DIVERSITY IN COURSE DELIVERY: PHARMACOLOGY 6 OFFERED ON CAMPUS AND IN A VIRTUAL CLASSROOM

[1.]Maclaren, P. and [2.]Shukla, H.

Auckland Institute of Technology, New Zealand

[1.]Email:peter.maclaren@ait.ac.nz

[2.]Email:hasmeeta.shukla@ait.ac.nz

http://www.ait.ac.nz

Abstract

Pharmacology 6 is a paper for the Bachelor of Medical Laboratory Science, offered by the Auckland Institute of Technology. In 1998 the course was delivered simultaneously to an on-campus stream and an online stream. The use of a range of technologies including computer mediated communication (CMC) and interactive computer simulations is evaluated.

Keywords

comparison of face-to-face, distance, online domains; computer mediated communication (CMC); distributive, interactive and collaborative technologies; virtual classroom; flexible delivery

Context

The Auckland Institute of Technology (AIT) is the largest of 25 New Zealand polytechnics, with about 25,000 enrolled students, both full time and part time. It offers a range of undergraduate and postgraduate degree programs as well as vocational and lower level courses.

The majority of courses are delivered on this Campus in a small class tutorial style teaching environment. The number enrolled in any subject is typically less than 50, with class sizes being typically less than 25. This small class environment has been a seen as strength, in allowing significant interaction between teacher and learner, and in supporting quite specifically targeted vocationally-oriented courses. However this environment is under threat, with increasing competitive pressures from regional, national and international educational institutions, and non-traditional education providers.

While increasing class sizes might be seen as one response to achieving economies in course delivery, there are restrictions in adopting this approach imposed by the campus environment of predominantly small-classrooms seating 30 or less students.

Pharmacology 6 is one of the modules of the Bachelor of Medical Laboratory Science, (BMLS). The BMLS is a four-year program that comprises of three years of academic study at the institute followed by a clinical training year. This last year can be completed in any approved medical laboratory in New Zealand, and places are now being negotiated along the east coast of Australia. While AIT has not been a traditional supplier of distance education, there has been some distance delivery of specialist courses using predominantly a paper-based correspondence format,

supported at a departmental level. The initial development of a distance version of the Pharmacology 6 course in 1997 was in this context.

Evidence of the potential of the online domain to enhance learning (Berge & Collins, 1995; Corderoy and Defoe, 1997; Harasim, 1989; Pendergast, 1996), together with the availability of development funds from a Educational Technology Grant, prompted the development of a online course for delivery in Semester 2 1998.

Course design for flexible delivery

The learning outcomes for the on-campus course had been defined according to the demands of the profession and the role the module played with respect to the other components of the degree program. Summative assessment requirements had also been determined in the course validation process. It was also decided that the overall timing of the course would be common across all domains. Ensuring common course start and finish times, with common timing of the administration of assessments, simplifies both administrative and examination procedures, making better use of limited resources.

The design of the distance and online courses was thus prescribed by the need to achieve the same learning outcomes; and they were planned from the outset as alternative delivery modes for the on-campus course, rather than separate courses. The requirement was therefore to match content with appropriate learning technologies, requiring an instructional delivery model, rather than a full instructional design model.

A flexible delivery model

Various models for Flexible Delivery have been proposed (Bell and Defoe 1998). The fact that learning outcomes and assessments 'milestones' were preset led to the development and adoption of the model shown in Figure 1.
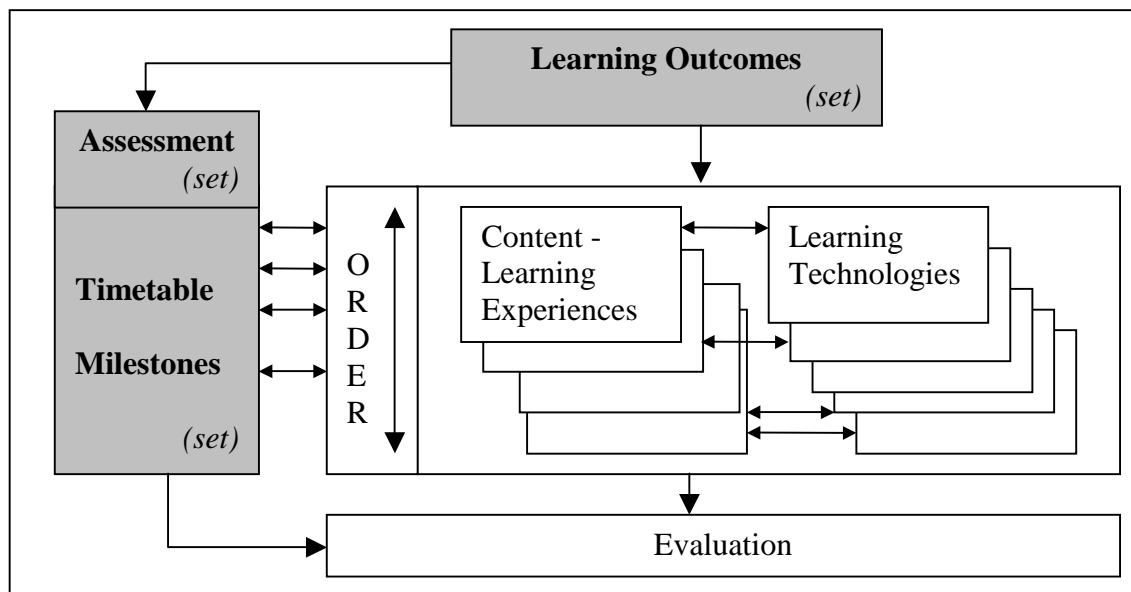
Figure 1: A Design Model for Flexible Delivery With set Learning Outcomes and Timetable Milestones

The key issue was the selection and matching of appropriate content and learning technologies to achieve the same learning outcomes in the different domain. The term *learning technology* is used to collectively describe *a distinctive combination of symbolic language, storage and delivery formats, delivery and presentation tools, and instructional techniques in an educational context*. This term is proposed as an alternative to the use of the term 'media' in describing delivery options. Learning technologies may be categorised as distributive, interactive or collaborative technologies (Lotus 1997). These categories may be related to Instructional Models (Learner Centered, Instructor Centered, Learning Team Centered) and Learning Objectives (Information Transfer, Skill Acquisition, Mental Model Change) (Lotus). The selection of a particular learning technology is governed largely by the learning objectives, the particular instructional model and the available resources (Figure 2).

While a First Generation paper-based correspondence model (Taylor 1995) had been initiated as a first step towards distance delivery, it was decided to develop this further to take advantage of new technologies. The costs of learning material development will be critically affected by the choice of the learning technology, and its associated materials. Small class sizes meant that in-house preparation of learning materials with a high fixed cost of development, or that required a transmission system with high fixed costs, would not be viable (Bates 1995).

It was determined that a Fourth Generation Internet based virtual classroom, that would support a wide range of learning technologies in the one application and which did not demand expensive media development, was the appropriate platform for development.
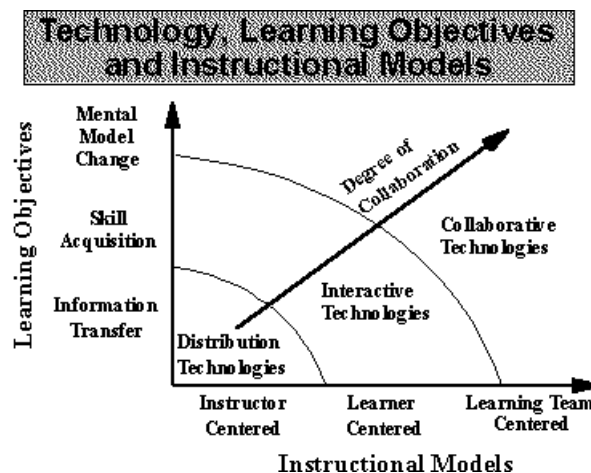

Figure 2: from Lotus (1997)

The virtual classroom — *learnonline* development

The requirements were for an integrated, easy-to-use package that would be accessible by students using a standard web-browser on operating systems including Windows 3.11. While the initial choice had been a commercial 'virtual classroom' application that was in use for other pilot projects, implementation problems with this package, and upgrades to the software meant that it no longer supported a Windows 3.1 platform. A late decision was then made to develop an in-house application using a Lotus Notes/Domino platform. This platform was already supported at the Institute, and provided for rapid development of the LearnOnline virtual classroom application.

The LearnOnline web delivery package was developed as a single Lotus Notes database, designed to present a course in a familiar book/chapter/section structure. The database allows the inclusion of any multimedia formats, integrated with an asynchronous threaded discussion forum for CMC. The database is searchable, provides a noticeboard for announcements, and allows for rapid development of online quizzes through standard forms.

The development was designed to provide a 'no-frills' platform that was fast loading, versatile and adaptable. While enhancements have been made to the original package, this platform currently remains the preferred online delivery platform for AIT, with the Lotus Notes environment allowing easy maintenance and replication. (a demonstration of some of the capabilities of LearnOnline is accessible at http://online3.ait.ac.nz/learnon/demo/course.nsf).

Course implementation

In establishing the distance and online courses the requirement was to match content with appropriate learning technologies. The relationship between the content and learning technologies in all three domains is outlined in Table 1.

The courses

The distance course was run once in Semester 2 1997, with 6 students, in conjunction with 18 students attending the on-campus class. The online course first ran in Semester 2 1998, with 10 students, in conjunction with 20 students attending the on-campus class. As part of the online course students were asked to complete an online survey of their experience; however distance students had not been surveyed in 1997.

The students

The on-campus class was scheduled as a weekly four-hour daytime session (classroom lecture and laboratory). The timing of this on-campus class was a key reason for some students enrolling in the online course, with both work commitments and timetable clashes with other subjects being an issue. Personal health issues were also given as reasons for choosing the online course.

In their written responses to the question "*What did you like best about the course*?" students included comments on not needing to take time off work, being able to study

---

[1] Some AIT Computer Laboratories were also still running Windows 3.1

when they chose and being able to work at their own pace. Stated advantages of studying via the Internet included:

For health reasons I could choose to do the work when I was feeling up to it. Distance learning is more flexible when a family needs to be taken care of.

Being able to work at midnight or anytime at all. This is important in a household with children or teenagers as it is difficult to get space and quietness.

Table 1: Content and learning technologies adopted for different domains.

Learning objectives	Face to face Domain	Distance Domain	On-line
Introduction to pharmacology	Lecture	Corresp. Worksheet	Web reference, Quizzes, forum discusion
Pharmacokinetics	Lecture Guest speaker Time article Self assessment problems	Corresp. Worksheet Time article Self assessment problems	Quizzes, Animation Audio interview and transcript Time article Forum discussions Self assessment problems
Pharmacodynamics	Lecture Experiment Computer simulation	Correspondence Worksheet Experiment Computer simulation	Quizzes Time-lapse photographic animation of experiment Reading activity Computer simulation
Drugs and the GI tract	Lecture Computer simulation	Correspondence Worksheet Computer simulation	Quizzes Forum discussions Computer simulation
ASSIGNMENT 1	Computer simulation	Computer simulation	Computer simulation
PRACTICAL ASSIGNMENT	Guest lecturer Group work	Handout Group work	Internet web references Group work
Drugs and the immune system	Lecture	Correspondence Worksheet	Quizzes, Animation Forum discussions
Drugs and NS	Lecture Computer simulation	Correspondence Worksheet Computer simulation	Quizzes, Animation Forum discussions Computer simulation
Drugs and CV system	Lecture Computer simulation	Corresp. Worksheet Computer simulation	Quizzes Forum discussions Computer simulation
ASSIGNMENT 2	Computer simulation	Computer simulation	Computer simulation
Drug abuse and testing	Lecture Class discussion	Time article	Time article Forum discussions

Note: The hardcopy text was used as a core reference in all topics across all domains, and is not included in the Table above.

The online students were not experienced computer users. Half (5) had never used the Internet before, and 4 had used it only occasionally (1 No Resp). Despite this lack of experience, most students reported only minor problems with the technology. Students reported the LearnOnline application as "easy" to use.

Once I worked out how to think "computer" I could move around quite easily and guess where to expect to find something and be right!

I found this a very easy to use. It was laid out in a very logical, simple format.

It was apparent from student comments that more instruction on 'browser basics', such as effective use of bookmarks, would assist students. *"The opportunity it gave me to master using a computer & internet"* was reported as a side benefit of the course.

AIT does not provide Internet dial-in-service for students; students were required to arrange their own Internet connection, through an external Internet Service Provider. Initial problems generally related to the setup of their own computers, or issues concerning their Internet Service Provider. The new user in particular is often unable to distinguish the source of problems, and while many were not strictly AIT's responsibility, it was important to be able to receive calls for assistance and direct students to the appropriate agency for problem resolution.

Six students indicated they had studied by distance previously, in correspondence mode. There was a positive response to the online delivery mode, with students appreciating the ability to communicate readily with the lecturer and other students through e-mail and the Forum

Students indicated their primary point of access to the course as their home (4 students), their workplace (3 students), or an AIT on-campus computer laboratory (2 students) (1 No Response). Two of the three students who had workplace access also had access from home. Two students who did not have home access to the Internet indicated that this was a problem for them, and required them to print hardcopy of material for home reference.

Tasks

Text, graphics, animations, interactive quizzes, interactive computer simulations, computer mediated communication were all components in the course delivery, organised as a structured set of course activities. While there is debate about whether highly structured courses may encourage a surface approach to learning (Bell 1997), the variation of activities and interactions involved in the Tasks appeared to involve the students in deeper learning, as reflected in the comment:

> ..doing the tasks and other requirements by yourself… makes you think more and to a certain extent you understand more about an issue, in other words it helps you learn better and develops our learning skills as well.

Text, graphics, animations and audio

While the LearnOnline virtual classroom provided essential tools for the online domain, it was not seen that this should be the only delivery option; technologies would be used where they were appropriate, not just because they were available. Thus a conventional printed hardcopy text remained the primary resource in all domains. Where an existing textbook exists, this remains an efficient 'distribution' technology. Although there are some advantages in having digital versions of text available (eg search capability), hardcopy remains a first choice for many, especially where there is any substantial or complex reading task. Students rated the textbook as a valuable resource.

Some supplemental text' material was provided online, including transcripts of two current print media articles which were immediately relevant to the course. Copyright clearance for the text was obtained from the publisher by email, and included in the course. These items were used as a basis for student discussions.

Simple animations (in animated gif format), derived from static textbook diagrams, were used where the addition of a time dimension, or colour, would enhance understanding. Available resources did not allow the production of complex diagrams, nor was it deemed appropriate. Students commented that the simplicity of the diagrams helped them to remember key points, and that they 'enjoyed' the animations and colour in the diagrams. This view appears to support the contention of Najjar (1996) that specific multimedia can help people to learn specific information.

A guest lecturer who discussed his personal experiences with determining drug dosages in treating a medical condition was a regular feature of the on-campus class. This personal 'presence' was brought online through the use of an audio file of an interview with the course lecturer, PDF format 'handwritten' notes, and a photo of the person. A transcript of the recording was available for those without sound cards, in order to ensure that the information was accessible to all.

Interactive technologies — quizzes and simulations

Online quizzes, using a variety of formats, were used throughout the course to provide formative assessment only. These were rated highly by the students:

> The one thing I enjoyed the most in this course was the online quizes that were given, they helped me understand the basics of Pharmacology.

The DOS Computer-based simulations, used in place of experiments using live animal preparations to investigate drug effects, were a key element of this course from its initial inception and provision on campus. Four commercially developed DOS programs were used, with on campus students accessing the programs in computer laboratories. Distance mode students were required to attend AIT in their own time to access these programs. Online students were able to download the DOS Computer-based simulation programs directly from the virtual classroom, and run them on their local computer, reflecting the capability of the online domain to support a wide range of technologies. While some students experienced problems in setting up and running these programs, students also commented that the simulations were an aspect of the course they most enjoyed.

Practical laboratory sessions

The on-campus class included two practical laboratories sessions (which distance students were also required to attend). The first involved the measurement of the effect of antibiotic strips on the growth of *e-coli* bacteria in a petri-dish culture. For online students, this experiment was replaced with a time-lapse video of the growth of bacteria (over an 18-hour period), and an online enhanced photographic image of the final state from which measurements could be taken for analysis.

For the second practical session, students were required to prepare a method for an experiment to assess the effect of alcohol on human performance. Online and on-campus students were placed in combined groups and required to devise a suitable method, using e-mail for communication. An on-campus session then tested the method. Online students were encouraged to attend this session and all but one was

able to do so. Results were made available to all members of the combined group, who prepared and submitted group reports.

Collaborative technologies

A key element of the online course is the Forum, which provides for Computer Mediated Communication (CMC) in the form of asynchronous threaded discussions. There were some eighteen discussions initiated by specific planned Tasks, as well as other discussions arising out of immediate issues. Higher level learning was identified as a potential benefit of CMC (Berge & Collins, Corderoy & Lefoe, Harasim, Pendergast). The quality of the responses, in the online Forum was judged by the Lecturer to be of a higher level than achieved in the classroom situation, reflecting the ability of students to research their comments by either consulting a colleague, or texts before responding.

The level of active participation in the Forum varied, with four students joining in virtually all eighteen Task-directed discussions, four students joining in seven or fewer discussions, and two students posting no responses. There was a small but statistically significant correlation between the student's final mark and their level of response in the forum ($r^2 = 45\%$, $p = 0.03$); this does not of course establish a causal link.

Most students rated the forum as helpful or very helpful, with the forum also featuring as an aspect students liked best about the course. The view that "Sociomotional variables, such as motivation, anxiety and satisfaction are claimed to benefit from working with peers" (Graham and Scarborough 1999) is supported by student comments:

> It wasn't so lonely having the "Forum" - you could have access to other participants thoughts and knowledge and it felt that in some way there was constant contact with others in the same situation.

> I also enjoyed the tasks which were given and the student forum, because it gave me feedback on how well I understood and answered the questions which were given to us.

Assessment

The issue of performing summative assessment by computer was considered but deemed impractical. While there are many systems that can be established to validate the authority of digital transactions, they cannot effectively determine whether assistance is occurring with the approval of the sender (Dowsing 1998). For this reason conventional supervised examination procedures were used. Online students were required to nominate a supervisor for the two tests, and the tests were posted in hardcopy to that person for administration.

Evaluation

Analysis of the final student marks, comparing the 1998 online and on-campus students, showed no significant difference between average final marks in the two modes ($p = 0.47$). Similarly, analysis of the final marks for 1997 distance and on-campus students showed no significant difference between the two modes ($p = 0.52$). This suggests that common learning outcomes can be achieved in the different domains with appropriate selection of content and learning technologies.

Conclusion

The online delivery proved to be an effective alternative delivery mode, providing diversity in the use of media, technology, and learning environments, and catering to the needs of a range of students who would not otherwise have had access to the course. The course established the 'virtual' classroom as an effective learning environment that is now being adopted across the Institute. To give the final word to a student

> this was quite a fun way to learn

References

Bates, A (1995) Technology, Open Learning and Technological Change, Routledge, London

Bell, M (1997) Flexible Learning within a Tertiary Teaching Subject, ASCILITE 97 Conference Proceedings, Curtin University. Available URL: http://www.curtin.edu.au/conference/ASCILITE97/papers/Bell/Bell.html

Bell, M and Lefoe, G (1998) Curriculum Design for Flexible Delivery - Massaging the Model, ASCILITE 98 Conference Proceedings, University of Woolongong, p169.

Berge, A and Collins, M (1995) Computer-Mediated Communication and the Online Classroom in Distance Learning, Computer Mediated Communication Magazine,2(4). Available URL: http://metalab.unc.edu/cmc/mag/1995/apr/berge.html

Corderoy R, and Lefoe,G (1997) Tips and Secrets for Online Teaching and Learning: An Inside View, ASCILITE 97 Conference

Proceedings, Curtin University. Available URL:
http://www.curtin.edu.au/conference/ASCILITE97/papers/Corderoy/Corderoy.html

Dowsing, R (1998) Flexibility and the Technology of Computer Aided Assessment, ASCILITE 98 Conference Proceedings, University of Woolongong.

Graham, M and Scarborough, H (1999) Computer mediated communication and collaborative learning in an undergraduate distance learning environment, Australian Journal of Educational Technology, 15(1), 20-46.

Harasim, L (1989), On-Line Education: A New Domain, in Mason,R and Kaye,A (Eds) Mindweave: Communication, Computers and Distance Education, Pergamon Press, Oxford. Available URL:

http://www-icdl.open.ac.uk/mindweave/mindweave.html

Lotus (1997), White Paper - Distributed Learning: Approaches, Technologies and Solutions. Lotus Notes. Available URL:http://www.lotus.com/world/emeaedu.nsf/641021c7cb140a3c852564060012ce06/0000227e [last accessed 10 March 1999].

Hajjar, L.J. (1996) Multimedia information and learning. Journal of Educational Multimedia and Hypermedia, 5, 129- 150 .

Pendergast, G (1996), 'Using Computer Supported Cooperative Learning to Deliver Effective Work Place Training', The Virtual University Symposium', University of Melbourne. Available URL:http://www.edfac.unimelb.edu.au/virtu/case-studies/prendergast.htm accessed 21/3/99)

Taylor, J.C. (1995), 'Distance education technologies: The fourth generation', Australian Journal of Educational Technology, 11(2). Available URL: http://cleo.murdoch.edu.au/gen/aset/ajet/ajet11/su95p1.html)