DELIVERING HEALTH EDUCATION VIA THE WEB: DESIGN AND FORMATIVE EVALUATION OF A DISCOURSE-BASED LEARNING ENVIRONMENT

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ABSTRACT

Constructivist learning theory suggests that important components of the learning process are learner interaction and discourse. The nature of health education is such that emphasis is placed on discussion of health attitudes, beliefs, values, and behaviours as a key instructional strategy. It follows then, that health education learning environments designed using constructivist learning principles and employing instructional strategies that allow for learner discourse and interaction should contribute to knowledge construction and attitude change. The rapid development of the World Wide Web and its increasing use for educational purposes provides a unique medium for such a learning environment.

This increasing utilisation of the Web, particularly in the tertiary setting, allows instructors to explore ways of taking advantage of the Web's potential to provide for learning experiences that go beyond that possible in the traditional classroom environment. Enhancements to the tertiary learning experience that can be realised with Web technologies include: (1) direct access to a variety of international resources on a broad range of topics; (2) access to a learning environment that is not limited to scheduled lecture and tutorial hours; (3) opportunities for a variety of learning activities including small group discussion and collaborative projects; and (4) exposure to and a forum for expressing and discussing different beliefs and attitudes.

However, while a number of tertiary institutions are now incorporating these enhancements with Web pages and Web-based instruction in subjects, there is limited research that demonstrates the efficacy of the Web as an instructional technology. Furthermore, there is little documented evidence of the efficacy of the communication capabilities of the Web in facilitating knowledge construction and attitude change in the area of health education.

This paper describes the development and formative evaluation of a World Wide Web learning environment designed to realise the potential of learner discourse in facilitating knowledge construction and attitude change within an undergraduate health education subject. The theoretical basis for the design of learning activities and a prototype Web environment will be outlined and the methodology, findings and implications of the formative evaluation for the learning activities and interface design will be presented.

KEY WORDS

Web-based instruction, health education, asynchronous communication, discourse-based learning, knowledge construction, attitude change.

1. BACKGROUND

Tertiary institutions worldwide are actively incorporating World Wide Web technology in subject delivery. This Web technology can provide for a number of learning experiences that go beyond that possible in the traditional classroom environment such as: (1) direct access to a variety of international resources on a broad range of topics; (2) access to learning environments that are not limited to scheduled lecture and tutorial hours; (3) facilitation for a variety of learning activities including small group discussion and collaborative projects; and (4) a forum for expression and discussion of different beliefs and attitudes. Such learning experiences, especially the opportunity for learner discourse, are considered important factors in the facilitation of knowledge construction.

While university faculty are exploring how such advantages of the Web can enhance the tertiary learning experience, there is limited research that demonstrates the efficacy of the Web as an instructional technology. Specifically, there is little documented evidence of the efficacy of the communication capabilities of the Web in facilitating knowledge construction and attitude change in the area of health education.

The Faculty of Education at the University of Wollongong has been utilising Web-enhanced instruction and Web-delivered instruction for several years. For the most part, utilisation of Web-based technologies has been implemented in postgraduate subjects, usually in the area of information/instructional technology in education (Agostinho, Lefoe, & Hedberg, 1997; Corrent-Agostinho & Hedberg, 1998).

In an effort to investigate the use of Web-based instruction in the delivery of health education at the undergraduate level, the Faculty has decided to implement Web-based learning activities as part of the tutorial component within its Health and Health Behaviour subject (a core subject for students enrolled in a pre-service teaching Bachelor of Physical and Health Education degree program).

This paper discusses the design of learning activities to be implemented in both Web-based and classroom learning environments; the design and development of a prototype Web environment to facilitate these learning activities; and, the formative evaluation of learning activities and prototype Web-environment.

2. PEDAGOGICAL AND SUBJECT MANAGEMENT ISSUES

Important components of the learning process are discourse and learner interaction. Duffy and Cunningham (1996) define learning as a "social, communicative, and discursive process, inexorably grounded in talk" (p. 181). Dialogue and discourse encourage the higher order thinking skills of cognitive conflict and resolution in providing context and a mechanism for explanation, justification and reason (Oliver, Omari & Herrington, 1997). Learners' interactions with instructors and other learners "give them perspective, place them within a community of learning, and contribute to their mastery of concepts and skills" (Price & Petre, 1997, p. 869).

This essential component of learner interaction and discussion in the learning process focused our attention on learning activities based in learner discourse. As such, the questions that guided the design and development of learning activities and a Web environment for the subject were:

- How do learners participate in and contribute to discourse-based health education learning activities within different instructional environments (classroom and Web)?

- What knowledge, attitude and behaviour changes occur for students who engage in discourse-based health education learning activities within different instructional environments (classroom and Web)?

- What are learners' perceptions of the effectiveness of different instructional environments (classroom and Web) for health education?

The Health and Health Behaviour subject was chosen as an appropriate subject in which to implement a Web-based learning environment and investigate learning outcomes for a number of reasons. History demonstrates that, among students enrolled in this subject, there is typically a range of computer experience from novice to experienced users. This allows us to investigate the true impact of the Web-based learning environment on outcomes for a typical student cohort. Most importantly, the content covered in the subject includes a range of both factual and affective issues related to such topics as disease, nutrition, and health behaviour thus allowing for the utilisation of discourse-based learning activities for which knowledge construction and attitude change could be measured.

Typically, the subject format consists of 14 weeks of two hours lecture time and one hour seminar format tutorial per week. For the initial implementation and investigation of Web-based learning activities within the tutorial component of the subject, the design of the study focuses on developing six weeks (three in each half of the semester) of online learning activities.

It was decided that these online learning activities would be conducted asynchronously. Laurillard (1993) suggests that a pedagogical benefit of asynchronous communication lies in the opportunity for learner reflection as asynchronous learning strategies provide for a high level of learner control in that they allow for the learner to participate in topic negotiation and for the description and redescription of learner conceptions. Other noted benefits of asynchronous communications include learner control of communications (i.e., subject matter discussed, number of topics discussed, speed at which communication about topics occurs etc) (Harasim, 1987, cited in Romiszowski and Mason, 1996; Romiszowski & Mason, 1996); there is the opportunity for self-directed learning (Romiszowski & Mason, 1996) and learner reflection.

2.1 DEVELOPMENT OF LEARNING ACTIVITIES

The first step to developing online learning activities was determining which of the subject topics would be most appropriate. A set of criteria was developed to help identify suitable topics: the health topic would cover both factual and affective aspects; the topic would have the potential to generate discussion among students; the topic would be one for which students might hold a range of views; and, learning activities developed for the topic could be conducted both in the classroom and within a Web-based environment.

The issues of health status and health behaviour are continuing themes throughout the subject with specific health topics related to these themes brought into focus. The first half of semester focuses on classification, epidemiology, risk factors and modes of transmission associated with a number of degenerative and communicable diseases. From those topic areas, HIV/AIDS was determined to be the most appropriate for the purposes of the study. During this first half of session, concurrent classroom and online tutorials focus on: (1) modes of transmission of HIV/AIDS; (2) risk factors associated with HIV/AIDS; (3) behaviour change associated with HIV/AIDS.

The second half of semester focuses on diet and nutrition as it relates to specific populations, weight control, disease, and athletic performance. The selected topics for study during this portion of semester are: (1) food facts including nutrients, food groups and recommended daily intake; (2) food choices including healthy eating and behaviour change; and, (3) body shape and body image.

Once topics were selected, development of the learning activities that could be utilised in both the classroom and Web-based environment commenced. This process included: reviewing the objectives of the subject; conducting a focus group session with health education and instructional technology lecturers within the Faculty; considering past practices and experiences of the subject lecturer; reviewing HIV/AIDS and nutrition teaching resource kits; and, identifying and reviewing Web sites related to HIV/AIDS and nutrition.

Given that the topic of health and health behaviour not only includes knowledge construction but also the exploration of attitudes and behaviours, facilitative learning environments should be such that the learner: perceives relevance in the learning activity; presents and is presented with new information; is presented with messages in a credible manner; is involved with the planning, production or delivery of the learning activity; participates in post instruction discussion; and, experiences a "purposeful emotional involvement" (Simonson & Maushak, 1996, p.1001). Learner-centred approaches such as collaborative group work, cooperative learning, peer teaching, open-ended questioning, idea sharing and reflection allow learners to share and challenge alternative points of view (Duffy & Cunningham, 1996). It is suggested that this occur within learning environments that provide a climate of acceptance that allow for opportunities to build a sense of self efficacy (Hendry, Shucksmith & Philip, 1995; O'Connor & Parker, 1995).

All Web-based and classroom-based learning activities were structured to allow for small group discussion and collaboration. The general format for the structure of each learning activity was to provide a stimulus for discussion in small groups (e.g., a survey to be answered, questions to be considered, etc.) with each group arriving at some consensus or shared understanding that could be communicated to the larger class during the subsequent lecture. In Duffy and Cunningham's (1996) terms, the learning strategy involves a problem which provides stimulus for an authentic activity where knowledge is developed through working on the problem.

3.   LEARNING ENVIRONMENT DESIGN

The objectives for the Web-based learning environment were: to provide necessary information about the subject outline and schedule; to provide access to resources (such as links to external Web sites) pertinent to the subject topics; and, most importantly, to support and facilitate the online learning activities.

A guiding factor in the design of the Web-based learning environment was consideration of the computer and Web experience of the students enrolled in the subject. Based on history with similar cohorts, it was expected that there would be a range of computer experience among the students with the majority having little experience with computers. Additionally, it was expected that there would be a range of Web use experience with the majority of the students having either no or little experience in using the Web. Brown and Thompson (1997) argue that the "interface design must provide ease of navigation, a sense of human interaction, helpfulness and responsiveness to the needs of learners studying in an information rich, self-directed medium." (p. 78) As such, particular attention was paid to constructing a Web environment with a simple structure with embedded communication tools that were easy to use.

The work of other researchers informed the design of the Web-based learning environment. For example, Oliver, Omari and Herrington (1997) have explored the use of investigative activities and scaffolding devices for collaborative learning in a World Wide Web environment. Their expectation that the collaborative environment would yield a high amount of cognitive interaction between learners was not realised. Their experience suggested that a more ideal form of implementation for Web-based learning would include: carefully planning group composition; requiring learners to provide feedback on their outcomes in order to maintain focus and ensure completion of learning activities; introducing learning activities after the learners become familiar with the Web environment; and, employing more adaptive forms of scaffolding for selective assistance.

A number of asynchronous communication tools available for Macintosh Web servers were reviewed in light of these assumptions. It was determined that using FileMaker Pro databases would allow for both a password control mechanism for the site as well as a seamless asynchronous discussion space.

The Web site structure is based on the above-stated objectives for the learning environment and is represented in the subject home page with four main components: (1) the subject outline which provides information such as the rationale, objectives, content, presentation, assessment, and participation expectations for the subject; (2) the subject schedule which provides, in table

format, the week-by-week timetable of lecture topics and tutorial activities; (3) resources and Web links which includes links to a number of Australian and international Web sites related to the topics covered in the subject; and, (4) the Activity Centre which facilitates the learning activities for the students who are participating in online tutorials.

Icons were chosen to represent the four main areas of the Web learning environment. These icons were replicated at the top left corner of the corresponding page and again in a navigational menu bar that appears at the bottom of each page allowing the student to move to any area of the site.

The external links in the Resources and Web Links page were chosen based on: relevance to the health topics covered in the subject; accuracy of information; interactivity; and, availability of Australian and international sources. Annotations were provided for each link to inform the student about the topics and contents of the site.

The Activity Centre was designed using a structure based on the suggestion by El-Tigi and Maribe Branch (1997) that Web-based learning environments should put minimal cognitive load on the student and that templates be utilised in screen design which "promote(s) understanding by allowing the reader to focus on new information rather than devoting time and energy to variations of format." (El-Tigi & Maribe Branch, 1997, p.25). The initial structure of each activity consisted of two or three Web pages including: a 'Things To Do' page; a group members 'Results' page (in cases were a questionnaire served as a basis for group discussion); and, a 'Discussion Area'. For each activity, a single graphic was selected and placed at the top left corner of each page of that activity as a visual cue for students engaged in a particular learning activity.

The Things To Do page (see Figure 1) outlines the activity and provides stimulus to the group discussion. Examples of discussion stimuli utilised in the learning activities include: a questionnaire (e.g., In what situations can HIV be transmitted?) to be answered and discussed by the group; a narrative that provides an example for groups to develop their own story (e.g., for risk factors of HIV/AIDS); and, ask the expert questions that require a group response.
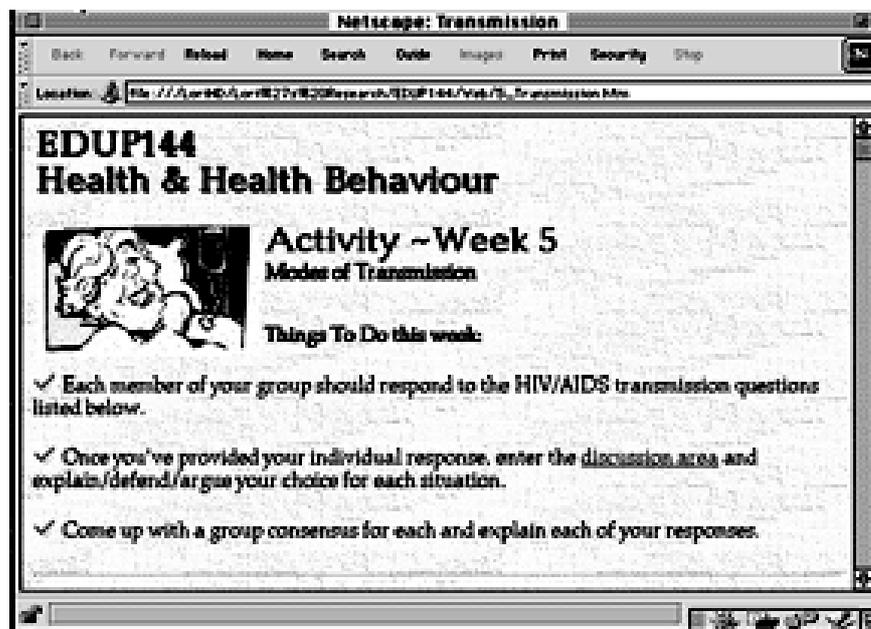

Figure 1: An example of a Things To Do page for the learning activities.

In cases where an online questionnaire provides stimuli to the discourse-based learning activity, results of the individual group members are provided on a separate page (see Figure 2). This facilitates the sharing of ideas among group members and provides basis for their discussion.
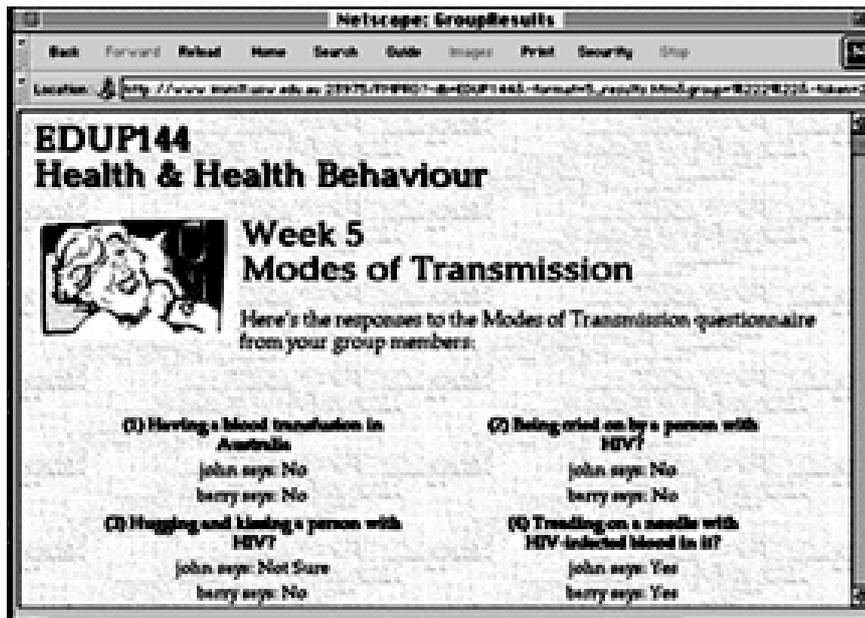
Figure 2: An example an online questionnaire results page.

The Discussion Area (see Figure 3) for each activity is designed to be the focal learning area. The content of the page (i.e., discussion comments submitted by group members) is generated via the FileMaker Pro databases. Thus, the comments are viewable only by group members and are displayed in chronological order on the page. The input box for a new comment appears after the comment which is most recently entered.
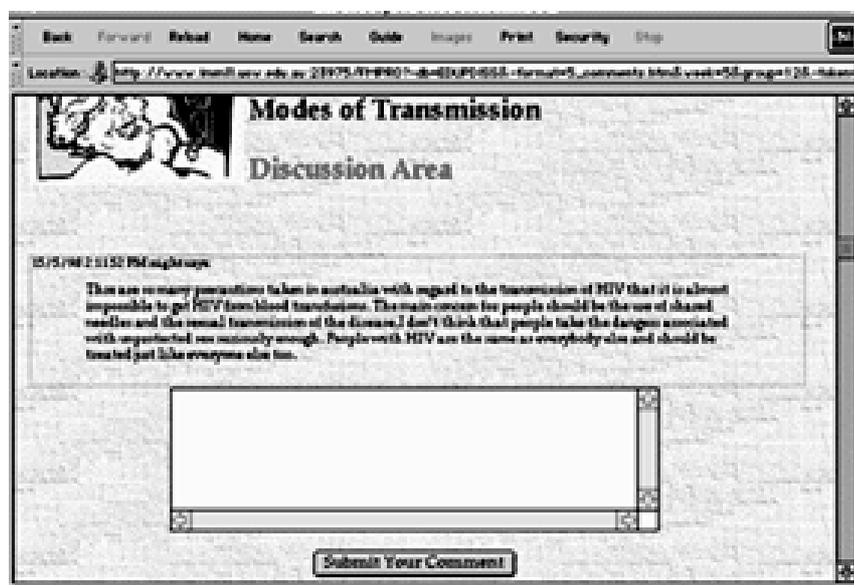
Figure 3: One of the Discussion Area pages in the Web learning environment

Once constructed, the Web site was mounted on the server and tested for technical reliability. When it was determined that the site was technically stable, formative evaluation of the site was conducted.

4. FORMATIVE EVALUATION METHODOLOGY

The formative evaluation of the prototype Web learning environment with embedded discourse-based learning activities involved a multi-staged approach including: review by experts in the areas of health education and instructional technology; review by instructional technology postgraduate students of the Faculty of Education, University of Wollongong; and testing by undergraduate teacher trainees of the Faculty of Education, University of Wollongong.

The health education and instructional technology experts were provided with a list of questions to help guide their review of the Web site. The questions covered: structure and navigation, readability of text, appropriateness of graphics and icons, clarity and quality of information, suitability of external links, and clarity and perceived motivating and discussion promoting characteristics of the learning activities. Once each expert had an opportunity to review the site in detail, an in-depth interview was conducted to collect their responses.

The postgraduate students involved in the formative evaluation of the Web site have a varied teaching background in terms of level and content and are focusing their postgraduate studies on the design, development and evaluation of technology-based teaching and learning materials. They were asked to complete a survey which consisted of the identical questions given to the expert reviewers.

While the expert reviewers and postgraduate students were requested to comment on the potential pedagogical effectiveness of the learning activities, they were not asked to actually participate in and complete the discourse-based learning activities themselves. However, in some cases, reviewers and students did participate in an impromptu group discussion led by the learning activity tasks within the asynchronous communication space. This not only tested the functionality that the Discussion Area would accommodate for students, but, more importantly, provided insight on the type of discussion that might be facilitated through the learning task.

Three classes of undergraduate students were asked to test the Web site for useability. The focus of this aspect of the evaluation was to ensure the site was technically sound and that the site structure, navigation, graphics, and information were clear. Students were asked to fill out a one-page survey of questions regarding: use of the password; navigation within the site; their opinion on the layout, design, graphics; clarity of information; and, ability to complete online questionnaires and make comments within the Discussion Area.

Each expert and student reviewer was provided with an individual user name and password. As such, during full implementation of the formative evaluation, the access control database contained at least as many users as it would during implementation of the Web site for the Health and Health Behaviour subject session. This allowed for an indication of the technical soundness of the database system.

5. FORMATIVE EVALUATION OUTCOMES

The information collected through this formative evaluation is presented in terms of site structure and navigation, quality of information, and learning activities. Generally, feedback regarding site structure and navigation was positive. The structure of the Web site was considered to be clear with the four main components easy to follow. The site was considered to be aesthetically attractive with an unobtrusive background and simple, recognisable graphics and icons and readable text in terms of font type and size.

Reviewers felt that the navigational icons were representative and few technical difficulties were experienced while navigating through the site. A suggested enhancement to the navigational capability of the site was a text-based replication of site navigation bar at the top of each page to make scrolling to the bottom of the page unnecessary. Reviewers also provided positive reactions to the quality and depth of the content within the Web learning environment. The information contained was considered to be clear and easily understood.

The links to external Web sites were considered to be appropriate given the health topics covered in the subject. Reviewers felt that the annotations for each link would provide students with useful information prior to their own exploration of the external Web sites. Some reviewers noted that the external Web sites chosen were detailed in content and dynamic in interactive features. It was suggested that students may become engrossed in exploring these external sites and as such, the subject Resources and Web Links page should clearly suggest that students bookmark the subject site in order to return easily. Some reviewers also suggested the Resources and Web Links page clearly state why the links are provided and if there is any expectation that the students explore the external sites. Additionally, some reviewers suggested including an assessment task for the subject which involves the exploration of the related Web sites.

Finally, the expert and postgraduate reviewers were asked to consider each of the six learning activities in terms of clarity of description and potential for learner engagement. In the main, reviewers felt that the learning activities within the Web environment would motivate participation in a group discussion experience. A number of reviewers suggested enhancements to the clarity of the description of the individual learning tasks. For example, many reviewers asked, "...where are the students to submit their final group product?" Additionally, many reviewers suggested that repeating the 'things to do' list with discussion stimuli on the corresponding Discussion Area page would allow students to easily review the task information while they are engaged in their discussion. These suggestions were considered during the process of revision of the Web learning environment

6.   FORMATIVE EVALUATION IMPLICATIONS

The Web learning environment was revised in terms of structure and content. Some of the general changes to the overall site included: revising the icons that represent the four main areas of the site to have a similar 'look and feel'; suggestions to bookmark on the home page and the Resources and Web Links page; and, replicating site navigation, in text-based form, at the top right corner of each page.

The majority of changes to the Web site were focused on the individual learning activities within the Activity Centre. Specific reviewer suggestions to describe learning activities and tasks in more detail resulted in a clarification of the structure of each learning activity and thus, a proliferation of pages for each activity. Now, each learning activity is associated with five main areas. The 'This Week's Task Intro' page introduces the student to the activity, relates the activity to the specific lecture, provides additional conceptual information and provides stimulus into the group activity by asking the student to respond to some initial, topical questions. Once the student submits their response to these initial questions, they are automatically moved to the 'Group Tasks' page. Here, the student may read a detailed description of the group task for that particular learning activity. The student also has the opportunity to view their responses and the responses of the other members in their group to the initial, topical questions by accessing the 'Individual Responses' page.

The earlier version of the 'Discussion Area' was maintained, however, based on reviewers suggestions, an abbreviated list of the group tasks was added to the top of the Discussion Area page. A 'Submit Page' form (see Figure 4 below) was also added to the structure of each activity as the area in which the group submits their final product.
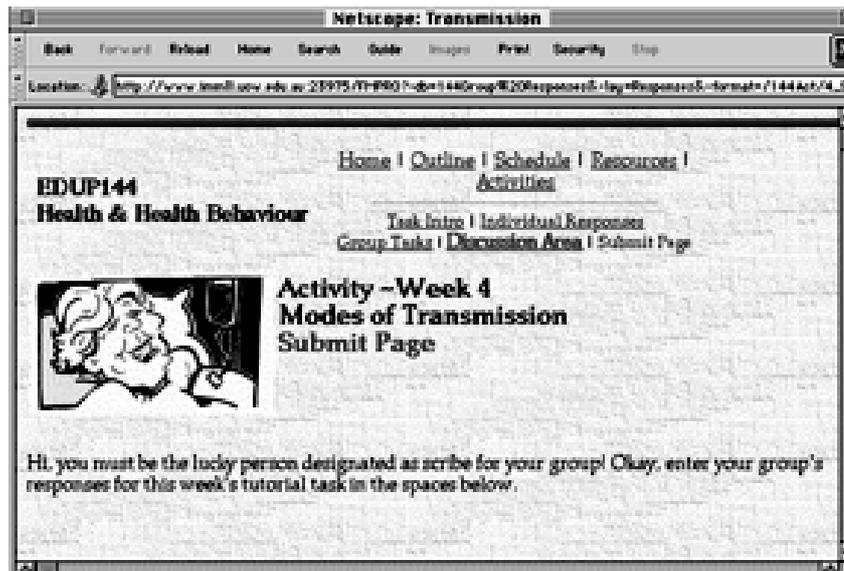
Figure 4: An example of a Submit Page in the Web learning environment

All five areas of the individual activities are available to the student at all times (i.e., students are not forced to follow a particular page sequence when engaging in the activity).

A number of pages were also constructed to assure students that their submissions to the activity (e.g., responses to initial questions, comments to the Discussion Area, and completion of the Submit Page) were successful. For example, when the group leader completes the Submit Page, the site responds with a confirmation (see Figure 5 below).


Figure 5: An example of a confirmation of the group submission to the Web learning environment

Additionally, when any group member returns to the Submit Page after the tutorial has been completed by the group leader, they receive a notice that the group task for that week is complete with a reminder of the group response (see Figure 6 below).
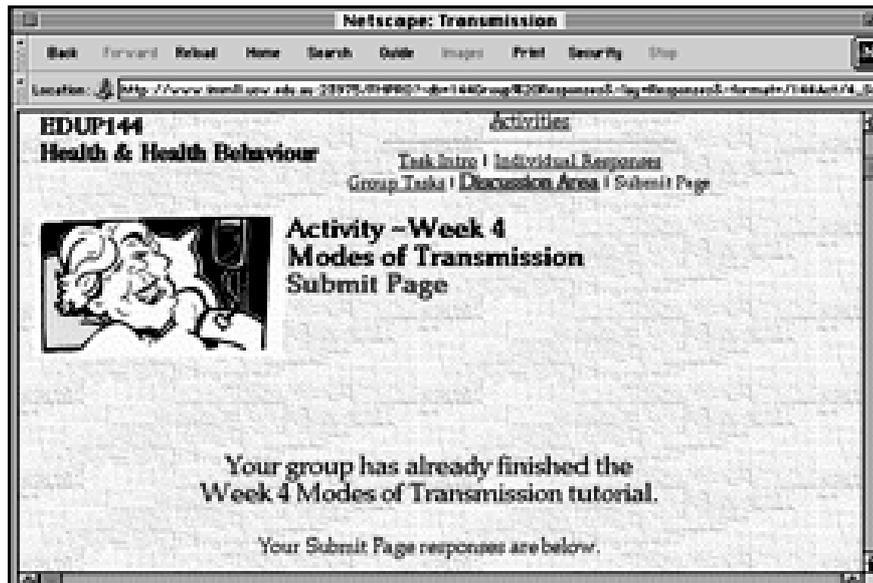
Figure 6: An example of a notice of the group completion of the week's tutorial task in the Web learning environment

The formative evaluation process with health education and instructional technology experts, instructional technology postgraduate students, and undergraduate teacher trainees proved to be invaluable in identifying ways in which the prototype Web learning environment could be enhanced prior to implementation.

7. NEXT STEPS

Implementation of the revised Web environment commenced July, 1998. During implementation, a crossover factorial design was utilised where students were randomly assigned into two groups and each group then randomly assigned to one of two learning environments (face-to face tutorial or Web) for the first half of session. In the second half of session, groups crossed over to engage in the alternate learning environment.

A variety of data collection protocols and tools were developed to collect quantitative and qualitative data. Pre and post tests related to HIV/AIDS and nutrition will allow for quantitative comparison of knowledge, attitude and behaviour changes experienced by students who have engaged in classroom or Web environments. Content and discourse analysis on the recordings of learner discussions during learning activities (via audio tape and electronic Web logs) will provide insight into how students interact to complete learning tasks in both classroom and Web environments. In depth, post implementation interviews will provide an understanding of the perceived effectiveness of the learning environment from the student and lecturer perspective.

The analysis of this data is expected to provide a fuller understanding of: the appropriate instructional strategies for health education at the tertiary level; the efficacy of the World Wide Web in delivering health education; how discourse-based knowledge construction and attitude development is supported in a Web-based learning environment; and, design issues for Web-based learning environments.

8. ACKNOWLEDGEMENTS

9.   REFERENCES

Agostinho, S., Lefoe, G., & Hedberg, J. (1997). Online collaboration for learning: A case study of a post graduate university course. Paper presented at AUSWEB'97, The Third Australian World Wide Web Conference, Southern Cross University, Lismore. Available URL: http://ausweb.scu.edu.au/proceedings/index.html [Accessed July 1997]

Brown, A., & Thompson, H. (1997, 7-10 December). Course design for the WWW - Keeping online students onside. Paper presented at the ASCILITE (The Australian Society for Computers in Learning in Tertiary Education) 97: What works and why, Perth, WA: Curtin University of Technology Western Australia. 74-81.

Corrent-Agostinho, S., & Hedberg, J. (1998). Creating a postgraduate virtual community: Issues for authors and students as authors. Paper presented at Open Learning Australia Virtual Conference: "Online Development: issues for authors and students", March 16 - 27, 1998. Available URL: http://www.ola.edu.au/virtcon/ [Accessed: March 1998][Accessed: May 1998 as archived site]

Duffy, T. M., & Cunningham, D. J. (1996). Constructivism: Implications for the design and delivery of instruction. In D. H. Jonassen (Ed.), *Handbook of Research for Educational Communications and Technology*, . New York: Macmilliam Library Reference USA.

El-Tigi, M., & Maribe Branch, R. (1997). Designing for interaction, learner control, and feedback during Web-based learning. *Educational Technology*, 37: 3, 23-29.

Harasim, L. M. (1987 , cited in Romiszowski and Mason, 1996). Teaching and learning on-line: issues in computer-mediated graduate courses. *Canadian Journal of Educational Communication*, 16: 2, 117-35.

Hendry, L., Shucksmith, J., & Philip, K. (1995). *Educating for Health*. London: Cassell.

Laurillard, D. (1993). *Rethinking University Teaching*. London: Routledge.

O'Connor, M. L., & Parker, E. (1995). *Health Promotion: Principles and Practice in the Australian Context*. St. Leonards, NSW: Allen & Unwin.

Oliver, R., Omari, A., & Herrington, J. (1997, June 14-19). Exploring interactions in collaborative World Wide Web learning environments. Paper presented at the Educational Multimedia/Hypermedia and Telecommunications, Calgary, Canada: Association for the Advancement of Computing in Education. 812-817.

Price, B. A., & Petre, M. (1997, June 14-19). Large-scale interactive teaching via the Internet: experience with problem sessions and practical work in university courses. Paper presented at the Educational Multimedia/Hypermedia and Telecommunications, Calgary, Canada: Association for the Advancement of Computing in Education. 869-874.

Romiszowski, A. J., & Mason, R. (1996). Computer-mediated communication. In D. H. Jonassen (Ed.), *Handbook of Research for Educational Communications and Technology*, (pp. 438-456). New York: Macmillian LIBRARY Reference USA.

Simonson, M., & Maushak, N. (1996). Instructional technology and attitude change. In D. H. Jonassen (Ed.), *Handbook of Research for Educational Communications and Technology*, (pp. 984-1016). New York: Macmillian LIBRARY Reference USA.