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PROJECT REPORT

E-LEARNING IN GEOGRAPHY: AN EXAMPLE OF PARTIAL E-LEARNING IN IN-SERVICE GEOGRAPHY TRAINING.

Chang Chew Hung and George Teh Puan Loon

INTRODUCTION

Much has been said about the potential of e-learning in teaching. E-learning potentially frees the student from spatial and temporal constraints: information can be accessed ubiquitously, and learning can occur at just a 'click' away. Educators and researchers are quickly examining how e-learning may facilitate or even enhance classroom learning (eg. Fabry, 1998; Lynch, 1998; Rada et al., 1996; Scott, 1996). But just what is entailed in e-learning, and what are the most useful "e-technologies"? This article will evaluate a variety of e-learning technologies and describe the process of designing an e-learning training course. The article uses an example of a geography course designed for in-service teachers at the National Institute of Education, NTU. The course design and implementation will be discussed, as well as students' responses and problems encountered. Recommendations are then made for solving these problems.

World Wide Web (the Web) technology has the potential to enhance learning because it involves synchronous and asynchronous information transfer as well as manipulation and retrieval from another geographical location. There is *"growing demand for a 21st century that is independent of time and space, oriented toward goals and outcomes, centred in the student/learner, geared to active [and] hands-on learning"*. (Aaggarwal & Bento, 2000: 4).

E-learning offers the advantages of self-paced learning, visualization, multimedia and hyperlinks to other resources on the Web, as well as allowing constant updating of materials and formative evaluation that is tailored to learners' progress. E-learning "technologies" range from the plain electronic manifestation of printed material to self-contained, highly interactive, communication-enabled and multi-mediated materials.

The course discussed here is an in-service course, "Teaching Selected Aspects of Climatology for Geography Teachers" which was delivered partly through the World Wide Web. In particular, the focus of this article is to examine the design considerations underlying an e-learning approach to in-service education.

DESIGN CONSIDERATIONS

The in-service course was delivered via 12 hours of face-to-face interaction and 18 on-line hours (total 30 hours of contact time) in 2001. The stages in the implementation of the on-line e-learning components follow the process as outlined in Table 1.

Table 1: Implementation of e-learning instruction for in-service course IHS2001.

Stage 1: E-learning delivery specification

1. Target audience is secondary school Geography teachers who have basic web navigation skills and who aspire to further their knowledge in selected aspects of Climatology and to enhance the teaching of these selected topics.
2. On-line course materials provide the content knowledge base which then acts as material for face-to-face class discussions and bulletin board discussions.
3. The on-line courseware is managed by Blackboard™ residing on the Centre for IT in Education (CITE) , NIE server. Access to courseware is through the World Wide Web for registered users with valid usernames and passwords.

Stage 2: Determining the scope of E-learning delivery

1. To enhance the content knowledge and to share and hence enhance teaching strategies of selected topics in Climatology.
2. Delivery of content knowledge is mostly presentational with visual aid (graphics and animations) and some degree of interactivity (navigational features).

Stage 3: Resource summary (specification of all activities that consume resources)

1. The courseware was developed by the first author in areas of content, pedagogical and technical aspects of the courseware development. Technical support staff from the CITE was also responsible for part of the technical and the administration aspects of the courseware development.
2. Web-based materials are developed mainly by hypertext markup language (HTML) scripting and uploaded to Blackboard web-based management system.
3. 100 work hours were planned for the initial development of the courseware to its final revision and its consequent uploading to the server. The actual time taken was, however, 130 work hours. This does not take into account the subsequent maintenance of course material, review of student responses to questions and facilitating of bulletin board discussion.

Stage 4: Content development

1. E-learning delivery content can be outlined under the following sections:
    a. Atmospheric Composition and Energy Balance
    b. Atmospheric Moisture
    c. Atmospheric Motion
    d. Climate Classification
    e. Climate Change
    f. Humans and their impact on Climate.
2. E-learning content is designed with the intention to provide sufficient content material to further the knowledge of the reader and more

importantly to prepare the reader sufficiently for discussion of issues (content and pedagogical) in face-to-face and on-line environments.

3. Materials are presented in a non-linear format in which users can access different sections of the web-based material through the use of an active content navigation bar (by the use of frames).

Stage 5: Prototype

1. Prototypes were created using one of the major sections of the web-based material and sampled by a neutral colleague who was not in the team.

Stage 6: User database Preparation

1. Users were created (usernames and passwords) on the system by the technical support staff.
2. Basic information (like identification numbers) was entered.

Stage 7: Full-scale implementation

1. Implementation of final product on 10 February 2001.

Stage 8: Maintenance

1. Review questions are set at the end of each section for evaluation. Submissions are reviewed and feedback is given to each learner.
2. Update and revise selected sections. Refinement of material is continuous and ongoing.
3. Discussion topics were hosted on the bulletin board.

In *Stage 1*, careful consideration needs to be given to the *target audience*, the *nature of delivery* and the *type of e-learning management system* to be used. Even in traditional, non e-learning courses, instructional design depends heavily on the target audience. It is especially relevant in e-learning instruction design because delivery is at a distance. The nature of delivery refers to how the web will be used for instruction: whether simple electronic versions of lecture notes, or highly interactive multimedia elements. The type of audience targeted and the nature of the course will determine this. For example, we found that presenting lecture notes on the web was useful for the in-service group who had few face-to-face contact hours. The few precious face-to-face sessions were better utilized for laboratory and tutorial work, which could not be conducted on-line. The e-learning management system chosen for this course was the Blackboard™ Courseinfo system, as it is highly flexible yet user-friendly. This system has a free trial available at its website (http://web.blackboard.com) that allows the course instructor to evaluate the system before deciding to purchase it.

In *Stage 2* the concern is with the overall appearance and scope of the on-line course. In particular, it includes the formulation of *course objectives* and deciding how the *content knowledge* will be delivered. In *Stage 3*, the various types of resources used are considered and planned. These include the personnel involved, their skills and expertise, total time taken (in work-hours) and even the software to be used to create the web pages.

In *Stage 4*, the actual *course content* is fleshed out. This is when the research into the course materials is done and integrated into a web-based e-learning format. After the materials are developed, a prototype is *tested* and *evaluated* in *Stage 5*. For our project, a colleague who was not involved with the development

was asked to evaluate the on-line materials.

When data on registered students are available, this is organized in a *student database* with the help of technical support staff; this is *Stage 6* of the course development. In *Stage 7*, the full-scale implementation takes place. *Stage 8*, in our view, is the most important: this stage requires constant *maintenance*—for updating the site, answering queries and facilitating discussions.

COURSE DELIVERY

Although an instructional strategy for e-learning is somewhat different from that for traditional instruction, much can be learned from traditional instructional strategies in a web-based environment. In designing this on-line course we adapted Gagné and Briggs' (1979) approach, selecting nine of their key instructional events to evaluate the e-learning experience. These nine key events are:

- Capture the attention of the learner.
- Describe to learners what objectives are to be achieved.
- Help learners to recall prerequisite learning.
- Present instruction to facilitate the learners' achievement of the objectives.
- Guide learners through the material so they begin to meet the objectives.
- Prompt the performance desired from the instruction so learners meet the objectives.
- Give learners feedback, and make suggestions for improvement as appropriate, so learners sense how well they are beginning to meet the objectives.
- Evaluate how well learners are beginning to achieve the objectives.
- Work toward helping the learners retain what they have learned and apply it.

We will discuss each of these events in relation to e-learning course design.

Capture the attention of the learner

E-learning allows for information to be presented in multimedia. Visual images have many advantages. They may "increase learner interest and motivation," present "inaccessible processes and events" to the learner, "sharpen powers of observation, guide learners to think and make conclusions, present relationships, organize new information, [and] function to integrate facts, skills and judgement" (Chatterjea, 1998). Furthermore, "visual representation can play a role in synthesising information or in identification of concepts as when we need to use diagrammatic and visual forms to communicate information, represent data and show relationships" (McLoughlin, 1997). In our experience, the use of animated visual images has produced positive feedback, and a few in-service learners have requested permission to use the animations in their own classes.

Describe to learners what objectives are to be achieved

This is an important element of e-learning instructional design.

"To design effective instructional materials and choose effective delivery systems, the developer must be able to properly determine the conditions of learning necessary for acquisition of new information and skills. Specification of... objectives facilitates this task" (Gagne et. al, 1992: p.25). Possible objectives of an on-line course

include a description of the goals to be achieved, the kind of solution expected, or the types of questions to be answered. These need to be clearly stated on the web pages to allow the learners to establish their own expectations of the course.

Help learners to recall prerequisite learning

An exercise to help learners recall prerequisite knowledge at the start of a module can be particularly useful. In our case, a pre-course quiz was given to help learners identify their areas of weaknesses in their understanding of Climatology, as well as to help them recall related concepts, strategies and intellectual skills. This feedback helped the instructor to fine-tune the content materials posted on the web.

Present instruction to facilitate the learners' achievement of the objectives

At the beginning of each section, clear instructions have to be given to guide the students through the content materials and activities so that their achievement of the objectives is facilitated. The web has an advantage over print in this respect, for the instructions can be embedded within frames or on buttons.

Guide learners through the material so they begin to meet the objectives

In web-based instruction, material needs to be carefully sequenced so that the students are led to achieve the course learning objectives. For example, in our case, the concepts of pressure had to be adequately understood before a general circulation model of the earth could be presented.

Prompt the performance desired from the instruction so learners meet the objectives

Web-based delivery facilitates prompting. Small buttons that call up different windows of activities can be more engaging for learners than simply reading materials off the web page. Prompts are especially important for higher order learning outcomes, such as analysis and problem solving, when the learners can be prompted to do an experiment or solve a real-life problem. Hypertext web pages offer advantages over linear presentation of information because learners can choose for themselves which pathway they want to explore. Megarry (1989:50) argues that giving the learner more autonomy in choosing how to interact with the information base makes for more effective learning. The kind of self-directed access that web delivery permits is especially important in a learner-centred course, as it permits access *at the point of need*. It also enables students to pace themselves, and to explore issues about a topic of interest more deeply, while spending less time on concepts that are already understood. In this environment learners are less likely to passively mimic what they see and hear from the teacher; they can become "more active participants in the creation of knowledge and meaning" (Brown and Thompson, 1997).

Give learners feedback, and make suggestions for improvement as appropriate, so learners sense how well they are beginning to meet the objectives

Web delivery has a number of advantages for the giving of feedback. Web connection between the learner and the instructor allows real-time assessment. In

our course, all participants had Web access, either at home or at school. This meant some course quizzes could be auto-corrected; other quizzes requiring open-ended responses were reviewed by the instructor asynchronously. This facility enables the number of face-to-face contact hours required for a course to be reduced, as well as time spent traveling. Moreover, feedback can be given to students as soon as they have completed an exercise or quiz.

The use of Discussion Board in the Blackboard system enabled collaborative learning in our course. The Blackboard Discussion Board is fully automated for ease of management and the discussion list is categorized by topic. The written transcript created in on-line discussion enables a collaboratively built knowledge base to be established for each topic discussed. In a message map analysis of interaction patterns on discussion boards, Webb (1989) found that students do respond to the messages of others, adding on and building upon the ideas proposed. The asynchronous nature of on-line discussions lets learners respond at a time that best suits them (Brown and Thompson, 1997), and allows for reflection and further research on the topic before responding. Hiltz (1986:98) found that *time for reflection* was an important factor in learning effectiveness. With Discussion Board immediate clarification can be given when the need arises, and students can learn from "whatever discussion is taking place even though they may not themselves have initiated it" (Brown and Thompson, 1997).

Evaluate how well learners are beginning to achieve the objectives

The web-based management system we used allows ongoing performance to be tracked. Progress summaries can be obtained at any point during the course, and the instructor can fine-tune content materials and activities in response to current performance for the learners' benefit. In our project, review questions based on the progress of the class were posted for each topic throughout the course.

Work toward helping the learners to retain and apply what they have learned

Although on-line discussions have the advantage of allowing discussions to be archived and documented, group dynamics and spontaneity are missing. For this reason, we think face-to-face interaction is still an important part of a web-based course. Class discussions can help learners retain what they have learnt, and group presentations of topics allow students to research beyond what they have learnt from the course, and apply their knowledge in a seminar presentation.

In addition to these nine key instructional events, e-learning presents other advantages. The Web is a rich source of information, much like a set of encyclopedia or a library. Unlike the CD-ROM, which can only hold about 600 megabytes of information, the Web is made up of many machines around the world, and allows almost limitless storage of information. Activities and discussions can be built around this feature of Web-based learning. Participants on our course were instructed to collect materials from other Web sites (some common links to the selected topics are provided on the course) for class discussion.

Since all the participants have Web access either at home or at work, physical space is no longer a constraint: course materials can be accessed from practically anywhere in the country, subject to availability of suitable hardware and infrastructure.

EVALUATION

A general open-ended questionnaire was administered toward the end of our course to solicit students' responses about their e-learning experience. In all, 11 in-service students participated in the exercise. With such a small group, these results cannot be considered conclusive, but the positive responses were encouraging:

- E-learning is media rich and it affords potentially vast range of resources.
- It allows self-paced learning.
- It encourages discussion and consultation.
- It cuts down traveling time and cost.

The negative feedback provided by the respondents gave a good indication of the problems encountered and hence the areas to improve on. Several key problems were brought up during a de-briefing sessions with the students:

- Repeated failed logging-in.
- Problems with saving the course content on the hard/floppy disk.
- Malfunctioning Javascripts™
- E-mail problems on Blackboard™
- Keeping attendance records

The problems encountered were all technical, which imply several things. The problem of repeated failures in logging-in to the Blackboard™ System was primarily due to difficulties with the University server. In fact, the course was moved to another server in the middle of their course. This problem remains unresolved and serves to show how e-learning today is limited somewhat by technical issues. Until these issues are resolved, e- learning will not gain widespread popularity quickly.

The difficulties students had saving course content on hard or floppy disks illustrate the general lack of computing skills among in-service learners. Although a prerequisite of computer literacy was required of all course participants, and all claimed to have basic computer literacy, clearly specific skill requisites need to be stipulated in the future, rather than the general requirement of "basic computer literacy". In fact, 55.6% of the participants subsequently rated themselves as "beginners" in terms of computer skill level.

The problem with Javascripts™ was a software-dependent problem. Some earlier versions of Web browsers are incapable of supporting Javascript™, and a number of participants did not have access to upgraded browsers in their homes/schools. In-service students' limited computer competence was further displayed when some could not identify which version of the browser they were using.

The E-mail function resident on the Blackboard™ system posed yet another problem. Mail delivered through Blackboard took days to arrive at the receiver's mailbox. Students were encouraged to get around the problem

by using their own conventional email systems. This problem has since been resolved.

A key feature of the web is that it allows for self-paced access and learning, and although attendance can be monitored using Blackboard™, keeping a check on attendance is a problem. Just how many log-ins are required and how long should each on-line session be? Users can log-in, go for a cup of coffee, for example, and come back to the terminal later. Blackboard™ automatically logs-out the user after 20 minutes of inactivity, but 20 minutes of 'attendance' is still recorded. Having a reduced log-out time would be impractical, as some web pages might require a longer reading time. Moreover, Blackboard only counts log-ins and doesn't indicate how long each user has been using Blackboard.

RECOMMENDATIONS

Because of the problems encountered during the course, a few recommendations have been made to improve things in the future. Firstly, computer skills prerequisites need to be carefully specified at the beginning of the course. For example, the hardware configurations of the user's computer, the type and versions of browsers and the required plug-ins such as Adobe Acrobat Reader™, FLASH™ or Shockwave™ have to be specified. Once these have been sorted out, other potential problems, like using older versions of browsers and students' unfamiliarity with graphical buttons, will be reduced. This is especially important for in-service teachers, who have varied backgrounds in computer use.

Secondly, an important modification will be to include an orientation lesson (in addition to the intended number of contact hours) to familiarize participants with e-learning course procedures. This is crucial so that participants can troubleshoot potential problems and become more competent using the interface.

The problem of keeping accurate attendance records might be solved by formatting Web pages shorter, and then reducing the inactivity time to automatic log-off. This will ensure that users have to be constantly "clicking" in order to register their access on the page. An improvement to Blackboard™ would be to allow *time tracking* instead of *count tracking*. However, this would still leave the problem of deciding how many sessions should be attended, and how long each session should be. How do on-line hours equate to classroom hours? There may be no answer.

CONCLUSION

Although the e-learning component for the in-service was designed around nine key instructional events outlined by Gagné and Briggs (1979), the e-learning experience resulted in mixed feelings among the learners. Negative responses reflected the technical difficulties encountered. On the positive side, others clearly felt the benefits of the course, and the use of interactivity and animation in e-learning not only facilitated learning, but provided examples for teachers to use in their own classrooms. Of particular importance, the participants found that the partial mounting of the course on the Web enabled them to learn in their own

free time at their own pace, thus releasing a substantial amount of time for other work.

In the final analysis, it can be said that any innovation, whether in e-learning or conventional teaching, should have sound pedagogical bases. To quote Cheah (1997):

> "If [changes] are introduced because they are the latest, and not because they bring about definite improvements in teaching and learning then perhaps we are being trendy rather than informed. There are certainly some practices which we can look forward to eradicating with the advent of computers, [like] writing drafts in long hand..., but we must make sure that whatever works now should be sustained" (Cheah, 1997: 140).

In the rush to be IT-equipped and IT-enhanced, we should not lose sight of the goals of education.

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