internet. Practicable presently with expensive high speed and telecommunication cables.

Internet-Phone - Using the E-mail address to dial and speak over the Internet. Requires special software and hardware. This technology is still evolving.

Inter-Relay Chat(IRC) or On-line Chat- An interactive conferencing environment. Akin to Usenet discussion groups but more advanced as it allows on-line discussions.

Listservs - Private bulletin boards where only subscribers will get to post and read news.

Mediabases - Databases that hold multimedia data such as video, sound, pictures and also text.

Multimedia - Files or applications that incorporate and intergrate text, pictures, audio and video data elements

Multi-user dimension Object Oriented(MOO) - Virtual reality environment where one can take part in role-play, participate in simulated games and interact with strangers.

Plug-ins - Programs or devices that allow non-internet based software to work on the Internet. For example, Shockwave is a software that allows applications developed on the Macro-Media Director authoring platform to run on the Internet web-browser.

Remote Login or Telnet - A geographically distant client computer can log into a host computer.

Usenet - A large network of bulletin boards classified by topics. Internet services that subscribe to Usenet will constantly receive news-feeds on all the topics that they subscribe.

Unix - An operating system and language on which most Internet based applications are designed and developed.

URL - Uniform Resource Locator , an Internet Web site addressing system.

Video Conference - Several people can participate, visually see each

other and interact in an electronic forum, whilst geographically separated. In Internet, this is possible with software such as CU-SeeMe.

Video-On-Demand(VOD) - The ability to transmit a video program over a telecommunication line. In Internet, with on-going research in data compression, it will soon be practicable to transmit large video file over existing telephone lines. However, for the present, VOD is only possible with high speed, high capacity and certainly costly telecommunication cables.

Virtual cafe or Cafeteria - A virtual environment simulating a cafe. Groups of geographically dispersed users can carry out conversations via computer terminals, probably with coffee served.

Virtual Reality - A non-physical computing environment, where one can assume roles and simulate the real world

Virtual Reality Manipulation Language(VRML) - Programming language that can implement internet based 3-dimension and virtual environments.

World Wide Web(WWW) - A hypermedia system that allow moving from one document or file to another document or file by a click on specific text or graphic in the first document or file. Also, simply known as the Web.

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1 For a brief description of these key-words and other italicized key words or terms in this article please refer to Appendix 1.

2 Distance-less education implies that distance will no more be an issue, as students with-in a campus or those at geographically distant locations will get the same quality education. See ref. 14.

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