REPLACING LECTURES WITH ON-LINE LEARNING: MEETING THE CHALLENGE

[1.]Oliver, R. and [2.]Omari, A.

School Of Communications and Multimedia
Edith Cowan University

[1.]r.oliver@cowan.edu.au

[2.]a.omari@cowan.edu.au

Abstract

This paper describes the design and development of an on-line problem-based learning environment designed to provide a means for creating a converged learning environment for on and off-campus students. The paper describes the environment and the intended implementation strategies as well as results from its initial implementation with a large cohort.

Keywords

on-line learning, World Wide Web, collaboration, student-centred learning, instructional design, convergence, problem-based learning

Introduction

There have been many projects and studies reported previously at this conference where teachers have made use of on-line technologies in their university programs and courses to support teaching and learning. In the main these projects have described innovative applications based around meeting the needs of learners in discrete and small classes (eg. Pennell, Durham, Ozog & Spark, 1997; James & Roberts, 1997; Brown, 1998). We ourselves have previously reported on a number of such projects each of which has informed our practice (eg.Oliver, Omari & Herrington, 1998; Oliver, Omari & Knibb, 1997). Some studies have reported the use of on-line technologies to support large cohorts but often these applications have been supplementary activities to what has been ostensibly a conventional delivery format.

Universities have traditionally used mass lectures as a means of organising the learning programs of large numbers of students. Recently there have been questions asked about the possible use of on-line technologies as an alternative to the mass lecture. Finding alternatives to the mass lecture have not necessarily been driven by a quest for enhanced learning. Many writers argue quite cogently in support of mass lectures as an effective learning activity (eg. Chanock, 1999). Mass lectures provide a means to motivate and enthuse learners and to provide frameworks for the course activities. The lectures provide efficient ways for teachers to communicate with large numbers of learners and for these reasons, many university teachers are quite reluctant to consider alternatives.

Most of the drive behind the use of on-line technologies as a replacement for lectures stems from the inflexibility of the lecture as a teaching method (eg. Chambers, 1999). The lecture necessitates student presence at a fixed place at a fixed time. This inflexibility prevents many learners from participating in courses and programs. The inflexibility also creates many overheads from the equipment and rooming needs associated with housing the event. On the other hand, on-line technologies create opportunities for all learners and it is this feature which has so much appeal to the university administrators (and the innovative teachers). Much of the development and inquiry associated with on-line technologies today is centred on exploring uses of the technology to create converged learning environments, where on-campus and off-campus learners can participate in the same learning program. Such research often seeks to find alternatives to mass lectures and has been an aspect of our development work in the past few years.

Finding alternative to mass lectures

The mass lecture is traditionally used to present information to the learners. In off-campus settings, the content presentation is usually attempted through several different means. A common form is through the provision of written materials which learners are required to read. In many settings the on-campus lecture is broadcast or videotaped and the off-campus learners are able to review the material in their own setting. More recently, developers have taken to creating electronic forms of the content and information delivered to learners through on-line technologies. One major problem with all these forms of delivery is the lack of learner engagement inherent in the presentation methods. In order for learning to be effective, learners need to be cognitively engaged as they process the course material and the traditional replacements to lectures have in the past involved quite passive forms of delivery (eg. Dehoney & Reeves, 1999).

In 1998 we had explored the use of a problem-based learning setting as a means of creating a student-centred learning environment to support converged learning. This study clearly demonstrated to us the potential value of focussed student-centred learning and provided us with a good understanding of the issues associated with this form of learning environment (Oliver & Omari, 1999). But the strategies we had employed were really dependent on having small classes and a small cohort and tended not to have the scalability required for more general use. In 1999 we had the opportunity (and need) to really extend our thinking on the use of on-line learning in our university teaching when we found ourselves teaching a unit with an on-campus enrolment of 250 students. Buoyed by the success of the learning outcomes and student satisfaction achieved with our previous implementations of problem-based learning environments, we set about to design such an environment that could be used with the large cohort. The challenge was to be able to create a scalable learning environment which could be used to implement a problem-based learning approach among a cohort involving a multitude of learners and tutors in both off and on-campus modes of enrolment.

RonSUB

The solution we proposed to our problem was to develop a database driven Web-based learning environment to support problem-based learning. The database elements were planned to enable the system to record, manage and support the interactions of a large number of students and a large number of tutors. The system was designed to support a weekly problem solving activity carried out collaboratively by small groups of students organised into cohorts (workshops) and under the care of a tutor. The resulting system, created using PERL and designed to run on any Web platform centred around 2 main components for administration and student interaction.

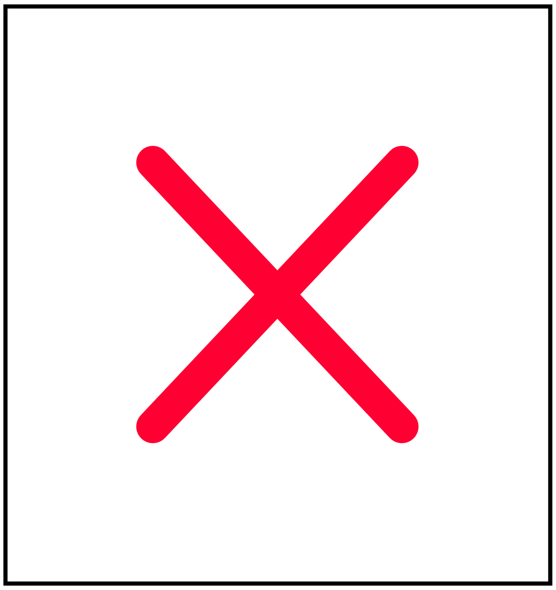

Figure 1: RonSUB System Features

Implementing RonSUB

RonSUB was designed to support a set of problem-based learning activities revolving around a consistent procedure as follows:

- Each week a new problem is presented, the purpose of which is to contextualise and authenticate the weekly content of the course.
- Students work within groups of 3 or 4 to explore the topic, locate relevant information and resources, consider the various options and outcomes and to create a response which is informed and well argued.
- The group posts this solution to a bulletin board, an action which then reveals to them the solutions of the other 4 groups in their cohort (workshop). Each group reads the solutions of the others and through their feedback, the solutions are given a peer-assessed grade. The Workshop tutor also reads the solutions and gives a mark which is added to the peer-assessed grade to give an overall mark for the solution (Figure 2 shows the management component and the marking system in process for a weekly set of postings).
- Students can view the marks achieved each week in a number of ways and this mark accumulates throughout the semester as each new problem is solved.

Figure 2: RonSUB Submission Management Component

The system was built and tested for implementation in Term 1, 1999 in an introductory multimedia unit which involved a theoretical element well suited to the problem-based mode of delivery. The cohort of 230 on-campus and 10 off-campus students were organised into 12 Workshops supported by 6 tutors, all sessional staff at the university. The initial implementation involved 10 problems to be solved across 10 weeks of the course and the results from this activity comprised 30% of the students' assessment for the unit.

The unit was run in the form of a one hour weekly lecture followed by a 2 hour workshop sometime later in the week with the tutor. The lecture traditionally covered the theoretical component of the course while the workshop covered multimedia development activities. The lecture was used to provide an overview for the content of the week and to introduce the new problem. At the same time the lecture was used to discuss the solutions to the previous week's problem. Tutors spent a little time in the workshops each week discussing the solutions posted and how they were assessed. Throughout the semester, the operation of the RonSUB system was investigated to determine how well it could act as an alternative to the weekly lecture. The lecture became a non-essential part of the course since the learning of the theoretical part was undertaken in the problem solving activity. Students enrolled off-campus kept up top date with the course through the course Web page, through communication with their problem solving partners and through inspection of the RonSUB system to see the marks awarded and the solutions of the other groups.

Outcomes

The system ran smoothly and efficiently throughout the semester and students quickly gained comfort and experience in the problem solving activities. The Web server had an enormous number of hits and managed to survive the student onslaught admirably (It was a Macintosh!). The off-campus students merged well with the on-campus students and collaborated and communicated though email. Interviews and questionnaires were used at several times during the semester to explore students' responses towards the alternative learning setting. Interesting outcomes from this inquiry included:

- **Lecture Attendance.** Attendance at the lectures dropped off considerably as the course progressed and students assumed responsibility for their own learning. By the end of the course only 25% of the students were attending lectures and most of these claimed to be doing so through interest rather than through a perceived need.
- **Task Completion.** Students tended to spend considerably longer on the problem solving tasks than had been anticipated. Some students calculated that they spent in excess of 3 hours per week on each activity.
- **Task Difficulty.** The majority of students felt that the problem solving tasks were not overly difficult and felt that they had improved significantly in their ability to seek information and to construct answers by the end of the semester.
- **Groupwork.** The students were quite positive about working in groups and in the main felt that they benefited from the experience and the majority expressed a willingness to work more in groups in future courses. There were some students however who would have preferred to work alone. The majority of these were the mature age students who felt at times that they were at odds in terms of their expectations and values with their younger counterparts.

- **Active Learning.** The majority of the students claimed to learn more from active participation in the learning experience although the group was divided relatively evenly in terms of their preferences for learning. Forty percent of the group indicated that they prefer to be taught than to have to learn for themselves although when made to learn for themselves, they claimed not to find this overly onerous.

Factors critical to success

As we move to further refine our use of this web-based system in new courses, it is interesting to reflect on what was found in this activity and how this can be used to our advantage in subsequent implementations. The factors that we found in this initial implementation to have a positive effect on the success of the activity included:

- **Integrated Assessment.** Much of the enthusiasm and energy the students derived for this activity was obtained from the fact that their solutions were assessed each week and the marks received were aggregated to form a significant part of the assessment for the unit. The strong motivation students derive from assessable activities played a large part in ensuring students' active and interested participation. Students were offered an examination as an alternative form of assessment for this component of the course. The cohort was unanimous in its preference to this form of integrated assessment over the exam format.

- **Problem Choice.** The subject and nature of the weekly problem also was found to influence the way in which the task was undertaken and the amount that was gained from the activity. Open-ended problems with broad solution spaces were useful to orient student inquiry but such tasks tended to reduce the burden on the learners to synthesise and distil answers from a corpus of information. As the term progressed it was evident that good problems had to involve a blend of open-ended-ness coupled with a high degree of specificity to enable the quality of the solution to be judged and for the different solutions provided to be compared and measured against each other.

- **Tutor Support.** As the activity progressed, it was evident that strong tutor support was a very important factor in ensuring the success of this project. All tutors needed to meet tight deadlines in terms of their marking of student solutions and had to provide informed feedback to help students see the ways in which their various solutions were graded. Not only was the continual and sustained support of the tutors essential in keeping the problem-based activity running smoothly and keeping all students feeling comfortable and satisfied with the assessment procedures, their help was needed to keep all students working collaboratively and cooperatively from week to week.

- **System Infrastructure.** This success of this project rested heavily on the reliability and performance of the computing infrastructure supporting the RonSUB software and the WWW connectivity. With 240 students using the system, and in excess of 25,000 hits per month to the server from this activity alone, unreliability had the potential to severely hamper the project's success. The infrastructure failed on several occasions but not at times which were critical. It was clear that system failure was not a feature that students could deal comfortably with and had the system been unreliable, much of the interest and enthusiasm (and tolerance) would have been undone very quickly.

- **Process Organisation.** The process organisation for the system needed to be firmly planned and implemented. It was clear from the outset that the processes involved in this learning setting were totally different to anything the students had experienced before. For that reason students needed to have a very detailed and accessible set of instructions and resources to ensure that they knew what to do and when to do it. At the same time, the processes had to ensure that students had access to the resources needed to complete the tasks. In instances when students were found to be uncertain or unsure of what had to be done, they were completely at sea. The process organisation in this project benefited from a firm weekly timetable and consistency in terms of what had to be done and when throughout the semester.

- **Resource Access.** Any problem-based learning environment requires students to have access to a variety and depth of resource material. Texts and print-based library resources tend to be finite and with large numbers of students exploring similar areas of inquiry can be exhausted quickly. The Web provides access to a vast array of resources for technology based studies but much of the information is concealed and needs to be discovered. We implemented our system with a resource sharing bulletin board which enabled students post and share Web resources. This feature was of great benefit to all and helped to reduce some of the burden associated with resource locating and access.

- **Flexible System Design.** The RonSUB system designed for this project underwent a series of iterative improvements throughout the initial implementation. The flexible design of the system enabled the improvements to be made seamlessly and without interruption to the process. The use of database systems design was the key to success here and significant changes were made to the system during its implementation without mishap or problem. The process we encountered suggested to us that those implementing similar systems should consider keeping their programmers on the payroll during the initial implementation to enable and encourage improvements when they arise.

Factors impeding success

There were also a number of aspects of the design and implementation which were unanticipated and which acted to limit the outcomes from this project in a number of instances.

- **Collaborative Groups.** The composition of the student groupings was an important factor in determining how well the group cooperated and the degree of harmony and satisfaction felt by members in this collaborative activity. Since all students in the groups shared each others' success (and failures), it was important for the groups to be relatively cohesive and cooperative. It was clear that groups needed to selected in a manner which supported homogeneity as much as possible. We found when we mixed school leavers with mature age students, there were often large discrepancies in values and work habits. We found when we mixed part-time students with full-time students there were problems with meeting times and task sharing. In almost al instances where groups had problems working together, the heterogeneous nature of the group appeared to be a factor in this. In subsequent implementations, we will be endeavouring to form the groups so that there is more rather than less homogeneity in the make-up.

- **Course Attrition.** The use of group-based activities relies heavily for success on the ability of the group to stay together for the duration of the semester. In our previous group-based projects run with 2nd and 3rd year students, the projects had maintained their groups and the outcomes had been positive. In this project run with many first year students, drop out rates were significant and this often left depleted groups. It was evident that when projects of this nature are run with first year cohorts consideration must be given to

- **Group Size.** When the project commenced, we had no real concern for the size of the groups that were formed and set a maximum of five students and a minimum of three. In running the project, it became clear that 5 was too many and that three was too few students. Groups which had 5 members tended to leave one member overworked. The group seemed to be too big to enable the members to share and work together. The groups of 3 quickly became groups of 2 as a result of natural attrition and the two students tended to find themselves overworked as they attempted all parts of the problem solving process from one week to the next.

- **Peer Assessment.** To encourage students to read each others' work and to encourage reflection and analysis as part of this process, we created a peer-assessment component to the assessment. Each group was required to choose the best solutions other than their own and through a voting system were able to mark each others' work. This system was the cause of a great deal of discontent among students. It was found that many markers used the results of previous weeks in a negative way to ensure the system was fair and working for all. The better groups found themselves being voted out of their top places by groups wishing to see more egalitarian outcomes. Since the peer assessment carried equal weighting to the tutor's mark, it was possible for this to cause significant disadvantage to some groups. To overcome this problem requires the tutor mark to be weighted more heavily and this will be a feature of future implementations.

Summary and conclusions

The feedback and findings from this implementation of RonSUB have left us very positive about future implementations. The system worked well for us and left us with little doubt that it could be scaled for use with 600 students. The learning outcomes were very positive although these have not been reported extensively in this paper. Student feedback showed strong levels of support for what we know is a far more effective form of learning environment than the traditional lecture and there appeared to be few costs to be borne by either staff or students in achieving these learning gains. It is our intention to further analyse the data gained from our first trials to more accurately pinpoint the learning enhancements that were achieved.

Perhaps the most important outcome from this paper is the interest it will spark in other teachers. The software that we used was designed to run on any Web server. It was designed in a flexible manner to enable a teacher to customise the setting to their own needs. For example, to choose the number of students and cohorts, to set new problems, to choose different assessment schemes. We have prepared instruction manuals for both teachers and students in PDF format and are keen to share all these resources with any interested parties. It is our hope that some teachers will find this approach appealing and would be keen to attempt a similar activity in their own setting. We are offering our software and resources free to interested people and invite interested teachers to talk to us. Our judgement of the success of this and other projects is not only the results we get in our classrooms, but also the results we can help other teachers to achieve as well. (And we have lots of other goodies to share as well!)

References

Brown, C. (1998). Generic class management strategies for an education lecturer in information technology. In R. Corderoy (Ed), *Conference Proceedings ASCILITE'98.* Wollongong, Australia: The University of Wollongong. (pp 107-120).

Chambers, P. (1999). Information handling skills, cognition and new technologies. *British Journal of Educational Technology, 30*(2), 151-162.

Chanock, K. (1999). One good thing about lectures: They model the approach of the discipline. *The Journal of General Education , 48*(1), 38-55.

Dehoney, J., & Reeves, T. (1999). Instructional and social dimensions of class web pages. *Journal of Computing in Higher Education, 10*(2), 19-41.

James, P. & Roberts, I. (1997). Using Lotus Domino and Notes to provide an electronic communication intranet environment for tertiary science students and staff. In R. Kevill, R. Oliver & R. Phillips, (Eds.), *What works and why: Proceedings of the 14th Annual Conference of the Australian Society for Computers in Tertiary Education*. (pp 292-305). Perth, WA: Academic Computing Services.

Oliver, R. Omari, A. & Stoney, C. (1999). Collaborative learning on the World Wide Web using a problem-based learning approach. In (J. Chambers Ed.) *Selected Papers from the Tenth International Conference on College Teaching and Learning*,. Jacksonville: FCCJ.

Oliver, R. & Omari, A. (1999). Using on-line technologies to support problem-based learning: Learners' responses and perceptions. *Australian Journal of Educational Technology, 15*(1), 58-79.

Oliver, R. & Omari, A. & Herrington, J. (1998). Developing converged learning environments for on and off-campus students using the WWW. In R. Corderoy (Ed), *Conference Proceedings ASCILITE'98.* Wollongong, Australia: The University of Wollongong. (pp 529-538).

Oliver, R., Omari, A. & Knibb, K. (1997). Creating collaborative computer-based learning environments with the World Wide Web. In R. Kevill, R. Oliver & R. Phillips, (Eds.), *What works and why: Proceedings of the 14th Annual Conference of the Australian Society for Computers in Tertiary Education*. (pp 444-449). Perth, WA: Academic Computing Services.

Pennell, R., Durham, M., Ozog, C. & Spark, A. (1997). Writing in context: Situated learning on the Web. In R. Kevill, R. Oliver & R. Phillips, (Eds.), *What works and why: Proceedings of the 14th Annual Conference of the Australian Society for Computers in Tertiary Education*. (pp 463-469). Perth, WA: Academic Computing Services.