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Using the Internet to teach Health Informatics

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Abstract

Since July 1998 we have been teaching an Internet-based distance learning course in health informatics (http://basil.otago.ac.nz:800). The development of this course and the experiences we have had running it are described in this paper. The course was delivered using paper materials, a face-to-face workshop, a CD-ROM and Internet communication tools. We currently have about 30 students around New Zealand, a mixture of physicians, nurses and other health staff. Some teaching methods have worked, some haven't, but in the process we have learned a number of valuable lessons.

Keywords: Distance learning, Healthcare, Internet, CD-ROM

Introduction

Health informatics is not just information science for health professionals. One definition of health or medical informatics is that it: "Comprises the theoretical and practical aspects of information processing and communication, based on knowledge and experience derived from processes in medicine and health care"[1]. Although it has been said that "Computers are to health informatics, what stethoscopes are to cardiology"[2], computers are an essential part of any teaching about health informatics. As Edward Shortliffe, one of the pioneers of the field has said: "Schools need to look beyond computer literacy concerns to develop formal informatics curricula that meet the needs of future practitioners who will function as users and creators of data and information."[3]. Internet technology is starting to be used in the medical education process in Australia and New Zealand([4],[5]), and increasingly IT skills are needed for good medical practice.

We decided to teach a post-graduate diploma in Health informatics, as a distance learning course to fulfill a number of objectives:

- To increase the number of health professionals in New Zealand with understanding of health informatics principles and computer technology.

- To allow those working in the field, or with interests in this area to gain professional recognition.

- To produce a network of people interested in this field and enable them to work together on research and clinical projects.

- A distance learning, part-time approach was taken to allow the widest possible participation.

- To increase the general awareness of the use of information technology in healthcare, by the production of "local experts" around the country.

From the earliest planning stages we decided that this course would be primarily taught using electronic means. This was done in order to:

- Enable us to use hyperlinks, multimedia and all the tools that computer-based courses can provide

- Make the medium (part of) the message

- Gain experience in this sort of teaching, to fulfil the University of Otago's commitment to flexible learning

- Allow flexibility in the development of the course, so that parts could be re-used or redeveloped for other courses.

- Allow students flexibility in their working pattern, and provide support for different learning styles[6].

Course design and production

Syllabus

The course comprises a number of papers. Each paper lasts for 1 semester (15 weeks), the first two papers 701 and 702 are compulsory, and the others can be chosen from a list of 5. The compulsory papers are: 701- Essential information management skills for health professionals and 702 - Principles of health informatics. Two papers are then chosen from the following**:** 703- Health information systems, 704 - Evidence Based Medicine,705 - Computer -aided learning in healthcare, 706 - Health data management and 707 - Research project. The course leads to a postgraduate diploma in Health Informatics.

Only one paper can be taken per semester and we estimated that a total of 200-300 hours work would be required to complete each paper.

I will describe 701 in more detail, as this has been the course that required the most development effort. 701 comprises 10 modules, each taking between one and three weeks to complete as well as a workshop for all the students at the beginning of the course and a co-operative project throughout the whole semester. The course was based around Microsoft Office Pro 97 and students were expected to use IBM-compatible PC's. This was to simplify support, and to allow the use of MS-Access. The core material was contained on the CD and structured as a series of ten modules.

The modules were Introduction to the course, Introduction to the Internet, Word Processing, Spreadsheets, Databases, Programming in Microsoft Office, Presentation software, Medline 1, Using the World Wide Web for health information and Medline 2 - advanced searching.

Because this course was new, the modules were not recycled from other areas directly but they did draw on other courses previously presented at our university. However they can be used independently and will be in future undergraduate programmes. Although the modules were of similar format they were not excessively constrained to make them identical in appearance or tone. Marks for the Course were assigned between competency tests (60%) and a collaborative project (40%).

Competency tests

The competency tests were designed to use the knowledge that the students had gained from the module, but apply it in a new way, thus demonstrating their understanding, and their ability to apply their knowledge. This is designed to lead to so-called 'active knowledge' [7]rather than rote-learning. Because of their open-ended nature, we did not attempt to mark these tests automatically. This had a major impact on the resources needed for the course but we believe it has a number of advantages over multiple-choice or other machine-markable tests:

- Passing the competency test reflects both skill and knowledge acquisition

- Time spent on the test is also time spent increasing knowledge.

- The students are treated as people able to achieve concrete results - so that their confidence in use of the tools increases.

- Copying is extremely difficult. Cheating, by use of an expert to solve the problems for the student is possible, but this cannot be prevented by any test performed at home.

In addition to the tests there were a number of exercises in each module, these were optional but support and model answers were provided.

Collaborative Project

This project continued during the whole semester. These projects were completed in groups of 5-7 students with a member of the teaching staff assigned to monitor and assist them. The Groups met using voice or text chat at least once a week, and had a common workspace available on BSCW (see below). The marks for the project were assigned as 20% for organisation and planning, 40% for a paper document of 10 pages or less describing the results of the project and the methods used to obtain them, 20% for a PowerPoint presentation about the project and 20% for a set of WebPages devoted to the project.

The project emphasised collaborative working and use of software tools above scientific results or software production. The actual topics we chosen by the students with guidance from the tutors. Project groups were formed by deliberately mixing disciplines, computing ability as assessed before the course started and geographical location. We expected students in the project groups to co-operate using Internet tools, critically appraise each others work and assist each other.

Target Audience

Our target student audience comprised people currently working in the health-care system in New Zealand. We did not want to limit the student numbers by excluding those who had not completed a formal degree programme, as is the case with a large number of nurses and other allied health professionals. New Zealand has recently undergone a series of reforms of it's health service, which is largely government funded, moving the hospitals from being directly funded by the government to

a purchaser - provider split. This has increased the push for computerization of healthcare institutions, for reimbursement and also increased the responsibilities and numbers of hospital and primary -care managers. We received funding from the New Zealand Ministry of Health, as part of their programme to encourage information technology use in the health sector and Capital Coast healthcare (the organisation that runs hospital services in Wellington) as part of its aim to upskill its staff in IT coinciding with the introduction of a new hospital computer system. In the case of the current (first) cohort of students, 57 % are physicians 25% are nurses and 18% are "others "- mostly working in an administrative role within the health system.

Table 1: Delivery systems

Media	Cost/unit	Cost of Development	Ease of revision	Convenience of use
CD-ROM	Low	High	Low	Medium
Text book	Medium	Low	Low	High
WWW Pages	Low	Medium	High	Medium

From the onset we realised that the course could and should not be a reduced version of an information science degree, partly because there would not be time in the course to reach the standard expected of information science graduates, but also because health informatics is a discipline in its own right. We expect our graduates to be able to specify and understand the process of building a health information system rather than be able to build one themselves - although they may progress further if they wish.

Staff

The staff of this course are the authors of this paper. Staff are drawn from a number of disciplines - Clinical medicine (DA and JG), Librarianship (AB), Medical Physics and Informatics (DP) and Information Science (SC). The staff are located around the whole country. Staff communicate by means of Email, BSCW and voice conferencing (see below). We still require a face -to -face meeting once every six weeks or so. Only one staff member (DP) is full-time on the project, the whole teaching, support and development commitment is run on approximately 2.5 full-time equivalents. The different members of staff are employed in different departments of the University of Otago, and also privately contracted to work on the course.

Course development

A top-down approach was used to develop the course material. The practical aspects are covered in the technologies section. Firstly the module titles were chosen, then authors were assigned to each module. They were required to produce component titles and section headings. After review by the other team members, they then added the course text and some diagrams. A particular staff member reviewed this material and at this time the need for animations, videos, hyperlinks to the WWW and example software was determined. The material and other resources were then passed over for editing and printing to the CD the editing process included creation of internal hyperlinks, graphical formatting, production of diagrams and page arrangement.

This edited material was passed back to the module author and reviewer. Changes were then incorporated into the final product. CD-ROM and Web pages were combined as in figure 1.

Technologies

Overview

The course involves the use of textbooks, CD-ROM, WWW pages and Internet communications. In this section we will describe some of the technologies used, the reason for using them and their success or otherwise. We decided on a combination of methods because of the need to provide a mix of media (see table 1).

Course Delivery

Textbook

For the 701 course we used the "Computer confluence" textbook[8].This book was chosen because it was already being used in our undergraduate introduction to computing, covered a lot of the syllabus and provided background material, presented in an attractive and readable format.

CD-ROM

This delivery method was chosen for 2 main reasons:

1) Cost per megabyte is lower than any alternative method

2) A wide range of tools are available to develop courseware.

Material for the CD was first produced in Microsoft Word or PowerPoint, then converted to RTF format and Imported into Authorware.

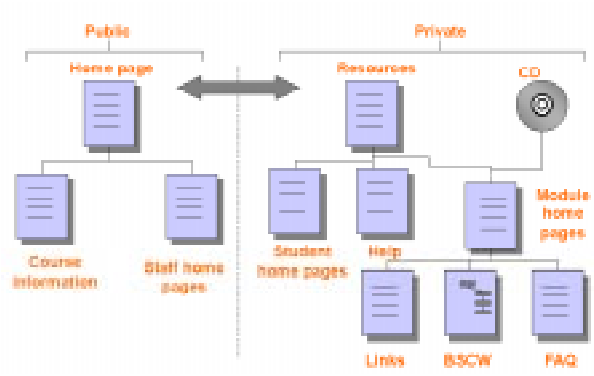

Figure 1: Relationship of the Web site to the CD-ROM

Authorware

Authorware 4.0 (Macromedia) was used to develop the CD-ROM based courseware. This package is reasonably priced for educational use and has a lot of features that support course navigation and structure including text-search facilities. Programming and course arrangement is done via a graphical interface that makes it easy to keep track of the overall design. Persistent graphics and buttons can give a consistent look to the whole presentation. A log file is created records the date and time of every visit to every page of the presentation. This file is used to create a learning journal that presents to the student the material they have viewed as well as how much still remains. We have also incorporated an annotation box, where students can add comments about the page they are viewing. This is especially useful for review purposes, as the annotations can be emailed to the module author or reviewer. We hope to be able to use the log files (with the student's consent) to study the learning process of our students.

WebPages

The relation between WebPages and the CD is shown in figure 1. WebPages have been created quickly in response to problems with software etc. by using Microsoft word and Netscape composer.

Multimedia

We have used relatively little "true" multimedia in this course. This is because of not only cost and time constraints but also for pedagogical reasons. Poorly produced or ill thought-out multimedia courseware is far less valuable in teaching terms than the equivalent time spent on conventional text and graphics. We decided to use multimedia presentations -videos with soundtracks and silent animations, only where we felt a definite educational advantage was being gained. This resulted in around 1 hour of video and 10 animations being produced. This was the single most costly part of the course, over $10,000 (US) was spent in production costs alone, and this material occupies over 500MB of space on the CDROM. Two software tools were used, MSCAM from Microsoft and Director 6 from Macromedia.

MSCAM

This is essentially a screen and commentary capture program for Windows applications. It is supplied free with MS - Office and produces video files in the AVI format. Because the sound quality of the originally recorded files was very low we were forced to follow a multistage process involving a professional sound recording studio, and adding the commentaries using Adobe Premier to produce the final result. This process takes quite a long time, but it was still a great deal quicker than producing animations from scratch. The videos are played on the student's machine directly from the CDROM using windows media player. The sound quality makes a great deal of difference to the overall perceived quality of the video, so we thought this effort was worth it. Shorter videos were much easier to produce, and comprehend than longer ones. We imposed a flexible maximum of about 1 minute for the videos, and limited screen resolution to 640x400 and 16 colours. The videos demonstrated such things as Installing Wizards, Use of FTP, Entering equations in excel etc. A total of 50 videos were produced for 701.

Director

Director 6 (Macromedia) was used for animation production. This was decided because the multimedia research group of the information science department uses it, and we have a number of staff experienced in it's use. It also integrates well with Authorware. The major problems we encountered using director were concerned with integrating it into the CD. Around 10 animations and an interactive crossword were produced using director.

Communication

Communication with the students is what differentiates a course from a textbook. We initially held a three day workshop for all the students so that they could; meet each other and the teaching staff, have a full introduction to the course and confirm that they could install the CD-ROM and use the communication tools.

Synchronous Communication

These tools can be either text or voice based. Video is not a real possibility for us at present because of bandwidth considerations. The tools we have used are summarised in table 2.

Table 2:Synchronous Communication tools

Tool	Type	Number of participants	Cost	Degree of use	Comments
Voxchat (Voxware)	Audio and text chat, half duplex.	Up to 5	Free for up to 5 participants	Used by all staff and students initially	Problems running under Windows 98. Solid and reliable but no longer supported.
Internet Conference Professional (Vocaltec)	Audio and text Chat, whiteboard.	No limit but need 4K per audio connection to server.	Around $40 US per seat plus $unknown for server	Widely used, initially, forestalled by licensing problems	Good product let down by a complicated model.
Conference Room (WebMaster)	Text Chat	Up to 200	$100US	Backup system	A simple web-based text chat system.
NetMeeting (Microsoft) & OnLive server	Text and Audio Chat, Whiteboard, Application Sharing	5 free, up to 25 with licensed server	$2,500 US for 25 seat server educational use. Client free.	Used by all groups in later part of the course	The OnLive server allows multipoint audio via a web interface and H.323 server. A good, reliable product
ICQ (Miribalis)	Text chat	No limit	Free	Used by one group	A very nice text chat application

Asynchronous Communication

The majority of the asynchronous work was done using email, but the University of Otago system does not allow messages greater than 1 MB. Although we set up some conventional newsgroups, the majority of document sharing and threaded discussions took place via a web-based document sharing system called BSCW. BSCW (Basic Support for Co-operative Work) was developed by the German Institute for Information Technology[9]. BSCW is a series of Python scripts that run on an HTML server and allow secure file storage accessed via web pages. With a sophisticated access control system and a rich array of threading and versioning features we present to the students only those areas that they should have access to - discussion groups, a software archive and their project area. The teaching staff has access to all areas that include the definitive documents for the course production, student results and administrative areas.

We are running the NT version of BSCW 3.2, using Microsoft's Internet Information Server 4.

Using the technology

One of the most time consuming tasks in this project has been assessing software and learning how to use it. As Stephen Downes pointed out in his paper to NAWEB '98,[10] proprietary solutions are expensive and prone to inflexibility. However, with major changes in WWW browsers every year as one example it can be seen that software in this area has not yet caught up with the stability of other personal computer software .

Managing audio sessions

The majority of the audio sessions take place with sound quality that is poorer than telephone lines. Simultaneous text chat is very economical of bandwidth and can be used to clarify points or give specific information. Meetings have to be well prepared, with a formal agenda and fairly strict rules about speaking in turns. Silence is taken to mean assent, and we do without the grunts and other noises usually used in telephone conversations.

Document Sharing

By using versioning and attaching notes to documents it is easy to set up a writing and revision cycle amongst a group. Many of the students work late into the night so we can answer their queries the next day, they can read the replies in the evening. Learning to do this sort of collaborative work is an important part of what we are trying to teach.

Future expansion

We hope to be able to take students from outside New Zealand in the near future, and we will be using this material and delivery system for a course in health informatics for undergraduates.

Conclusions

Education is a human and collaborative process. Distance learning is, by definition a more isolated process than traditional face-to face methods. In many ways the teaching staff act as guides for the learning of the students rather than in the traditional role of source of knowledge. However we still wish the course to be more than an animated textbook so the majority of the multimedia interaction is with human's mediated by the technology rather than with Artificially Intelligent agents. There are a lot of similarities between our work and that reported by Hirumi and Bermudez-[11] most especially the realisation that this is a learning experience for the teachers as well as the students. We also agree that more interaction is needed than can be provided by a model that has the educator producing material and the student reading it.

Central to the teaching of the course is the concept of application of knowledge. All the tests are designed to be formative as well as normative. We also believe that a vital part of education is the sharing of ideas between the members of the student body. A human as well as professional and educational relationship has to be built up among the students and with the staff. The workshop, and the ability to communicate with each other in ways that are economical and can fit around the schedule of working students allow this course to offer more than the usual distance learning course, but it still does not have the richness of a face-to-face environment. This is irrelevant because in many cases including this one, the choice is not between face-to-face or distance, but between distance learning and nothing.

The fears of academics that machines could replace them are not borne out by our experience; rather, with the use of technology the human skills of teaching can be extended.

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