

Better than sliced bread: An evaluation of on-line delivery

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The Internet has been adopted by an increasing number of Tertiary Institutions as a mode for Unit and course delivery. In many instances Web-based instruction replaces synchronous modes of delivery typified by face to face lectures and workshops with asynchronous modes such as the World Wide Web and e-mail. The effect of this paradigm shift on the role of the learner is critical but has yet to be investigated.

Introduction

There have been a number of influences driving universities to consider *flexible delivery* as a major focus of teaching and learning. Flexibility delivery has the potential to make life long learning more student focussed. It promises access for a wider group of students by meeting a variety of individual needs including the need for greater control by the student over the time, place and pace of their studies. (Bell & Lefoe, 1998) Communication technology developments have made it convenient for Tertiary institutions to adopt the Internet as a primary mode for unit and course delivery.

At one extreme the Internet is the environment used to present the whole of one or more units in a course. In this case a Web site becomes the *virtual campus*: "an institution or set of institutions, engaged in a delivery of degree granting programs in higher education, using technology and methodology outside a traditional classroom" (Lippincott & West, 1997, p 5) At the other extreme, a Web site may be used to support learning by providing *on-line resources* or the tools for on-line discussion. In between these are *converged learning environments* (Oliver, Omara & Herrington, 1998) which use components of the World Wide Web to create environments in which there is little apparent difference for those studying on or off campus.

Australian Catholic University (ACU) is a multi site institution with campuses in the Australian Capital Territory, New South Wales, Queensland, and Victoria. Prior to 1998, the School of Education in New South Wales offered two cross-curricula Information Technology units to Master of Education (Curriculum) students. The delivery mode was face to face on one Sydney Campus. It was difficult to attract sufficient numbers to make the units viable. These units are now offered by on-line delivery to larger cohorts of students from all campuses across the University. Students from New South Wales, Australian Capital Territory, South Australia and Northern Territory as well as from Brunei have successfully completed the units.

Recently our Head of School was talking with one of his Master of Educational Leadership students who was also studying both of the on-line units. When asked what he thought of the unit he stated "Better than sliced bread". Generally students are very happy with what is being offered and how it is being presented. The effect on the role of the learner of this paradigm shift from traditional modes of study to an on-line environment is critical but has yet to be investigated. The purpose of this study is to report on the this ongoing investigation into the role of the learner in this paradigm shift within the School of Education.

This paper reflects firstly on how the Internet has been adapted for learning. To do this, it explains what is meant by Web-based instruction (WBI) and provides reasons for its rapid expansion. It discusses some of the issues raised by researchers to evaluate its effectiveness. Secondly, data collected during the first study period for the two units are examined in an attempt to assess how student learning has been affected by on-line delivery of these units. Finally the paper provides some principles for the successful expansion of on-line learning at a post graduate level.

Adapting the Internet for learning

Web-based Instruction

We have adopted the following definition of Web-based instruction (WBI).

Web-based instruction (WBI) is a hypermedia instructional program which utilizes the attributes and resources of the World Wide Web to create a meaningful learning environment where learning is fostered and supported. (Khan, 1997, p 6)

WBI systems have *components* which are integral to them (Banathy, 1992) These *components* contribute to the various characteristics or *features* of the learning system. Khan (1997) lists a number of *components* of WBI. These include content development, multimedia, internet tools, computer storage devices, connections and storage devices, authoring programs, servers, and browsers and other software applications. These contribute in various combinations and ways to produce the *key features* of WBI such as interactivity, multimedia, on-line search and multiple experiences which are inherent to the web and are essential ingredients of WBI. The *components* also contribute to a number of *additional features* such as convenience of use, on-line support and cost effectiveness which are dependent on the quality and sophistication of the system.

In WBI, the synchronous (time dependent) *features* of traditional face to face lectures and workshops may be replaced with asynchronous (non time dependent) learning and communication *features*. The asynchronous print and video based features of traditional distance education may be replaced by a different set of asynchronous *features* including interactivity, on-line search, global accessibility and convenience. The *features* of the WBI system will depend on the instructional model developed for the particular learning material and the intended audience.

Influences driving Web-based instruction

There are a number of influences driving the expansion of on-line delivery of courses and programs of study. These are based on economic, commercial and educational considerations.

The West Report (1998) is clear that communications and information technologies (CITs) will revolutionise university teaching by providing *virtual universities*. According to West, increased access to the Internet will allow the delivery of enhanced quality, low cost virtual courses, especially in introductory units where subject matter is fairly standard across institutions. Academics have challenged the data used to justify the claim for its cost effectiveness. Ryan (1998) cautions that until all of the benefits and costs of on-line learning are factored in then these claims for cost effectiveness can not be supported. While the pervasive use of the Internet provides the means to "break the grip of the print, the boredom of the lecture theatre and the tyranny of distance" (Walker, Lewis & Lasky, 1996, p 33) it is more likely that academic administrators are guided by principles of efficiency and control. Bigum (1996) argues that the call for academics to teach flexibly is based on organisational and not educational interests.

Zelmer (1999) observes that the world wide trend toward global alliances of universities will result in members of these groups offering course and units almost seamlessly to students world wide. The Internet will be a vehicle for much of this course delivery. Lazenby (1998) sees global higher education moving towards an open, more flexible model as it adapts to social and economic pressure. He argues that it is business more than government that is driving this agenda as it strives to meet its needs for the merging knowledge-based economy.

Romiszowski (1997) argues that the growing use of technology-based communication networks for learning is a case of necessity being the mother of invention. He identifies a number of key competencies for participants in the work place of the future. These include self-directed and just in time learning, the skills of cooperative problem solving, and the areas of competency and related technologies. The employable adult of the future must not only have access to the content implemented on the knowledge networks but must be able to interact with both novices and experts to develop these skills. Cost effective media networks such as those created by WBI systems are most suitable as the environment for this interaction.

The web was chosen for the Open Learning Technology Corporation (OLTC) project to publish materials via the Educational Network of Australia (EdNA). These materials provide a dynamic and expandable set of resources including pedagogy and practices for the professional development of teachers. Project leader, Wild (1996) admits that the Web was not chosen because of its instructional effectiveness nor for its ability to publish a large range of knowledge types. It was chosen for its ubiquity and its low publication costs.

Lefoe (1998) considers that universities are attracted to WBI because it provides access to target markets, is cost effective, and facilitates global access to the learning resources. Chesterton (1999) suggests that the use of CITs in the delivery of education is seen as enabling a less labour intensive form of delivery than traditional face to face and also permitting tertiary institutions to extend their markets beyond their local populations and attract fee paying students.

Issues in evaluating the claims of WBI for learning

Hedberg, Harper and Brown (1993) suggest a number of factors which impact on the effectiveness of WBI for learning. Researchers need to investigate the cognitive demands of different navigation systems, determine the extent to which current multimedia design models address the issue of navigation, investigate the importance of navigation in achieving improved learning outcomes, and evaluate the efficiency of navigation systems in giving control to the learner both in learning options and cognitive development.

Clark (1994) holds that while WBI may be more efficient than other delivery modes, it is the pedagogical dimensions which will determine the effectiveness and worth of it. Reeves & Reeves (1997) claim that there is a fundamental misunderstanding that the unique features of the Web are its rich mix of media and its linkages to global resources. Researcher needs to have a clear understanding of the *dimensions* of interactive learning that the web can provide. These include pedagogical philosophy, learning theory, goal orientation, task orientation, source of motivation, teacher role, metacognitive support, collaborative learning, cultural sensitivity and structural flexibility. It is the learning *dimensions* which will ultimately determines the effective of the particular WBI system.

Chesterton (1999) agrees that the scope and extent of evaluation of these CITs is quite limited. He cites the lack of available time and the required skills of the staff upon whose shoulders the task falls to carry out the relatively sophisticated evaluation techniques, as major reasons for this. Whatever the evaluation strategies, these also need to assess outcomes beyond those stated for the program. These unstated outcomes include changes in attitudes towards the technology, in student's self esteem, in participation and achievement in other programs, and in generic knowledge and understanding.

The changing role of the students

The model for Web-Based Instruction

In 1997 we decided to trial the delivery of two Information Technology focussed MEd units by on-line delivery in 1998. The decision was based to a large degree on a survey conducted on graduates from the Sydney area who had undertaken Information Technology based curriculum and cross-curriculum units during their undergraduate studies with us at Sydney campuses. The data indicated that 15 out of the 19 who responded wished to upgrade their professional qualifications and 16 would consider further study at ACU. It suited 11 out of 19 to study either completely off campus or by mixed mode. Over 50% already had an Internet Service Provider (ISP), access to e-mail and would purchase the required computer technology to study on-line. This demonstrated that even those who could attend on campus studies had a preference for studying from home. In addition, discussions with Master of Educational Leadership presenters indicated interest from cohorts of their students in Adelaide, Canberra, and Lismore to study Information Technology based units to complete their degrees. Here the WBI would replace a mixture of weekend off campus residentials and traditional distance education.

The aims, pedagogical underpinnings and features of the School of Education on-line WBI model are described in detail in Matejka & Maguire (1999). The two units are accessed from the Web site and are password protected. We attempted to create a virtual learning community unbounded by space to replace the traditional classroom. Rheingold's (1993) computer-linked culture is one in which the participants discuss issues and interact to the extent that they form webs of personal relationships on the Web. According to Schrage (1991) the goal of such a community is to create a shared experience in which learners participate, rather than a passive experience that is merely shared. There is the potential for

supportive collaboration within the community which is based on the need to solve problems: way beyond the need to communicate or for teamwork per se. We heeded Hiltz's (1994) conclusion that the critical factor in determining the effectiveness of an on-line course is the timeliness and quality of the instructors responses to participant questions and feedback.

The units were not directed towards technology educators. It was assumed that participants had reliable access to a multimedia computer. They were reasonably computer literate, subscribed to an ISP and were connected to the Internet. They were proficient with the World Wide Web and with e-mail. Participants were responsible for their own connectivity problems. Internet access as well as software were provided on the Sydney and ACT campuses for those without the required hardware and software.

Data were collected from students in 1998, the first year of offering of the two units. These were collected from participant discussions, informal feedback, interim and formal end of unit evaluations. These data were analysed to provide a picture of the manner in which participant's roles as learners changed over the study period. The analysis does this by examining a number of factors: the manner in which participant experiences with the technology affected learning; participant's changes in attitudes to the technology; shifts in the participant's knowledge skills and attitudes; and how well the WBI model met participant's needs and expectations.

How the technology affected learning

A number of factors were identified which affected the way in which participants connected to the Web site and how they interacted with the learning material and activities once they did. In some cases problems were of great concern and frustration to those who experienced them. Most problems were solved by the end of the study period. Experiences in a first on-line unit made students better prepared the second time around. The "technology" factors which affected learning included the following.

- **Connectivity.** The majority of students had few prolonged problems in this regard. This was, however, an ongoing problem for a few students who never achieved reliable connectivity to the Web sites. The sources of the problems were not always apparent to us but they included the reliability of the ISP, hardware and software problems and interruptions to the ACU Web server on a few occasions. These hiccups may have been the reason why a few students never appeared to get on line or to answer e-mail sent to them.
- **The technologies.** A few participants seemed to have been sold "real lemons", never really getting their computers set up to a reliable state. Those with their own computers generally reported fewer problems than those who used one or more "foreign" computers. These problems ranged from disk crashes and data losses to dislocation caused by operating system replacements, lost e-mail transmissions, and a failure to receive and open e-mail attachments. We had most problems with e-mail attachments from those students who chose to use "free" ISPs such as Hotmail and sent e-mail using Web Browsers. The other problem with attachments was overcome in the main when we insisted files be sent in rich text format. Certain file format were always a problem at our end.
- **The location of the technology.** Participants who did not have the technology in their own home generally experienced greater difficulties than those who had to access this at work or at some other location. They had problems with adapting to different systems, with transfer of files and the in time wasted in having to visit another site to access or upload resources.
- **Information Technology literacy.** It was expected that participants would have the minimum levels of computer literacy outlined previously. It was anticipated that they

would have varying levels of IT literacy. We became aware of a small percentage of participants which had difficulty with vital components of the CITs because of poor literacy skills. Sending e-mail, e-mail attachments, file management, site access and FTP proved difficult for some merely because of this. Some students commented that the assumptions made about them as learners meant that the level of instruction was not explicit enough at times for their level of computer literacy. Most times the problems were overcome by the assigned presenter on a one to one basis by e-mail or by telephone. If the problem was more general, supplementary material was uploaded to Web site to attempt to cover the deficiency.

- **The technology and/or the IT literacy.** In some cases it was difficult to determine whether technology problems were a result of the technology or literacy problems. In most instances it seemed to be a combination of both.

What was apparent from our experiences was that the majority of the participants had little formal training in "computing" and therefore had limited understanding of computer basics such as file structure and maintenance which are essential for effective computer use. Our solution was not to include these "basics" in the stated outcomes for the units as we did not consider them appropriate at a post graduate level. We attempted to solve the problems on a one to one basis. We started to compile a database of frequently asked questions (FAQs) which address these identified misconceptions and problems and which will be available for all of our web learning sites.

Changes in participant attitudes to the technology

The importance of Information Technology in education has already been discussed in some detail. Its influence is not likely to decline. Since an educator's attitude to technology will influence the role it plays in his or her teaching and learning it is important that factors which influence changes in attitude are determined.

Attitudes to the technology changed over the course delivery. Not all embraced the technology at the end of the first unit. Some still had obvious reservation because of their experiences with troublesome technology. Some may have still been ambivalent at the completion of two on-line units. However, no person who successfully completed the first unit and was enrolled for both units withdrew from that second unit. The benefits of WBI must have outweighed the costs to them. One participant now saw a role as an innovator in a school in which most colleagues were not computer literate. Some appreciated the experience of on-line study as an end in itself since it gave them the chance to explore technologies which all educators have to use. Many saw that they now had the skills and confidence to apply technology to classroom and on-line learning situations. Future studies will focus on this important aspect.

Shifts in participant knowledge, skills and attitudes

Participants, many of whom were educational leaders, studied one or both of the units to develop their Information Technology literacy as well as to learn about its role as an educational tool. They wanted to learn about technology by using the technology. They wished to develop the knowledge and skills to apply technology in their teaching space.

There were obvious changes in knowledge and skills in terms of stated and unstated outcomes for each unit. The stated outcomes are those derived from a unit's aims and objectives. The unstated outcomes are those "beyond those stated for the program" (Chesterton, 1999) which are achieved in the course of studying on-line. Stated knowledge and skill outcomes can be measured by the individual's success in achieving the outcomes for the assessment tasks. In each unit participants had to acquire knowledge and the

software skills to develop a working solution to a problem they had identified and defined. Very few brought these skills to the units. Changes in attitudes were not possible to determine from the current data.

The present study did not seek data to determine the full extent of the unstated outcomes achieved by individual participants. However, it is possible to speculate in this regard. Specific knowledge and skills had to be developed to study the units on-line. Participants also learned general IT skills which they would now have the confidence to apply in their classrooms. Comments illustrated quite a shift in attitudes to their own learning as well of that of the pupils in their classes. One felt that she had taken a more proactive position as a learner. Another stated that rather than being presented with a 'chunk' of knowledge to be learnt and applied she was made responsible for collecting and analysing information that was of interest and relevance to herself. One participant was insightful in observing that learning is not confined to "narrow outcomes" as the processes required to study on-line are also integral to the learning. One had become aware of a changing role as a teacher - more as the facilitator of learning since often, students knew more about the technology and how to access information than the teacher does. Another was less impressed since on-line study required self motivation which he just hated. This participant found it difficult to actually get on with the learning process.

Participant needs and expectations

Analysis of the data revealed a number of participant needs and expectations of their on-line studies. These included a need for the WBI model to

- Build a virtual community to support their learning
- Offer flexibility over when, where and the pace at which they studied the learning materials
- Meet individual learning styles
- Incorporate authentic assessment tasks
- Develop Information Technology literacy
- Enhance classroom use of Information technology

The first four will now be assessed in terms of how well our WBI model met these needs. The last two have been discussed in the previous section.

Build a virtual community

This proved to be a most basic need of the group. Our WBI model incorporated a number of features to support the development of our virtual learning community. These included the following.

- **Web based learning resources.** The unit outline, assessment details and a selection of resource material in portable document file (pdf) form were uploaded for the commencement of the study period. The WBI model required topic material and activities to be uploaded progressively over the learning period to allow for the construction of knowledge, as one participant put it, "in an open ended environment which rewards divergent thinking". One participant observed that this model was superior to "paper" distance education, which tends to be an influx of material at the beginning, followed by nothing until assignments are due. The Web site was user friendly and proved "relatively easy to use at a superficial level". The presentation of information in a range of media forms was considered useful. The integrated technology allowed flexible delivery and access. This observation sums up feelings about the learning resources. "In terms of methods of instructions, it enables the

learner and the educator to have access to a range of methods (not just the overhead!) and to incorporate a range of IT (which match the various learning styles) such as audio, visual, etc. It is highly interactive and it allows access to a breadth and depth of information never previously available."

- **Weekly News Bulletins.** These weekly bulletins were well received by all. Quite intentionally they were not sent as e-mails but presented on Web pages. This made them more permanent since they remained on the site until the end of the unit. Participants reported that it was great to be able to print them and refer to them whenever necessary. These kept them on track with their reading and activities. They gave them something regular to look for each weekend to keep them informed and on task.
- **Discussion.** The discussion facility was well accepted although it was not used as effectively as it could have been. Our units are not discussion based, being very practical in nature. Responses to discussion topics are not part of formal assessment. Perhaps, therefore, this unwillingness to participate is not surprising, given the fairly time consuming and exacting set of topics, activities and practical projects to be completed in each unit. In the first unit the discussion pages were updated manually by the presenters from e-mails received from participants. The thumb nail pictures of the students included next to each response were much appreciated by participants. In the second unit, discussion was automated by a threaded discussion package. This did not improve the participation rate. We feel that for participants to make the effort to contribute and respond to others, the topics must be a more integral part of the learning in our unit. We are working on this in the second offering of the two units.
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- **Assigned presenters.** That strategy of assigning each participant to one of the two presenters worked very well. There was a maximum of 20 participants per presenter group. This strategy personalised the support and overcame problems with redundant e-mail and phone messages. Participants were very happy with the level of service from presenters, their enthusiasm and their feedback. One participant felt we could have provided more, perhaps a phone call or so during assignment preparation time.
- **Critical friends.** Feelings were mixed about this feature that was intended to promote cooperative learning. A "critical friend" was to collaborate and support each participant's learning in the unit. This "friend" had to carry out a peer review of the final "issues" paper as part of the assessment. This had to be sent back to the writer. E-mail was the medium. Some thought the idea was excellent but the concept was never fully implemented. Not everyone seemed comfortable with the idea. There was uncertainty about the role of the critical friend and choosing one. There were problems with the timing of responses of some. Perhaps the term "critical friend" was a problem. Perhaps the peer review should not have been part of an assessment task. It was a feature which was dropped from the second unit offered. We are considering how this feature can be refined and reintroduced.
- **Videoconferences.** For most, this was a new experience - one which was daunting for some. These were well received by students as a means to get to know others in the virtual community. They put a "face to the name". Links at times were quite slow and this meant that interactivity was not as good as it could have been. Participants outside of Sydney felt they had been offered a great opportunity. They had spent less time getting to their local sites than colleagues who had to meet at the one Sydney site. The unanimous feeling was that these should be used as an introductory component of each unit as well as to wrap up things at the end. Unfortunately, budget constraints have meant that these have not been offered in the 1999 unit offerings because of the costs involved. Connection to University and TAFE sites outside of the ACU network cost in excess of \$100 per site (per participant) per hour.

- **Teleconferences.** Teleconferences worked very effectively. They were used to teach software packages to presenter groups and for discussion of task topics. They were well received for these off-line tutorials as they allowed participants with only one phone line to complete the hands on activities in real time. They were less awkward than the video-conferences because they fostered more spontaneous interaction. They allowed participants to learn from home. They avoided the need for a babysitter for one participant. Only one participant seemed dissatisfied with them because their schedule made it impossible to attend them because of other commitments.
- **Participant profiles with e-mail contacts.** The individual participant profiles which included information about themselves, their interests, e-mail addresses and pictures were displayed on individual Web pages on the site. The information about others in the community was very well received. The profiles helped build the virtual community to an extent. The inclusion of photos helped put a face to the comments.

It was apparent that we did not succeed in building our virtual community as well as we had planned. Most of the support structures discussed above did work. Participants achieved the stated learning outcomes for the units as well as many unstated outcomes with the same degree of success as classes which learned by traditional face to face modes. One participant observed that the videoconference, telephone and informal e-mail contact made the mode of delivery informal and personal. Another reported that participants formed peer groups on-line as compensation for not having time in class to talk, a very important part of the process of social intercourse and for points of clarification. However, we did not get all participants to feel they were part of a supportive learning community. There was evidence that the volume of e-mail between participants was not widespread or frequent. There was a fairly general feeling that there was not a sense of belonging to a group. One participant reported that this form of independent study lead to a feeling of isolation. It appears that those independent learners who work well on their own were quite happy with the situation. We will need to work on this aspect of on-line delivery as well.

Offer flexibility

Participants were attracted to the units because the on-line mode gave them greater control over when, where and the pace at which they studied the learning materials. This was even the case for those who were resident in the Sydney area. The presentation of information in a range of media forms which allowed them to respond to it at their own rate was seen as superior to most traditional ways of learning in the classroom. There was general consensus that this greater control over their own time was a real benefit of on-line study.

Meet individual learning styles

Comments demonstrated that participants realised that they had different learning styles to others in the group and that WBI developers needed to be aware of the different ways in which people learn. The comments showed that our model of WBI met many of these individual learning styles. Participants appreciated that they could apply their own learning styles to the study material and activities. One participant stated that WBI allowed adult learners to "take control of their learning". It suited "mixed ability classes, allowing them to work at their own pace". The on-line delivery allowed the learner to explore information in different ways. The worked solutions to problems allowed learners to see a problem and its solution simultaneously in order to "visualise" the way in which is to be solved.

Incorporate authentic assessment tasks

Students attracted to MEd courses seek authentic assessment tasks which are predominantly practical and which have relevance back in their teaching domain. A literature review related to IT Issues was criticised for its lack of applicability although the participant admitted that "in time I appreciated the value of the literature review". This criticism led us to review this for the next implementation. The participants had to focus the review to provide a working statement for the resolution of an IT issue in their workplace. This was accepted as a very worthwhile task. The timeliness and quality of the electronic feedback were appreciated.

Conclusion

This paper reports on our first attempts at systematic data gathering and analysis of this to provide evidence to test the feelings we have about WBI. Though the data are limited we have been able to identify a number of needs and expectations of participants which our WBI system must be able to satisfy. We have presented factors which affect how participants access the learning site. We have some tentative ideas about the shifts in knowledge, skills and attitudes to technology. We have presented an evaluation how well the features of our WBI model meet students needs. We have left many questions unanswered. We have not evaluated the claims made in the discussion of the literature. We have indicated where we intend to work on fine tuning our model so that it is more effective in achieving its learning goals for participants.

As a result we have refined our data gathering instruments in 1999. We hope that these will provide some of the answers that all educators are seeking about the efficacy of delivering course and units on the World Wide Web.

In closing we offer a number of Principles for the successful expansion of on-line learning based on our analysis.

- Develop, implement, evaluate and refine a WBI model which matches the defined needs and expectations of the participants.
- Plan and develop a web site with features which provides a rich resource environment for on-line learning.
- Allow for true flexibility in the units delivery. Listen for signs of problems which are impeding participant learning and be ready to react to these in a timely and positive way.
- Build a supportive virtual community through features such as e-mail, group discussion, cooperative learning and speedy feedback. Devise strategies to ensure that these support mechanisms work.
- Include authentic, practical assessment tasks and projects which allow the participants to identify and define a problem within their educational context and to propose and develop a working solution to that problem.

Gathering evidence to test these will be the focus of our future research agenda.

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