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Teaching a Diploma in Medical Informatics using the World Wide Web

Dr Richard Pascoe
Computer & Information Science,
University of Otago,
Dunedin, New Zealand
Telephone: +64 3 479 8321;
Fax: +64 3 479 8311;
rpascoe@commerce.otago.ac.nz

Dr David Abernathy
Wellington School of Medicine
University of Otago,
Wellington, New Zealand
Telephone: +64 4 385 5999 ;
Fax: +64 4 385 5552;
wisdda@mash.wnhealth.co.nz

Abstract

In this paper is discussed the preliminary development of a Diploma in Medical Informatics which will comprise courses offered entirely through the Internet in the form of World Wide Web documents and electronic mail. Proposed use of such educational technology for the delivery of these courses within a distance learning environment is based upon a conversational framework developed by Laurillard (1993) and an associated classification of this technology according to the length to which elements within the conversational framework is supported.

Keywords: Diploma in Medical Informatics, World Wide Web (WWW), Distance learning, Educational Technology

1 Introduction

Medical Informatics is formally defined as "the field concerned with the cognitive, information processing, and communication tasks of medical practice, research and education including the information science and technology to support these tasks." (Shortliffe & Perrault 1990). Medical informatics is an emerging discipline important to clinical medicine and in medical education. Many medical schools are recognising its importance and establishing programmes which attract graduates from a variety of backgrounds: doctors in specialist or general practice, nurses, other health care workers, computer scientists, present and potential health service managers some of whom become future managers of health information systems.

The Diploma in Medical Informatics (DipMI) starting in 1998 is being developed jointly by the Departments of Computer and Information Science, University of Otago and the

Department of Medicine, Wellington Clinical School. The DipMI will be taught in a distance learning environment with participants located through out New Zealand and hopefully internationally. The participants will be expected to have access to the Internet for 2 reasons: first, to gain practical experience of what information technology contributes to Medical Informatics; and second, to participate in the DipMI since an objective is to deliver this Diploma entirely through the Internet using the World Wide Web (WWW), Email, and other such electronic media.

Practical experience of what information technology contributes to Medical Informatics will form an integral part of the program. Medical informatics is concerned with the provision of computer systems and electronic information in health care and particularly with the evaluation and effective use of information technologies. Medical informatics in patient care, research, and education requires a combination of and interface among several disciplines. The difficulties and inadequacies of existing systems can be appreciated by direct involvement, and innovative uses of medical informatics methods and technology explored, leading to better clinical information systems in the future.

Development of this diploma has been guided by three issues:

1. what is the general background of the student. Familiarity with the various student backgrounds is an important issue, discussed in Section 2, when considering the level of detail to include within courses forming the DipMI;

2. what are the students expected to have gained from completing the DipMI. The authors have identified various skills and knowledge, discussed in Section 3, that they believe students should have acquired on completing a Diploma in Medical Informatics; and

3. what are the most suitable educational methods for assisting students from (1) to (2). In particular, those methods most suited to distance learning through the Internet.

Education through the Internet using *inter alia* the WWW is an emerging trend, and this Diploma will be capitalising on the increasing body of technical knowledge and educational theory associated with this trend. In Section 4 is discussed our approach to delivering a DipMI using this new technology to stimulate and educate people in the field of Medical Informatics.

2   Students Enrolling for the Diploma

The authors' expectations of the type of students who will enrol for the DipMI are: doctors in specialist or general practice, medical researchers, medical academics, and present and potential health service managers some of whom become future managers of health information systems. A common requirement for anyone belonging to one of these four groups of is that they must be a medical graduate.

The authors expect that all students will be computer aware; however, there will be markedly different levels of expertise in their use of computers. With this in mind, all students will be expected to participate in a workshop at which fundamental skills associated with accessing the course material will be taught. This is essential since the entire course is based on the use of the World Wide Web. Another result of the varying levels of computer expertise is that a course will be provided within the DipMI to assist those people from any group who need to gain experience and expertise in the use of some standard software packages such as word processing, electronic presentations, spreadsheets, and databases. Another paper will be offered for those people who believe they are sufficiently proficient in these basic computing skills. In this paper, other more advanced skills will be presented.

The DipMI is designed to ensure that each group is given both a general perspective on the field of medical informatics and a perspective relevant to their own medical background. For example, there will be one paper, a medical informatics survey paper, in which everyone will participate to gain a general perspective of the different aspects associated with medical informatics. Other papers will be offered to explain the use of computers in medical research, the teaching of medicine, evidence based medicine, and the management of patient records. Everyone will also be expected to complete a paper which is based on a project in which each student pursues some research of their own interest using their individual background knowledge together with knowledge gained from participating in the other papers. This structure of the DipMI based upon the authors expectations of the background of students enrolling for such a DipMI is summarised in Figure 1.

3   Expectations for students completing the Diploma

Graduates of the DipMI will be able to effectively use computers and associated technology to solve and medical problem when appropriate. This requires that students have a general understanding of computers and associated technology so as to know where solutions may be found and how to select the most appropriate for a given problem.

Graduates will have a good understanding of how to use standard software packages for word processing, presentations, numerical and image analysis, and in particular storage and retrieval of medical data. Throughout the DipMI, emphasis will be placed on use of the Internet for locating resources, including materials for each course constituting the DipMI, and for collaborating with other health professionals.

Graduates will also have an understanding of principles underlying various approaches to information processing. These approaches include artificial intelligence and natural language processing and understanding them will allow students to evaluate the advantages and disadvantages of new medical software packages such as those for processing computer based medical records, drug interaction avoidance, and diagnostic assistance.
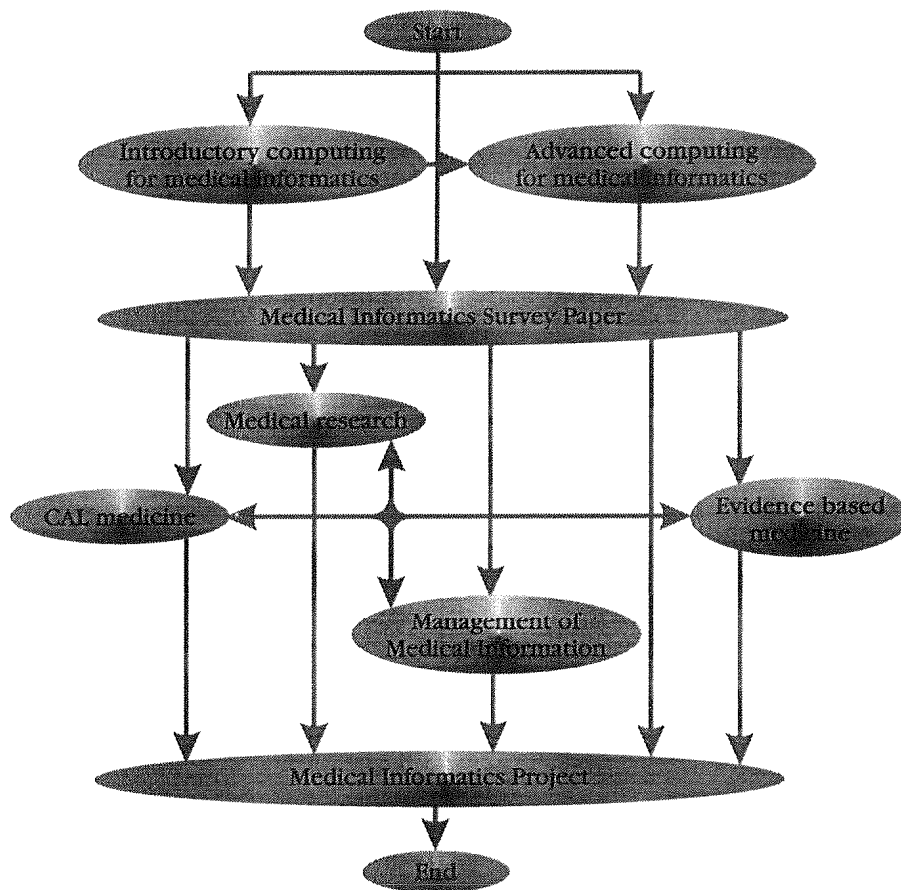
Figure 1: Structure of proposed Diploma in Medical Informatics with arrows indicating possible progression through the various courses constituting this Diploma. Students are required to complete 4 courses to achieve a diploma.
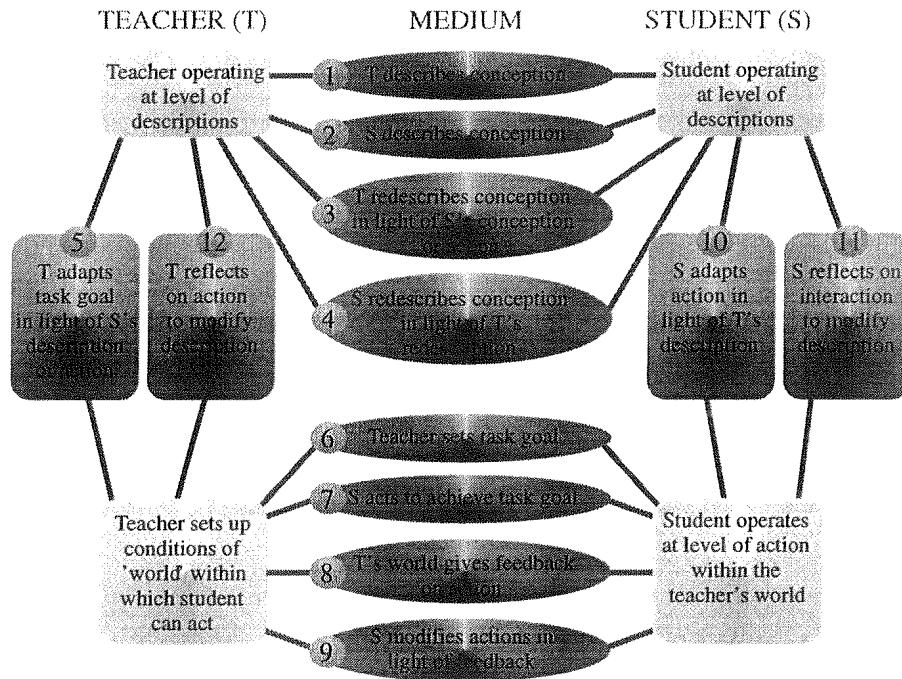
Figure 2: Conversational framework (Laurillard 1993)

4   Use of Educational Technology

As a starting point for developing the delivery of this Diploma, use is being made of a framework for the effective use of educational technology defined by Laurillard (1993). Central to this framework, summarised in Figure 2, is Laurillard's belief that: 'the learning process must be constituted as a dialogue between teacher and student'.

As shown in Figure 2, the framework comprises 12 elements (numbered 1-12) some of which are specific types of interaction between teacher and student, while others are involved with individuals reflecting on feedback of these interactions and adapting their environment accordingly.

New educational technology is being introduced with the use of computers in the learning process. Examples of this new technology include: hyper-media, such as hypertext (WWW) and multimedia, computer simulations, micro-worlds, email, collaborative environments, such that many people participate in discussion through computers, and so on. Laurillard classifies various types of educational technology according to their ability to support the 12 elements of the conversational framework presented in Figure 2. Her classification is summarised in Figure 3.

The observation made by Laurillard from this classification is that some combination of the different types of educational technology is needed to adequately support the conversational framework she believes accurately represents the learning process. To this end, in the next Section the authors describe the combination they have initially chosen for use

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	Print	Audio-visual	Television	Video	Self-assessed questions	Hypertext	Multi-media resources	Simulation	Microworld	Modelling	Tutorial program	Tutoring system	Tutorial simulation	Audio-conferencing	Video conferencing	Computer conferencing	Computer supported collaborative work
1 T can describe conception	✓	✓	✓	✓	✗	✓	✓	✗	✗	✗	✓	✓	✓	✓	✓	✓	✗
2 S can describe conception3	✗	✓	✗	✗	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓
3 T can describe in light of S's conception or action	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✓	✓	✓	✓	✓	✗
4 S can redescribe in light of T's redescription or S's action	✗	✓	✗	✗	✓	✓	✓	✗	✗	✗	✓	✓	✓	✗	✗	✓	✗
5 T can adapt task goal in light of S's description or action	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✓	✓	✗	✗	✗	✗
6 T can set task goal	✗	✓	✓	✓	✓	✗	✗	✓	✓	✓	✓	✓	✓	✗	✗	✗	✓
7 S can act to achieve task goal	✗	✓	✗	✗	✓	✗	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	✓
8 T can set up world to give intrinsic feedback on actions	✗	✓	✓	✓	✗	✗	✓	✓	✓	✓	✗	✓	✓	✗	✗	✗	✓
9 S can modify action in light of intrinsic feedback	✗	✓	✗	✗	✗	✗	✓	✓	✓	✓	✗	✓	✓	✗	✗	✗	✓
10 S can adapt actions in light of T's description or S's redescription	✗	✓	✗	✗	✓	✗	✗	✗	✓	✓	✓	✓	✓	✗	✗	✗	✓
11 S can reflect on interaction to modify description	✗	✓	✗	✓	✓	✗	✓	✗	✓	✗	✓	✓	✗	✗	✗	✗	✓
12 T can reflect on S's action to modify redescription	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✓	✓	✗	✗	✗	✗

Figure 3: Media comparison chart (Laurillard 1993)

in delivering the proposed Diploma in Medical Informatics.

4.1 Delivery Media Adopted for this Diploma

The World Wide Web is an exciting medium through which to deliver a DipMI. The course material can be modularised and then each module can be linked to others containing relevant material. Students can start on any module and, if necessary, follow links to other modules to learn about any background information they have skipped. Thus all modules can be presented at once and students can determine their own path through the modules and can follow this path at their own rate of learning. If the modules contain links to ancillary material beyond the course requirements, students can pursue their own interests in more detail.

Students can form their own descriptions by introducing new links within the WWW documents and by annotating the content of these documents. Providing a facility by which a teacher can view these alterations to the original course material will enable feedback to the student, thereby achieving elements 1-4 of the conversational framework shown in . Figure 2.

The content of a WWW document can be presented in a variety of ways. active graphics, for example, where as the mouse moves across a graphic image explanations can pop up describing components of the image. Use of video, and animation can also capture a person's interest and imagination. Obviously the creative use of Java applets widen even further the opportunities for presenting course material.

Development of this diploma in Medical Informatics is in a very early stage and our adoption of Laurillard's approach to the use of new educational technology provided by computers is an excellent starting point. Over time our own experiences will suggest innovative methods for using an increasing variety of technologies to improve the delivery of the courses and to give the DipMI a character all of its own.

References

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