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COMPUTER AND INFORMATION LITERACY SKILLS FOR PROFESSIONAL ENGINEERING EDUCATORS

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Abstract

This paper aims to raise awareness of the need for upgraded skills among professional engineering educators in order to keep pace with changes in the global information network. It is shown how extensive resources on the Internet may contribute to research as well as being valuable teaching supplements. A short discussion on the need for a type of "information literacy" that includes "computer literacy" is presented. This paper also briefly presents some background information about the Internet's extensive, and rapidly improving, resources. In the context of the ability to explore the global hypermedia environment, different types of Internet tools and academic usage of the Internet are listed along with different types of information resources.

1. INTRODUCTION

In recent years, the Internet and its glamorous product, the World Wide Web, have introduced radical changes in the direction of knowledge and information dissemination worldwide. The rapidly growing acceptance of extensive Internet resources underlines its potential to make further changes in years to come. Presently, much of the information which academics need to use, both for research and teaching, is no longer available only in the traditional printed formats. The Web has not only exploded the amount of global information but has made possible the use of a wide variety of media files available over the Internet. It is envisaged that the availability of powerful tools such as the World Wide Web inevitably will have a significant impact on how teaching and learning activities are conducted in traditional classrooms, and how this might improve and/or change in the future.

This paper aims to raise awareness of the need for upgraded skills among professional engineering educators in order to keep pace with new phenomenal opportunities that are available for information dissemination worldwide. It attempts to show how the global hypermedia network may contribute to research as well as being valuable teaching resources. The need for a type of "information literacy" that includes "computer literacy" is sug-

gested. The new type of computer literacy has a much wider scope than just the ability of working with some so called "user-friendly" wordprocessors, spreadsheets and databases. It covers the ability to use a variety of computer applications on virtually different platforms in order to find information and then to be able use the information and manipulate it for one's own purposes or tailor it such that others can learn from it.

Many engineering educators may face trepidation in the process of immersing themselves in the new information technology, and in developing the new computer and information skills required to work with different computer platforms and different network related application programs. This has caused some reluctance among many engineering educators to adapt new educational technology, including the Web, as part of their professional development. There is an urgent need to not only provide information on the global network, but also support the educators during the transition time as they become immersed in the technology and learn about the services which might be useful to them. Options such as providing a readily accessible resource person in faculties and providing support through local and regional Internet professional communities are to be considered as viable solutions.

2. INTERNET TOOLS AND ACADEMIC USAGE

The rapidly growing acceptance of extensive Internet resources underlines its potential to further make changes in the direction of knowledge dissemination across the globe. This inevitably will have a significant impact on how teaching activities are conducted in more traditional classrooms, and how this might improve and/or change in future.

The potential benefit of the Internet/Web, as an emerging and new educational delivery tool, has already been explored in many aspects of teaching and learning activities at different educational levels. Examples are: using WWW/Mosaic to support classroom education [1], the establishment of national electronic clearinghouse to enhance the quality of university teaching [2][8], using Web to foster regional and global co-operation among professional educators [3], publishing engineering educational resources on the Web [4], and engineering laboratory courseware delivery using Web technology [5].

It is interesting to remember that the Internet has an origin in the universities where most information is freely and publicly shared. Universities and academic institutions around the world were at the forefront of providing traditional Internet tools and resources during the 1980's. They are still acknowledging their obligations by setting up and maintaining not only extremely useful Web sites but also all kind of traditional Internet services for disseminating research information, teaching support materials, freeware programs and utilities across the world.

2.1 Traditional Tools

Traditional Internet tools and resources can be broadly classified as follows:

Telnet and FTP servers: allowing the user to login to another computer and transferring files from remote computers respectively.

Archie servers that provides a database of anonymous FTP sites and the their contents. Example is the "Archie.au" that lives on the backbone of the Australian Academic and Research Network (AARNet)". This site also provides a large amount of publicly available files as well as mirrors of the most popular overseas archives.

Gopher servers that provides a world wide information retrieval system; allowing users to explore and

retrieve information stored on the initial connection server as well as offering connection to other worldwide information services.

Wide Area Information Services (WAIS) that allows search and retrieval of text or multimedia document files over the network. It enables the user to request a document using natural language and to view the document before transferring.

List/Mail servers and Usenet providing electronic communications among people and electronic bulletin boards respectively.

By browsing the information provided in [3], "Internet Services: Electric Power Systems and Engineering Education Sites", one may find some useful pointers to particular FTP, Gopher, List/Mail servers relevant to engineering education in general and power engineering in particular. Figure 1 shows a sample pointer repository page that lives at the "WWW Archive for Power Engineering Education [3]. There are many other national, regional and global pointer repository pages on the Network.

2.2 The World Wide Web

Unlike traditional Internet tools, the efficiency, convenience and in some cases the speed of the World Wide Web interface seems to be an undisputed fact. For some "surfing the Net", that is browsing the Internet using the Web, is fun and fascinating, to say the least. Web uses a standard addressing mechanism called a "Uniform Resource Locator (URL)" to specify the location of files on local and other servers. This allows the user to access data via all usual Internet protocols and data services. The URL can point to a file that resides on a local system (file://), on an anonymous FTP server (ftp://), on a Gopher server (gopher://), or on a WAIS server (wais://). The URL is also used to point to a Usenet newsgroup (news://) a connection to a telnet based service (telnet://) or a page of hypertext and/or hypermedia information (http://). The interesting concept behind the URL seems to be quite simple: "if it is there, one is able to point at it".

A simple comparison between telnetting to an Archie server with accessing Archie via a Web gateway clearly shows the superiority of the latter. Moreover, providing access to local document files via the Web makes it possible to use the Web as a publishing platform as shown in [4], where different media files as well as simulation and data

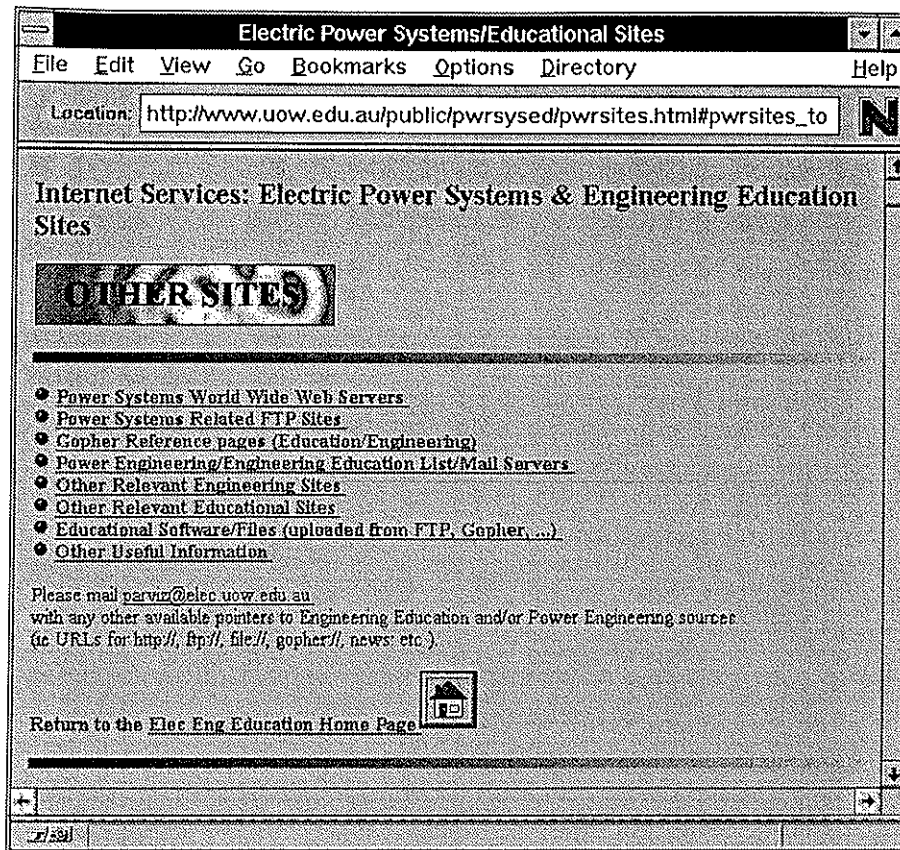


Figure 1: Power Engineering and Engineering Education: Pointer Repository Page

processing programs are integrated (linked) in a meaningful and structured way.

2.3 Academic Usage of the Internet Resources

During the last ten years most academics enjoyed the efficiency, convenience and the speed of personal computing for simulations, word processing and spreadsheet tasks. They also enjoyed an undisputed privilege of having free direct access to the Internet. They have been using Email, Telnet, and at a lower scale other traditional Internet tools such as file transfer protocol (FTP) for many years. Nevertheless, for many academics, especially those involved with so called "less glamorous disciplines", mastering Internet and exploring other avenues available to them is seen to be a big jump from using Email.

A survey conducted at the University of Canberra across six faculties to establish the extent of usage of Internet tools and resources for teaching and research purposes in 1995 [6]. The survey results revealed that

"Email is regularly used by academics on a daily basis. Telnet is used on a weekly basis to access library databases, but most other forms of Internet applications, ie. Archie, Gopher, FTP, WAIS, are used infrequently. The finding that WWW is used infrequently is surprising considering the publicity surrounding the use of Internet generally. Academics use Internet infrequently in delivering and receiving teaching materials to and from students and feel barriers to further use are a lack of time and training."

Table 1 shows academic usage of specific Internet resources in terms of daily, weekly and monthly basis. The figures shown in this table were extracted from the paper entitled "Internet and the academics; use and non-use" by Applebee *et al* [6].

Moreover, an international survey of academic Internet usage conducted by Email and published in 1995 showed similar results. The survey participants were collected from electronic discussion groups (also known as listservers) worldwide. Although the participants were generally more experienced Internet users, the paper showed that the Internet resources were not being utilised as one may expect [7].

Internet Tools	Daily Usage%	Weekly Usage%	Monthly Usage%	Never%
Telnet:				
Access Databases	5	22	25	48
Library Catalogues	8	43	29	18
Campus-Wide Info Service	10	30	35	25
WAIS	2	7	13	78
FTP (Archie)	3	9	13	75
World Wide Web	13	19	15	53
Gopher	5	16	27	59
Listserver	25	9	14	50

Table 1: Academic usage of specific Internet resources

3. COMPUTER/INFORMATION LITERACY REQUIREMENTS

Although "literate" is defined by the dictionary as able to read and write, information literacy is often defined as "having the skills which enable the recognition of the need for information, and the ability to locate, evaluate, and use it effectively". Similarly, computer literacy implies having the ability to locate computer information, understand it and be able to manipulate it.

The University of Wollongong's Information Literacy Policy statement includes the following definition: "To be information literate an individual requires skills which enable the recognition of the need for information, and the ability to locate, evaluate and use it effectively". Information must be seen in its broadest sense as meaning everything from printed words to graphics, animation and software files. The ability to locate information in a variety of formats requires the development of appropriate skills.

In an environment where information is increasingly available on the Internet in electronic format, computer skills become an essential part of being information literate. For educators this means being aware of the type of information available on the Internet and having the ability to locate it, using a variety of tools. This information may con-

tribute to research as well as be valuable teaching resources. Computer skills are part of the key to not only being able to read or view the information but also use or manipulate the information for one's own purpose. For the educator this may mean effectively using the information to create new knowledge which can be integrated into the existing discipline and passed on to students. In doing this the educator develops information literate students who are able to engage in independent self-directed learning through their own broadening knowledge of the world of information.

Students now entering the academic system increasingly have good computer skills gained through school or their experience with a home computer. Many have Internet connections at home. Their expectations of the technology and their teachers are rising. Students are increasingly wanting to know how to evaluate and cite Internet resources as they include them in their written work and projects. Just as educators have needed a knowledge of and familiarity with printed information in their field in order to evaluate and verify references, today's educators also require an familiarity with and understanding of Internet resources. Educators will need their new found computing skills to locate and evaluate these references.

Some educators may be anxious about how they

will be able to acquire new computing skills or the amount of time needed to become proficient in manipulating the information. It is true that time will need to be allocated to developing these skills, however, they should not be seen as an added extra but as essential to the education process.

3.1 Benefits to Education

One of the major growth areas in tertiary education is that of computer-based and computer managed teaching and learning. During the last few years, many projects were funded by governments and private enterprises to change traditional methods of courseware delivery to so called "flexible delivery methods". The Internet accommodates a great variety of engineering resources partly were developed by these projects. It is not too difficult to find a variety of educational video files, animations, text, images and computer aided modules and educational simulation programs in national or global Web, gopher and ftp sites.

The National Electronic Clearinghouse for University Teaching in Engineering [2] is an example of a government funded project. This project announced in 1994 with the aim of enhancing the quality of engineering education by maintaining and publishing relevant, up-to-date and innovative teaching and learning materials. There are also many public domain clearinghouses in all engineering disciplines containing a variety of resources such as tertiary teaching and learning support materials and computer simulation programs.

Engineering educators should be aware of the availability of these resources, and not reinvent the wheel by making use of resources and knowledge of fellow educators. The use of these resources make lectures more relevant to a variety of learning styles. An educator that is aware of these resources has a better opportunity to make students aware of the Internet extensive tools and services, and to encourage students to be more self directed in their learning.

3.2 Benefits to Research

Engineering educators may have traditionally conducted research by searching printed indexes, following references found in bibliographies or through personal contact with colleagues. Research can now be enhanced via the burgeoning resources available on the Internet. Most Australian

university libraries have extended their printed collections by providing access to electronic databases via telnet connections. With time many of these databases are also becoming accessible via a Web interface. The provision of access to many electronic resources has been undertaken with the aim of allowing academics to work directly from their desktops, offices and homes.

Electronic publishing is also increasing, making available a range of full text electronic journals. These electronic journals may or may not have a printed equivalent. Teaching and research institutions, organisations and companies are turning to electronic publishing as a cheaper means of distributing documents, papers, texts, software and other media files. These may be stored on FTP servers or made available via the Web. The opportunity to establish email contact with authors of documents or software files around the world is an additional bonus to research. The ability to take advantage of these resources is reliant on having the skills to locate and manipulate them.

3.3 Strategies for Removing Barriers

The survey completed at the University of Canberra found that the greatest barrier for academics in terms of increasing Internet usage was the time. The major drawbacks in using the Internet resources for educational purposes are the diversities in computer platforms and operating systems. For instance, there are more than 10 widely used formats for static images that are mostly computer hardware and operating system dependent. Similar diversity exists for audio, video and animation files. An educator wishes to explore the Internet and to use new educational delivery tools in his/her teaching and learning activities should invest a great deal of time to get familiar with media files available on a hypermedia environment.

The Internet extensive teaching and learning resources can not be effectively utilised by academics unless appropriate training courses and supports are provided by universities. This will assist academics to constantly develop skills to cope with these new resources. In addition, the availability of a resource person at a faculty/department level would assist in alleviating common hardware and software problems that are related to the use of new educational delivery tools and resources. A development project proposed and funded by the University of Wollongong will be demonstrating the viability and functions of a hypermedia

resource person at a Faculty level. This project delivers a number of sample hypermedia modules to be used for small group demonstration and in-house training of interested staff members in the Faculty of Informatics. It also provides essential support materials required for the usage and development of teaching resources.

Apart from some institutional support and local training courses, the supporting role of professional Internet communities at regional and global levels has to be highlighted, and the establishment of new discussion groups, list and mail servers is to be promoted. Internet-based professional communities have provided support during the transition time as the educators become immersed in new educational tools and learn about the extensive Internet educational resources and services.

4. FINAL REMARKS

Mastering the Internet is a necessity as it will play a more significant role in engineering education and research in the future. This paper shows the extensive resources and information available on the Internet. These resources can contribute significantly towards improvements in engineering education and research at tertiary institutions. A new definition of computer literacy was introduced which incorporates the ideas of locating, evaluating and being able to manipulate information in all of its Internet formats. The results of surveys conducted locally and internationally reveal that there are barriers for academics to master the Internet. A range of strategies for removing these barriers have been suggested.

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