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And the winning email question is... (or how I got students to ask the questions they needed to ask)

Dr Derek Abbott
Department of Electrical and Electronic Engineering

"The key point is that I helped the students to relax and feel as though they could ask anything"

Description | **Aims** | **Process** | **Evaluation** | **Future developments** | **Contact**

Description

For some years I had been trying to use email as a method of feedback from students. This strategy was a success in that it created a system of mandatory weekly email reports from my final year project students. The key element here was that I got the students to not only write on their weekly progress, but also their goals for the following week. This continues to be an excellent tool for keeping final year project students focussed and accountable.

One notable failure was my idea of asking students during lectures to email me questions about anything that was unclear during the class (The response was really low!). The problem was (i) shyness (most students like to ask questions anonymously) and (ii) after the lecture is over, the questions are no longer fresh in the mind of the student.

This all changed in 1998 when I attended courses organised by the ACUE and HERDSA and learned of and adapted a technique used by Prof. Frederick Mosteller (Professor of Statistics at Harvard). He would ask his students at the end of each lecture to write the "muddiest point" in the lecture on a scrap of paper. He would then answer the 2-3 most common questions in the following lecture.

In combining my original email idea with Mosteller's technique I created a surprisingly powerful evaluation strategy that has seen student satisfaction increase markedly in my 2nd, 3rd and 4th year Electronic Engineering Subjects.

Aims

- to get immediate feedback from the students on the unclear issues
- to rectify misunderstandings quickly
- to ensure the requisite information is absorbed prior to introducing new material
- to give insight as to how to adjust lecture material

Process

I realised that Prof. Mosteller's technique was the answer to my problem as (i) it's an anonymous system and (ii) it's an immediate process (whilst the mind is still fresh), so I adapted this idea. However, I made a number of important rules:

(i) I replied to every question by emailing the whole class. Students usually had about a week to review the answers as I would answer the questions immediately after the lecture and the lectures were generally weekly. I also posted all the questions and answers on a web page so that students could look at the entire body of question/answer material. This required a considerable investment in time. On the evening of a lecture I would spend between three and five hours responding to questions (depending on class size, which varied between 60min and 180max). My

hope is that the 3-5hours is just the "set up investment" and that the same answers can be recycled to some extent so that in future years the job becomes less time-consuming. This hypothesis is yet to be tested!

(ii) I answered all questions clearly & sincerely no matter what. I made it a rule to treat each question seriously and not "talk down" to those questions that appeared rather trivial. For questions that were too complicated to reply by email, I would let the students know that I would reply verbally in the following lecture. It was vital that students felt that no question was too stupid.

(iii) I used humour and simple mental pictures in my replies. I wanted to make the material engaging for the students so that they would be interested in the response and feel capable of understanding it.

(iv) I even replied to quirky comical questions. The inclusion of quirky humour resulted in each class having a number of "in jokes" that we would revisit and all laugh at during lectures ...this created a class "bonding experience." This humour also encouraged students to look at all the questions and answers for the amusing ones. By looking at all the material they developed a picture of the other students' difficulties as well as their own.

(v) I also asked my colleagues to cast an eye over the web page, both to double-check my own explanations and to make sure my humour was appropriate.

Another "twist" is that at the beginning of each lecture I would award a prize for the most "perceptive question." This was defined as the question that stumped me and made me think the most. The prize was the lowest denomination of money that happened to be in my wallet. This could be anything between 5 cents and a $50 dollar note. Thankfully, I never parted with more than $2 at a time. But the element of risk was something that kept the students highly attentive.

This whole process kept me in tune with where the students were at and helped me to improve my lecture format and content. I also found that setting appropriate exam questions became much more straight forward.

Examples

Muddiest Points:-
---

1) Bipolar transistors

OK....I'll go thru' this again.

2) Superposition theorem

OK.....I'll go thru' this again.

3) Electron/hole interaction during conduction

There is a depletion region between the n-channel and the p-substrate.
So holes and electrons are segregated, when the transistor is on.

4) Exactly what is going on when the MOSFET is on.

When the n-MOSFET is on, holes are repelled from the surface and electrons are attracted to the surface. The "sheet" of electrons at the surface is then a conducting channel that connects source and drain.

5)Why did you wear a yellow tie with a green suit?

It was actually a gold coloured tie. I wore it to keep you awake ;-)

Evaluation

The method was tried in my 2nd, 3rd and 4th year Electronic Engineering Subjects. My student evaluation of teaching **(SET)** scores were, prior to this innovation, hovering around a very respectable 70% for the overall sum-up question: "How do you rate this person as a university

lecturer?". Subjects adopting this technique are now getting a rating over 85%. The 3rd year subject is particularly significant as it is an electronics "minority" course to Mechanical Engineers, who hate doing this subject outside their normal discipline. This subject normally gets a student evaluation rating of around 67% with only a 55% attendance rate. Post the changes I received an evaluation of over 90% and also had an 87% attendance!

Future developments

My next goal is to make in-class feedback even more immediate and continuous. Dr. Wen Soong, a colleague in my department, and I are jointly developing an electronic display that counts yes/no responses from the students. Yes/no buttons will be wired to every desk in a lecture theatre and the display will be visible at the front. We call this the "electronic class voting system". Similar ideas have been tried in the US with great success. With this system in place I will be able to get on the spot feedback on whether the students understood the material presented and what percentage found it difficult. This will not provide the reflection time that the email technique allows, but it will alert me as to when the lecture is going off track.

Interesting Open Questions Yet to be Tackled

How many students looked at the questions before the following lecture?

What would other evaluations show? Are there improvements in exam marks?

Reference

D. Abbott (1999) 'And the winning email question is...how I got students to ask the questions they needed to ask,' In I. Roberts & M. Kiley (Eds) *LearnIT Symposium*. ACUE, Adelaide, pp 13-22.

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Plots, Blocks and Video Tape; Experimental Design Made Easy

Dr Glenys Bishop
Department of Applied Mathematics

"I was trying to show students what an experiment actually looked like in real life, concentrating on the design rather than the analysis"

Description | **Aims** | **Process** | **Evaluation** | **Contact**

Description

This project deals with teaching large statistics classes in the first and second years of tertiary education and with the effective use of educational technology. The main aim of the project was to produce a six minute video showing the interaction between local scientific researchers and statisticians and illustrating the concepts of experimental design. The video is suitable for showing during lectures in introductory statistics courses.

The concepts of experimental design are hard to teach. Students display a lack of understanding of the basic principles. Postgraduate and Honours science students who have studied an introductory statistics subject during their undergraduate programme often fail to grasp the concepts. One reason for this is that the available teaching aids (such as commercial videos) for this level offer so much information on statistical analysis that issues of design are not clearly discernible.

Aims

The purpose of this project is to:

- improve the quality of learning and understanding statistics by introducing relevant and innovative teaching practices in our introductory courses;
- to produce a local, context rich video about Experimental Design that develops the concepts of randomisation, replication, confounding and blocking by using an example of recent experimental research work in another discipline and showing its relationship with statistics.

Process

In the Department of Statistics, as in similar departments around Australia, we regularly use commercially available videos for motivation. One problem with these is that the subject matter is not local. The other is that the examples often involve complex statistics and so the detail is glossed over. I deliberately chose an example that was not too complex and that provided a useful context for the subject matter being taught in lectures. There is no discussion of analysis on the video because that would blur the issues of design that I was aiming to impart.

Production of the video involved:

- finding a willing research student with a suitable experiment
- liaising with the student, planning the content of the finished video

- arranging times and locations for three video shooting sessions
- writing the script for the voice-over
- constructing diagrams in PowerPoint
- one and a half days of editing.

A six minute video suitable for showing in lectures as a motivational example of the use of statistics was completed in 1996. The subject matter of the video is the design of an agricultural experiment. I chose this particular experiment for two main reasons. First, David Sloane, the postgraduate student responsible for the experiment was very cooperative. I relied upon his goodwill for assistance with the filming and for agreeing to appear on the video, discussing the reasons for his experiment. Second, his experiment used the principles that I wanted to illustrate.

After viewing my video, students understand what a plot and a block actually look like in practice (see clip below). An experimental design is no longer just a series of diagrams and numbers on a page. They can also see how an individual experiment fits into a research programme.

In summary, we have been able to teach old concepts more effectively than previously and the students have grasped these concepts better because of the practical video example. Student learning has been improved because students have been able to visualise an experiment rather than have the concepts presented in the abstract.

Evaluation

The success of this project has been monitored in several ways. Students have a written assignment, the content of which directly addresses the material covered in the video. This enables me to see if students have gleaned the important concepts from the video. Other lecturers in my department use the video and provide feedback. So far both these measures provide support for the utility of the video. Finally, more subjectively, I can judge the students' enthusiasm for the video from the mood of the class.

Comparisons with earlier student groups who did not have the benefit of the video are unfortunately not possible as there are a number of confounding variables that would undermine the legitimacy of such a comparison. One of the best ways still to evaluate teaching materials is for the lecturer to monitor what works best for her/him.

In July 1996 I showed this video at the Statistics Education Workshop in Sydney. In August 1996 I showed it at the New Zealand Statistics Association conference and in 1998 at the International conference on teaching statistics in Singapore. The video has always been reviewed favourably and numerous lecturers from Australia, New Zealand, the United Kingdom and the USA have requested copies.

Example from Experimental Design 4.0 M

Contact

The video is available for a cost of A$10, which covers the copying expense. An additional A$5 is needed if postage is required within Australia or A$10 overseas.

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Dr Glenys Bishop was previously on staff in the Department of Applied Mathematics, now at the Australian Bureau of Statistics.

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Data Acquisition in the Undergraduate Physical Chemistry Laboratory

Dr Mark Buntine, Dr Vicky Barnett
Department of Chemistry, Adelaide University

"Students conduct experiments in real time using technology readily available in the commercial and research environments. They can now concentrate on the chemistry, not on plotting graphs."

Description | **Aim** | **LabVIEW** | **PASCO** | **Evaluation** | **Contact**

Description

National Intrument's "LabVIEW" and PASCO's "Science Workshop" are graphical software environments for computer-based instrument control, data acquisition, display and analysis. In almost universal industry use, LabVIEW was initially adapted for specific experiments in the undergraduate Physical Chemistry laboratory. Most recently, we have incorporated elements of PASCO's Science Workshop into the laboratory curriculum. The Science Workshop package offers a more cost-effective approach to data collection and analysis. A graphical "front end" to both software packages makes acquisition and manipulation of data quick and easy.

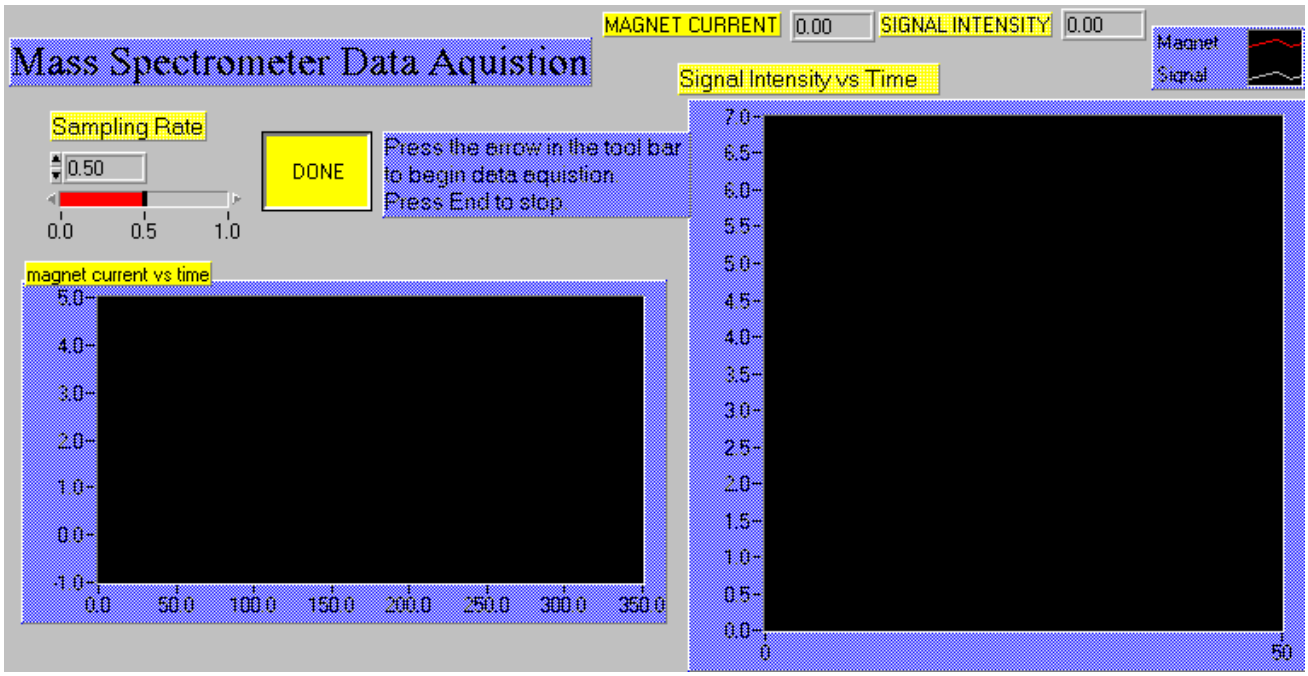
Aim

- to streamline and improve experimental practice so that students can concentrate on the core aspects of the experiment
- to give students experience with industry-standard software

LabVIEW

Prior to the introduction of LabVIEW students would perform the experiment under question, with one student conducting the experiment and the other spending time manually plotting the data for analysis. LabVIEW allows students to concentrate on the experiment itself by automating the data acquisition. Previously also, a student may go home, spend half an hour drawing a graph before realising that something was wrong. Now they can instantly spot the mistake on a computer-generated graph, re-examine the variables, identify the possible error and run the experiment again. LabVIEW helps the students focus on the point of the experimental learning exercise.

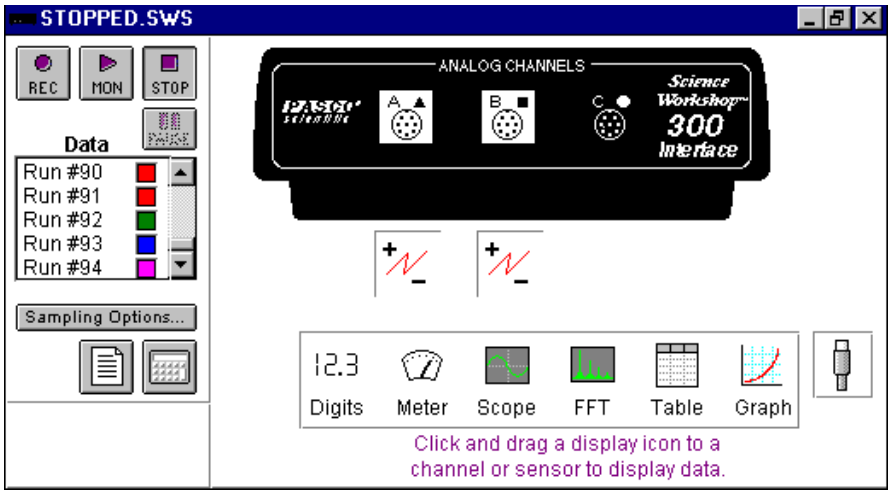
LabVIEW is used in our "Potentiometric Titration" and "Mass Spectrometry" (see screen image below) experiments.

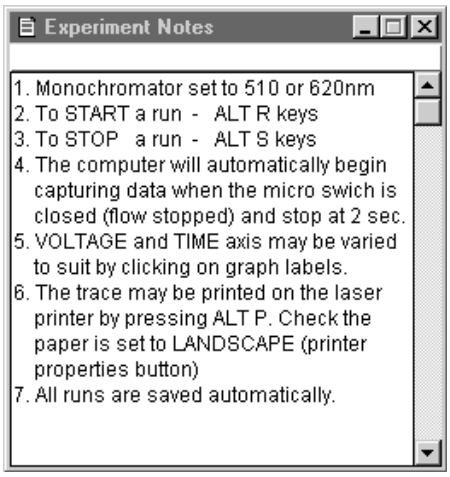


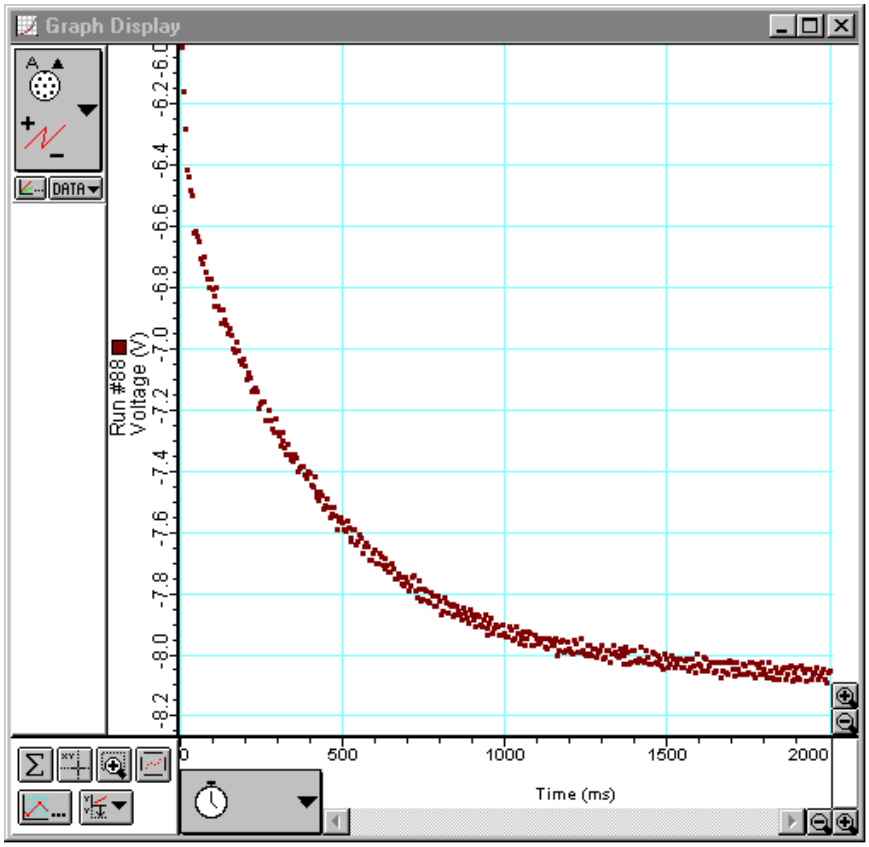
PASCO Science Workshop

One problem with using LabVIEW is the large expense associated with the top-of-the-line data acquisition hardware. As we have expanded the use of computer-aided data collection and analysis in the undergraduate laboratory, we have remained conscious of the costs involved. PASCO's Science Workshop offers a cost-effective means of expanding this initiative to many experiments in the laboratory. Science Workshop is a modular suite of hardware and software that can be tailored to suit specific teaching needs.

Currently Science Workshop modules are used in the following undergraduate experiments: "Ion Selective Electrochemistry" (see screen images below), "Stopped-Flow Reaction Kinetics" and "High Performance Ion Chromatography" as well as several pH measurement and ion complexation activities. The software suite consists of multiple windows, one window displays the data, another allows for students to control the experimental parameters, while a third provides customised notes reminding students of actions to be performed.







Evaluation

Evaluation of the use of LabVIEW and Science Workshop has taken several forms. On-going and immediate student feedback is sought during each laboratory session. Such an evaluation mechanism aids in refining the laboratory protocol so as to ensure effective learning outcomes. A second evaluation tool draws upon the impressions of students, demonstrators and academic staff brought together in a "focus group" type environment. In-depth discussion helps to identify areas for improvement in the software.

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Learning and Teaching Support

A Logical Course of Teaching

Professor Neil Burgess
Department of Electrical and Electronic Engineering

"I wanted to emphasise the difference between university and school. The underlying assumption is that university students should be more independent learners"

Description | **Aims** | **Process** | **Evaluation** | **Contact**

Description

Logic Design is a first year subject introduced in 1996. Made up from a balance of new material and a previous third year topic, the subject aims to give a grounding in the theory and practice of logic design with a particular reference to computers. After passing this subject, students should be familiar with methods for specifying and synthesising logic circuits, and be prepared for more advanced studies in computer hardware and their operation.

With a projected class size of 150 students, all the well-known problems of the lecture format were likely to be exacerbated, so a group problem-based approach was implemented.

Aims

- to motivate students
- to promote independent learning
- to get students used to working on major problems in groups
- to demonstrate to colleagues that alternative teaching methods are possible

Process

The whole subject is overarched by a project to design a simple computer, called the *ultra*RISC processor, that has only 15 instructions. At the first class meeting the students self-organise into groups of 4. Each group has 7 WorkPackage topics: the first 6, at a frequency of one per week, introduce the concepts and techniques of Logic Design; the 7th WorkPackage defines the operation of the *ultra*RISC processor and invites the students to exploit the "missing" 16th instruction to enhance the processor's performance.

The students are asked to keep a log-book of their meetings, progress, opinions, hurdles encountered, etc. The log-books are inspected three times during the semester and are also handed up with the final design.

The last meeting of the class is a mock sales convention where each group gives a poster presentation extolling the clock speed, number of gates and other design features of their processor. This meeting introduces a small element of peer review since each group is asked to nominate its preferred five (rival) designs. A small mark (out of 4) is awarded proportional to the number of "votes" a group's design receives.

These group based exercises count for 50% of the assessment, the other 50% being an open book exam, which one colleague aptly named an "honesty check".

Evaluation

A Student Evaluation of Teaching **(SET)** presented mixed results. The statements "The novel style of teaching employed by the teacher should be continued" and "I prefer this style of teaching to a lecture-based approach" both divided the students evenly. More encouraging results were obtained from the statement "Overall, the assessment of the subject was fair" (65% of students agreed with this).

One point worth noting here is that student approval, although important, was not the aim of the innovation, which was to improve independent learning. The following student quote captures the ambivalence that students perhaps felt when confronted with a new learning and teaching style:

"Initially I didn't like his teaching method, but looking back, I think it worked well: If a lecturer tells me something, I'll forget it; if I look it up in a book, I'll forget it as well, but at least I'll know where to find it later".

The designs that were handed up demonstrated clearly that the more able student groups really "took off" in exploring a wide number of issues outside the planned syllabus to enhance their designs' performance. These enhancements were, not unnaturally, heavily promoted at the convention and led to much interaction between the student groups in justifying claims made on the posters.

The less able students typically stuck to carrying out the letter of the WorkPackages and if the material didn't say "Try to enhance your processor's performance in any way you can" then there was plainly no need to do so!

Finally, there was a strong correlation between the course assessment marks and the exam marks achieved.

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Learning and Teaching Support

An integrated, discipline-specific model of communication skills development

Ms Margaret Cargill
Language and Learning Service,
Advisory Centre for University Education / Faculty of A&NRS

I wanted the students to have consistent guidelines across the Faculty for similar assignment types - and for lecturers' expectations of student writing to be explicit, so students knew what to do to improve their skills.

Background | **Aims** | **Process** | **Evaluation** | **Reference** | **Contact**

Background

In 1991 the Faculty of Agricultural and Natural Sciences were facing a number of issues that prompted them to take action on students' communication skills. Employers had indicated that graduates lacked appropriate written and oral communication skills, there was an increasing gap between the entry-level communication skills of many students and those required of graduates at all levels, and the Faculty had relatively large numbers of international postgraduate students.

There are two usual approaches to addressing these types of issues:

i. Designing single subjects to teach 'communication skills' which students are then expected to apply in other subjects and situations. However, it is not clear whether skills taught in this way, and assessed through content specific to the communication subject, are in fact applied effectively in other subjects and situations. There have also been reports that such subjects may lead to resistance in students required to take them if they are perceived to be irrelevant to their course content.
ii. Encouraging all lecturers to incorporate writing skills into their subjects and courses, since they are in the best position to know how effectively students have expressed discipline-specific concepts and relationships in their writing. However, content-specialists can be reluctant to devote precious course time to assessment of writing, and often believe that they do not have the skills to teach students how to develop their writing skills.

The alternative described here is an integrated, faculty-wide approach in which there was full collaboration between content lecturers and language and academic skills specialists.

Aims

- to integrate teaching and assessment of communication skills into content teaching at all levels;
- to enable students to take more responsibility for their own learning and skill development.

Process

The integrated model of discipline-specific language and learning skill development can be described in these terms:

- a range of strategies and activities to teach and assess the desired skills, integrated into a range of core subjects throughout a course or discipline,
- supported by a wide variety of targeted resources which students access as the need arises in their particular learning situation.

The first layer of the model rests on a team-teaching approach, with the team consisting of me (as Faculty Language and Learning lecturer) and the regular lecturer in the core subject. Together we structure a class that focusses on a set assignment: an essay for first years; practical reports or a field-day poster in later years. Clear and detailed assessment criteria are presented, together with examples of previous student writing. These are discussed in terms of how well they meet the criteria, and what could be done to improve them. At every stage the students are referred to the resources available to support their independent learning of the skills - these resources form the second layer of the integrated model.

For this second part of the model to be effective, a number of conditions must be met:

- students must experience the resources as meeting their specific needs when the needs arise;
- each 'chunk' of resource should address one problem only;
- students should be able to locate the chunk they need readily;
- the specific skills represented by the chunks should be required for success in the core subjects; and
- students should be able to see clearly the relationship between the assessment criteria in the subject assignment, the skills, and the resources designed to help them learn or revise the skills.

Specific changes include:

Faculty-wide writing guidelines

Faculty-wide guidelines were developed for all assignment types commonly set by lecturers. These are available in a booklet, 'Written Communication in the Faculty of Agricultural and Natural Resource Sciences' (Cargill and Bellotti, 1997, revised annually). This text is also available electronically to all students via the Faculty's homepage. A companion 'Lecturers' Guide' suggests ways to integrate the guidelines with course and subject documentation, and these have been widely taken up.

First year essay writing

It is important that first year students are introduced early to the Faculty's emphasis on developing excellent communication skills. To this end we focus on an essay in core first semester subjects of all courses. First students receive teaching about the specific features expected of essays in this discipline area. The procedure then varies across subjects, but in them all the essay is marked stringently according to the criteria and may subsequently be resubmitted for an improved mark.

Final year communication skills focus

Compulsory capstone subjects with a strong communication skills focus are also in place in the final year of the Faculty's degree courses: Communication in the Agrifood Industry ; Grape Industry Policy, Practice and Communication; and Principles and Practice of Communication. The integration of skill and content foci mirrors the world of work students are conscious they will soon enter, and the approach is well received.

Self-access resources

A core set of language use issues has been observed to cause problems for Faculty students. These include problems at both sentence level (sentence structure, punctuation, grammar) and discourse level (information order, 'flow' within and between paragraphs). To enhance the efficiency of the service offered to students, as well as to help meet the needs of external and part-time students, there was a need for targeted, discipline specific resources they could access in their own time frames. Self-access Tutorial (SAT) booklets were developed, trialled and made

available, originally through Language Development Drop-in Centres on both Faculty campuses and now online (with some still to be made available - access for Adelaide Uni only). The SATs have been developed using examples taken from Faculty student writing. They focus on problems most commonly encountered by Faculty students and include a diagnostic test for students to evaluate their own learning needs.

Evaluation

Extensive evaluation was undertaken to ensure that the faculty-wide writing guidelines met the learning and teaching needs of both students and academic staff. These included extensive trialling during the initial development phase, formal student and staff evaluations during their first year of use and subsequent annual reviews which I coordinate in my role as the Faculty Language and Learning Services lecturer. The booklet has also been adapted for use at Batchelor College, N.T.

Evaluation responses at the end of 1998 showed that the electronic form of the self-access modules has not been utilised effectively by on-campus students, and that the hard copy form was often preferred. (The responses of external students have not yet been sought.) More detailed formative evaluation was conducted with focus groups and Honours classes. This showed that development needs included:

- further simplification of the terminology used to describe grammatical categories;
- refinement of the template and navigation system to ensure students always know where they are, both within the module and within the whole database; and
- increased sophistication in the diagnostic tests.

The first two of these areas have been addressed; the third is still in train.

Areas identified as in need of development in the most recent of our regular action/reflection cycles in the Faculty include a more systematic focus on second year degree and diploma subjects, and on the needs of external students. There is also a need to improve our strategies for assisting content lecturers to integrate resources with all assignment tasks. This last is being addressed in the 2000 Mindtrail project (http://www.mindtrail.com; inactive 2/9/03). A further emphasis should be the provision online of resources on proposal and thesis writing for postgraduate and honours students, and of more detailed language development resources specifically for students from language backgrounds other than English, both of which are currently available only in workshop or short course form.

Reference

Cargill, M. & Bellotti, M. (1997). Written Communication in the Faculty of Agricultural and Natural Resource Sciences. Adelaide: University of Adelaide. [URL: http://voyager.library.adelaide.edu.au/cgi-bin/Pwebrecon.cgi?DB=local&Search_Arg=%3FCarWriPg1&Search_Code=CMD*&CNT=25]

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This page is based on the more detailed paper:

Cargill, M. (1999). Resisting generic-ness: a discipline-specific, integrated, collaborative and faculty-wide model of language and learning skill development. In G.Crosling, T. Moore & S.Vance (eds.) *Language and learning: The learning dimensions of our work. Proceedings of the Third National Language and Academic Skills Conference*. Melbourne. Monash

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Visual aids to computer identification of plants

Dave Christophel
Department of Botany

"*We can harness information technology to place powerful botanical tools in the hands of students and allow them more independence in their learning.*"

Dave Christophel and students in the forest

Background | Description | Aims | Process | Evaluation | Contact | Other links

Background

When we introduce second year Botany students to the skills and techniques of plant identification, we are compelled to use the standard publication, which uses black and white photos, and a single entry dichotomous key. With this type of key students must answer the first question presented, such as 'anthers opening by slits, or anthers opening by pores', before they can move on to the next question, and so on until the plant is identified. The student may be holding a plant with a very distinctive and colourful flower, but cannot use this visual information to hasten identification. This can be a mind numbing and complicated process.

In the third year subject Biodiversity and Evolution of Plants I wanted to teach a practical class on tropical rainforest biodiversity, and this required the students to identify rainforest plants. The first problem was that the Leaf Atlas available for tropical rainforest plants was expensive, and was only going to get more expensive as other categories of plants and more species were added. Secondly, from my experience with second year Botany students, I knew that the traditional taxonomic methods for plant identification were not likely to motivate them to accurate identifications. The solution to this was the development of a digital version of the Leaf Atlas.

Description

I previously developed a Leaf Atlas in collaboration with Bernie Hyland from the CSIRO Division of Plant Industry, who is also Adjunct Associate Professor in the Department of Botany at the University of Adelaide. This Atlas is a comprehensive collection of over 1000 X-ray images of the leaves of Australian tropical rainforest plants. The images illustrate structures in the leaves that are characteristic for each species and thereby allow accurate identification of samples, a considerable improvement on traditional black and white line drawings.

In our third year Biodiversity and Evolution of Plants practical classes we ask students to use a botanical key (computerised data base of botanical characteristics developed by Trevor Whiffin from Latrobe University and Bernie Hyland) to identify botanical specimens. Final identifications

are achieved by visually comparing the samples with X-ray images of the leaves in a Leaf Atlas. While the Botanical Key is readily available on computers in the Department of Botany's teaching laboratories, the expense of the Leaf Atlas limits its availability to students, causing frustration and restricting learning opportunities. Compared to the Botanical Key, the Leaf Atlas is a cumbersome tool to use and students require demonstrator support.

With the approaching revision of the Key and Atlas, we had the opportunity to compile the images in digital form into an image data base and thereby make them more readily available. Powerful information retrieval tools were then integrated with the database. Ultimately, the digital Leaf Atlas could be integrated with the existing Botanical Key to provide a seamless botanical reference tool. The development of integrated botanical databases has been one major focus for the Rainforest Cooperative Research Centre

Aims

The project aims to:

- Allow students to work more effectively in practical classes
- Help students to develop skills in information retrieval
- Allow students to experience the roles and value of Information Technology to the contemporary discipline of Botany

Process

To be usable, the many images in the Leaf Atlas had to be scanned at high resolution. Each uncompressed image occupies approximately 1 megabyte of disk space and so must be heavily compressed for obvious practical reasons. It is vital that no visible artefacts are generated by the compression process and a fractal compression facility produced by Iterated Systems Inc. was selected by the team as the best available option. A compression ratio over 10:1 is being achieved (compressed image size < 100 Kbytes) by Trevor Whiffin at Latrobe University, with no apparent reduction in image quality.

A cataloguing system has been developed for the management of the digital images. This has allowed efficient retrieval of the images and includes an index linking the images to the Botanical Key. The digital Leaf Atlas was first used in beta version with students in 1998.

The first subject to benefit from the digital Leaf Atlas was Biodiversity and Evolution of Plants. Students in this course spend 10 hours in the laboratory working with Australian Tropical Rainforest Trees and they were able to work far more efficiently and independently with the digital Leaf Atlas. Using a digital format tripled the number of actual plants that students could identify. The use of digital technology, including extensive on-line help, has made possible a staff

to student ratio of 1:21, as compared with 1:6 in other similar practical classes. It may even be possible to extend this ratio further, as we only had 21 computers to work with. Importantly, the students enjoyed using the digital Leaf Atlas in comparison with book based keys and atlases.

We anticipate that the digital Leaf Atlas could become a valuable resource in other undergraduate subjects including Botany II. In addition to applications in undergraduate teaching, we also expect the Leaf Atlas to be a useful research tool for postgraduate students and staff. Already one student has used the Atlas on a laptop to identify seedlings associated with an endangered species she was studying for her Honours project. The Leaf Atlas and Botanical Key are also available to students on field trips at their accommodation in North Queensland.

Delivery medium

The digital leaf atlas and botanical key are available to students on personal computers in the botanical teaching laboratories. The leaf atlas is stored on a CD-ROM, although network-based distribution is also possible. The Leaf Atlas will be available for purchase after November in 1998.

Evaluation

A standard Student Evaluation of Teaching was administered and found that the students were happy with the practical component of the course, although the questionnaire did not specifically address the new digital technology.

Prior to the development of the Leaf Atlas the following criteria for success were developed:

- the success of the production of the digital Leaf Atlas
- the educational benefits to students and more efficient use of laboratory time and demonstrator resources

The Leaf Atlas achieved both of these goals.

Our plans to publish the digital Leaf Atlas as a component of the next edition of Australian Tropical Rainforest Trees and Shrubs will involve the publishers in an evaluation of the previous points and also market issues.

We anticipate that the digital leaf atlas will help to make the next edition of Australian Tropical Rainforest Trees and Shrubs a common botanical tool.

Future

The image database will eventually be valuable for other applications beyond sample identification. The digital medium allows fine image detail to be stored and magnified making the database a valuable resource for other teaching including the structure and function of anatomical features. There is also no reason, technically, why the same approach could not also be taken with the flora of South Australia.

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Other links

Other WWW sites with information related to this project are:

- CSIRO Home page
- CSIRO Tropical Forest Research Centre

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Learning and Teaching Support

Problem Based Learning in a Large Teaching Format

Dr Ted Cleary
Faculty of Medicine, Dept of Pathology
The University of Adelaide

Introductory Medicine (IM) is one of four subjects taken in first year Medicine at the University of Adelaide. Conducted in Semester 1, the subject is innovative in that it applies a problem-based approach to a large group (approx. 150 students) setting. This is made possible by the use of small, student led tutorials.

Objectives | **PBL Process** | **Evaluation** | **Contact**

Objectives

the objectives of the course are:

- To introduce the student to some clinical problems
- To build medical vocabulary
- To introduce the student to the process of clinical case analysis
- To seek an understanding of the pathophysiological basis of the symptoms and signs in these patients
- To introduce them to the techniques of PBL
- To convince them that learning significant information from the preclinical years will help them in later years
- To provide the motivation to be effective medical practitioners.

The PBL Process

Each case in the course is discussed over a two week period in 4 x 2 hour sessions. Six cases are covered in a semester. The process begins with a written protocol describing the patient's presentation (5 - 12 lines) which is distributed "cold" to the students at session 1. They are asked to consider this protocol with the view to identifying the important pieces of information in it. They then spend 3-5 minutes in "buzz groups" discussing these issues. Information is then shared with the large group. Students are invited to explain any new terminology introduced and I provide vocabulary for terminology as it arises. Data points, hypotheses, additional questions and learning issues are identified as they arise.

When this process is complete, students elect to explore the learning issues they wish to examine in more detail, either singly or in a cooperative manner prior to the next class. At the next meeting, the summary of the previous discussion is reviewed. The students begin by sharing their findings in buzz groups with spokespersons reporting to the large group. New observations and hypotheses are added to the data and students are invited to comment on these or to offer alternative suggestions/explanations. This completed they are invited to consider, in their groups

the state of play. What now? More information from the patient? Review of the hypthoses? New learning issues?

By session 4 students come prepared to provide explanations for the physical signs and to talk about specific diagnoses and differential diagnoses.

Assessment is given in the form of an ungraded pass/fail. An end-of-Semester exam draws on the knowledge derived from the clinical cases discussed during the course. The focus of the exam, like the course, is not on the correct answer but the reasoning process involved.

Evaluation

The initiative is being evaluated through both a questionnaire and one-on-one interviews with a randomly selected person from each small working group. The course is an evolving process, so this feedback is important.

Contact

This project has been devised and run by Ted Cleary with assistance in the evaluation from Ray Peterson.

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An Applet a Day: Using Java for Interactive Assessment

Dr Geoff Crisp
Department of Chemistry

"It's about providing students with web tools so that they can manipulate their learning materials and generate more sophisticated responses."

Background | **Aims** | **Process** | **Evaluation**

Background

Student learning patterns are strongly dependent on the assessment they are asked to undertake. The problem with most of the common forms of web assessment, such as Multiple Choice Questions, (MCQ's), is that the level of interactivity required from the student is very limited. The student reads the question, looks at the associated graphics or sounds and answers the question. Although it is possible to construct questions that test synthesis and evaluation, it is very time consuming as the teacher is trying to verbalise abstract concepts that require a complex manipulation of ideas, data and visual construction.

If online assessment is to be more than MCQ's testing recall it will need to motivate students by encouraging true interactivity. Students need to actively test ideas and consequences in real time in order to make connections between numerous abstract concepts. Java applets and Java scripts allow just this. Assessment then is not an activity that takes place after learning, but rather assessment becomes an integral part of the learning process.

Aims

This project had two driving forces:

- The first was a desire to improve student learning through assessment that provided feedback that was integrated with learning.
- The second was to improve student support in an era of diminishing resources.

One way to achieve these goals was to raise the level of the kinds of interactions available to students on the web.

Process

Many academic teachers use technology and multimedia to enhance their presentations and students usually respond favourably to visually stimulating material. It should be possible to use this same approach to enliven both formative and summative assessment tasks. We are involved in developing modules for online assessment (in our case using the commercial package Test Pilot1). In particular, we are incorporating freeware or shareware java applets and javascript into the assessment tasks. Our goal is to enhance the experience and performance of students undertaking any form of online assessment or web-based interactive activity by providing a suite of tested applications that can be embedded into the assessment or online activity.

The students take data, information or a scenario and manipulate aspects of these. As a result of their intervention additional information is generated that enables the students to answer questions, form hypotheses and achieve a deeper understanding of the topic. The end result is that students are more

aware of what they don't know or find difficult to understand.

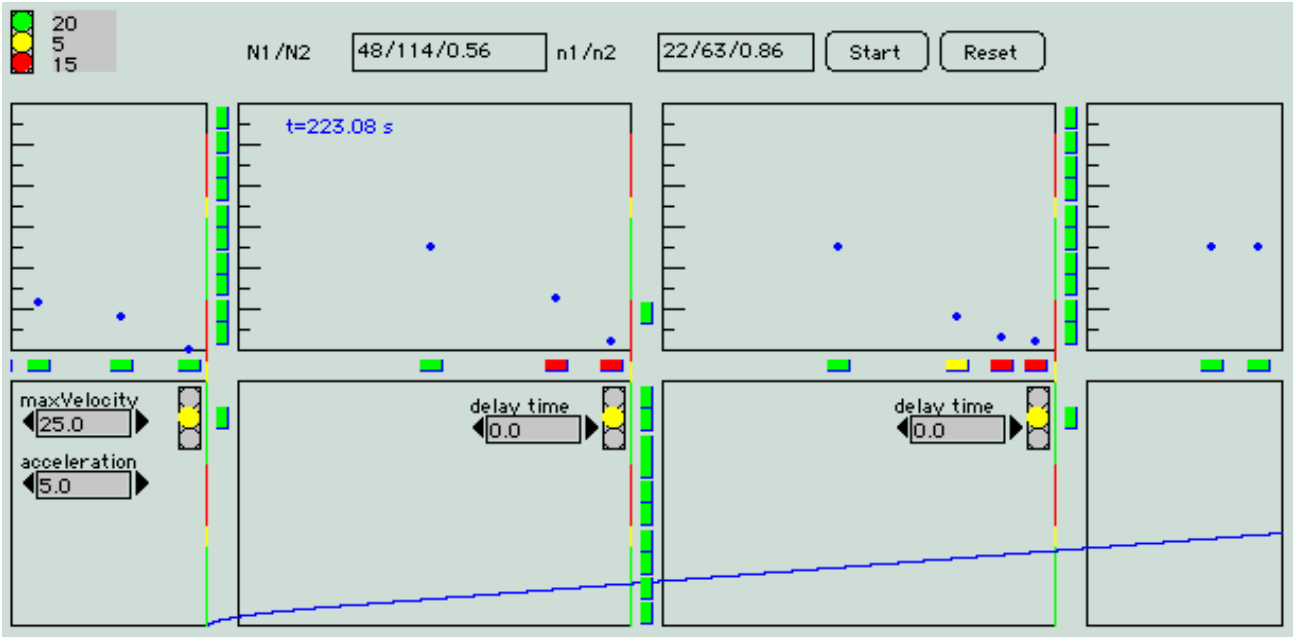
Rather than replacing face-to-face teaching, the Java applets are designed to augment live interactions between students and teachers. Student support, according to this rationale, needs to enable students to better articulate their problems so they get maximum value from face-to-face teaching time.

The types of Java applets that Chemistry is presently using include 3 dimensional representation of molecules that can be rotated in real time and bond lengths and angles obtained, a chemical structure drawing package that allows students to draw chemical structures and reactions over the web, an online scientific calculator, a slide show for presenting additional information without the need for scrolling, and the use of graphing packages that deliver statistical information for use in equations.

This approach has a number of advantages, including making the tasks interactive and visually stimulating, as well as enabling students to progress beyond recall responses to multiple choice questions. The approach we are taking is not dependent on the commercial software we are using but would be applicable to many of the online assessment tools available.

For examples of some of these applets see:
http://ajax.acue.adelaide.edu.au/

or play the traffic light game:



Evaluation

Evaluation will take place later this year and again in the following year. The point of the evaluation will not be to test the value of Java applets as opposed to some other solution, but primarily to seek student feedback on the usefulness of these tools. The overall aim of the Faculty is to improve the educational experience by providing better support mechanisms, of which the interactive Java applets are only one aspect.

A reasonable question to ask is 'Why Java Applets? ' Often proprietary products are browser or platform dependent. Also, plug-ins are often required - which immediately puts up a barrier for off campus students. Java applets attempt to resolve these issues. The resolution is, for a number of reasons, sometimes imperfect, but the aim is laudable. However, there is no special allegiance to Java; if a product better able to deliver this cross-browser, cross-platform performance emerges then the project team will use it.

Further development

Building up the applet collection is the first step. The next will be writing instructions on how others can incorporate them into the activities of their discipline area.

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Dr ALICE - tutorial software that makes a difference

Professor Michael Detmold
Mrs Bernadette Richards
Ms Jenny Richards
Faculty of Law

Dr Henry Detmold
Computer Science Department

"A Library and a University: There is an important difference between a library and a university. The provision of media (whether electronic or not) is fully analogous to a library function. University teaching, however, is a process; media resources are only a component within that overall process. It has been possible for a long time to write a university course onto a computer and provide access to it. This is just like writing the course on paper, binding it, and depositing it in the University Library. The real issue in computerizing education is to computerize the university, not just its library. Like the University, ALICE is a system supporting the process of pure intellectual exchange."

Background | **Aims** | **How ALICE works** | **Evaluation** | **Contact**

Background

There is a tendency for students in tutorial groups to remain passive learners who wait for the 'right' answer, or 'right way' to think about a problem; they expect these to be provided by the teacher. Also, certain students can dominate a live tutorial session, either with legitimate discussion or with waffle, allowing the more reticent to avoid engaging in group discussion. Even when teachers put significant effort into tutorial management, there is a non-educational cost in both time and effort. This effort includes preventing domination by certain students, wandering by waffling students, coaxing shy students (often at the expense of perfectly sound contributions by those who are not shy) and generally keeping the tutorial on topic and schedule.

Other limitations of the conventional tutorial environment include the difficulty for teachers to monitor individual students' understanding (particularly when students will go to great length to avoid exposure), and difficulty of access for some students, particularly those with young families or who are professionally employed.

In March 1999 ALICE (Adelaide Law School Intranet for Collaborative Learning) was introduced into the Law curriculum. ALICE is an online tutorial program that provides students with a series of questions to answer on particular topics. Students type in their answers, reflect on them and edit as much as they like. They then submit their answers for review by other students, and if they wish, can engage in online discussion with other students. Students can continue to edit their answers until they feel satisfied with them, and then reveal the teacher's answers. Students can then compare their well considered answers with the teacher's and reflect further on differences.

The program was developed as a means of providing students with alternative access to study, promoting participation by students who are reluctant to participate in the live tutorial environment, and reinforcing existing teaching (which is through lectures, seminars and tutorials). Students undertaking ALICE tutorials are actively engaged in independent learning. This means they can explore an answer in depth, at their own pace, and then reflect on their answers in light of those written by other students. This ensures that they take their own ideas as

far as they can go before seeing the 'right' answer. It is hoped that by doing this they will consider ideas and learn subject content more deeply and widely through reflection, discussion and argument than they would have through passive learning.

Within the Law School, some subjects have contact time allocated to ALICE, and others recommend use of ALICE as an adjunct to their existing curriculum. ALICE tutorials differ for each topic, and range from problem scenarios, drafting clauses and case analysis. ALICE lends itself to both practising the basics of problem solving and fine-tuning points of law.

Aims

- to encourage full, positive engagement of most of the class for most of their learning time;
- to provide students with the opportunity to carefully construct and refine answers without premature intervention by the teacher or other students;
- to provide teachers with the opportunity to monitor student understanding by viewing answers used in online discussion;
- to provide all students with equality of access to high quality curriculum-based interaction.

Communication is the most critical element of a successful ALICE program. Staff are given introductory tutorials at the beginning of each year where they are guided through ALICE. This is done in a seminar format where both the benefits and flexibility of the system are highlighted.. Students receive an ALICE introductory tutorial for O-week and are kept informed about ALICE on a regular basis through the ALICE website http://rumpole.cs.adelaide.edu.au/law-school/ALICE.html (inactive 14/10/05) and through weekly emails.

The ALICE website contains:

- an ALICE News Bulletin with information on tutorials (updated weekly);
- trouble shooting tips;
- FAQs; and
- the ALICE User Guide, which is also available in hard copy.

Students log into their personalised 'to do list' which contains tutorial-based work that is outstanding. Students use ALICE in two sessions for each tutorial topic:

Session 1
Students select a tutorial and begin by providing their name and a brief introduction. They then answer a series of questions. During Session 1 they are encouraged to discuss issues via the Discussion Forum but are unable to view any other answers. Students can continue to edit their answers until they are ready to submit. Only once they have submitted their answers by clicking on the 'session end' button can they progress to session 2.

Session 2
The student is queued for this session until either a nominated number of students becomes available (this is usually 3) or 24 hours elapses, whichever occurs first Once students are allocated to their 'tutorial group' they are introduced to the other members of the group and given access to each other's answers. They can then compare answers and engage in online discussion with each other. Following this they can each edit their own answers as much as they wish, and then reveal the teacher's response. At this point, the tutorial user can compare her/his answers with the teacher's and can continue to explore answers on the discussion board.

Teachers can monitor answers and discussions, and communicate at any time with students on the discussion board. The actual quality of the student response is never assessed. The fact of substantive participation is sufficient - answers are monitored and checked to ensure that students are not simply entering answers in order to go through the motions and access the teacher response.

Flexibility and adaptability
ALICE can be expanded to meet the individual requirements of courses. For example, in one

course, students voted online for an ALICE tutorial question that would be discussed further in a live seminar. In another course, extra sessions were added to facilitate learning of specific skills.

ALICE support staff
A dedicated ALICE tutor is employed by the Law School to write and conduct tutorials, or to advise academic staff who wish to write their own tutorials. An Electronic Resources specialist develops the programme and designs and maintains the website and News Bulletins. Ongoing technical support is provided by the Computer Science Dept.

Participation
In 2000, ALICE was used in Criminal Law, Contract Law, Corporate Law/Associations, Property Law, Legal Skills 11 and Open Systems and Client/Server Computing (from Computer Science). Participation rates ranged from 33% to 87%, with most around 50%. The lowest participation rate occurred where ALICE was not integrated with the teaching of the course and simply sat alongside of the course content. Highest participation occurs when the staff running the course actively encourage ALICE participation and are involved in the setting of the questions. The highest participation rate occurred in courses that allocated 5% of the overall grade to ALICE participation.

There have been approximately 1.9 million "hits" and over 65000 student responses on the ALICE web site since 1999.

In a recent survey when students were asked why they participated in ALICE 60% responded because it was compulsory and over 50% in order to practice answering questions. 40% of respondents said it was for revision and 30% to assist in the learning of the material (students were permitted to give more than one answer). Students therefore participate in the ALICE tutorials for a variety of reasons.

Evaluation

There was between 5% and 13% difference between the credit/distinction and pass/fail ratio for ALICE students in comparison to the subject results overall. In other words, for a particular course the trend for differences between grades in ALICE students is a higher percentage receiving credits and distinction, and a lower percentage receiving passes or fails when compared to the results obtained by the entire cohort for that course.

It has to be acknowledged here that not all students have warmed to the ALICE programme. There are some who resent the change and fail to see value in it. However, not all students warm to the seminar approach either, they simply want to be passive participants in the learning process and wish to be 'educated' not to participate themselves.

Student comments regarding ALICE spread from 'blow it up' right through to positive and supportive. Students acknowledge that it gives them added access to the material and a chance to review what is covered in class. They emphasise that it does not provide any new material - it is a reinforcing process.

Students emphasised the need to synchronise ALICE with course conduct and commented favourably on the continued availability of ALICE throughout the semester and the increased flexibility in learning it provided

All subjects that used ALICE in 2000 have continued to use it in 2001, and Torts and Constitutional Law have just started using it this year.

Although there was much confusion and initial wariness when it was first introduced, ALICE is now becoming a normal part of the Law School curriculum. The number of subjects using ALICE has increased and coordination has helped enormously to monitor, overcome and often avoid day to day problems.

There appears to be clear evidence, as reflected in their final grades, that using ALICE allows students to develop greater understanding of the subject content.

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Dr Catherine Driscoll
English Studies

". . . there are too many promising skills and opportunities suggested by the medium to not try and find forms of it that work for learning and teaching in English Studies . . ."

Background

I decided to incorporate electronic forums into my teaching and learning practices following my observation, in a previous teaching position, of an email list used for discussion of assessment tasks. Though that list was mainly administrative some discussion about the subject in general was initiated by the students, and I noted that most of the students who enjoyed and avidly used this forum were not the students who actively participated in tutorial discussions.

Another important inspiration for my continued commitment to using electronic discussion forums, even when there were points at which it didn't seem to be working as well as I'd anticipated, was the recognition that email is a cross between conversation and writing. As English Studies are largely concerned with expressing oneself in writing, the fact that email discussion gives students practice in putting their academic thoughts down as written prose, without the formality and constraints of an essay written for assessment, seems likely to be very useful. An email discussion list may appear to be simply a useful addition to traditional study methods. My experience so far is that, when it works, it can dramatically transform the students' learning practices and their understanding of the relevance of English Studies.

A discipline like English Studies, which is not clearly directed to vocational training for most of our students, must now closely consider the relevance of its core skills, and a further reason for the employment of IT in teaching and learning for English arises here. English Studies are always about accessing, evaluating and disseminating information in the forms that are most appropriate to a particular project or question. To this end it is no longer adequate for our students to only know about books and libraries; we need also to equip them for research, writing and presentation in electronic forms.

Aims

- to provide an opportunity for students to use an alternative discussion forum, especially if they are not confident in face to face tutorial discussion
- to enable students to practice expressing their arguments and ideas in writing outside of directly assessed tasks
- to encourage students to experiment with the newer forms of communication technology makes available

Process

My first concerted attempt at integrating email discussion lists into subject design was 20th Century American Literature in 1998. The electronic forum used to discuss the internet in this course was both a trial in teaching methods and a redirection of what English Studies courses might consider. Only those weeks in which we were focussing on the internet were

offered entirely on-line, but feedback from the students indicated that they felt it would be better to offer the email discussion group element across the whole subject. Somewhat surprisingly, even those students who had difficulty adapting to the technology advocated this approach as it meant their investment in learning the necessary computer skills seemed better justified. In the following year I tried integrating an email discussion list into an honours subject. Although the students found the list useful for follow-up questions after seminars, they didn't use the forum extensively for discussion between themselves. They were a small group who already knew each other, so the idea of discussing on email didn't gel with them. However, the few who did use the list for extended discussion generated written material that was useful to them later when they were writing essays.

In the same semester I included an email discussion list as part of the 2nd/3rd year subject The Idea of Youth: Fiction, Film and Youth. In the early part of the year students used the forum to spontaneously communicate with each other about the subject content, interspersed with accounts from their lives outside of the university in references to television news and past personal experiences and so on. As this participation was not assessed in any way it seems likely that students who contributed were interested in alternative modes of 'classroom' discussion. It was again evident that the students most active on the discussion list were usually not those most active in face-to-face tutorials.

For purely academic reasons the list was beneficial to students' understanding and application of the subject. The students were tapping into a spontaneous enthusiasm for the subject matter. They were able to make connections between study and life outside the university, and could discuss the relevance of analyses and arguments raised by the course to a range of contexts and issues.

This success proved fragile, though. The same subject also included an assessed bibliographic exercise that involved using the discussion list. Students were asked to find a text relevant to the subject and then to comment on at least one other text chosen by the other students. This bibliography and the attached comments were then placed on the subject's website http://www.adelaide.edu.au/English/iyouth.htm (inactive, 3/4/03). While this exercise was a success in itself it had a disastrous effect on the discussion list. It seemed that once the medium was used for assessment students could no longer see it as their own, and the discussion which had previously taken place on this list died very suddenly.

Evaluation

Apart from my own observations and personal feedback, I used Student Evaluation of Teaching (SET) questionnaires. In The Idea of Youth: Fiction, Film and Youth the SET results indicated that the majority of students thought the computing aspects of the subject were useful, commenting favourably, for instance, on the bibliography exercise. However, the students only offered lukewarm endorsement for the discussion list, although they had quite actively used it in the first half of the subject. Perhaps the assessment task tarnished their opinion irrevocably, or perhaps they didn't realise the educational value of the list because the discussion seemed so informal.

I will continue to use the discussion list in the Youth subject, next time separating the bibliography exercise (using web based forms for input and response) from the discussion forum. Both are valuable, but perhaps not compatible in the one space.

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The Library Skills Workbook

Ms Margaret Emery
University of Adelaide Library

The Library has assisted all first year students at the University by the use of a number of discipline-based self-paced Library Skills Workbooks since 1989. In 1998, about 2,000 first year students completed Library Skills Workbooks in a number of disciplines. During 1998 the Library initiated a project to test a web-based Library Skills Tutorial with a group of first year students.

An online Library Skills Tutorial for Science was developed using WebCT software, and 440 first year Science students completed this tutorial in Semester 1, 1999. The tutorial was designed as an active learning program with questions to be completed online, giving the students immediate feedback. As the tutorial was web-based, students could access it and complete most of it from computer labs on campus, or from home as well as from within the Library. The basic principles of information retrieval taught by the tutorial are applicable to all disciplines, but the examples, questions and emphasis are relevant to science students.

During 1999, the Library entered the second phase of the project, to develop further tutorials, for Humanities and Social Sciences, Health Sciences and Economics. These will be available to first year students in 2000. The aim is to provide the foundation which prepares students to make life long use of information sources and systems.

The development of the Library Skills Workbooks was encouraged by a University Teaching Development Grant in 1989, and the conversion to an online environment has been aided by a grant from the Deputy Vice-Chancellor (Education) in 1999.

Information about access to the tutorials will be available from the Library's web site: <www.library.adelaide.edu.au>

and further information about the project is available at: <http://online.adelaide.edu.au/LearnIT.nsf/URLs/Learning_library_skills>

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Research at the Centre - A new orientation to undergraduate Anthropology

Dr Deane Fergie
Department of Anthropology

"The core of the anthropological enterprise is questioning what seems in a particular context to be common-sense. What are the insights from our discipline for public debate in Australia? How can students truly contribute to this?"

Description |**Aims** |**Process** | **Evaluation** | **Contact**

Description

From 1991 to 1997 'Anthropology of Ritual Performance and Art' and 'Towards an Anthropology of Australian Society' were second and third year subjects in the Department of Anthropology in which a research-based approach to learning in anthropology was developed at the University of Adelaide. Both utilised students' own choice of projects as the core of the curriculum. In this course students focussed on assignment research work on a single ethnographic ('ethnography' in this course refers to the social and cultural study of texts that emerge from social and cultural research, the key method of which is intensive, participative observation) area or theme, chosen from an extensive list provided. The research program engaged students in working with ethnography and developing their conceptual, analytic and critical skills. The research program was the core of the course. All other work was designed to facilitate this task. The thrust of the course was to engage participants in a process of active learning whilst developing research and analytic skills. A "hands-on" approach was central to these subjects. Reflecting this, lectures took up only one hour of class time each week. Two hours of class work was devoted to a workshop in which students provided much of the input and work to develop practical research skills that contributed to their semester-long specialised research project. In this way skill development, which is often left implicit in the teaching process, was made explicit in these subjects.

Aims

- To lay a foundation for understandings of the development of anthropological insights into the human condition through a focus on ethnographically grounded analyses
- To build participants' conceptual, analytic and critical skills
- To develop a detailed and active research engagement with a body of ethnographic material
- To facilitate critical and anthropologically informed reflection on contemporary issues

Process

- **Lectures** were intended to be the orienting backdrop to facilitate the staging of the students' own research.
- **Workshops** were not intended to shadow or be a direct counter-point to lectures, as tutorials often are. Rather the workshops were designed to be a context in which students could develop and practice the skills required for research: reading; effective note taking;

discerning, collecting and choosing relevant sources; conceptual clarity; critical analysis; narrative skills.

- **The research program** in this course was set up so that each student would specialise in the ethnography of a particular area over the course of the semester. Each piece of work was intended to be a building block in that program.
- **Portfolios** contained set readings and provide space for research notes, compiling a research bibliography, essay outlines and a critical review of a major book in the area the student specialised in. There are three portfolios, each building on earlier skills and handed in consecutively, allowing the lecturer to check that students were getting the gist of the course.
- **Assessment** had three basic components - portfolio/workshop assignments (70%); a major research assignment whose preparation is undertaken in the workshop (25%), and the student's own assessment of their achievement against particular goals set in the first week (5%).

Evaluation

A questionnaire specifically designed for the course by Deane Fergie is used to obtain feedback. Improvements to the teaching and curriculum followed from this. Feedback was extremely positive, typical comments were: "Was very helpful in training me in the skills of critical analysis" and "Especially helped me to be more analytical".

It was stressed in the evaluation that the course aimed at an active learning strategy. The strategy itself as well as its implementation were legitimate objects of student criticism. The course was very well received by students and most adjustments were at the fringes of the structure or were adjustments to the relative value of components of assessed work.

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Learning and Teaching Support

Ouch! My Tooth Hurts

Dr Janet Fuss
Professor Grant Townsend
Dental School

Dr Mounir Ghabriel
Dept of Anatomical Sciences

Many students nowadays don't relate to text the way we did. They're geared for information in a visual format.

Background | **Aim** | **Process** | **Titles** | **Evaluation** | **Contact**

Background

Neuroanatomy is an area that undergraduates in the health disciplines find challenging. The concepts are demanding, and difficult to understand, remember and apply clinically. Students new to the area often fail to see the clinical relevance and perceive the material presented as isolated. The importance of a good understanding of neuroanatomy is often not realised until long after graduation. The structure and function of the human cranial nerves are important in all aspects of general medical and hospital practice. For the dentist, the clinical applications notably occur in the areas of pain control and anaesthesia, oral surgery, prosthodontics and gerodontics. For medical practitioners, cranial nerve assessment is an essential part of the neurological examination.

Ouch My Tooth Hurts was the first in a series of five case-based video tutorials on the human cranial nerves. Embedded in a clinical situation and using a cartoon style and actual specimens from the dissecting room, these tutorials enable students to understand neuroanatomy in its applied context. Production continues on four more tutorials.

Aims

- to create a stimulating visual presentation
- to put anatomy in a clinical context
- to produce something that could be easily used at home
- to break down student isolation

Process

Each video-tutorial begins with the presentation and history of a clinical case of a cranial nerve disorder using computer-generated, photographic and real time video images. At this point a series of questions is put to the students asking them to summarise the information, to identify

problems and to formulate hypotheses to explain the clinical problem(s) with particular reference to the sensory and motor nerve pathways affected. There will then be 10-15 minutes of small group discussion with a tutor available to assist if required. The video is re-started allowing the students to review the first set of questions. Following this clinical tests may be seen, and further clinical and/or neuroanatomical information is given leading to subsequent small group discussion(s). Each video-tutorial concludes with a summary of the anatomy and arrangement of the pathways of the relevant cranial nerve and a review of the aims and objectives of the tutorial. A workbook, with matching images and text allows the students to take the information presented home for study and self-assessment of their observation skills, approach to problem solving, interpretation of information, and knowledge.

The videos are available for loan, the video format being chosen specifically to make this access as easy as possible (as opposed to using interactive multi-media).

Ouch, My Tooth Hurts is primarily intended for use by 2nd year dental students and 3rd year medical students.

Titles

Titles in the series:

Video Tutorial titles	Cranial Nerve
*Wok's wrong in the kitchen?	I
Half my world is missing	II
Double Trouble	III, IV, V
*Ouch, my eye hurts	V (a)
*Ouch, my face hurts	V (b)
*Ouch, my tooth hurts	V (c)
*A thorny problem	V (motor)
Philipe's fast car!	VII

*completed

Evaluation

Student and staff evaluations of the first video tutorial in this project rewarded us with positive feedback. The student responses to the open questions provided us with many positive comments, such as 'It was very simple and easy to understand' and 'We now have a clear, concise package to take home', and numerous useful comments on features that have led to improvements in subsequent tutorials.

All students agreed or strongly agreed that studying the neuroanatomy of the trigeminal nerve in a clinical context was a valuable experience, and the great majority of students indicated that their knowledge and understanding had been improved through participation in the video tutorial.

Most students (97%) and staff (95%) agreed or strongly agreed that the video tutorial would be useful for self-directed learning and revision at home. They also agreed that the quality of the images was good (85% and 95% respectively); the use of matching images in the video and workbook assisted understanding (92% and 95%); and the colour coding of pathways improved understanding (92% and 100%). Following the tutorial about 10% of the students requested loan of the video.

Thanks to Annie McQueen for her work on the graphics and overall presentation to the project.

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Clinical Self-Assessment in Dental Practice

Dr Robert Hirsch
Dental School

"We wanted students to realise that when they were out in practice there would not be someone there, looking over their shoulder and evaluating their performance. We wanted them to be able to accurately assess the quality of their own work."

Background | **Aim** | **Description** | **Process** | **Evaluation** | **Contact**

Background

Under our previous clinical assessment procedures, tutors working in a clinical setting with five to seven students may have kept notes about individual students' performance, and gave summative assessments at the end of a Semester to the staff coordinator of the discipline. This often resulted in inadequate day-to-day feedback to students about their clinical progress, and kept the assessment secretive.

Tutors generally come from outside the University; some did not feel confident in providing feedback and there was the potential for a wide variation in assessments across tutors and disciplines.

With the development of the new Problem-Based Curriculum in Dentistry, see Drilling for Gold: A Problem-Based Approach in Oral Diagnosis there was a golden opportunity to revamp clinical assessment, making it a uniform system across all years and disciplines. We also wanted to change the assessment process from a secretive one, with grades given only at the end of a Semester, to a truly continuous assessment in which the students have a major input, particularly in learning to accurately reflect about the quality of their work.

Aim

To develop a system in which students learnt to effectively assess the quality of their clinical work and other professionally-related issues (eg time management, infection control), using a range of specific criteria which had been developed for each area of dental clinical practice.

Description

Assessment in Dental Clinical Practice consists of the following components:

- A portfolio of ideas and information collected by each student
- Self assessment against provided criteria
- Self assessment compared with tutors' assessment of performance
- Staff mentor discussions.

Of particular interest in this case study are Self Assessment and the Staff Mentor discussions.

Self Assessment

Each student is provided with a self assessment booklet containing duplicate pages. Each page

provides space for student and tutor ratings and comments on four areas:

- infection control;
- knowledge base;
- skills base;
- professional behaviour.

Following a procedure, students carry out the self assessment, hand the booklet to the tutor for comment and then tear out the top sheet and give it to the tutor. By retaining the copy in the booklet the student then has a compilation of self-assessment across disciplines in one booklet. The booklet is shown to Staff Mentors during reviews of progress.

Staff Mentor Discussions

Throughout the year staff members (other than tutors) meet with six to eight students on a regular basis for review self assessments and to discuss any areas of concern. The Staff Mentor also works through each student's portfolio and list of patients with them. If the Staff Mentor is concerned with any particular issue then he/she follows-up with the appropriate clinical tutor. This practice allows one member of staff to have an overview of the overall progress of a number of students in all disciplines.

Process

For staff involved in developing the assessment, the key factor was determining the criteria. Without clear and easily understood criteria for students and their tutors the system would not have worked.

Evaluation

At the end of the first semester following introduction of the system students were provided with a questionnaire. A number of improvements were made to the system as a result. The formal assessment, which had been a component in first semester, was discontinued because students perceived that the formal assessments put them under additional stress. The important aspect of clinical self assessment that we want to encourage is for it to be part of the way things are done every day in the clinic, rather than a specific/unusual event that is feared or avoided. In addition, where the tutor had taken responsibility for keeping the assessment pads in first semester comments from the questionnaire indicated that it would be far more efficient and effective for students to maintain their own documentation. This is now the practice.

Students were given a news sheet which informed them of the results of the questionnaire and of the changes which were to commence from the beginning of second semester.

As this process has only been conducted for one semester it is still in the pilot stage and further evaluation is planned. Comments would be most welcome and can be made to Dr Hirsch, see contact details below.

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Learning and Teaching Support

Literacy Matters

Christine Ingleton and Barbara Wake
Advisory Centre for University Education

"There has been a change in philosophy among teaching staff . . . staff have accepted responsibility rather than blaming high schools."

NEW! You can now view and download the full Literacy Matters document (not for the fainthearted, 5MB, but OK over the University of Adelaide network. Use caution if at home! Or print the pages you want, or see below for ordering a printed version by mail).

Background

The four most enduring concerns staff express about students' inability to communicate effectively are:

- students are frequently unable to interpret critically and evaluate subject material
- they are often unable to write according to the logic of the subject
- they are often unable to give an oral presentation based on their own analysis of the content
- as a result, many students resort to plagiarising information

Preliminary research with Year 12 teachers, university teachers, 1st year university students and employers has revealed not only different expectations about student literacy, but that the responsibility for teaching these skills was generally believed to lie elsewhere. A frequent comment from university staff was that literacy and communication skills should have already been learned at secondary school, but this was refuted in interviews with Year 12 teachers, who reported that their desire to develop their students' critical literacy skills was limited by the task of catering to a very wide range of students and a public examination system which rewards rote learning.

Over two years (95 & 96) the Literacy Project described here included research on the causes of literacy problems, the explicit teaching and assessment of literacy, communication and critical thinking skills, together with the development of subject material in selected subjects and courses. This is documented in the ACUE publication *Literacy Matters,* published in 1997.

Aims

Improvement in students' literacy and communication skills through the:

- identification of communication skills required by staff, employers and students;
- identification of current levels of students' skills through early diagnosis and formative feedback;
- development of curriculum and assessment to include communication and literacy skills.

Process

Rather than viewing literacy as a remedial problem for individual students, the stance taken in this Project was that literacy is a curriculum issue, and that literacy needs to be taught in context. This approach stressed the following:

- the need to identify how logic and knowledge are constructed in the discipline

- the need for students to learn explicitly and precisely how to communicate that logic and knowledge.
- the need to integrate communication skills into course objectives *and* the assessable work of students

A linguist was employed to identify the language features of essays, reports and short answers, and in particular, how students were expected to construct logical arguments, professional reports and so on *in their discipline*. Materials were developed collaboratively for use by students and staff, while assignments, tests and exams were worded to reinforce the appropriate communication of logic and style of presentation.

In introducing literacy and communication skills the Project initiated a cycle of change:

consultation	with head of department with subject co-ordinators with students with language advisor
analysis	of problems in students' communication of how logic and knowledge are communicated within subject discourse
curriculum	define assessment criteria develop course objectives and desired communication skills develop teaching materials
teaching	provide diagnostic writing tasks to evaluate communication skills provide staff development for teaching and assessing communication skills assess and evaluate sequential development of skills through tutorial tasks and assignments introduce active problem solving and discussion in tutorials
assessment	make assessment criteria explicit to students provide feedback on development of communication skills include marks for communication skills in final assessment
evaluation	evaluate student texts before and after introduction of communication skills enable qualitative and quantitative evaluation of program by students and staff

Evaluation

The Literacy Project spanned three discipline areas; a single subject in both Mathematics and Labour Studies, a whole degree in Commerce, and a Faculty wide implementation in Agricultural and Natural Resource Sciences (ANRS). Test and exam results and Student Evaluations of Teaching (SET) were the main forms of evaluation used, as well as interviews with staff. Journals and formal question and answer surveys of students' perception of the subject's impact on crucial literacy skills were also used with generally positive feedback. Evaluation of student texts before and after the introduction of the communication skills in Commerce showed great improvement in using report formats and handling logic in explanations. In the Labour Studies subject, students in the year following the project requested a re-run of the seminars on essay writing run during the project. The pass rate in the English language skills subject ESL for Mathematical and Computer Sciences demonstrated that this was a more appropriate subject for the development of rich language than the previous Philosophy subject had been.

Commerce students were asked: *In your writing and communication of ideas at university, have you learnt new skills that are different from those required in Year 12?*

One reply is representative of a number:

"Yes, I have better writing skills and comprehension skills. I'm more self-motivated in terms of learning."

A Commerce staff member commented:

"There has been a change in philosophy among teaching staff . . . staff have accepted responsibility rather than blaming high schools."

A Labour Studies staff member reported:

"Showed that we can teach writing skills; and students definitely improved."

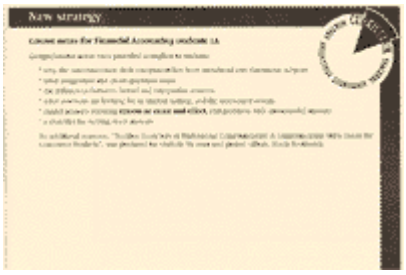
Examples

See the online resource Written Communication in the Faculty of Agricultural and Natural Resource Sciences.

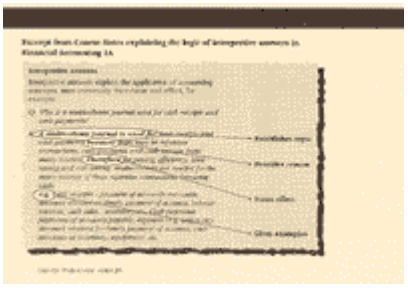
The booklet ***Literacy Matters*** is available for the cost of postage through the CLPD. Please contact clpd@adelaide.edu.au or fax us on 8303 3553.

Click on the thumbnails below to view some examples from *Literacy Matters*

1. Before...



2. New strategy



3. Excerpt from course notes

4. After...

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The on-line management of pests: discussion forums as a learning/teaching tool

Dr Mike Keller
Applied and Molecular Ecology

"I hoped that on-line peer interaction would encourage students to think more independently, more deeply about the subject."

Description | Aims | Process | Evaluation | Contact

Description

Integrated Pest Management is a subject designed to provide a comprehensive introduction to the various means of managing insects, plant diseases and weeds in agro-ecosystems. The subject is taught using lectures delivered via video conferencing and with laboratory practicals. In 1998 we trialled a Lotus Notes assisted discussion forum to enhance our subject delivery. A web site was constructed which provided access to general announcements, questions and answers about the lectures and practicals, as well as the discussion forum. Participants can log on at any time, and follow a hierarchical series of contributions on a topic of interest. Discussions can follow saved paths and debate of a particular point can be picked up even after others have moved on to other areas.

We envisaged that using the medium of the on-line discussion forum we could generate student interest and interaction, and encourage students to think about their topics in greater depth.

Aims

1. Encourage student participation in learning, especially the development of informed opinions.

2. Encourage unstructured research on a broad practical topic.

3. Provide opportunity for written expression.

4. Provide opportunity for interactions with peers in a relaxed environment.

Process

At the start of the semester students were given instruction on how to use (1) the World Wide Web, (2) the discussion site, and (3) email. Instructions for the discussion site were given to them in printed form and were available on-line at http://www.waite.adelaide.edu.au/Teaching/IPM.

To get the ball rolling we posed a controversial question for the students to discuss on-line : "Would it be possible to eliminate synthetic pesticides from agricultural systems?".

We began with a brain-storming session in which students identified aspects of the problem. This session was designed to be question driven rather than informational, and lasted about 1 hour.

Each student agreed to address one particular aspect of the problem, but all were free to

comment on any part of the discussion. They then read the relevant literature and developed an informed position. It was stressed that contributions should be supported by references wherever possible, so that the debate should include personal opinion and objective supporting material.

Students were given three weeks to participate (excluding two weeks of mid-semester break). This was extended by two weeks at the request of the students.

The lecturer did not contribute to the discussion except to correct factual mistakes. The reason for this was to allow students to interact without heavy-handed interference.

Assessment issues
The main points to be considered in assessment were:

* Marking should be easily understood.
* Marks should reflect how well the students achieved the aims of the assignment.
* Feedback should be given to students on their intellectual performances as well as the quality of their writing

The most difficult element of the assessment procedure was to devise a method that rewarded optimal participation. The assessment needed to take into account not only the quality of a contribution, but the number of contributions. Additionally, it needed to reflect the responsiveness of the contributions to the on-line discussion, otherwise there was the risk of encouraging a series of insular short essays.

In the final assessment system students were marked on each contribution and the maximum score for each of the following criteria was awarded. By grading on the maximum score obtained the assessment procedure was weighted in favour of students who contributed more postings.

Criteria: Maximum for all entries

* Overall contribution of new information that is relevant to the subject
* Analysis, synthesis and critical thinking
* Responsiveness to other contributors
* Supporting references

In addition to marking the entries, constructive comments were given to explain how marks were evaluated and to suggest improvements. I give a single mark which is the maximum score in each category across all contributions. This gives students an incentive to make extra contributions as they can potentially improve marks each time they join the discussion. Also, there is not necessarily a need to address all criteria in every contribution. I return marks by electronic mail and they are confidential.

Evaluation

An evaluation of the students' feelings and behaviours was undertaken at the completion of the subject. The evaluation aimed to discover how and when the students responded to the on-line discussion, and their impressions of the learning value of the initiative. As a result of this evaluation and the observations of the lecturer, the following problems were uncovered:

Firstly, there was poor participation at the start with a flood of contributions just before the deadline. This exacerbated the already low level of debate/interaction.

Some contributions were virtually stand-alone essays, which inhibited debate.

For the lecturer the main problems were the amount of time required for a class of 70 students, working out what level of intervention was appropriate, and designing appropriate assessment tasks.

Lessons Learned
The following points summarise the lessons learned from this presentation of the subject:

* It is best to choose challenging questions, especially questions that are open-ended and topical. The nature of the topic under discussion is crucial to its educational value. Those problems that involved public debate or that had no clear solution and had accessible resources and references stimulated the best discussion.
* Online discussions seem to work best when they are integrated with other face-to-face activities.
* Many students needed guidance and my students found a series of brief tips on the website, as well as printed material, very helpful.
* Serial deadlines encourage timely discussion and avoids the 'rush at the end'. It also allows students to progressively improve their work as they read and compare other contributions.
* It is very important to provide timely, confidential feedback.
* Organising students into smaller groups helps the process. 70 postings was too many for the students to read.

A more detailed paper is available.

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Learning and Teaching Support

Learning Through Design

Mr Michael Liebelt
Department of Electrical and Electronic Engineering

"I wanted to give students a holistic view of the design process"

Background | **Aims** | **Process** | **Evaluation** | **Contact**

Background

In my third year Microprocessor Systems subject (about 140 students) I was faced with a dilemma common to many educators in a design field. I needed to convey basic concepts and theory so that the students had the intellectual tools to engage in microprocessor system design, but focussing on the theory and concepts created an arid and dull subject. This was dissatisfying for me as a lecturer as I knew that microprocessor system design is a creative and challenging practice involving complex trade-offs. I felt the subject as I was teaching it ignored the reality that in practice theory is in the service of design. Instead I was seeing students approach knowledge and skills as compartmentalised and isolated. Rather than motivated to learn, the students appeared motivated to pass the exam. The better students weren't extended and I wasn't challenged either.

In 1998 I decided to develop and present a subject that moved away from a focus on information for its own sake (or rather for the sake of passing an exam) and toward a focus on a holistic view of the design process. This entailed changing the subject delivery from fact-based lectures to a more interactive process with design as the focal point and information playing a support role.

To achieve this I used a Project Based approach. I set a project - to design a microprocessor system to operate a robot. Students developed a paper-based hardware and software design for the microprocessor system in first semester. In second semester most students took a lab work subject in which they could realise their design in an actual robot. Ultimately I believe the change in teaching focus and process enabled the students to appreciate the artistry and compromises involved in a creative design-like practice. They could begin to see how exciting the implementation of engineering knowledge could be.

Aims

to -

- get students to learn about the complexity and multifaceted nature of the design process
- allow students to appreciate how enjoyable engineering can be when you are creating something
- reinvigorate my teaching practice with a fresh approach

Process

Through discussions with other lecturers in the department about these kinds of issues, in particular Neil Burgess who had developed his own problem based design subject, I began to formulate an approach that I thought would deliver the aims I had set.

A group based, project centred approach was taken. Working in groups of four the students were to produce a project report detailing their design. To get there they had four homework worksheets, staged to ensure that they were motivated to acquire knowledge at the appropriate time. The process was facilitated by a weekly discussion where students could ask questions and talk about their difficulties. This, and a short talk of 10-20 minutes duration that gave an overview of a particular technique or issue, took the place of lectures. Often the topic for the talk was determined by student questions during the preceding week and was decided upon only on the day before the discussion session. A comprehensive set of notes that covered the essential knowledge but not the complete range of design techniques was also given. A web site held reference material - notes, project specification, copies of worksheets and sample solutions for worksheets. Students were encouraged to submit questions to me by email, in which case I would post my replies on the web site for all to see, or to ask questions face to face after our weekly discussion sessions or at any other time.

This innovation in teaching practice was first tried in 1998. My satisfaction in teaching improved markedly as the students were asking questions relevant to their needs rather than simply acquiring disconnected facts. The good students were able to get deeper into the topic than they had previously as they were no longer constrained by the lecture material. The class as a whole began to come to grips with the trade-offs intrinsic to a design practice. The project is worth 25% of the final grade, with a confidential peer assessment contributing 5% of this. Each group's worksheets accounted for 20%. Individual assessment is through a final exam worth 55% of the final mark.

The exam perhaps doesn't fit ideally with the overall strategy but it is important to obtain a reliable individual assessment and it is impossible in practice to eliminate plagiarism from the worksheet assignments and difficult to identify passengers in project groups.

In designing the learning and assessment activities in the course one of my aims was to keep my overall workload approximately the same, given that it was bound to involve some increased assessment time but less lecturing and preparation time. Overall I almost got it right - I feel that the workload has increased slightly, but the upside is that whereas previously many hours would have been spent preparing and delivering lectures, now those hours are spent in interactive engagement with the students, which I find much more satisfying.

Evaluation

A SET evaluation in 1998 found satisfaction with the new course was slightly higher though the students' comments were quite polarised. Many students loved the independent learning and creative aspects of the subject, but others felt the lecturer had abdicated responsibility.

In the course of weekly discussions I was able to explore a wider range of issues in microprocessor systems design than I had previously, and feedback from the class, both immediate and through subsequent questions, indicated a good appreciation of those issues.

Relatively few students submitted questions by email, but most appeared to be reading my replies. Some of the questions showed a very good appreciation of the engineering issues and I found this to be very satisfying. Clearly, some students were acting as spokesperson for their groups. Many students preferred to ask questions face to face - particularly, it seemed, those who were less confident of their knowledge.

Exam marks were not significantly different from what I had previously seen, but the exam did explore student understanding of a wider range of issues than previously. There was evidence that the students had at least as good a grasp of the informational content as in previous years, as well as an appreciation of the design subtleties.

Improvements as a result of this feedback and my reflections on the first implementation have

consisted of fine-tunings rather than any significant overhaul. Topics are now presented in a slightly different order to maximise their usefulness. The lecturer can now anticipate the junctures in the subject where students can go "off the rails", pursuing inappropriate solutions, and can guard against this by introducing a discussion of related issues at the appropriate point. More technical and administrative information is now provided on the web site.

As an indication of external validation I was asked in 1999 by the Advisory Centre for University Education to present my experiences at an Introduction to University Teaching course.

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An investigative approach to technical problem solving

Valerie Linton
Chair: Welded Structures
Department of Mechanical Engineering

When plunged into a real-life situation, students, although having the technical skills to deal with the situation, often lack the ability to obtain and rationalise information to answer the (usually undefined) question at the centre of the problem. The exercise reported here set out to provide a roadmap to allow the students to successfully navigate from a presented problem to a solution satisfactory to all concerned parties.

Background

This exercise was performed as part of a fourth-year elective course on welding. The course covers a wide range of topics, each of which can be addressed in lectures. However, application of the knowledge acquired to an unfamiliar problem usually requires engineers to draw on a number of topics in a way that is often difficult to teach through lectures and tutorials.

The project described here took the form of a role-playing exercise, where the students were presented with a request for technical assistance on a failed component. The normal response of students would be to use only their current knowledge to rapidly reach a conclusion about how the component had failed. However, in most situations this approach would lead to incorrect conclusions and a failure to address the crux of the matter. This was a situation I had observed frequently in the industrial workplace before I joined the University. I wanted, therefore, to give the students an opportunity to deal with a real situation in a controlled environment where they could learn from their frustrations and experiences.

The exercise was a departure from traditional teaching methods in that the students investigated for themselves the best way of dealing with the problem through role-play interactions with other parties of their choice.

Goals

The exercise had a wide range of goals, all of which were non-technical. The exercise objectives for the students were:

- to learn about the investigative approach to problem solving
- to learn about dealing with clients and customer relations
- to be able to apply background and obtained knowledge to an unfamiliar problem
- to be able to define the 'real' question and answer that question

Process

The students were unaware that this project was going to happen: it was slotted into the

course as an 'interruption' to mimic the way in which problems come up in the workplace without warning. The students were given the opportunity to work on the problem over three consecutive lectures/tutorials (a total of five hours' effort), endeavouring to assist, and report back to, their client.

The students were divided into groups and given letters (with accompanying photographs) from clients requesting assistance with a failed component. There were three different scenarios so that at least two groups were working on each scenario. The text from one letter follows; this letter was accompanied by a photographs of the failed chain link and the fracture surfaces.

> Dear sirs,
>
> A serious accident occurred in my fab shop yesterday when a chain link on the overhead crane broke while the crane was in use. Fortunately no one was injured but significant damage was caused to equipment.
>
> I can get the chain fixed but I am concerned that it might break again and we might not be so lucky next time.
>
> Am I ok just to fix it?
>
> Looking forward to your assistance.

After reviewing the information received, the students were asked to present to the rest of the class a summary of that information, a list of actions to be taken and further information to be sought, and the question they were trying to answer.

The students were then free to implement their action plans, including options to request lab analysis, consult reference material, talk to the client, and talk to materials suppliers or fellow engineers.

After an hour the students were requested to report progress to the rest of the class, particularly addressing the following questions:

- Did you get the information you wanted?
- What would you have done differently?
- How did you feel after talking to the client?
- How had your understanding progressed after talking to the client/lab work/reading up?
- What were the important elements of the previous step?
- What elements did you expect to be covered that weren't?
- Is the question you were trying to answer the one you now think you want answered?

Additionally, the students were asked to summarise the information they had received, list their new actions and identify the question they were trying to answer.

At this stage, three clear areas of frustration were emerging for the students. First, the information the groups were using was a jumbled mix of things they had been told, things they thought they had been told and things they thought they knew about. This mixture was leading the groups down dead ends and on wild goose chases. Second, in conversations with the client, the students were not obtaining the information they wanted and this manifested as frustration with the client. Third, although the question the students thought they were trying to answer had evolved in their minds, they were failing to address the key question of the problem.

At this point the three main tools I wanted the students to apply were introduced, namely:

- the importance of distinguishing between known facts, assumptions and theories
- the use of open and closed questions to gain the required information
- the need to identify the real question at the centre of the problem

In addition, a suggested process was introduced as a flow chart.

The students were then given more time to apply these tools to their exercise and again report back to the class. Finally the student groups had to report back to their respective clients. At the end of the exercise, the main points coming out of it were summarised and the 'answers' to the failure investigations given.

There was no formal assessment of this exercise. However, the progression of the students' understanding of the process was evaluated through observing how they improved in their approach to the problem. The student groups' presentations to the class also improved and matured as the exercise progressed.

Student response

On the whole the students responded very positively to the exercise. It provided them with an opportunity to tackle some actual problems and apply their knowledge. Importantly, all of the students took an active role within their groups, engaging for the whole exercise.

Evaluation

At the end of the exercise the students were asked to complete tailored SET assessment sheets. The SET results indicated that the students had enjoyed the exercise and felt that they had gained something from it. Although this had been a stand-alone exercise, I found that there were knock-on benefits throughout the course. For example, during class students were happy to tackle, in the same manner, bigger questions for which they didn't necessarily have all the required information.

Future developments

I would like to expand this approach to problem solving more widely through the course to the point where it becomes second nature for the students. For example, when a new topic is introduced, the students currently sit back and wait to be instructed on the topic. They assume that the information received in this way will be all they need to do the associated assignments.

I would prefer the students to use investigative thinking and discussion in class in order to identify the key pieces of information they need to discover and learn about in order to be able to tackle associated projects or assignments.

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Anatomical Paper Cutouts: Three Dimensional Diagrams of Anatomical Structures for Medical and Paramedical Students

Dr N. A. Locket
Department of Anatomical Sciences
The University of Adelaide

"I wanted to help students understand the subject in three dimensions, on their own, independent of dissecting room facilities"

Preamble |**Aims** | **Process** | **Evaluation** | **Contact**

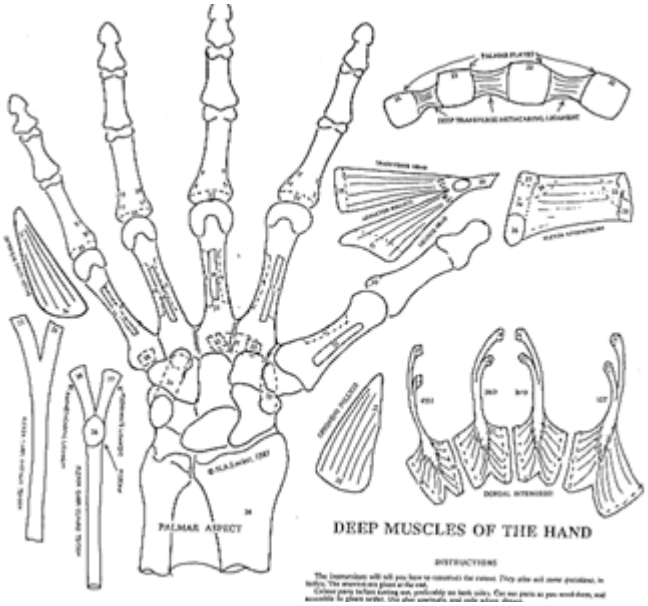
Preamble

Three-dimensional understanding, difficult for some students, is a vital part of learning anatomy. Students dissecting cadavers reveal the parts for themselves, but at first deep structures are not seen. Dissected specimens and expensive commercial models which help clarification are not available at home. Half skeletons are now scarce and expensive. Some institutions, particularly overseas, do not include dissection or access to human material in their courses, others are reducing dissecting time.

Most illustrations show all the parts visible at one time, though they may be of disparate functions. This, and student difficulties in visualising things in three dimensions, prove obstacles to understanding.

Aims

- To isolate functional components of anatomy for students
- To promote active learning
- To provide a means of studying anatomy in 3D



Process

I have designed and produced a series of paper cutouts focussed on the limbs, which every student can make up to form three dimensional anatomical diagrams. Annie McQueen, a medical graphic designer funded through a CAUT grant has produced cutouts of other regions, including the skull, which forms the basis for future examples covering the head and neck. Students label and colour the parts if they wish, the made-up cutout being useable

unlabelled for self-testing, or labelled for reference. Full instructions, and questions highlighting important points, are given with each set. Some cutouts deal only with part of the anatomy, clarifying the underlying pattern; complementary cutouts show the rest. Parts may span two regions, which is not apparent in limited dissections, but can be well shown in paper cutouts. Cutouts promote active learning of one concept at a time, the students building and demonstrating the anatomy in depth, unlike dissection where the part is progressively disassembled. Completed cutouts are a three dimensional resource for work at home, where specimens are not available. Reproduced by photocopying, the cutouts are inexpensive and need no hardware. Once designed, cutouts are available to each year of students and adaptable for courses at different levels, e.g. medicine, physiotherapy, nursing and sports science.

Evaluation

Student Evaluation of Teaching (SET) questionnaires have found that a large majority of students considered the anatomical cutouts to be helpful or very helpful in assisting visualising anatomy in 3D. The cutouts were considered time well spent, and engaged the students in thinking about anatomy while they were constructing them. Many students have retained their cutouts years after completing the course.

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Learning and Teaching Support

The Internship Program

Dr Clement Macintyre
Politics Department

"For students to get to work on real policy documents, with all the privileges and constraints that entails, is an invaluable opportunity and that's really what the program is about"

Background

Since 1995 in the parliament and 1997 in the public sector, the Internship Scheme conducted by the Politics Department has given students an opportunity to contribute to the formation of public policy.

In this Scheme students don't just write essays that are read, marked, given back and then deposited in the bottom of a drawer, but write reports that may be used to shape the policy of Government Departments or other organisations. Hence, students write longer and more focussed pieces than they would for an undergraduate essay.

The Internship Scheme provides students with the opportunity to leave the immediate university environment and work in a place where they can pursue applied research. The Internship may take place in a Government Department, with a member of Parliament, or in non-government organisations, such as political parties, lobby groups, and community organisations. Students learn how to define an issue, research the issue and write a polished report.

It also facilitates the building and maintaining of strong links between the University and both Government and non-government organisations, and enables students to build networks which may lead to better employment prospects.

Aims

- To enable students to develop applied research and writing skills
- To help students define and develop some expertise in a practical research problem in the policy area
- To integrate the university more closely with external agencies

Process

The Internship Scheme is an upper level undergraduate subject, with no disciplinary pre-requisites and is open to anyone across the university. The underlying principle of the Internship Scheme is that it should further the interests of both the intern and the Parliamentary supervisor. The final 5,000 - 7,000 word report needs to satisfy all the usual academic conventions and also be of some use to the participating organisation.

Students can choose between the Parliamentary and General Stream. The Parliamentary Stream is shared with the other two South Australian universities, the General Stream is for Adelaide students, and places them with Government Departments, lobby groups, political parties and other non-government organisations.

After enrolment, students choose from the topics and internships available, depending on their interests. An attempt is made to match the students' preferences with their placement as much as possible. Final selection and placement is determined by quota based on academic merit.

At the beginning of the year there are a small number of academic seminars that orient the students to the issues and ideas that they will be confronting (how to write in the format required, formation of public policy, and so on). Students then meet their Parliamentary or organisational supervisor and negotiate a topic. A contract; that stipulates the aims, methodology and time of all parties, as well as the obligation to submit a report by a given date is drafted and signed by both supervisors (academic and organisational) and the student.

The students then undertake independent research at their own pace, and may utilise law, parliamentary, university or other libraries, interviews, surveys and whatever other information-gathering strategies and resources relevant to their topic. During this time they regularly meet their academic supervisor, who acts as a facilitator, providing guidance on how to put the report together and work through any problems. They also meet their organisational supervisor on an agreed schedule to make sure the report is meeting the organisation's needs.

At the end of the academic semester all students attend an 'Internship Conference' at which they present a summary of their findings and to which all participating supervisors are invited.

Assessment is either 100% research report or 80% research report and 20% which can be either an essay based on the initial seminars or a reflective essay in which the students write about their experiences as an intern.

Evaluation

A specialisedStudent Evaluation of Teaching (SET)was developed for the course by the lecturer and theAdvisory Centre for University Education. Evaluations so far have been generally positive, but many of the issues, such as the students' reactions to their organisational supervisor, are out of the lecturer's direct control. Some students felt there was a lack of support and would prefer more structure, and as a consequence the lecturer has made himself more available.

Formal evaluations of organisational supervisors have also been positive. Nearly all those parliamentarians and organisations that take on students do so again, a strong indication of their satisfaction with the value of the initiative.

The program has also had some noteworthy accomplishments. Consideration has been given by one MP to the introduction of a Private Members Bill based on the findings of the report prepared for him (he has since moved to the Ministry) and a report prepared in 1997 played a significant part in the redrafting of legislation relating to the privileging of counselling records connected to sexual assault.

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Making Practicals Practical: Introducing Student-Driven Experiments

Professor Simon Maddocks, Dr David Tivey, and Mr Robert Kemp
Animal Science Department

"To have real involvement and enthusiasm from students requires real questions, asked by the students themselves. This means, to some extent, promoting student ownership of the learning process."

Background | **Aims** | **Process** | **Evaluation** | **Contact**

Background

Physiology of farm animals is an undergraduate topic that was previously taught to students enrolled in two distinct degrees, based at two geographically distant and culturally very different campuses. In 1997 we made the decision to rationalise our course offerings and develop a new subject. This presented some obvious problems given the need to integrate the students from both campuses. But this also presented us with the opportunity to address greater pedagogical issues and possibilities and we decided to make a radical break with the teaching methods of the past. Principally, we wanted to rekindle student enthusiasm for learning, that is, for answering questions that they developed, using the methods they designed.

Traditionally, practical based subjects were a labour intensive and expensive way of teaching. A four hour practical would take a full day to prepare, and another to clean up. Also, the practicals were recipe driven and discouraged critical and imaginative thinking on the part of the students. The most difficult concept to impart was that individual facts are only as valuable as understanding how they work together in a system. This holistic approach was very difficult to foster in students who only needed to memorise isolated facts to pass their assessment.

As well as these educational issues, we were faced with the difficulty of integrating two student bodies from different campuses, with different expectations and a history of negative, unfounded assumptions about each other.

Aims

- To create a question driven rather than information driven course. We believed the best way to accomplish this was;
- to establish a research skills based course.
- to rationalise learning and teaching resources and time.
- to facilitate the interaction of two diverse and mildly antagonistic student groups.
- to promote student ownership of the learning process.

Process

For the first five weeks we concentrated on how to go about developing the right questions, ones that could be tackled through some research, ingenuity and application; in other words, how to frame hypotheses. We started with a question, rather than presenting information, which set the tone for the entire course. The conundrum we began with was; 'Are Men Stronger Than Women?'

In this first part of the course we took the students through the process of formulating research questions, designing appropriate tests and writing and reporting their findings. The students learned how to phrase hypotheses, read and write abstracts, design experiments, plot data and present a talk. Working in groups that we selected so as to maximise cross-campus interaction, the students were encouraged to work through their own problems with experimental design, using the lecturers and tutors as advisors to their project. We tried to keep the ownership of the thinking and working of the group as much with the students as we could and this included assessment, which was, in part, peer based.

Background material in animal physiology was delivered in lectures and tutorials. Each week the students were given a synopsis of the relevant topic matter and three to eight questions that covered the examinable material. A continuous assessment component required one nominated question each week to be answered and submitted for marking.

In the second phase of the course the student groups chose their own research area from a standard array (e.g. 'digestion', 'cardio-vascular'). Like any good research question, the students began with what they knew about the area, and formulated questions about things that puzzled them. For example, one group looking at the cardio-vascular system arrived at the question 'Is fitness dependent on blood pressure or heart rate?'. From these kinds of ruminations students began to comprehend the systemic interdependence of aspects of animal physiology.

Equipment and budgets were available for carrying out experiments, but this also created limitations; was it possible to test what they wanted to test with the materials on hand? Another benefit here was that students had to take responsibility (with strategic input when sought) for organising their own equipment requirements.

Evaluation

The results were in most respects better than we could have hoped for. The new subject was far more effective than the two subjects it replaced. The barriers between the students from different campuses were broken down, and the students showed a marked enthusiasm for learning. Students were now routinely turning to abstracts from current databases rather than out-dated textbooks for information. In the final exam for the subject the students showed a much greater capacity for systematically and precisely answering questions than the students who had learnt in previous years. A Student Evaluation of Teaching (SET) evaluation confirmed that the practicals were perceived as achievable and that the students felt, in general, positively about the subject.

Comments included:
"The questions given were the source of greatest learning. Tutorials around completed questions would be valuable, I think."

Overall, the teaching staff have been encouraged by the success of the restructured subject, both in the response of students to the new format and their performance in the subject. Importantly, the decision to combine physiology teaching across the two degrees proved to be right, and little or no distinction could be made between the two groups of students on completing the subject. However, taking into account student feedback, the subject still requires some refinement. Staff will revisit the subject content and evaluate the value of the first practical in its present format, possibly replacing it with a series of "how to" exercises to better prepare students for the research based practical.

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Mekong eSim: A role-play/simulation project for 2nd year Environmental Engineering students

Holger Maier
Department of Civil and Environmental Engineering

Multiple awards!

The Commonwealth of Learning Award of Excellence for Distance Education Materials
The citation for the award can be viewed at: http://www.col.org/edea/edea_citations.htm#mekong (inactive 25/8/03)

The Pearson Education UniServe Science Teaching Award with the following acknowledgment:

"Your submission was outstanding. Your project was very innovative, in the sense of being a new way of teaching using information technology. It was based on sound educational principles and backed by evaluation that was sensible, thorough and convincing. The collaboration across institutions and disciplines in your submission was very constructive. Your submission was judged to be more competitive in all aspects."

Award winner for

"Exemplary use of Electronic Technologies in Teaching and Learning in Tertiary Education: Best Web Based Project", 2001
an annual award from ASCILITE: (Australasian Society for Computers in Learning in Tertiary Education).

Congratulations to Holger Maier and his team!

"I'm one of those people who likes context, and consequently have always thought about how I can make learning experiences as realistic as possible…The Mekong eSim really works. You believe in it, and can see the students coming out with a good experience... It's something they'll remember, and relate to other things being taught"

Background | Aims | Process | Evaluation | Future Developments | Contact

Background

This learning activity is about environmental decision-making. It is a web-based role-play/simulation project, set in the Mekong area of South-East Asia and is a collaboration between four institutions: Adelaide University, The University of Technology, Sydney (UTS), The University of Sydney and The Sepang Institute of Technology.

In role-play/simulations participants take on a particular role by adopting a persona within a simulated environment. Based on the success of two pilot roleplay/simulations in 1999, focused on the Beverley Mine in SA and the use of Australia as a nuclear waste repository, Holger Maier and Keith Walker won an Adelaide University Teaching Development Grant to develop the Mekong eSim project in collaboration with Rob McLaughlan from UTS.

Aims

The Mekong eSim was developed as a realistic international problem which emphasised collaboration and cooperation. The design of the simulation also enabled staff to integrate their own interests in environmental problems and international development issues in the classroom, and to explore the use of groupwork.

The student learning objectives were to:

- identify the political, social, economic, cultural and scientific dimensions to decision-making in resource management conflicts;
- identify the responsibilities and appropriate responses for characters in the role-play/simulation;
- develop communication, research, critical thinking, negotiation and decision-making skills;
- communicate and integrate with students studying the same curricula at multiple campuses.

Process

One hundred and sixty second and third year students from the four institutions were assigned roles in teams of 3-4, based on stakeholders involved in conflicts surrounding water resources issues in the Mekong Basin. Potential stakeholders included non-government organisations, international agencies, government agencies, business interests, farmers and fishers from up to six countries.

Through research and oral and written communication assignments, the students investigated their roles and researched relevant water resources and development issues, proposed options and negotiated with one another. Most of the interaction occurred over the internet, with some structured face-to-face debriefings at Adelaide and UTS.

Assessment

The assessment schedule laid out below gives a good idea of the range of individual and group assignments which structured the eSim. Students also assessed themselves and their peers using a software package called SPARK, currently being developed at UTS. Information on this development can be found by contacting Jo McKenzie from the UTS Institute of Media and Learning (jo.mckenzie@uts.edu.au). Group work processes are not yet being assessed.

Figure 1: Example extract from assessment schedule

Students from all Universities will be expected to contribute about 40hrs to eSim. This is consistent with the workload for the course you are undertaking and the amount of assessment the eSim occupies in your subject.

Assessment Item	Submission type	% of eSim mark	Submission place on website	Due date
Role Profile:Individual	Individual	7		
comprising description policies, strategies, representation issues			Student dropbox & group pages	15 March (5pm)
Role Profile:Group	Group	10		
comprising description, policies, strategies, group diversity issues, persona representation			Student dropbox	18 March (midnight)
Role Profile:Public	Group	3		
comprising description, policies			Role profile forum in discussion board	18 March (midnight)
Issue paper	Group	20		
comprising issues specific to each persona			Student dropbox	26 March (9am)
Participation	Group	30		
comprising email, public inquiry, news events, funding proposals. Includes a group self and peer assessment which is due 6 April.				Periodic
Critical Learning Incident	Individual	15		
comprising observation, clarification, interpretation, intervention, outcomes, knowledge gained			Critical Learning Incident forum in discussion board & student dropbox	6 April (midnight)
Debriefing Report	Individual	15		

A more detailed description of the project can be found at:
http://www.eng.uts.edu.au/~robertm/mekong/Information.htm

Some publications on the Mekong e-Sim have recently become available on the web:
http://science.uniserve.edu.au/pubs/callab/vol7/mclaugh.html
http://www.ascilite.org.au/conferences/melbourne01/pdf/papers/mclaughlanr.pdf

Evaluation

The role-play/simulation project is being evaluated from both student and staff perspectives. Students provided feedback through a questionnaire and a nominal group technique, while teaching staff from the four institutions were interviewed via telephone/email. To date, says Holger, 'some of the debriefing reports have been fantastic - they demonstrate that the eSim addresses so many of the attributes we'd like to teach'. The debriefing reports are based on face-to-face debriefing sessions, as well as individual critical learning incidents that are posted on the web for others to see and learn from.

The following is an excerpt from one of the debriefing reports:
"On the whole I found the Mekong e-sim a highly beneficial learning experience. I had worried at the beginning whether the simulation would provide an accurate representation of the true decision making processes, and how effective participation in the e-sim would be. I was surprised at how well the simulation ran, and how much more it taught me about the process of natural resource management than a normal lecture course would have. The method of learning was as interactive as any other practical experience. And the knowledge was garnered in the same manner, meaning that it was internalised, rather than memorised. This was despite the fact that the environment for the learning was highly artificial."

Future Developments

Future roles in the simulation could include financial and commercial perspectives – perhaps some collaboration with Economics or Commerce?
A number of students who participated in the e-Sim in 2001 worked with Holger over the summer to make the following changes to the e-Sim.

1. The production of a student handbook, which can be downloaded from
http://www.eng.uts.edu.au/~robertm/mekong/Information.htm

2. Some changes in the assessment, including:

2.1 Role profiles are provided as part of the student handbook, and the
students are only required to make a group submission on proposed group strategies, group diversity issues and persona representation. This is self and peer assessed.

2.2 There are two new online quizzes designed to ensure students engage with the e-Sim early and learn vital background material. One quiz is on the roles and responsibilities of the various personae and the other on background information about the Mekong region. The quizzes are multiple choice, but the students can attempt them as many times as they like. Each time they attempt a quiz, questions are drawn from a random pool. The students are required to obtain 8 out of 10 marks in order to pass, which will yield them 5% of the overall mark of the e-Sim for each quiz. The new assessment structure is given in the student handbook and an introductory slideshow about the e-Sim, which can be viewed or downloaded from http://www.eng.uts.edu.au/~robertm/mekong/Information.htm

3. Student tips in the form of quotes from a number of last year's students have been added.

4. The number of pro development groups (e.g. engineering firms, media) has been increased.

5. Summaries and categorisation of background reading material have been provided in the student handbook

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English as a Second Language (ESL) for Mathematical and Computer Sciences (6767)

Ms Ursula McGowan and Ms Barbara Wake
Advisory Centre for University Education

This is a 3 point subject which was designed for students from non-English speaking backgrounds (NESB) within the Faculty of Mathematical and Computer Sciences. It was offered from 1995 to 2000 (inlc) and was taught by lecturers from the ACUE Language and Learning Service with input by staff from the Departments of Pure Mathematics, Statistics and Computer Science. It was discontinued in 2001 as part of the rationalistion of courses within budget constraints.

Overview | **Aims** | **Process** | **Evaluation** | **Contact**

Overview

ESL for Mathematical and Computer Sciences is a 3 point credit-bearing subject that may be taken by NESB students who:

- have matriculated in a country where English is not the language of instruction.
- entered the University as overseas students presenting an IELTS or TOEFL score.
- matriculated in Australia but were eligible to do ESL in Years 11 or 12.
- and are currently enrolled in, or have already completed at least one first year subject in Mathematics, Statistics or Computer Science.

Aims

To provide:

- knowledge about English in use
- skills in using English
- strategies for further developing language skills.

The program was designed to provide language skills within the context of first year subjects in Mathematics, Computer Science and Statistics.

Process

The construction of the course began with a needs analysis survey of staff and students to determine just where the students' difficulties lay. Content was provided by staff from Statistics, Pure Mathematics and Computer Science while the methodology was devised by Ursula McGowan and Barbara Wake of the University's Advisory Centre for University Education. This collaborative work environment was essential to the project's success. The subject was coordinated in 1995-96 by Mathematics lecturer, Dr Alison Wolff, in 1997 by Dr Catherine Quinn, in 1998 by Ms Alison Jobling and in 1999 and 2000 by Ms Barbara Wake.

ESL for Mathematical and Computer Sciences is run over 1 semester for 3 hours per week. This time is divided into a lecture and workshop (combined) and a 1 hour tutorial. The semester-length program focuses on listening, reading, writing and speaking skills appropriate to the study of Maths and related subjects. There is a special emphasis on speaking throughout the course.

The subject was given in Semester 2. This was to allow time for new first year students to discover and identify the nature of language learning needs they have in the context of maths-related subjects.

The subject deals with the specific problems NESB students encounter. Topics include: strategies for asking for clarification, discussing and explaining statististical data, writing short answers in statistics, tackling "wordy" maths questions, "talking maths" by translating symbols into everyday speech, describing and interpreting graphs, using context in reading, and so on.

For example, 'wordy' problems involving real-life situations are often perplexing for NESB students. To prepare them for this they are taught strategies for making sense of the underlying algebraic problem, even when they can't understand some difficult or culture-specific words the problem contains.

In dealing with statistics and graphs, students learn to differentiate between dissembling and interpreting data and practise the language for doing so both orally and in writing.

In reading articles about the Internet and other computer-related issues, they are helped to identify issues to do with the use of information technology. The students write a short essay and present a seminar which sets out and supports their opinions on current issues in information technology.

The students are also monitored closely during and after the course. They write a weekly journal which is collected several times during the semester. Their comments and suggestions are encouraged and lecturers respond to them and take them into account during their teaching.

Evaluation

A formal evaluation using the University's Student Evaluation of Teaching (SET) as well as informal evaluations found each year that the students were happy with the course. The vast majority of students agreed or strongly agreed they would recommend the course to others and that they had received clear feedback on further improvement.

Contact

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Law actors know more than they think, then think more so they know

Associate Professor Bob Moles
Faculty of Law

". . . the principles of contract law are not so different from ordinary people's expectations, so students thinking clearly about possible legal responses before they had knowledge of the law had a fair chance of coming up with a suitable answer - drama was ideal for this."

Background | **Aims** | **Process** | **Evaluation** | **Contact**

Background

I have thought for some time that the conventional lecturing system encouraged students to rote learn something they had probably not experienced and to discuss it in a language which was not their own. In my first year Contract and Legal Skills subject I wanted to turn the situation around, to enable the students to use their own language and their own experiences and in doing so to suggest that:

- the principles of contract law are not so different from ordinary people's expectations, therefore if they could think clearly about what might be appropriate legal responses, they had a fair chance of coming up with a suitable answer;
- on the other hand, if the answers provided by contract law are very different from what we might expect, then this has to be noted and explained.

It followed that if they were therefore to think about what might be an appropriate legal response before they had studied "the law", they would have some benchmark from which to test their intuitive understanding. If that accorded with "the law" then it would have a reinforcing effect - if it differed, then they would be more likely to remember those differences and to think about the reasons for them. So we needed a situation which would get this thinking process under way. What I came up with was drama.

Aims

With this approach I aimed to: -

- emphasise the fact that learning is an active engagement. The student's ability to think and reason is of primary importance
- make the learning environment stimulating, memorable and collaborative

Process

The script: The first step was to write an appropriate script. I chose a house moving scenario as most people would have had some experience of this and it would not introduce any unnecessary complexity. Of course, to make it a legal issue there had to be a

dilemma or conflict. (Example of the script I used.) (Link not active 30/1/03.)

The characters: Now that I had some of the basic features in place, I needed to flesh the situation out with some "characters" with the usual array of virtues and vices - so that the students could appreciate that we are dealing with a social and not just a legal situation. People do not walk into solicitors offices ready labelled as "contracts" or "torts" problems. I also wanted to bring to the attention of the students the difficulties arising from communications problems (including sexist attitudes) and how they may be employed in situations of difficulty.

The mechanics: In the first lecture I explain the concept and ask for student volunteers. These volunteers have a week to prepare the script and then present to a class of 100 students. After they present the first part of the situation I ask the rest of the students if they thought that any legally enforceable agreement had been established, which elicits differing points of view. The lecture group is then asked to divide into smaller groups representing the "yes" and "no" opinions, and to write up their reasons in support of their views. At this stage they can consult with the "characters" who are still "in character" and will argue from that point of view. We then ask the representatives from each group to meet and formulate the basic views on either side. The views of each group are then written up as graphic displays, and made available to the students through the student file server**.** I then follow this pattern through two more iterations in following lectures until we have covered all the relevant options.

Evaluation

Many of the students did become involved and in their small groups were found earnestly debating the rights and wrongs of the various participants in the drama. They developed a depth of understanding that students had not achieved in previous years using traditional teaching methods, although their exam marks were no better (and no worse). I take this as an indication of the bluntness of the exam instrument rather than a criticism of the subject methods.

Without doubt the students' capacity to confidently undertake new legal learning experiences improved markedly, as evidenced in placements the students undertook at the end of the year. I surmise this is because the thrust of the subject was to instil in students the confidence that they have the basis of legal reasoning already, and that this understanding is a good place to start from. In contrast the traditional method implies that the students know nothing until they get it from a book.

The strongest negative response was the feeling that whilst this was all good fun, the other lecture group had been getting underway with their lectures, and the students in my group were worried that they were not "doing contract law". It was difficult for them to believe that their own reflections could have value, and they were concerned about being left behind. This problem was obviated in later implementations because all the groups used the drama method.

This page is a summary of a more detailed description appearing on Uniserve Law.

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Learning and Teaching Support

In the Business of Innovating Futures

Ms Joanne Pimlott
Director, Enterprise Education Group

"What we need is an entrepreneurial society in which innovation and entrepreneurship are normal, steady and continuous." Peter Drucker

Background

We originally established a Graduate Diploma in Business Enterprise to meet the specific needs of graduates from any discipline who wanted to receive education, training and support to establish and manage their own innovative small businesses. Immediately we recognised the opportunities for extending this exciting and increasingly relevant educational experience. An Enterprise Education Group (EEG) was formed that sought to promote and develop an enterprise culture, entrepreneurship and small business management education, and offer this to the higher education sector, secondary school system, small business sector and general community.

The EEG comprises academic, research and administrative staff of the Mechanical Engineering Department together with lecturers from elsewhere in the University of Adelaide, Flinders University, the University of South Australia and the Small Business Management Education Centre of the Adelaide Institute of TAFE. Local business people also contribute to programs in the capacity of guest speakers and mentors.

Aims

To:

- give students an understanding of the nature, processes and practices of entrepreneurship, innovation and small business management;
- provide students with opportunities to become more enterprising in attitudes, skills and behaviours;
- enable students to become familiar with and to assess their own skills, abilities and aptitude for self-employment;
- provide students with the knowledge and skills needed to effectively establish, manage or work within an innovative small enterprise.

Description

We offer a number of programs and schemes that teach entrepreneurial skills, using a flexible delivery through which the students can co-create the curriculum. These programs (listed on our website) cater for graduates from any discipline, as well as TAFE graduates.

Students attracted to the programs, whether on-campus or externally (through Open

Learning Australia), usually have quite pragmatic interests. They often have clear business aspirations and enjoy taking responsibility for tailoring their learning experiences. This produces a truly student centred education for intrinsically motivated students with a natural inclination to pursue excellence.

We have made a sustained effort to infuse the curriculum with opportunities to be enterprising, rather than just be a series of subjects about enterprise and entrepreneurship. We ask our students to take an entrepreneurial approach to their education. What do they need from the course to fulfil their aims? How can they best access information? How will they know that they have achieved their educational goals? In this model the teacher becomes a facilitator rather than a transmitter of knowledge. Students are encouraged to 'shape' their own learning in order to cater for their individual needs. For example, students who are in the process of establishing their own businesses are encouraged to develop a business plan for their own business, rather than use an abstract example. From this students can glean where their particular weaknesses are in relation to the many aspects of business planning, and can work on those areas. Each case (student) is itself a mini innovation in curriculum that feeds back into the curriculum development process.

Environment
It was important to this initiative to create a sympathetic environment. The EEG is based at the Thebarton Commerce and Research Precinct (not part of any other campus) as are the new enterprises established by graduates of our programs. The Campus is also predominantly self-funding and revenue is obtained from commercial tenants who see a benefit from moving onto a university campus. These tenants, together with the graduate entrepreneurs' new enterprises and others within the business incubator (also located on campus) give the campus a strong business and entrepreneurial orientation. Most enterprises are in the category of 'intelligent' or actively pursue innovation. The Campus is therefore very conducive to the goals and activities of the EEG; i.e. it has an entrepreneurial culture.

Network
In addition to the Graduate Programs the EEG develops and runs a range of non-award programs in the areas of small business management, entrepreneurial management and innovation. Examples are: workshops on self-employment offered for university students and graduates; short courses on innovation strategies for small business owner/managers; staff seminars on entrepreneurial management run as part of the University's staff development program, and self-employment workshops run for senior secondary students in conjunction with students' work experience in businesses on the Thebarton Precinct. All of these initiatives allow the EEG to remain close to the market-place, to source business people and entrepreneurs as guest speakers for the Graduate Programs, and to learn about the myriad of challenges facing small business, the results of which are 'fed' into the programs developed for graduate entrepreneurs.

Evaluation

The testimonials to date indicate that those who have participated in our programs particularly the Graduate Certificate or Diploma in Business Enterprise, both on-campus and externally, gain some or all of the following as outcomes of the course:

- An increased level of self-confidence
- A greater ability to stay focused on the objective or goal for which they were pursuing study which is usually the goal of getting a new business up and running;
- Marketplace knowledge that may well have taken many more years to acquire if they were only learning 'by doing' i.e. by the actual practice of starting a business instead of the addition of learning through the course
- Networking with others also engaged in business creation process
- Assignments linked to business activities or project work being undertaken
- Structure of course 'forces' individual to 'stay on track' with their business goals
- Improved ability to recognise an opportunity and know how to evaluate it whether it be an idea for a new venture or an opportunity to assess an existing business'

position or part of an organisation.

- The website has a section titled "Success Stories" <http://www.eeg.adelaide.edu.au /success.html (inactive 25/8/03)> which includes details both of the diversity of graduates who have participated in the Programs as well as a number of testimonials. (see http://www.ecic.adelaide.edu.au/ne/newsroom/#feb11)

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Learning and Teaching Support

Development of a Studio Course in Physics

Dr Judith Pollard
Department of Physics and Mathematical Physics

"By taking control of their own learning and working in groups gaining hands-on experience, students can maintain their enthusiasm and develop better understanding."

Background

The Department of Physics and Mathematical Physics has developed a Physics studio class for its first year students, replacing the traditional structure of separate lectures, tutorials and practical sessions. Although the traditional lecture/tutorial course used many strategies to increase the involvement of students with both the subject and each other, for many students the course was still not satisfactory:

- there was little opportunity to monitor the progress of students and provide feedback until after an exam at the end of first semester which had a large assessment weight. There was a consequent lack of opportunity for rescuing students at risk of failing
- the laboratory course was not closely integrated with the theoretical part of the course
- despite effort to make the material presented in lectures lucid and memorable, lectures remained an ineffective learning environment

In the first semester of 1999 a new approach, the studio class originally developed for an introductory physics course by J M Wilson at the Rensselaer Polytechnic Institute (Ref 1), was tried.

Aims

In a studio class all aspects of the course are integrated and presented to the group of students in the same room, in order to:

- reduce the dependence on lecturing
- integrate the theoretical and laboratory components of the subject
- encourage cooperative learning
- make the students more responsible for their learning
- integrate the use of information technology into the course

Process

The Studio Program

With the assistance of a Committee for University Teaching and Staff Development (CUTSD) grant, the level I, second semester topics Electricity and Magnetism, Thermodynamics, and Quantum Physics were repackaged so that a pilot group of students experienced an integrated program comprising a series of Preparation Activities and Studio Sessions.

In the Preparation activities, each student worked through a set of notes at his or her own pace; the notes give a clear statement of the aims and learning objectives of the section, provide a guide to the text book (Ref 2), introduce supplementary information (Ref 3) and include short concept-based questions to allow self-testing.

Each Studio Session was a class in which students worked in groups of 5 or 6 for approximately 150 minutes to develop the ideas introduced in the Preparation. Each Session was structured around thematic Activity Sets which guided the students through interrelated pencil-and-paper exercises, computer simulations and computations and short practical activities. The Session also included brief lecture segments which provided an overview of the current topic with emphasis on aspects which particularly benefited from verbal description. Printed Solutions were supplied at the end of each Session, to help students consolidate their understanding.

Evaluation

Evaluation was undertaken through interviews and focus groups (conducted by a staff member of the Advisory Centre for University Education), a free response questionnaire, written evaluation and a comparison of final assessment. The main points to emerge from the evaluation were:

- teaching staff had greater opportunities for meaningful interactions with students
- most of the students were enthusiastic about the studio program. Attendance at the sessions was excellent, with the incidence of absences less than half that at the lecture-tutorial program
- students were more actively engaged in the learning process during sessions
- more time was spent each week outside teaching sessions by studio students (3.5 hours) than by traditional program students (1.5 hours). This increase of 2 hours per week for studio students in private study was partly compensated by a reduction of 1 hour per week in class time. Studio Physics students did comment on the increased workload required
- overall, students reported that the studio approach aided their understanding of the work. Most studio students believed the small group environment offered greater opportunities for learning and appreciated the opportunity to work at their own pace, to monitor their mastery of the work and to work collaboratively
- studio students experienced a growing understanding of the concepts of physics during the semester, whereas students in the traditional lecture/tutorial program very commonly achieved most of their understanding in the period immediately preceding the exam
- exam comparisons gave mixed results. Capable studio students performed as well as their first semester results would predict. Struggling studio students who applied themselves consistently throughout the semester did better than expected. On the other hand, those students who failed to work effectively before and during the sessions had very poor final results

Further development

The program is being revised and presented to the entire class of 120 students for a large part of the second semester of 1999. This requires offering 3 streams of Studio Physics with as many as 44 students in each stream, assisted by a member of staff and a postgraduate student. Significant practical difficulties are caused by the need for students to attend two 2 hour sessions each week, instead of the 'standard' pattern of lectures, tutorial and laboratory session. The response of these students to the Studio format will be used to identify the best aspects of the program, with a view to incorporating them into

Physics I in future years.

Cost of Implementation

The requirements for the preparation, equipment and face-to-face teaching of a Studio Program differ from those of a standard lecture-tutorial-practical subject, and all contribute to the implementation costs.

If the content of the subject is based closely on a suitable text book, the time required for production of Preparation and Session notes is similar to that for preparing a new course of lectures with associated practical work.

If the program is designed to make significant use of computing and to introduce a new range of experiments, significant costs are incurred. On the other hand, it is often possible to design a Studio program which operates within the constraints of existing computer and laboratory resources, thereby avoiding large additional costs.

A comparison of face-to-face teaching costs is dependent on the number of students taking the subject, the number of Studio classes and the number of students in each class. For Physics I, which requires a repeated series of lectures because of timetable rather than class size constraints, there was a saving of 6 lecturer-hours per week. In addition, 1 tutor-hour per group (of up to 16 students) was replaced by 2.5 staff-hours per group (of up to 24 students). Thus for classes smaller than 96 students, total contact time was comparable for lecturers, and less for tutors. As the total number of students increases, the Studio program may become relatively more expensive because the "economies of scale" of large lecture classes are lost. However, if the timetable and teaching spaces are sufficiently flexible, the class size and number of classes can be adjusted for optimum economy, so that face-to-face teaching costs are comparable with those of a standard program.

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Learning and Teaching Support

The Logic of Physics

Dr Judith Pollard and Peter Veitch
Department of Physics and Mathematical Physics

"Reproducing algebra is not the same as understanding the logical structure of a physics argument"

Background

Most teachers, irrespective of discipline, hope that their students are understanding the subject matter at hand and not merely reproducing material for the sake of passing the subject or course. Unfortunately, assessment methods often fail to discriminate between deep and superficial learning, and since the latter is often easier, assessment can drive students to learn superficially. Many articles and books on learning and teaching exhort teachers to use methods of instruction and assessment that develop and reward deep understanding, but what would these look like? The following is a short account of how this problem was tackled within the Physics discipline.

A large part of the lecture time in a conventional calculus-based subject is devoted to derivation of results by applying general principles of physics to systems of interest. The students' understanding of these derivations may be tested with an examination question such as:

Use Gauss's law to find the electric field just outside a conducting surface carrying charge density per unit area σ

Typically, student responses indicate that they do not understand the core concepts or the logical structure of the physics. Furthermore, assessment procedures that do not discriminate between answers given by rote and those based on an understanding of the concepts can perpetuate the problem. Research built on these observations (Pollard, 1993), where students were invited to 'think aloud' as they worked through some problems, confirmed that most students distorted the logic required to understand and answer the questions and were unaware that they were doing so.

Consequently, we made some simple modifications to the way physics questions for tutorials were structured that encouraged students to explore the concepts of physics and how they are related. This approach is clearly relevant to those subjects, such as mathematics, chemistry and engineering, where students easily fall into the trap of substituting rote learning for understanding.

Aims

To improve:

- The extent to which students understand the logical structure of physics in general, and the logical development of derivations in particular
- The validity of assessment of this aspect of their understanding

Process

Tutorial questions were rewritten such that they required the students to explicitly construct their knowledge in the following ways:

- Identifying the important concepts
- Establishing the relationships between the concepts
- Confronting common misconceptions
- Relating the concepts to reality
- Developing higher level problem-solving skills

We hoped that students working with these new problems would develop strategies of problem-solving and an understanding of the concepts and their logical connections such that they would be able recognise and apply principles in their appropriate context.

The new approach is illustrated by Examples 1 and 2, an old-style question about Gauss's law and its replacement. Gauss's law states that the net electric flux emerging from any

closed surface is equal to the total charge enclosed by the surface divided by ε_0 . It can always be used to find the average electric field over a surface, but its real value is that, in situations with appropriate symmetry, it provides a simple way of finding the electric field at a point.

Example 1 is the way questions were previously put:

Use Gauss's law to find the electric field just outside a conducting surface carrying charge density per unit area σ

It has been replaced by Example 2:

(a) Describe the Gaussian surface used in lectures to derive the electric field near a flat charged plate. Describe two other Gaussian surfaces which could be used instead. Be careful in specifying their position and orientation.
(b) In response to the question:

Use Gauss's law to find the electric field just outside a conducting surface carrying charge density per unit area σ

the following student answer was given:

$$\Phi_E = \frac{q}{\varepsilon_0}$$
$$= \frac{\sigma A}{\varepsilon_0}$$
$$\therefore \quad EA = \frac{\sigma A}{\varepsilon_0}$$
$$\therefore \quad E = \frac{\sigma}{\varepsilon_0}$$

Comment on whether this answer is satisfactory, and make any improvements you think necessary. (Pollard, 1994, p.4).

Variations on standard exam questions are also possible. By supplying the algebra and asking students to explain the important steps in the derivation, it is possible to assess the students' knowledge of the logic of the process rather than their ability to recall a rote

response

Evaluation

Student responses to a question of the type shown in Example 2 more clearly indicated the level of Physics understanding at which the students were operating. Even when students do not produce a complete answer to this question the subsequent discussion in tutorials encourages them to examine and appreciate the logic in a way which is rarely encouraged by standard textbook problems (details in Pollard, 1993). A study of students trialling the process in tutorials found that it helped middle range students, comprising the large majority of first year physics students, improve their approach. For very good students, deep learning strategies appeared to already be in place. For students who were struggling and committed to a memorisation and regurgitation strategy the new question type may have even been counterproductive, decreasing the effectiveness of their favoured (or only) learning strategy and thereby increasing their sense of being overwhelmed.

Feedback from tutors in the same study was also positive, indicating that the students were aware of the need to probe concepts, and were willing to do so.

The approach is now further embedded in the curriculum and has been more widely adopted.

Acknowledgement: *Alistair Blake's observations of his students' responses provided the original inspiration for this work, and he contributed significantly to the evolution of the project documented here.*

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Back to case study

Variations on standard exam questions are also possible, to give a better indication of whether students actually understand the derivation. The following question explores the transport of energy by a pulse:

Figure 5

A wave of arbitrary shape moves to the right with a speed v along a string with mass per unit length μ and tension T as shown. (Assume small displacements.) Figure 5 shows a **snapshot** of the string at time t_1.

(a) When a pulse travels to the right along a string, energy is transported to the right. In terms of work, force, and displacement, explain how energy passes the point x_0

(b) At time t_1, in what direction is the segment of string Δx moving?

(c) At this instant, what force is being exerted on it by the string to its left?

(d) By considering the direction of the force due to tension at different points on a pulse, show that the direction of the transverse component is always given correctly by the relationship

$$T_{trans} = -T\frac{\partial y}{\partial x}$$

(e) As a sinusoidal wave travels along a string, is the rate at which energy passes a point constant with time?

(f) If not, for which displacements of the string is it greatest?

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Learning and Teaching Support

Communication in the Agrifood Industry

Professor Otto Schmidt
Applied and Molecular Ecology

"Relating research outcomes to the general public and diverse interest groups requires unique communication skills. Students in this subject acquire practical experience in formulating and presenting scientific information to non-scientific audiences via media releases, extension bulletins, electronic communication systems, and a poster display. Students also learn to present themselves to potential employers. Invited speakers, who are leaders in the agricultural and scientific community, are invited to discuss important topics."

Description | **Goals** | **Process** | **Evaluation** | **Contact**

Description

For students to successfully navigate their way in the job market they need writing and communication skills, in addition to an ability to think creatively and critically. During their undergraduate years students learnt how to write scientific papers and essays and how to present these papers to a scientific audience. Their ability to communicate this knowledge to a lay audience is developed in the subject Communication in the Agrifood Industry.

Communication in the Agrifood Industry is a third year subject that consists of three 2-hour formal periods per week over a Semester. These periods are divided into;

- electronic communication
- guest speaker
- student presentations

The subject provides students with experience and skills in several areas they will need if they work in agricultural production and related job environments. Indeed, many of the skills learnt here are applicable to many other career choices.

In this evolving course students learn by doing and their assessment is integrated into the activities and based on the proposed outcomes.

Goals

- To provide an opportunity for students to integrate and extend their knowledge of agricultural science and policy
- To incorporate scientific information effectively into agricultural management practices and the formulation of new policies
- To develop communication skills preparing participants for an involvement in local, national and international developments in agriculture and environment

Process

This subject forms a bridge between the rigorous academic study already undertaken by students and the working environment they will soon encounter. The students are given the practical skills necessary to interact with and influence others through the four elements of the course structure.

Computer Groups. Here the students learn to communicate electronically, to retrieve local and international information through the Library system and the World Wide Web, and to prepare a homepage.

Student Presentations. The value of discovery or technological breakthrough is ultimately judged by the extent to which it leads to changes in practice. In the agricultural sector, the findings of research are transmitted to farmers and other end-users through extension services. It is their activities that determine, in part, how fast farmers and others learn about new technologies. This section of the subject involves the writing of a Press Release and a Poster. The presentations are marked by the students as well as the subject convenor. This year the posters will be presented as a component of the "Waite Science on Show" event (part of the "Innovate SA" activities).

Job Application. Students respond to realistic job advertisements that include selection criteria and a job description. They perform job interviews with a panel of experienced academics, who provide valuable feedback after the interview.

Invited Speaker Presentations. Outside expert views on agricultural practice and policy, seminar presentation, job application skills, career prospects etc. The speakers are generally invited to provide unconventional views and a forward-looking perspective of their area. Students are encouraged to raise critical issues and interact with the speakers.

Evaluation

A student evaluation of the course has been completed, but the results are not yet on hand. There is also a need to track the employment success rate of graduates. This is already undertaken at a Faculty level, but requires breaking down to assess the impact of the subject . Even then, such an evaluation poses problems of analysis, not the least because of the sheer diversity in course content. Anyone who can offer feedback on the evaluation process is welcome to do so.

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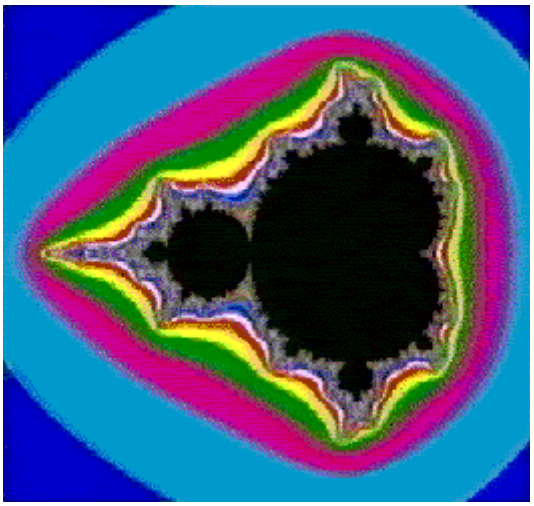
Fractals are Fun!

Associate Professor Paul Scott
Department of Pure Mathematics



"Mathematics is an enjoyable subject. One thing I like about this course is that while the students are having a good time, they are also challenged. They come with enormous faith in computers and calculators, and then discover that under repeated iteration there is chaos instead of order. Ultimately this course challenges students to think for themselves, and that is what university is all about."

Description | **Aim** | **Process** | **Evaluation** | **Contact**

Description

Fractals are useful for modelling (for example in engineering) and are particularly suited to modelling nature. The difficulty in teaching the mathematical concepts of chaos and fractals is that the concrete realisation of the maths needs to be seen and manipulated. This has previously been too complex for students to attempt. This course utilises computer technology to provide an experiential learning environment. The students can get immediate feedback on their understanding by generating their own fractals.

Aims

The original aim was to teach fractals. The question that arose immediately for me was - `how do you make an extremely complex subject both understandable and enjoyable?'

Process

This is a third year course. Lectures are given in Aldus Persuasion, as there is a good deal of imagery in the lecture material. This is obviously important here as fractals are visually intricate sets. Regular sessions (one every three weeks) are held in the computer lab where the students work on their own programs. Simple Pascal programs (it doesn't have to be Pascal, Turtle Logo would do, for instance) have been written and are run using CodeWarrior software, along with written instructions. Students are motivated to get both the maths and programming right. If either their mathematical understanding or the programming are incorrect, the fractal construction will fail. Students are encouraged to experiment, and are assured that mistakes in this kind of endeavour are an integral part of learning. While it is true that programming is difficult for some students, the level required here is very simple, and as an exercise it is excellent for logical thinking. Following is a segment of the program for generating a Twin Christmas Tree fractal, along with a simulation of the fractal as it would be if the input was correct.

```
program TwinXmasTree; {Constructs Twin Christmas Tree}

uses
TurtleGraphics, Types, QuickDraw, QuickdrawText, Fonts, OSUtils, Events;

var
Order: Integer;
Color: RGBColor;

procedure Twin (Size: Real; Level: Integer); {change of name here}

begin {We now make changes in this part of the
program; compare this with
the last Sierpinski program. We place the three
'blueprint' squares
in different orientation}
pu;
fd(Size/2);
lt(90);
pd;
Twin(Size / 2, Level - 1);
{The iteration takes place in the position of
Square 1}
pu;
fd(Size / 2);
rt(180);
pd;
Twin(Size / 2, Level - 1);
{The iteration takes place in the position of Square 2}
pu;
lt(90);
bk(Size / 4);
pd;
Twin(Size / 2, Level - 1);
{The iteration takes place in the position of Square 3}
pu;
bk(Size/4);
rt(90); {Now bring the turtle back to its initial position and heading}
fd(Size / 2);
lt(90);
end;
```

Evaluation

A Student Evaluation of Teaching (SET) found that the subject was generally enjoyed, although some students would have preferred it to be more mathematical. Responses to the question 'what was most useful in this course?' included:

`Lectures, because of the use of computer and screen to ... provide actual running examples of fractals etc.'

`The use of computers to aid teaching; it would have been difficult to see what was going on without them.'

According to SET the students also found the course challenging, the lectures and practicals valuable for understanding the subject, and that the use of teaching materials enhanced learning.

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Continuous Assessment in Physiology

Dr Garry Scroop
Department of Physiology

"Despite deliberate attempts within the curriculum and our teaching practices to promote modern educational goals, retention of the traditional formal examination process drove the students in a different direction - the students came not to learn physiology, but to pass it!!"

Overview | **Aims** | **Process** | **Evaluation** | **Contact**

Overview

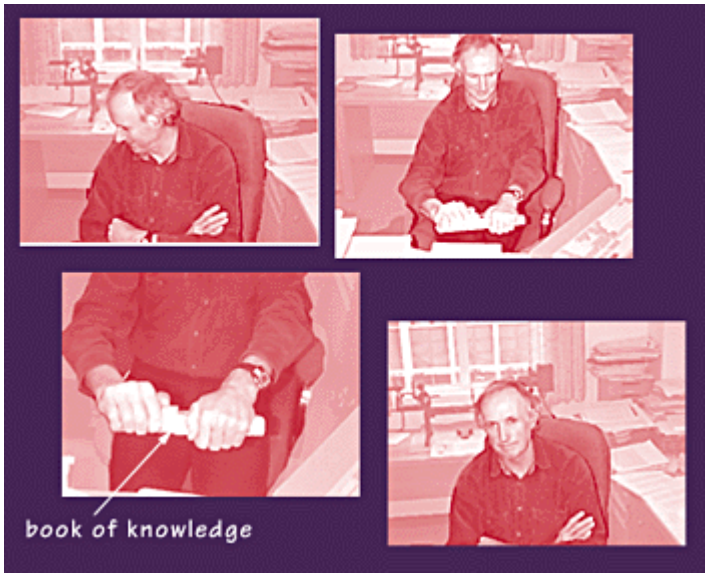
Courses in the biological sciences at Adelaide University typically employ end-of-semester or end-of-year "barrier" examinations as the principal fail/pass assessment. The questions included in such examinations are commonly in the format of essays or written brief notes and students avidly access past examination papers in an attempt to predict likely questions for their assessment and accumulate the appropriate factual information.

The stress and time constraints of "barrier" examinations often divert the students into poorly constructed and poorly written answers with the intention of including all the factual information at their command in the time available; student reasoning and problem-solving abilities become secondary considerations. The sheer volume of examination scripts and the nature of the student answers often ensure that the examiners base their assessment mark principally on factual content. As such, the outcome of any attempts by the subject curriculum to address modern educational issues remains unknown.

In essence then, this method of assessment drives the student learning experience into a test of factual recall ability. The more educationally desirable outcomes of developing problem-solving strategies and skills in self-directed learning and the instillation of life-long learning practices are not addressed. This is the background of frustration which led to the implementation of a truly continuous assessment process in the third year science programme in Exercise Physiology where the driving principle was the promotion of developing just these skills.

Aims

- To use the assessment process to drive the learning experience.
- To use the assessment process to develop communication skills between students in the framework of factual recall.
- To use the assessment to develop problem-solving skills and lateral thinking in the students.
- To allow the students to provide a written example of reasoned argument in a more conducive atmosphere.



Process

The assessment is in 2 forms:

1. Four Multiple Choice Question (MCQ) papers each comprising 40 questions requiring 5 responses in each question. The 4 MCQ papers are at regular intervals in the semester each with a 2 week lead-in time for submission. They are open book and students have been encouraged to consult their colleagues. All questions can be answered using the Handbook with lecture synopses which has been provided for all students. Many of the questions are not straight-forward and require considerable research and discussion with colleagues to answer them. Handbooks of Review Articles in main subject areas are also provided for reference.
2. Four, one page written assignments designed to encourage lateral thinking and creative problem solving and where a didactic response is often inappropriate. Indeed, the one-page limit has been adopted to discourage students from regurgitating factual information in the hope that the examiner might find the answer contained within! The questions are structured to bring together the students' thoughts on broad-ranging issues with practical applications in mind. There are 4 assignments at regular intervals in the semester each with a 2 week lead-in time for submission. These responses provide the principal method for ranking students. All marked assignments have written comments and a model answer is provided.

Evaluation

Student Evaluation of Teaching (SET) evaluation has been strongly positive. The vast majority of students agreed or strongly agreed that "The assigned work was valuable for my understanding of the subject" and that "The assigned work could be completed on time". The students' criticisms (primarily procedural) will be used to improve the course in the following year.

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Learning and Teaching Support

Research Project Practicals

Dr Garry Scroop
Department of Physiology

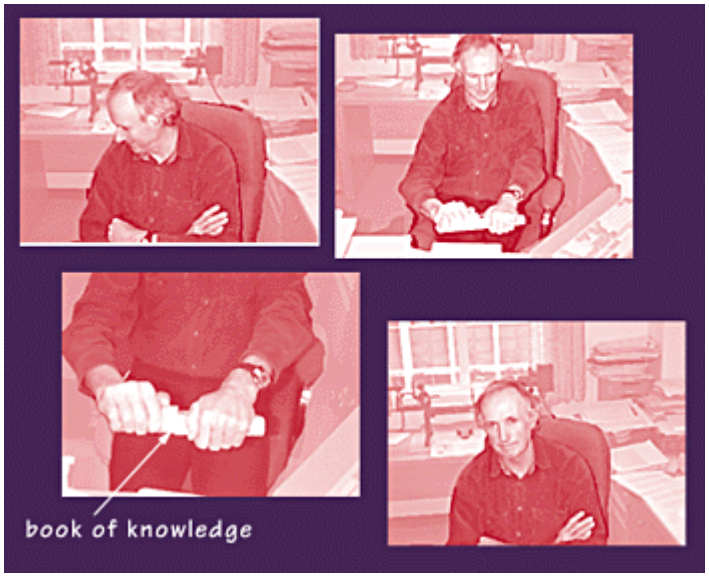
In 1990, the Physiology Department at the University of Adelaide replaced standard tutorials and `recipe-based' laboratory sessions with `research practicals' that simulate real world research projects.

Overview | **Goals** | **Process** | **Response**| **Evaluation** | **Contact**

Overview

The Research Project Practicals (RPP) in the Department of Physiology are student-driven practical exercises comprising semester-length research projects for second year students. The central theme is to provide practical experience in the scientific method of problem-solving, where the students are active researchers rather than passive recipients of information from recipe-driven experiments

The aim is primarily to teach physiology problem solving skills using the scientific method, rather than to teach specific physiological content. For students, the aim is to have an educational experience rather than an assessment experience.



Goals

Fundamentally, the goal of this teaching method is to produce better graduates. It was felt that

the traditional teaching method was using exams as a stick to motivate the learning of facts, which were soon forgotten afterwards. Contrastingly, the RPP provides an intrinsically motivating learning exercise that nurtures the critical thinking skills necessary for scientific careers and/or post-graduate studies.

Process

Students, working in small, independent research teams initiate and develop group research projects and use themselves and colleagues as the experimental subjects. They are supported by an academic staff member acting as project supervisor. The Project is conducted in a small laboratory module equipped with the basic research infrastructure appropriate to the physiological system under investigation. After reviewing the background literature the student group prepares a short research proposal in the format of a conventional request for a Grant-in-Aid and submits it for evaluation and approval. The development of the research project during the semester is guided through group discussions with the academic staff research supervisor. The application of the scientific method to problem-solving in physiology is progressively reinforced. Student research groups are also provided with computer-based access to relevant research literature and appropriate software for data acquisition and processing and statistical analysis. Student performance is assessed at regular intervals through a literature review, poster presentation, final research manuscript, and peer group review.

Response

Preliminary experience indicates that this new teaching method motivates students and teaching staff and provides an important learning experience which students can carry forward. The complete support of the teaching staff has been a necessary component of the success of the RPP.

Evaluation

The innovative teaching approaches and assessment practices used are under continual review in light of student feedback. In 1993, The University of Adelaide published its Quality in Teaching and Learning document which described the RPP as one of the most innovative programs within the University. The RPP has been recognised by a committee set up by the Higher Education Council as an example of Best Practice in Teaching.

Resources

The department of Physiology at the University of Adelaide publishes an information booklet, *Research Project Practicals in the Department of Physiology.*

A detailed article including examples of student feedback and "Cautionary Tales" appears under the title "An Inquiring Mind" by Dr. Garry Scroop in *Developing Lifelong Learners through Undergraduate Education,* Commissioned Report No. 28 National Board of Employment, Education and Training, August 1994.

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Enhancing Medical Students' Skills in Interacting with Drug-Seeking Patients

Dr David Taverner and Dr Jason White, Research Officer Jane Dodding
Department of Clinical and Experimental Pharmacology
The University of Adelaide

Those patients seeking drugs, rather than treatment, are notoriously difficult to deal with. As larger numbers of abusable drugs become available, there is an acute need for medical students to acquire generic skills for handling these patients. We detected a particular deficiency in medical student training in this area, and have developed and assessed a video based approach to address this.

Description | **Aims** | **Process** | **Evaluation** | **Acknowledgments** | **Contact**

Description

Having learned the basics of medicine and pharmacology, students need to understand how to apply their knowledge in prescribing drugs for patients. Appropriate prescribing of psychoactive drugs is a key part of a medical practitioner's contribution to the prevention of drug abuse and dependence. Until 1998 we did not assess the adequacy of our students knowledge and skills in this area.

One of the difficulties in teaching students about this very important aspect of medical practice is that the knowledge required is skills based, and would, we conjectured, best be learnt experientially. In this project we have produced an interactive video-based tutorial and associated materials that enable medical students to learn how to interact with drug-seeking patients. We evaluated its effectiveness for teaching using interviews with simulated patients in 1996. We have also transferred the tutorial to a computer-aided learning (CAL) format and compared effectiveness of the video and CAL formats in 1997. What we learnt has been incorporated in current teaching practice: currently the video form is used for regular teaching, and students are assessed in a simulated patient setting.

Aims

- To produce an interactive video-based tutorial package that aids the teaching of interpersonal skills specific to interactions with drug-seeking patients
- To evaluate the effectiveness of the video package as a teaching aid using interviews with simulated patients
- To produce a CAL package with similar content to the video package and compare the effectiveness of the two packages

The objectives for students are:

- to understand the legal and ethical obligations governing prescribing of psychoactive drugs
- to identify patients' drug-seeking behaviour
- to learn appropriate prescribing practices

Process

The video and accompanying tutorial package were gathered from selected general practitioners consulting in Adelaide and based on their experiences with drug-seeking patients. Eight scenarios of three minutes duration were developed, with each scenario followed by questions that elicit from students their opinion on the good and bad aspects of each interaction, and what, if anything, the students would do differently.

The CAL package was produced using digitised video clips (16, 2 minute clips in Quicktime), assembled in a Microsoft Access database. Clips were presented with background information, and multiple choice questions were asked to assess learning. Incorrect responses lead to extra information being presented.

Evaluation

Fifth year medical students (total 130) at the University of Adelaide received a tutorial either with or without the video, or with the CAL package. Relevant skills were evaluated through simulated patients trained to role play four different scenarios as drug-seeking patients. The students were randomly assigned to one of these scenarios and role played with the simulated patient. Following this consultation the `patients' assessed the students' skills using a check list based on the skills presented in the training video. A research officer also assessed the students from a recording of the consultation. A skills-based short answer question was asked in the end-of-year examinations.

Student opinions about the different tutorial types were obtained. They completed a standard evaluation form about the tutorial they attended, which was evaluated independently (by the Advisory Centre for University Education).

Outcomes
There was no statistically different student preference for any particular format, although the video-based package was marginally preferred. Student performance in simulated patient interviews and in the examination question was not determined by their teaching method. The cost of the CAL package appeared to be less over a 5-year period, taking into account teaching time, providing CAL facilities were available.

The results suggest that clinical skills can be taught effectively via several different methods. Collaboration between institutions in the development of CAL tools should be an efficient teaching strategy with a wide range of applications.

This study has been published as:

Medical Education, Volume 34, Issue 4, April 2000 pp 285-292 Comparison of methods for

teaching clinical skills in assessing and managing drug-seeking patients
D Taverner, C J Dodding & J M White

The video-based teaching tutorial is in current use teaching medical students.

Acknowledgments

This study was funded by the Committee for Drug and Alcohol Education for Medical Students (CADEMS) and was run in conjunction with Professor John Saunders, University of Sydney.

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Multimedia Learning and Assessment Program in Pasture Agronomy

Dr Philip Tow
Department of Agronomy and Farming Systems

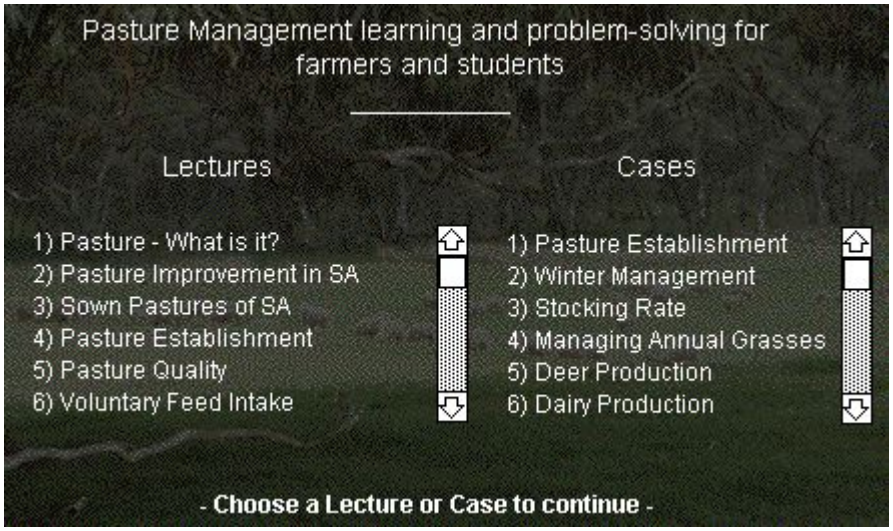
"The development of an interactive, multimedia learning and assessment programme in Pasture Agronomy greatly accelerates the experiential learning available to students."

Description | **Aims** | **Contents of Module** | **Evaluation** | **Contact**

Description

"Pasture Management" was designed to assist students in the second year of tertiary agriculture and natural resource courses to develop understanding and decision making skills in pasture paddock management. The program is meant to complement field exercises and decisions are based initially on assessment of paddock condition and on utilisation goals. It comprises several interactive computerised Case Studies which include background information, series of questions and choice of answers, with feedback. Assessment of the program has shown that it is interesting and useful to students at the targetted second year level.

This image is the initial menu:



Aims

- To create a concrete application for the learning taking place in the course
- To give students the skills to interpret what they have learnt
- To provide a problem solving approach
- To contribute to the creation of professionalism in the education of farmers
- To improve motivation by making learning more interesting

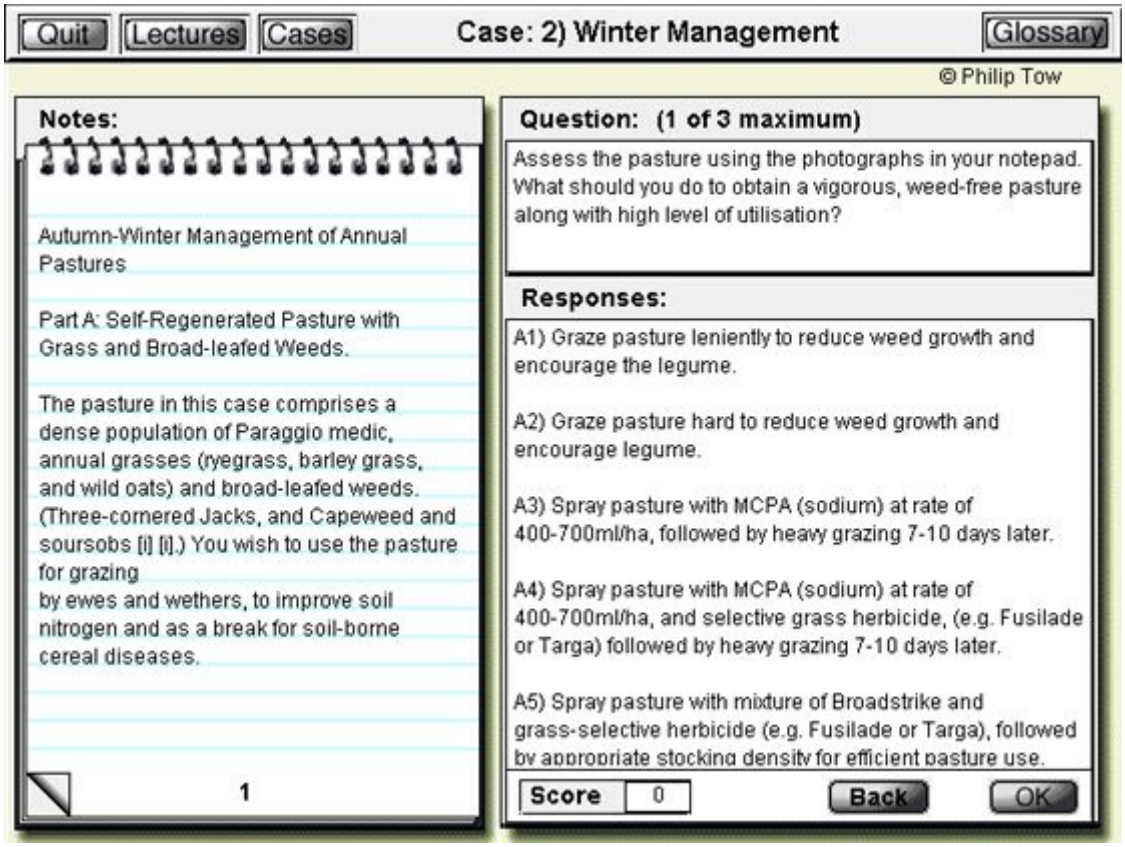
Contents of Module

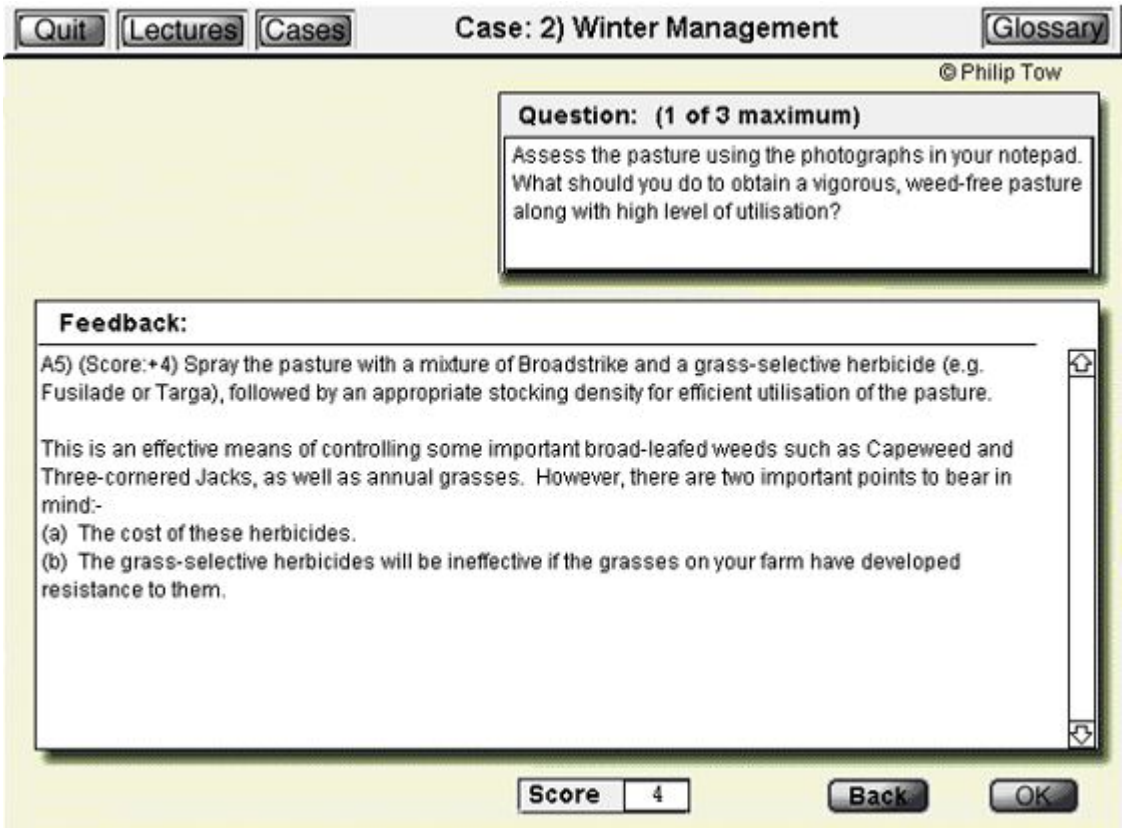
The following types of information and opportunities for student learning are included in this package.

1. Illustrated summaries of lecture material on pasture agronomy in the form of major principles, examples and applications, and research results.
2. Illustrated case studies from pastures used for sheep, dairy cows, beef cattle, deer and pasture seed, have been included.

   The case studies are written as modules driven by a core programme, allowing addition of new examples at any time. They deal with a selection of pasture species and cultivars for particular climates, soils and enterprise goals; pasture establishment; management and utilisation of pasture for livestock production, legume seed production, and rotation with crops. Case studies may comprise single event examples of cause and effect or more complex sequences.

3. A reference, diagnostic, and identification section containing drawings, photographs, video sequences, and brief written descriptions, of pasture plants, weeds of pastures, insect pests and pest damage in pastures, nutrient deficiencies of pasture species and the effects on pastures of unfavourable weather and poor management. At present this section contains over 600 photographs of pastures and related topics.
4. A glossary giving definitions of scientific and technical terms (still being completed).


Quit
Lectures
Cases
Case: 2) Winter Management
Glossary
© Philip Tow
Notes:
Autumn-Winter Management of Annual Pastures
Part A: Self-Regenerated Pasture with Grass and Broad-leafed Weeds.
The pasture in this case comprises a dense population of Paraggio medic, annual grasses (ryegrass, barley grass, and wild oats) and broad-leafed weeds. (Three-cornered Jacks, and Capeweed and soursobs [i] [i].) You wish to use the pasture for grazing by ewes and wethers, to improve soil nitrogen and as a break for soil-borne cereal diseases.
1
Question: (1 of 3 maximum)
Assess the pasture using the photographs in your notepad. What should you do to obtain a vigorous, weed-free pasture along with high level of utilisation?
Responses:
A1) Graze pasture leniently to reduce weed growth and encourage the legume.
A2) Graze pasture hard to reduce weed growth and encourage legume.
A3) Spray pasture with MCPA (sodium) at rate of 400-700ml/ha, followed by heavy grazing 7-10 days later.
A4) Spray pasture with MCPA (sodium) at rate of 400-700ml/ha, and selective grass herbicide, (e.g. Fusilade or Targa) followed by heavy grazing 7-10 days later.
A5) Spray pasture with mixture of Broadstrike and grass-selective herbicide (e.g. Fusilade or Targa), followed by appropriate stocking density for efficient pasture use.
Score 0
Back
OK


Quit
Lectures
Cases
Case: 2) Winter Management
Glossary
© Philip Tow
Question: (1 of 3 maximum)
Assess the pasture using the photographs in your notepad. What should you do to obtain a vigorous, weed-free pasture along with high level of utilisation?
Feedback:
A5) (Score:+4) Spray the pasture with a mixture of Broadstrike and a grass-selective herbicide (e.g. Fusilade or Targa), followed by an appropriate stocking density for efficient utilisation of the pasture.
This is an effective means of controlling some important broad-leafed weeds such as Capeweed and Three-cornered Jacks, as well as annual grasses. However, there are two important points to bear in mind:-
(a) The cost of these herbicides.
(b) The grass-selective herbicides will be ineffective if the grasses on your farm have developed resistance to them.
Score 4
Back
OK

The package is designed to allow flexibility in its use for learning. It may be used simply as a reference document or, more importantly, to place the student in the role of manager, assessing a situation and deciding on a course of action. The case studies give experience in simulated management and in testing the outcomes of alternative courses of action, modelling the decision making or problem solving process - what factors to consider, what action takes priority. The student also needs to withdraw from the simulation mode from time to time in order to search for information. The programme is designed to advise the consequences for the enterprise of particular management choices. It may also quiz the student on his or her understanding of the problem and suggest avenues for further study.

Evaluation

In 1998, the Pasture Agronomy subject at Roseworthy was presented for the first time to third year students in association with comparative field exercises and computer exercises using the pasture/livestock simulation model Grass Gro. An assessment of student opinions showed that "Pasture Management" was regarded as a useful learning tool mainly by those third year students who had no farming background. The conclusion I initially drew from this was that, except for those students with very limited experience *Pasture Management* was not particularly useful beyond second year.

However, questioning of the students during the field exercises indicated that , while most understood when and how to make some basic pasture management decisions, they were unable to understand and make decisions on the more complex aspects of grazing management. These were related to interactions of date of commencement of grazing,stocking pressure, stocking duration and rainfall pattern, and their effect on pasture growth, efficiency of utilization and the capacity of the annual pasture legume to produce seed for subsequent regeneration. Although these aspects were illustrated in the field plots (which the students were guided in assessing), few students were able to interpret them or define their significance. They had, it seemed to me, missed some of the important learning on complex interactions contained in *Pasture Management*.

Pasture/livestock simulation models such as Grass Gro offer a wide and useful range of simulation outcomes. However, they do not deal with the more complex and detailed paddock management principles and applications. Experience so far indicates that interactive , multimedia Case Studies such as *Pasture Management* complement the simulation models. They assist student learning by broadening the usually limited experience in paddock management students are able to gain through field experience. This applies even more to students in natural resource courses and to students from overseas.

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Adelaide PBL Bachelor of Dental Surgery Curriculum

Professor Grant Townsend
Faculty of Dentistry

Overall we aim to produce graduates who can practise as oral physicians in the 21st century, with the ability to communicate effectively, self evaluate, and diagnose and formulate treatment plans of varying complexity, as well as provide a range of treatment procedures for patients.

Description

A philosophy centred around student self-directed learning (SDL), problem-based learning (PBL) and contextual learning pervades the entire course. Our goal is to provide a course that is centred around the professional context for development of clinical reasoning skills, is intellectually stimulating and an enjoyable experience for students and staff. We strive to promote a desire in students to continue learning after graduation and to equip them accordingly. The new five-year PBL-based Bachelor of Dental Surgery (BDS) curriculum at the University of Adelaide commenced in 1993 and was implemented progressively, one year at a time, with the first cohort of students graduating at the end of1997.

Reasons for Change

A new BDS curriculum based on a PBL philosophy was introduced by the Faculty of Dentistry for various reasons, including an explosion of knowledge in dentistry leading to new philosophies, new techniques and on-going controversies, major changes in the patterns of dental disease, and an increasing proportion of the population who are retaining their teeth.

Major Objectives of the BDS Curriculum

The following objectives have formed the foundation of the new curriculum:

- to develop a more flexible curriculum structure, one that can respond rapidly to, and reflect, developments in the science and practice of dentistry.
- to provide a core experience for all students, supplemented by elective options (referred to as selectives), enabling degrees to be customised to some extent,
- to facilitate greater opportunities for contextual learning. We have moved away from the traditional model where most of the basic and applied science material was presented in the early years. This material was often not reinforced later in the course where its relevance would have been appreciated more by students. A greater integration, balance and flow of material throughout the course is an important objective.

- to introduce problem-based learning throughout the course so that students (and later graduates) are able to better integrate material and apply their knowledge, have improved clinical reasoning and communication skills, and have developed skills necessary for continued learning post-graduation
- to reduce formal contact hours for teaching and provide greater opportunities for self-directed, experiential learning throughout the course
- to make greater use of developments in computer-aided learning, audio-visual material and laboratory-based technique exercises
- to develop a course that students find stimulating and enjoyable, and one that engenders life-long learning.

Course Details

A relatively small number of streams integrated both horizontally and vertically over the five years of the course have replaced the previous large number of separate subjects. This change has been linked to a reduction in formal contact hours and greater co-ordination in the presentation and assessment of material. Students are introduced to dental scenarios from day one and have hands-on experience of many aspects of clinical dentistry during their first year.

Major Streams

YEAR LEVEL	I	Dental Clinical Practice 1	Dental & Health Science 1	Human Biology
	II	Dental Clinical Practice 2	Dental & Health Science 2	Structure & Function of Body
	III	Dental Clinical Practice 3	Dental & Health Science 3	Diseases & Disorders of Body
	IV	Dental Clinical Practice 4	Dental & Health Science 4	Selectives
	V	Dental Clinical Practice 5	Dental & Health Science 5	

Major Streams Figure 1. Major streams of the Adelaide BDS curriculum.

The new course at Adelaide employs a variety of teaching methods within a PBL philosophy, including resource lectures, interactive class meetings, problem-based sessions, laboratories and clinic sessions.

Assessment

The method of assessment of students forms a very important component of our BDS model. Assessment of students' performance takes many forms, including practical and tutorial assignments, workbooks, group projects, practical exercises, oral presentations, written examinations and end-of-year interviews (viva voce examinations). Exams are integrated and problem-based. Student self-assessment is encouraged and students are required to keep journals of reflection. The assessment procedures aim to:

- provide students with opportunities to demonstrate application of knowledge, attitudes and skills, not just recall of information.
- test for problem resolution and management as important aspects in justifying decisions, as well as the use of basic science information.
- encourage students to monitor their own performance as an essential part of their education.

Dental Learning Packages

A series of clinically-based situations, referred to as Dental Learning Packages (DLPs), is the main PBL format used in the curriculum. The DLPs are timetabled during class meetings in the Dental and Health Science stream. They aim to provide a realistic context for student learning and have been designed to integrate and coordinate with material presented in the other streams. For example, DLP 1.4 presents patients with either genetic or environmental enamel defects to introduce students to the timing and sequence of tooth development at the same time as they are studying genetics in the Human Biology stream. DLP 2.6 which presents issues of risk factors associated with periodontal disease by describing a patient with undiagnosed diabetes, is discussed while students are studying the biochemistry of energy metabolism in Dental and Health Science II and risk factors for periodontal disease in Dental Clinical Practice II.

Generally, DLPs consist of two parts that are discussed over two to three weeks and follow standard PBL process. During Part 1, students interact using variable group dynamics, with staff facilitating, and identify areas for independent study. Following discussion of areas that have been identified in Part 1, students work through Part 2, using the information gained from their own study. The sessions conclude with a review of the package.

The DLPs were initially presented in paper format only but we are now adapting them to video and CAL modules. For example, DLPs 1.3, 1.4 and 2.1 have been converted to CAL modules and DLPs 2.4, 2.5, 2.7, 3.2 and 3.3 use video triggers.

Journals

The creation of sound self-judgement for students is an integral goal in any educational sphere, but particularly in dentistry because of the "hidden" nature of dental procedures. The student clinicians must learn sufficient skills to accurately self-assess their performance, because following graduation this is the most commonly available assessment. A sound development of self judgement is the beginning of life-long learning. The journal serves many roles by providing:

- a reflective process, an essential part of the Kolb learning cycle;
- an outlet for personal feelings, especially anxiety;
- a time for feedback about a student's progress and hence assessment;
- feedback to the teacher concerning, e.g., the course assessment procedures, changes needed and course content;
- a precis of the year's work that can be used for further study or revision;
- a scientific basis for the learning process.

The roles of the journal are presented to students in their first week of first year as part of their introduction to the new course. This General Studies unit, *Communication and Learning,* is based around a dental clinical problem that aims to improve group interaction, begin to develop group process skills, reduce anxiety, boost confidence, begin to develop clinical reasoning, knowledge and skills, increasing students awareness of their own learning as well as introducing students to a journal of reflection (Wetherell and Mullins, 1996). Each students is expected to keep a journal, which is read by staff involved in Communucation and Learning.

After being introduced to the concept of journals, students are then required to keep them throughout the remainder of the course. The journals relate particularly to the Dental Clinical Practice stream, but students are encouraged to record and analyse their experiences relating to each of the streams. The journal helps formalize the reflective process and provides a process of continuous self-examination, that seeks to provide deeper and more meaningful learning, by converting experience into knowledge.

Evaluations

Since the introduction of the new curriculum, surveys have been routinely distributed to students at the end of each semester to obtain anonymous feedback on their perceptions

of the new course in general (Wetherell, Mullins, Winning and Townsend, 1996), as well as the dental learning packages (Winning and Townsend, 1995) and journals of reflection (Wetherell and Mullins, 1996). They are asked to indicate their view of the BDS course, on a five-point scale (5-strongly agree to 1 - strongly disagree).

Students' perception of the workload in the 'new' curriculum was that it was reasonable (3.3 ± 0.60) with some increase in workload in second (3.6 ± 0.51) and third year (3.9 ± 0.64). Students in the 'new' curriculum indicated that for them the balance between theory and application was good (3.0 ± 0.54 for first year, 3.3 ± 0.48 for second year and 3.0 ± 0.55 for third year).

DLPs

DLPs were evaluated at the end of each semester in 1994 and 1995. Using the same scale described above, students were requested to indicate whether they considered they were taking responsibility for their own learning and whether they appreciated the relevance of DLP content to their future careers. Students agreed that they were taking responsibility for their own learning (4.2 ± 0.68 for first year and 3.7 ± 0.91 for second year). Similar results were found in response to their perception of the relevance of DLPs to their future careers (4.3 ± 0.83 for first year and 3.7 ± 0.91 for second year).

Journals of Reflection

At the end of each year students are asked to indicate what they believe are the main advantages and disadvantages of keeping a journal. They are asked also to list any problems they have experienced in keeping a journal and how these problems could be resolved. Finally, students are asked to rate the value of keeping a journal as a learning experience.

For first and second-year students, 40.7% considered the journals were valuable, 37% satisfactory, and 24.4% considered they were of limited value/no use. Most of the students (98%) considered that the journals gave them an opportunity to provide feedback to teachers about their teaching and course content.

Approximately 85% of students felt that the journals provided an opportunity for reflection and served as a source of feedback about their progress. 63% of students felt the journals were important as a summary of the year's work for revision, while 81% believed they were very important or at least of some importance in providing an insight into how one can learn.

It is impossible for educators to teach students everything they need to know. Curricula that are flexible and encourage students to take responsibility for their own learning and engender life-long learning are required. We believe that if students enjoy their undergraduate experience at dental school and have developed an ability to self assess and apply the PBL skills they have learnt throughout their course, they are more likely after graduation to become competent oral physicians who can keep pace with a rapidly expanding body of knowledge.

Graduates and their employees

We have recently completed a survey of the first cohort of graduates from the new curriculum (Greenwood, Mullins, Townsend, Wetherell and Winning, 1999). A questionnaire derived from a list of adjectives formulated by the UK General Dental Council was administered to new graduates and their employers after six months of practice. Responses were obtained from 31 of the 39 graduates and their employers. The graduates were rated as demonstrating good or very good levels of performance by more than 80% of their employers for 12 of 17 objectives. Over 96% of employers rated the graduates as good or very good in terms of their understanding of the scientific basis of dentistry, awareness of their personal limitations, and awareness of their moral and ethical responsibilities. Responses from graduates generally paralleled those of their employers. The response of employers were consistent with staff evaluations providing some confirmation that the new curriculum is achieving its desired outcomes. More details about outcomes of the evaluation process are included in the Dental School's Teaching Portfolio which can be viewed at <site no longer available, 22/8/06>.

Selected Publications

Townsend GC and Burgess VB (1993) New curriculum developments at The University of Adelaide. *Aust Dent J 38*: 238-242

Wetherell J, Mullins G, Winning T and Townsend G (1996) First-year student responses to a new problem-based curriculum in dentistry. *Aust Dent J 41*:351-354.

Townsend GC, Winning TA, Wetherell JD and Mullins G (1997) New Problem-based Learning dental curriculum at The University of Adelaide. *J Dent Ed 61*: 374-387.

Winning TA, Marriott P, Wetherell JD, Mullins GM and Townsend GC. (1994) *Implementing computer aided instruction in a PBL dental curriculum*. Research and Development in Problem Based Learning Vol 2 (Ed: Ostwald M and Kingsland A) pp 369-383

Winning, TA and Townsend, GC. (1995) *Evaluation of computerized learning packages in a problem-based dental curriculum.* J Dent Res 74: 565

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Use of PhotoCD & Portfolio Format in Teaching

Dr Jeff Trahair
Department of Anatomical Sciences

Images are powerful tools for underpinning experiential learning. In the anatomy subject I teach I need the equivalent of a well authored electronic atlas, but have struggled to find an effective delivery format. The PhotoCD format holds great promise as a cost-effective and simple delivery system for any teaching that depends on, or is enhanced by, a large number of good quality images.

Background | **The Problem** | **Solutions** |**Does it Work?** | **Contact**

Background

Teaching in the discipline of Anatomy relies on the intensive study of structure as a basis for understanding function. Considerable effort and cost is required to produce the many images which form the mainstay of our teaching. In the past, these images have been produced photographically, which has inherent difficulties.

Firstly, the images are relatively inflexible. Once they are prepared as slides, for example, they cannot be altered or combined with text without considerable effort. This is potentially a costly exercise, should you have several requirements for an image (eg for different courses, to be used in an exam, as part of an image library etc.) and therefore need several different slides. In some respects photo images are entirely inflexible. There is no possibility, for example, of linking images, or instantly enlarging portions of the image should this be useful for teaching purposes.

A second problem is that technical (darkroom) expertise is required to prepare the images properly. The technicians with this expertise usually do not have the discipline knowledge required to produce the images exactly as they are needed, so a labour intensive collaboration can ensue.

With the advent of the digital acquisition of images (from scanners, digital camera, video capture), or digital authoring (from software and image/clip art libraries, or the Internet) many of these limitations can be overcome, providing avenues for creative and constructive input by the author. Image editing software allows the teacher to control all aspects of the image's final appearance, and presentation software can provide links between images or between images and other forms of information, and portions of an image can be enlarged with the press of a button.

However, the matter of cost remains. To be effective, the images need to be full colour and of good quality resolution. Even higher-end desktop PCs can struggle with the task of managing a presentation of 40-60MB, let alone a computer which is portable. As the demands in terms of MB increase, the presentation can slow considerably. In addition, these expensive computers are arguably under utilised, if their resources are relegated to the rather menial task of being used just as slide showing devices. In respect of cost and portability, the old hardware solution, the slide projector, still has the advantage.

The Problem

How can large libraries of images be efficiently managed, especially for the presentation and creation of student learning modules? How can we have all the advantages offered by computers and the portability of our old and inexpensive slide projectors?

Solutions

We have been using PhotoCD format and Portfolio as a tool for managing and delivering good quality images. The format stores images in 5 resolutions as an `image pac' of about 6 MB total. (As an indication of the quality, the highest resolution is designed to produce photographic quality poster size prints from dye sublimation colour printers.) The PhotoCD and Portfolio format also allows creation of stand alone presentations and atlases playable on a PhotoCD (or CDi) player (as well as a CDROM). These devices are relatively cheap ($230 - $1000), and the video output can be presented via projection equipment or a TV monitor. Thus, for a simple presentation, it is possible to have rapid access to up to 100-600 (depending on resolution) full colour images using very simple, cheap and reliable (compared to the computer-based options, including web delivery) equipment.

The learning modules on Portfolio are both interactive and flexible. Students and teachers can gather round the television monitor and enlarge portions of an image, or move between images, or images and text, with ease. The modules can be readily accessed outside of class times. Interactivity is developed as part of the authoring process.

The production of PhotoCD material is achieved on the computer. Although PhotoCD can only provide a subset of the computer's capabilities (still images), it does this with a high level of efficiency, and at fraction of the cost. Once the content is finalised, it is transfered to CD using a CD burner.

Does it Work?

Yes, we have been using PhotoCD collections in our teaching for 4 years, and have libraries of discs authored by many of the staff in the department. At the very least, a Portfolio presentation or image collection runs just like a slide show (with sound if desired), but in addition supports linking to other images or text. Indexes can be created to add flexibility, so images can be easily redeployed for different teaching demands. The PhotoCD Portfolio thus allows all the advantages of presentation software, but does not slow down with additional demands of large files, or slow delivery over the internet (or intranet). Additional benefits are the stability of the platform and its low cost. The production of high quality image libraries is also an important advantage. If the titles are authored as CDi titles and plyed on suitable hardware, they can incorporate full motion video (MPEG 1) and many other highly sophisticated authoring possibilities.

Five years later...

We certainly could not do without PhotoCDs for our teaching - we are converted to its value. Everyone else seem to prefer solutions that rely on lots of money and expertise, and so resources and equipment that are often not there.

Contact

If you have had similar experiences with PhotoCD and/or are interested in following up this idea, Dr Jeff Trahair can be contacted on:

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Learning and Teaching Support

Simulated Patients

Dr Jane Vernon-Roberts
Clinical Studies Unit, Faculty of Medicine

Dr Anna Chur-Hansen
Department of Psychiatry, Faculty of Medicine

We needed to do two things. Firstly, students required more contact with appropriate patients to fully develop their clinical skills. Secondly, we wanted to develop better and more objective assessment procedures for clinical skills. Simulated patients has been the educational innovation that achieved those objectives

Description

The Clinical Studies Unit has trained increasing numbers of 'actors' to be employed as simulated 'patients' for student training. While clinical staff of the hospitals were sceptical at first, there has been increasing acceptance that such surrogate patients can be remarkably good at presenting the symptoms and some of the physical signs of a range of diseases. Unlike true patients, trained surrogates are able to participate in the assessment of the students by providing feedback on interpersonal, English language and medical communication skills; and by providing the medical assessors with information on deficiencies in the range of questions considered as relevant to the simulated disease process, posed by students during history-taking with simulated patients.

Aims

- To standardise the 'patient' performance.
- To assist 'criterion' marking of students performance.
- To encourage self-directed learning.
- To enable student practice with feedback to be the norm.

Background

Because of the marked reduction in the average number of days spent in hospital by in-patients, it is rarely the case now that a patient spends the full period of an illness as an in-patient of a teaching hospital. Consequently, students have infrequent opportunities to follow the course of an illness in a single patient, and this makes it difficult for students in the earlier clinical years to gain the necessary matrix of clinical and pathological science, and for their knowledge level to be adequately assessed.

Process

The introduction of simulated patients for acquiring and assessing clinical skills has been a

significant step forward in medical education at the University of Adelaide. This has been augmented by using the simulated patients for the preparation of demonstration videos for self-directed learning and assessment. These have been particularly valuable in demonstrating history-taking, the systematic examination of body systems, the undertaking of procedures (such as taking blood pressure), and in dealing with complex and sensitive issues such as the autopsy.

There are two main aspects of the Simulated Patients process:

- Standardising patients performance

  Following initial work on the scripts the simulated patients are video taped with a young physician posing as a good student. (Good students are often the ones that put surrogate patients on the spot.) This is followed by a debrief with all players and then everyone involved works on the scripts again in the light of the workshop experience.

- Enabling students to practice with patient feedback

  Students work in pairs with a surrogate patient. The encounter is videotaped. Immediate feedback is provided by the trained surrogate patient. Further feedback is provided from a tutor if the relevant video is provided and feedback requested.

Further Developments

Experience of the use of simulated patients for clinical teaching and assessment indicates that it is possible to advance beyond the subjective and qualitative assessments traditionally used to determine the clinical competence of medical students. Simulated patients are used in Objective Structured Clinical Examinations (OSCE), for standardised tests of clinical competence. Assessment of students for clinical competence increasingly uses the standardised approach.

Simulated patients are also used in Clinical Studies to provide additional training for students with a Language Background Other Than English (LABOTE).

Evaluation

The response of students in formal Student Evaluation of Teaching (SET) questionnaires has been very favourable. Evaluations of the benefits of surrogate patients have been extensively (and expensively!) undertaken overseas (see Barrows, 1993)

Reference

Barrows, H.S. (1993) An overview of standardised patients for teaching and evaluating clinical skills., *Academic Medicine*,Vol 68, No 6.

Research

Use of Simulated Patients to evaluate students' learning and language skills in an objective and quantifiable manner:

Publications

Chur-Hansen, A. & Vernon-Roberts, J. (2000) "The evaluation of undergraduate students' written English language skills." *Medical Education, **34***, 642-647.

Winefield, H.R. & Chur-Hansen, A. (2000) "Evaluating the outcome of communication skill teaching for entry-level medical students: does knowledge of empathy increase?" *Medical Education, **34***, 90-94.

Chur-Hansen, A. & Vernon-Roberts, J. (1999) "The use of standardized patients to evaluate undergraduate medical students' spoken English language proficiency." *Academic Medicine,* ***74***, 829-834.

Chur-Hansen, A., Vernon-Roberts, J. & Clark, S. (1997) "Language background, English language proficiency and medical communication skills of medical students." *Medical Education*, ***31***, 259-263.

A. Chur-Hansen's (1998) unpublished doctoral dissertation("An investigation of the English language proficiency and academic and clinical performance of University of Adelaide medical school undergraduates") reviews the literature on the use of standardized patients in Australia and as a tool for evaluating English language proficiency.

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Drilling for Gold: A Problem-Based Approach in Oral Diagnosis

Dr John Wetherell and Dr Gerry Mullins
Faculty of Dentistry and Advisory Centre for University Education, The University of Adelaide

`The essence of what we're trying to do is to help students take responsibility for their learning; for what they say and do. They should feel free to say, "Hey, I don't know this", or "Yeah, I know this really well." Problem-based learning, experiential learning, journals and self-assessment are just the tools we use to achieve this, not ends in themselves'.

Description |**Aims** | **Process** | **Assessment** | **Evaluation** |**Resources** | **Contact**

Description

During their sessions in Oral Diagnosis, fourth-year dental students treat patients in a clinic within the Primary Care Unit of the Adelaide Dental Hospital. Teaching sessions consist of two hours of clinical work with patients followed by a one hour discussion in an adjacent seminar room. Each student attends one session per week, in groups of twelve or thirteen, for the whole academic year. At the start of the year, two one-hour lectures set the scene for the coming program.

The teaching program is designed using experiential and problem-based learning principles, with 80 per cent of the final grade derived from two self-assessments.

Aims

The first lecture encourages a sense of ownership and control of the course amongst students. It is they who develop both their learning aims and the teaching aims of the tutors by answering the following questions:

- `What things would you like to be able to do at the end of the year that you can't do now?'
- `A good teacher is . . .?'

In answer to the first question, students have nominated objectives such as the following:

- To have the ability to make a correct diagnosis
- To acquire a holistic approach to treatment
- To have patience with patients
- To act on constructive criticism

Guidelines for the tutors are compiled from answers to the second question, `A good teacher is . . .?' Qualities nominated have included:

- One who can empathise with students and communicate on the same level

- One who keeps an open mind and will listen to alternative viewpoints
- One who is accessible out-of-hours for advice
- One who allows you to determine your own level of knowledge and skill

Process

To create a productive learning environment, an `umbrella' of trust must be set up early in the course, so that students feel free to express themselves, to question, to make errors and not be judged beyond redemption. the first meeting of the group is solely committed to this task, with students and staff introducing themselves and their interests to each other, and the staff demonstrating the friendly and respectful attitude cardinal to the success of the course. an open, constructive working environment is essential for problem-based learning, otherwise students will not feel free to question and disagree with their teachers. The two main theories underpinning learning in Oral Diagnosis are problem-based learning and experiential learning. In problem-based learning students are learning from their involvement in problem solving, both in the clinic and seminar settings. This is achieved by tutors guiding students through problem solving with appropriate questioning, for example: `What do you know about this problem?', `Do you need more information?', `Are you sure of the facts?', and so on.

In the complementary experiential learning process, the students are encouraged to involve themselves fully, openly and without bias in the new experiences that are presented to them. They then reflect on these experiences from several perspectives. Following this critical reflection they are then in a position to create abstract models, and solve problems with these models by active experimentation.

The crucial reflection period is facilitated firstly by the seminar period which follows the clinical session, and later through the use of a `journal of reflection'. This journal serves to integrate and expand the knowledge gained from the clinical work, and enables knowledge to be created through the transformation of experience. A journal review is conducted once a term, at about the time the students are assessed. For students experiencing problems, a frank and open discussion ensues with the journal used as a focus for the appraisal. The aim is for students to realise what they need to do to improve the situation, and thereby accept responsibility for their improvement. Students then document their plans for improvement in their journals.

Assessment

At the end of the first and second semester, students are asked to self-assess and justify their grade by reflecting on the semester's achievements. The objectives students set at the beginning of the year act as guides in their decision-making. In their assessments they discuss their strengths and weaknesses, concluding with a negotiated grade. These assessments account for 80 per cent of their final mark, the additional 20 per cent coming from an end of year problem centred clinical test.

Evaluation

The components of the course have been evaluated separately. In a study of the appropriate conditions for journal use* the vast majority of students considered the journals a valuable tool for reflection and feedback that provided an insight into the learning process. At the end of Semester 1, 1995, 4th and 5th year students were surveyed to determine their views on the effectiveness of the assessment processes and, in particular, self-assessment**. The overall assessment process was seen by both groups of students as reflecting the objectives of the course (84% of the total sample agreed that this was so), and as being implemented in a fair way (81% agreed). Seventy percent said that they had a 'positive' or 'very positive' attitude to self-assessment, with only 7.5% having a 'negative' attitude.

Resources

References

*Wetherell J, and Mullins G. The Use of Student Journals in Problem Based Learning. *Medical Education*, 1996 (in press).

**Wetherell J, and Mullins G. Self-assessment in Dentistry; the first steps in lifelong learning. *Research and Development in Problem Based Learning*, 1995 Vol. 3.

Other Sources

This page is largely based on the more detailed paper;

Wetherell J, and Mullins G. A problem-based approach to a course in oral diagnosis. *Australian Dental Journal*, 1994, 39(3) 190-2.

The experiential learning model used in the course is based on;

Kolb DA. *Experiential learning experience as the source of learning and development*. Englewood Cliffs: Prentice-Hall, 1984.

The reflective journals take their inspiration from;

Boud D, Keough R, Walker D. *Reflection: Turning experience into learning*. London: Kogan Page, 1985.

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Learning and Teaching Support

Family Attachment Scheme

Dr Ian Wilson
Department of General Practice, The University of Adelaide

" Unlike the hospital experience which provides only a snapshot of a patient we wanted to provide students with an opportunity to get to know patients over a full year and within a family context. Students are able to interact with 'real' patients with 'real' problems."

Description |**Aim** | **Process** | **Evaluation** | **Contact**

Description

The Second Year subject, Doctor, Patient and Society II consists of 3 parts: Population Health; 'Beyond Me' and Family Attachment.

Through a General Practitioner tutor families are identified and then approached to be part of the scheme. Students, in pairs, meet with these host family on four occasions over one academic year.

Although the intention was that each session with the family would last for approximately 1 hour, some of these interactions last up to 4 or 5 hours and in some cases become quite a social event.

Students have structured tasks for each visit and their overall work contributes to 15% of their result for *Doctor, Patient and Society II.*

Aim

The aim of the Family Attachment Scheme is to enable all students to appreciate the interaction between disease and the family by being 'attached' to a family for an academic year.

Process

During the first visit by the student to the host family the student and family get to know one another. The student produces a family tree which includes all members of the household and a milestone chart so that by the end of the first visit students have recorded details of the family structure and the major events of this century which the family see as important to them.

The second visit involves the students taking a medical history of the nominated 'patient'. The case notes provide the students with an excellent guide for future use.

Despite some initial concerns, the task for the third visit has proved to be very successful. Students are asked to do a survey of the quality of family relationships along the lines of an 'Apgar'*. One or more members are invited to comment on whether the following statements are true "Almost Always", "Sometimes" or "Rarely":

- I can *turn to family support* if I am disturbed
- My family *talks* successfully

- My family will *support* me in a new endeavour
- My family expresses *affection* easily
- My family spend *time* with each other

These responses are then scored. The correlation between the score and the students' observations was consistently high.

The purpose of the fourth and final (formal) visit is to focus on the interaction between the patient and society. The students are asked to accompany the patient when they consult a care provider. Students are made aware that they are there to support 'their' patient, not the medical practitioner.

Some students and family have maintained their relationship informally through further visits, birthday cards and the like. While this is not a formal part of the program it is not discouraged.

*An 'Apgar Score' is the score resulting from a survey of fitness of new born babies based on indicators such as heart rate and respiration.

Evaluation

The Family Attachment Scheme was first introduced in 1995. To evaluate the program the 3 main groups participating in the program: students; families and general practitioners, were surveyed. Comments were overwhelmingly positive. Of considerable interest was the number of families who agreed to be involved in the Scheme in subsequent years.

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Learning and Teaching Support

Keith's Teeth

Dr Tracey Winning and Professor Grant Townsend
Faculty of Dentistry

Keith's Teeth is a computer assisted learning (CAL) module that provides realistic and clear clinical situations. The module, built on HyperCard, presents standard Dentistry Learning Packages (DLP) components, including objectives, concepts, a dental situation, and accompanying resource materials. The resource materials include references to and extracts from manuals, texts, and journal articles, as well as a series of relevant images.

Description | **Aims** | **Process** | **Evaluation** | **Publications** | **Contact**

Description

The problem-based learning dental curriculum at The University of Adelaide uses actual dental situations called Dental Learning Packages (DLPs) from day one of first year. DLPs are designed to provide context for the material covered by the course, and to integrate and coordinate material across streams. The DLPs are presented in paper, video or CAL modules.

Aims

- To enhance the realistic nature and understanding of the dental situation by the use of images of the dental situation
- To provide an enjoyable learning method for students
- To provide a resource that is both self-paced and that students can access in their own time

Process

Conversion of paper DLPs to computer modules makes them self-paced and self-directed, enables feedback through access to glossary, text, data, and image-based resources and takes into consideration the variable learning preferences of students by incorporating images, sound and text.

The packages are available in the Faculty of Health Sciences CAL Suite. Students work through the computer-based DLP in scheduled class sessions, proceeding at their own pace, and choosing their own paths of exploration. They can also access the computer-based DLP in non-contact times for self-directed learning. 'Tutor' and 'Overview' buttons provide answers to common navigation questions. At any point, students can leave a DLP or move further into the package. The students are active, answering questions presented in the problems and discussing them in small groups (2/computer). A staff member facilitates and provides feedback during DLP sessions enabling clarification and/or confirmation of ideas and concepts.

Evaluation

Keith's Teeth was evaluated during development, has been used in class since 1995 and was evaluated by first year students in 1995 and 1996. In summary, students were very positive about the computer DLP with respect to the effectiveness of computer DLPs as a learning technique, they enjoyed the learning format, and their interest in the subject was stimulated, the package was easy to follow, and they preferred a computer-based DLP to paper DLPs. Students felt they have a better understanding of the topics and clinical situation under discussion and part of this involved their perception of a more structured and organised package. They appreciated and made good use of the glossary and resource image series. They commented that they could work at their own pace. They appreciated working in smaller groups for the computer DLPs compared with the paper format. DLPs in CAL format run well with one staff member facilitating a group of up to 24 students, requiring 12 personal computers. In terms of reduction of staff numbers involved, this compares favourably with one staff member facilitating groups of 16-18 students when paper-based DLPs are used.

Positive feedback have also been received at conferences where the package has been demonstrated. Computer-based DLPs have now been developed and are used in first year (DLPs 1.3 and 1.4), second year (DLP 2.1). Development of further CAL DLPs and conversion to web-based formats are in progress using a virtual gallery as part of Adelaide Online.

Publications

1 Journal publication (refereed)
Winning TA, Townsend GC. (1997) Dental Education Bytes: A South Australian Perspective. J CAL in Dent 2(2) (CD-ROM Journal)

2 Conference Paper (non-refereed)
Winning TA, Marriott P, Wetherell JD, Mullins GM and Townsend GC. (1994) Implementing

computer aided instruction in a PBL dental curriculum. Research and Development in Problem Based Learning Vol 2 (Ed: Ostwald M and Kingsland A) Proceedings of the PBL Conference `94, pp 369-383.

3 Conference Publications (Abstract)
Winning TA, Marriott P, Wetherell JD, Mullins GM and Townsend GC. (1995)
Conversion of dental problems to computer assisted learning modules. J Dent Res 74: 762

Winning, TA and Townsend, GC. (1995) Evaluation of computerised learning packages in a problem-based dental curriculum. J Dent Res 74: 565

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Learning and Teaching Support

Computational Composition

Dr Rob Woodbury and Mr Teng-Wen Chang
Faculty of Architecture and Urban Design

"I really wanted students to be able to interact with me and their fellow students from any place and at any time."
Rob Woodbury

It is becoming common practice in some universities to provide, in electronic format, basic subject resources such as syllabi, task assignments, readings, task submissions, discussion groups, exemplary task solutions, and others. These clearly work best if integrated into a common interface that students find simple and accessible.

Computational Composition is a module in Design + Form, a subject in the Department of Architecture. We have authored all of the subject material for this module on the Internet, in what we hope is a form that reflects the goals of the subject--the making of strong and coherent architectural compositions.

Our subject material provides for students several things that conventional handouts do not:

- An electronic bulletin board (a bboard) which students can use to communicate to subject staff, but more importantly with one another.
- Handouts, including text, graphics and computer data files, all accessible through a simple and common interface.
- Electronic handin of student assignments.
- An electronic gallery of student work. Students handin work directly to the gallery and instructors mark the work by visiting the gallery (student marks are not displayed).
- Access to extensive help and tutorials authored by academics from other universities.
- General information about the module, including a statement of goals, schedule, due dates, reading lists and staff information.
- The ability to keep subject material up-to-date, especially to extend it in response to student questions and comments.

We hope that electronic subject material can enable richer, more productive interactions among students and lecturers.

Evaluation
We created similar, but much more primitive, material for a 1995 subject in Computer-Aided Design. We evaluated this earlier work through the Department's internal Student Evaluation of Teaching. We are currently working with ACUE staff to develop effective ways to evaluate this year's effort.

If you have any ideas that might contribute to our project and especially to its evaluation please mail Rob Woodbury.

Instructor:	Rob Woodbury
Tutors:	Sarah Paddick and Rob Woodbury
Demonstrators:	Krassimir Spassov, Jo Rees, Lisa Borg, and Damien Madigan.

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Learning and Teaching Support

Games in Early Design Education

Dr Rob Woodbury, Dr Susan Shannon and Mr Tristan Sterk
Department of Architecture

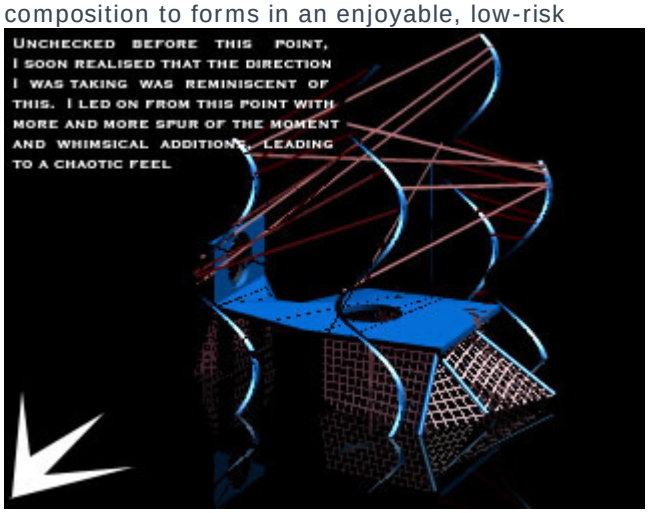
"Learning about Architecture should be serious play. To play happily requires confidence in your game, a quality missing for many new students of design. We aim to help students play with form and design through using simple computer-based exercises based on the metaphor of a game."

Background | **Aims** | **Process** | **Evaluation** | **Contact**

Background

In design studios students have traditionally designed manually at the drawing board and on the modelling bench, utilising skills of inventing, manipulating and describing form to move towards a design solution which satisfies the requirements of the project. For those students who lack confidence and skill in form-making, their inability to invent, manipulate and describe form is a debilitating handicap leading to frustration and disillusionment.

We have developed a game-based, computer simulation curriculum that bypasses these difficulties. Students develop the ability to successfully apply learned theories about composition to forms in an enjoyable, low-risk



collaborative learning environment that allows them to more readily express their creative intent. This then builds confidence in beginning learners who all too often lack the skills initially to invent or manipulate form, or to express their ideas graphically.

In developing the games which form the basis for the teaching and assessment tasks in this subject, we thought that incorporating the "play" which is associated with "games" captured and developed an important essence of "good" designing: as something intrinsically engaging, both bounded and free, and open-ended.

Aims

- to foster greater confidence and competence in students in the early parts of their

design education
- to free students from the constraints of their hand-drawing skills limitations so that they could better develop and convey their designs
- to engage students with design as both playful and serious
- to introduce basic design considerations in an engaging and light-hearted way

Process

Computer Aided Teaching

In order to play the games a substantial facility with a computer-aided design package is required. We chose *Form•Z* as the program. We introduced it to the students in Semester 1 through structured teaching in CAD 1, a compulsory Level 1 semester length subject which brought students into the computer aided teaching suite (CATS) for 3 hours every week. The 10 exercises used in CAD 1 have game-like aspects of their own, as an introduction to the pairing of CAD and games play.

In the CAT suite everyone can see everyone else's screen, and also "click" onto any one else's submitted work in the class. This produced a collaborative learning environment that contributed enormously to the skills the students developed. This phenomenon was unfortunately illustrated by a student whose residence was some distance from campus and who habitually worked at home and was not connected to the Internet. His work eventually suffered because he lacked the intrinsic and explicit knowledge that was common currency for the students regularly interacting in the CAT suite and through the website.

The games were designed to gradually introduce students to more complex design considerations. The 5 games: Symmetry-Asymmetry; Figural Space; Balance and Contrast; Solid, Void and Hierarchy; and Narrative which were developed for the 5 Tutorial Exercises in the Design and Form 1B subject all draw on rule-based play to initiate student form-making. The rules are the geometric concepts underlying these games.

While the latter games are complex, this is no impediment to displaying expertise in creating the figural space images. This is the enabling power of CAD game playing. The majority of beginning design students would not have the hand-drawing skills to compose views of their figural space game solution.

Assignments and assessments

The final two assignments progressed students skills at compositions by asking them to create a holistic designed environment in which there was an experiential brief as well as a compositional brief. The assignments provided an opportunity for students to amalgamate the compositional strategies they had developed in the games playing and restate these strategies in a more complex built environment. There were "rules" for the compositions which closely mirrored the type of rules introduced for the tutorials.

The critical evaluation of whether form-making strategies can be learnt and refined through self-directed, structured play with form-making games is largely a result of looking at the outcomes from these two final assignments where students are required to compose structures with strong compositional strategies, but structures which also have other functions, as well as show through a narrative how they came to these final designs, and furthermore to be able to write reflectively about their process and outcome.

The Design and Form website (inactive, 31/1/03) has course materials, assignments and examples of the students' work.

quicktime movie of a student's work (3.2mb)

The student who created this child's play space reflects on the design: http://practical.cats.adelaide.edu.au/arch/DFIb_99/assignments/Composition/plwinen (inactive, 31/1/03)

For the learning goals and assessment criteria for the nightclub exercise: http://practical.cats.adelaide.edu.au/arch/DFIb_99/assignments/Night_club/ (inactive, 31/1/03)
Powerpoint examples of the students' submitted work is in the left frame.

Evaluation

A comment from a student on the structure of the subject reads:

"It's the most enjoyable, relaxed [subject], but the work is fun to do . . . ".

This comment supports the assertion that the games are fun to play. Another commented on the use of games in the tutorials:

"Games in Tutorials helped really understand what we were doing (not only how)."

Our observations and formal assessments support the view that most students are very competent with formal compositional strategies for students at the end of their first year, and that they are competent with the form-making tool *Form•Z* as a means to game play. Using this tool they are able to model what they imagine, they are able to refine and manipulate forms and to create a polished outcome.

*Games in Early Design Education benefited from a CUTSD grant.

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Collaborative Learning in Problem-Solving Tutorials

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"Previously some of the students didn't think enough about the problems at all. The solutions were often just handed out, and the students were not getting what they needed for learning…With this new approach the students got into the spirit of the whole thing as well…it created a really good learning environment"

Background | **Aims** | **Forming Groups** | **Process** | **Evaluation** | **Sources** | **Contact**

Background

Undergraduate engineering students are often required to provide specific answers to a set of problems as part of a tutorial. Students in these situations are often dependent on the tutor when they are unable to solve a problem, and the weaker students rely on the tutorial solution as their main resource for understanding the solution to the problem.

An important educational objective in engineering is to develop students with keen problem-solving abilities. This can be difficult to achieve in the traditional tutorial format where complex problems require a more open ended problem-solving approach, and where the integration of knowledge from different subjects may also be required.

One method which appears to have assisted students to improve their understanding when solving problems in tutorials is collaborative learning, and this approach was used by Fraser [1] to improve student learning in engineering.

Aims

- to develop a collaborative learning approach for problem-solving tutorials
- to encourage students to become more self-ulected in their learning
- to enable students to develop their problem-solving ability

Forming Groups

The class group comprised 38 second-year students enrolled in the Bachelor of Engineering (Chemical Engineering). The subject, Process Heat Transfer consisted of two lectures and a two hour tutorial per week.

Students were allocated by the teaching staff to 8 groups comprising either 4 or 5 members on the basis of their grade performance in previous subjects and gender. In terms of grade performance, each group had a mix of high, average and low achieving students. The groups were not given any formal instruction on collaborative learning, or on group dynamics as part of this subject.

Process

Each week, students were given a tutorial paper divided into two parts. The first part consisted of questions and exercises which covered basic concepts reviewed as part of the subject. Typical questions in this section were: "What is thermal conductivity?", "Discuss the mechanism of radiation heat transfer." Students were encouraged to complete these in individual study time as part of their review of the lecture program, after the problem-solving tutorial. The second part of the tutorial consisted of 2 - 5 problem solving questions which were of varying degrees of difficulty. Some questions were extremely challenging and required that students tackle them from various points of view in considering possible solutions. It was these problem-solving questions which were the focus for the tutorial session. Previously the subject was comprised of two hours of lectures and a one hour tutorial. In this trial we expanded the tutorial to two hours so that students had time to work on the open-ended problem-solving questions.

Each group submitted the group's solution to the problem(s) for that week, and these solutions were then marked by their peers during the tutorial session. It was anticipated that by having a group solution to a problem, this would encourage a more collaborative approach in both discussing and resolving issues when reaching a possible solution. Each group member was expected to contribute to the development of the group's solution to problems as part of the group process.

In the peer assessment process, each group's solution was assessed by another group at the tutorial. This process took place in the tutorial and enabled groups to obtain instant feedback on their work. Students when assessing work were provided with guidelines on the grading categories and what was required for a solution to be awarded a particular grade. The main purpose of the peer assessment was to provide further opportunities for discussion between the assessing and assessed groups on the different methods used when solving problems, and to provide another mechanism to enhance student learning of problem-solving approaches. The lecturer also reviewed the assessed solutions to ensure the process was completed as objectively as possible.

Evaluation

Two questionnaires were administered to the class group during the semester, and a semi-structured interview was conducted with one member from each group in the second to last week of the semester. The vast majority of students believed that they had learnt a great deal from working with their fellow students and that the value of the approach was in observing the different methods and processes used by individual students when attempting to solve problems: "this [tutorial method] enables me to see how others get their ideas and how they rationalise to solve problems presented". The students also responded favourably to the formation of groups based on mixed ability and thought that it worked well. Although successful in some respects, the marking of group solutions was undertaken solely by the lecturer in the second half of the semester due to student concerns regarding their ability to mark objectively.

The benefit of the technique extended beyond improved student learning. Equally important was the reduced demand on teaching resources. We didn't need to use any part-time tutors and so there was a cost saving component. There was also a reduction in the number of students needing to see the lecturer (Dr Zhang) outside the tutorials with problems relating to their learning. It appeared that the students were able to gain sufficient support from the group to resolve their problems. This was considerably different to previous years conducted with the traditional tutorial format, where a large number of students would frequently seek support, advice or clarification of problems from the lecturer. This success is still ongoing, after several years of implementation. The general approach has also been an inspiration in supervising postgraduate groups.

Sources

This paper is based in large part on the more detailed;

Zhang, D.K. and Peterson, R.F., Collaborative Learning Groups for Problem-Solving Tutorials. Australasian Journal of Engineering Education, 7(2),165-170.

Reference

[1] Fraser, D.M., Collaborative Study Groups - A Learning Aid in Chemical Engineering. Chemical Engineering Education, 27, 1, 38-41 (1993).

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