

ELECTRONIC MODEL FOR INTERACTIVE TEACHING AND LEARNING IN CYBERSPACE: TOWARDS VIRTUAL UNIVERSITY

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ABSTRACT

Education is the most important aspect in human life. However, a lot of people did not pursue their education just because they are too busy and do not have time to attend to higher institutions. Distance learning has inevitably reduces the number, yet many others cannot afford to attend scheduled classes due to other engagements or duties. Fast advancements in computers and communication technologies have created a new environment suitable for teaching and learning known as the cyberspace. In cyberspace, the information could be accessed from anywhere around the globe. When the information is combined with available resources on the World Wide Web, it can provide an interactive environment for teaching and learning. This paper proposed an electronic model for interactive teaching and learning in cyberspace. In addition an intelligent interface to support the model is also discussed. Such a complete electronic model is vital in facilitating virtual university.

INTRODUCTION

Education is one of the greatest investment in developing the country (Wan Mohd. Zahid, 1995). Most people achieve high grades in secondary school, or even in higher institutions at degree levels. Nevertheless, most of them left their educational opportunities to fulfill their current needs and possibly to gain other experiences in the real world. Some of these people however, have high interest in continuing their study. Unfortunately, several constraints such as time limitation, mobility, organization policies, and other factors have discouraged them to do so.

Distance learning was introduced as an alternative for those who are not able to spend their full time in college or university (see for example Qasim, 1995). Students enroll as part time students and therefore required to attend several classes on the weekends or at anytime as scheduled by the institute. The problem arises when the students who are also employers of an organization were assigned to go out station or have to do extra work during the weekends. Such problems could affect the students' grades and lecturers' evaluation. Hence, a new media is required to help the students improve their learning. The media chosen is not restricted to having the latest technology on hand but to make teaching and learning effective (Qasim, 1995). Several alternative systems and media available are radio and television, video recorders and computer terminals. In addition, course materials could be presented in cassettes or VCRs (Video Cassette Recorders) and the communication between the students and instructors could be held between the telephone line. This indicates that the students do not have to leave their office and possibly not required to attend the weekend classes. In this way, they could spend time, working and learning effectively at the same time.

To date, fast advancements in computers and communication technologies have created a fast and accessible medium for teaching and learning, that is the World Wide Web (WWW). The WWW is the universe of network-accessible information where all information from all over the world are gathered and accessed by people around the globe. The cyberspace (another term used) is the total interconnectedness of human beings through computers and telecommunication regardless of their physical geography (Thing, 1999). In this paper, the term WWW and cyberspace are referred to the same meaning that is, to connect human beings from all over the world via the telecommunication line no matter where they are.

The WWW and other information technology softwares such as Hypertext Transfer Protocol (HTTP), Gopher, Netscape Communicator and Internet Explorer could be used to replace the traditional educational system with a new interactive environment (Warendorf and Tan, 1997). Interactive environment referred in this paper is a virtual environment where most of the important interaction in the traditional classroom is preserved. Important interactions include talking or chatting, instructing, discussing and the most important form of interaction is getting immediate reply from the system.

In classroom based learning for example, students have direct relationships and communication between other students and instructors. They could discuss the given topic and the instructors could provide the instructions from time to time and monitor the students' progress. When the students encounter problems they could ask the instructor directly and receive the answer immediately. These interactions make the classroom more "alive".

Computer network could change the learning environment into one that is more interesting and unique (Eisenberg and Ely, 1997). For example, electronic classroom supported by WWW have an advantage over the traditional classroom such that WWW support classroom-based in three ways (Butler, 1995):

- WWW as a tool for bringing the world to the classroom.
- WWW as a tool for supporting classroom activities.
- WWW as a tool for opening the classroom to the world.

Three prominent characteristics of new Internet genres are interactive, personalized and evolutionary (Soft-AEC, 1999). Hence, the characteristics of new Internet genres could facilitate WWW as the medium for interactive teaching and learning.

This paper discusses the teaching and learning in cyberspace, the important interactions and the WWW as a delivery medium. The electronic model for interactive teaching and learning is proposed and highlighted. In addition, an interface between the system and the user is also discussed. The proposed electronic model is vital in facilitating the development of a virtual university.

TEACHING AND LEARNING IN CYBERSPACE

In cyberspace, all the materials or information are accessible from any place or location regardless of their physical geography. For the educational purposes, course material could be made available on the Internet and the students could access the materials from their home, office, cyber café or other places with Internet access. In this case, the accessibility of the material and class attainability is controlled by the student (Owston, 1997).

The characteristics of new Internet genres as mention above could be exploited to promote interactive teaching and learning. The first characteristic, known as interactive focuses on how human and computer interact during the learning sessions. It also focuses on how the human and another human interacts during the sessions. Such interactions are important to promote two-ways communication between the student and the instructor as well the course contents. The second characteristic, that is personalized, focuses on the communications. The Internet and supported software provide two-way networks so that two-way communications could be performed. In addition, the point-to-point and multicast communication are also supported. Thus, the communication is not restricted to an individual but also to a group of people. The third characteristic of the Internet genres known as evolutionary describes the Internet as an evolutionary medium. More appropriate devices will come up and be evolutionary in the sense that their 'look and feel' will be closely related to common non-computer devices or communication act.

One of the success factors of the teaching and learning in cyberspace depends on the instructors themselves. The instructors need to have enough skills and training so that the teaching and learning will be more effective (Owens, 1995). They should have basic knowledge in developing the course materials for the students to access. On the other hand, the students need to have skills on how to use the Internet and have the ability to use these skills effectively and wisely in evaluating the information from an abundance of electronic information to support their learning process (Papenfuse, 1995).

The study conducted by Blumenthal (1996) shows that students with access to Scholastic Network and the Internet excel in finding, comprehending and evaluating information, as well as presenting information and idea effectively. They achieved high scores on measures of information management, communication and presentation skills. The study also reveals that network and Internet access help the students become independent, critical thinker, able to find and evaluate the information as well as able to express their knowledge and ideas in compelling ways. Student skills could also be improved as they keep using and browsing the Internet (DeVoe, 1998; Nomoto et al., 1997).

A study by Klein and Lukka (1998) shows positive effects of WWW as an alternative to students course handbook. The student could access the current and updated information on the WWW. The WWW was also demonstrated as the tool for posting the messages to the students using the electronic or online noticeboard. In their further experiments, WWW has been used to support teaching, learning, assessment and administration. Several benefits have been listed as follows:

- Updated learning materials.
- Absent students could catch up and able to find the notes online.
- Cost saving in reprographic overheads.
- Frequently updating and correcting the course materials.
- Opportunity to access the materials from other places.

The multimedia technology incorporated with WWW has also influenced the students' learning capabilities (Kaplan, 1997). Kaplan indicated that students using multimedia supplements for their course materials did significantly better on tests compared to those who did not use them. However, electronic classroom without any intelligent supported softwares or programs would not be effective. A study has shown that implementation of electronic classroom increases instructors' workloads (Dyreson, 1996). Instructors have to perform additional work, such as replying email, updating course materials and many other work related to the course. This is due to the manual implementation of the system, in such a way that everything need to be done by the instructors. Hence, an effective model for teaching and learning in cyberspace is vital in enhancing the

process of teaching and learning as well as reducing the workload of the instructors.

ELECTRONIC MODEL FOR INTERACTIVE TEACHING AND LEARNING

The proposed electronic model (see Figure 1) for interactive teaching and learning consists of two main components namely the Intelligent Tutoring System (ITS) and the user interface. ITS is a computer program that uses artificial intelligence techniques for representing knowledge and carrying on an interaction with a student (Clancey, 1981). It has been developed as an alternative to Computer-Assisted Instruction (CAI) or Computer-Assisted Learning (CAL) (Jamaludin et al., 1989; Meenakumari and Radhakrishna, 1991). The role of CAI in overcoming the teaching problem is summarized as follows (Butcher, 1983):

- i) Open University teaching is "at a distance". Students learn in isolation and often have little feel for how they are faring with respect to the rest of the course population.
- ii) Despite the fact that tutorials are held in local centers there are still barriers to students receiving individual tuition.
- iii) Computer marked assignments which form a part of most course assessment schemes only provide the students with an overall grade later approximately 2-3 months after they have completed the assignment.

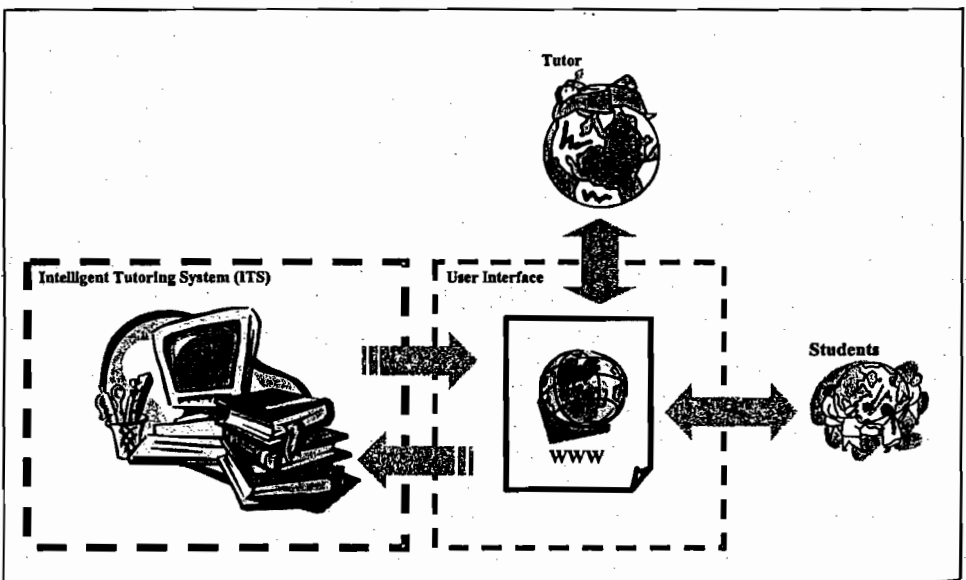


Figure 1: Electronic Model

Even though the teaching problem have been overcome by employing CAI, it does not improve teaching and learning to totally. An intelligent system that can "handle" students, as the human tutor is required. The use of ITS in education can enhance the teaching and learning process (McArthur et al., 1993). Meenakumari and Radhakrishna (1991) suggested that ITS exhibits intelligent in the following ways:

- i) ITS has knowledge of the subject being thought (Domains Expertise).
- ii) ITS has current information regarding the student knowledge (Student Model).
- iii) ITS can articulate the solution or the thinking process and can communicate with the students (Communication Expertise).
- iv) ITS possesses knowledge regarding the pedagogical aspects of teaching and be able to choose the best teaching strategy (Teaching Knowledge Expertise).
- v) ITS has learning capability (Learning Expertise).
- vi) ITS has the heuristic problem solving capability.

In addition, ITS has the capability to diagnose difficulties, misconceptions or lack of understanding and provide appropriate remediation (Kit et al., 1991). Generally, ITS consists of Expert Systems module, pedagogy module, student model and user interface (see Figure 2). The main component in ITS is Expert System (Clancey, 1981; Clancey, 1986). It has the ability in guiding the students to solve problems and measures the students' performance. The interaction between the students and ITS is controlled by the pedagogy module. During the teaching and learning process, the students' levels and their progress are determined using the student model. The asynchronous nature of ITS make them an ideal candidate for use over WWW (Goldstein, 1997). In general, the communication between students and the system is through the interface. Moreover, it is an advantage of ITS for use over WWW without special interface programs (Okazaki et al., 1997). Thus, WWW is an ideal platform for ITS.

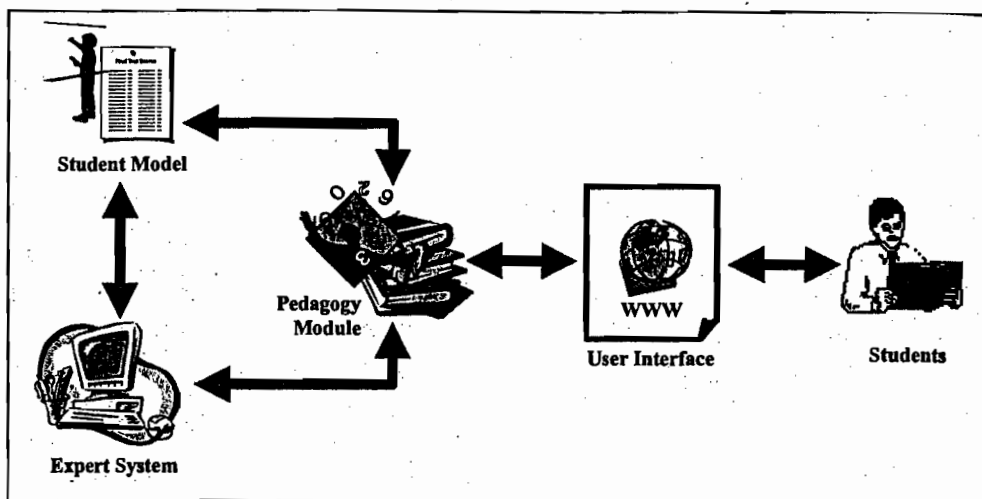


Figure 2: Expert System

ITS provides the students with suitable course material based on the students understanding and performance. It also receives the questions from the students and provide the feedback. It can be viewed as the human tutor teaching the subject and evaluates the students understanding at the same time. However, during the teaching and learning process no human tutor is required. His role has been taken over by the ITS tutor. This means ITS could reduce instructor workload (Koedinger et al., 1997).

In the proposed model (Figure 1), even though the role of the human tutor has been replaced by ITS tutor completely (in the system), human tutor still has to play an active part in the process of teaching and learning. Much of their role however, takes place outside the system. They are responsible in updating the ITS tutor knowledge about the new student information, the course materials and monitoring the ITS performance during the teaching and learning process. In some cases, ITS tutor might not be able to provide relevant answer to a given question. In this case, human tutor has to play their part in providing the answer and at the same time recording the ITS faults for maintenance. Human tutor is required in the proposed model to provide responses that would not be provided by the ITS. In the traditional classroom, interaction between student and other students, the student and course materials and the student and the instructor are not a problem. This feature is incorporated in the proposed model since the interaction is the main component that supports the interactive learning, particularly for learning using WWW (Rieber, 1999; Fadzilah and Wan Hussain, 1999).

Another important feature in the proposed model is the user interface. User interface is a medium where the communication or an interaction is performed. The interface needs to be flexible to deal with any users at different levels and

background. However, the most important aspect of the user interface is to make the user use the system or communicate with the system effectively and comfortably. It is agreeable that the nature behaviour of user interface is a primary determinant of the "friendliness" or "usability" of the systems (Scvaneveldt et al., 1984). Therefore, an intelligent interface is proposed to facilitate the electronic model.

INTELLIGENT INTERFACE

Previous study shows that human computer interaction has the potential to fulfill three key roles in supporting the users (Tylers et al., 1991):

- i) It helps the user accomplish intended goals on the target systems.
- ii) It enables the user to understand how both the target systems and the interface operate.
- iii) It magnifies the capabilities of the user.

Most of the computer systems display icon and menu selection interface to help user use the system effectively. However, in some systems their interface consists of too many buttons or menus. Even though in most of the computer system hot keys are provided for users to select the menus, new users will face some difficulties in remembering the keys and use them effectively. Many users preferred to switch to pointing devices such as a mouse instead of the keyboard to select the menu or button. Switching the devices could be a constraint when the peripherals are not organized. Errors and speed in menu selection interface also increase user's stress (Wallace et al., 1995).

The interface for the proposed electronic model consists of two components (see Figure 3). The first component is the preprocessing module and the second component is the WWW. The discussion on intelligent interface is focused on the preprocessing module that utilizes several artificial intelligent techniques such as natural language processing (NLP) and speech recognition (SR). Intelligent interfaces should make applications easier to use and understand (Bonar and Liffick, 1991).

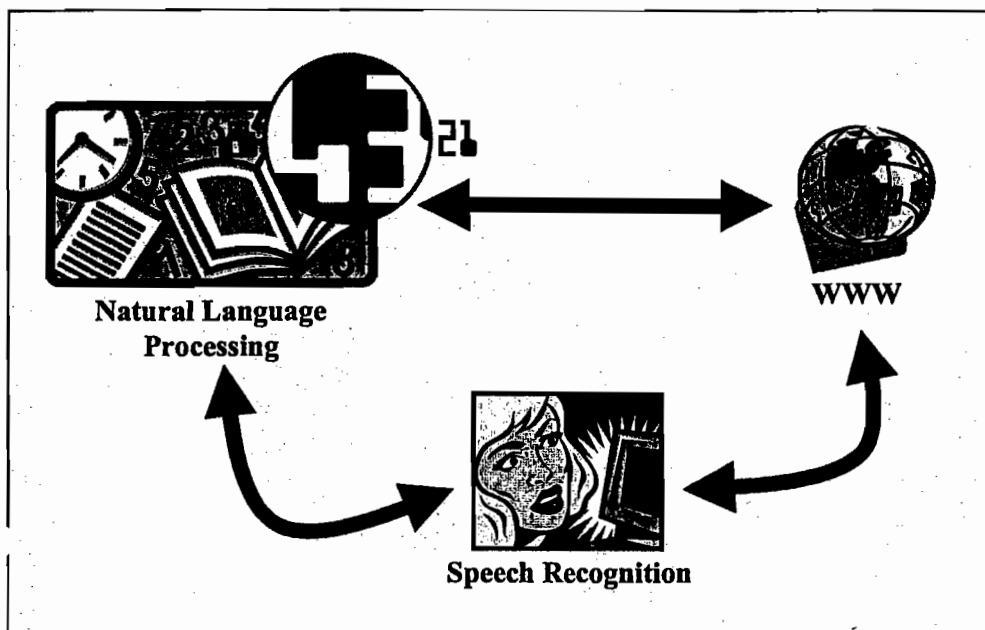


Figure 3: The Preprocessing Module

NLP processes the students' questions by extracting the keywords from the main sentences (Ahmad Zaki, 1987; Ahmad Zaki et al., 1989) and the keywords are then presented to the ITS. Consequently, the SR processes the students' questions presented via voice. The same process as in NLP is then performed before the keywords are presented to the ITS. By combining both techniques, students questions are fed into the NLP if the questions are in textual representation. On the other hand, questions represented by voice will be processed by SR before the NLP processes the keywords. The ITS will reply the student's questions in the same form as the questions were asked. The preprocessing module will convert the answer into textual or voice representations. Such interaction is almost the same as in the traditional classroom. In this way, the keyboard and other pointing devices constraints could then be reduced.

CONCLUSION

As the technology became more sophisticated, an interaction between human and computer will no longer be a constraint. Future direction in human-computer interaction would be wider and more interactive depending on the goals of the system designers (Shneiderman, 1990).

The proposed model for interactive teaching and learning employs several artificial intelligent techniques namely, ITS, NLP and SR. It also exploits the

potentials of WWW as the medium for teaching and learning. By combining the techniques of NLP and SR, teaching and learning process could be further enhanced. ITS performs teaching as the human tutor, evaluates the students performances, provides guidelines and provides the students with relevant feedbacks. On the other hand, NLP and SR process the students' questions and present them to the system. The reversed process is performed when preprocessing module presented the answer or feedback from the ITS.

The interaction promoted in the electronic model would be an advantage in future educational systems. As the system keep monitoring the students' progress as well as managing the communication between the students and other students, the teaching and learning process in cyberspace will become more interesting, interactive and challenging.

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