



In this issue...

From the Director.....front cover

Ian Johnston, UniServe•Science

Putting you in the Picture..... 3

Tim Marples, UniServe Australia

**UniServe•Science Computer
Assessment Workshop report** 4

Ian Johnston, UniServe•Science

Articles

Open Learning: The Challenges Ahead ... 6

Sharon Fraser, University of Western Sydney

Biochemistry Assessment Surveyed 8

*John Swann, University of Technology,
Sydney*

Conference Update 9

Confessions of a Modern Luddite.....10

George Bodner, Purdue University

Resource List.....12

Reviews

Chemistry teaching Graphics V 1.1.....13

*Rowan Hollingworth, The University of
New England*

Planetarium Software: a comparative review
14

Mick Pope, Bureau of Meteorology

Resource List (continued)15

MacMolecule V 1.7.....16

Gareth Denyer, The University of Sydney

CAUT Reports

Interactive Animation for Developing
Weather Map Interpretation Skills.....17

Ric Lowe, Curtin University of Technology

Interactive Teaching and Testing
Tutorials for First Year Chemistry.....18

Peter McTigue, The University of Melbourne

Calendar of Events back cover

UniServe Sites..... back cover

From the Director

Whither UniServe•Science?

UniServe•Science is at a watershed. We are just two years old and within one year our funding runs out. We have also just gone through a time of upheaval. Both of our full-time staff members, Dianne and Mick, whom you would know if you ever had occasion to contact us, have gone on to bigger and better positions elsewhere. We wish them well in their future careers. And at the same time we welcome aboard Anne Fernandez and Mark Nearhos. You, the users of UniServe•Science, will hear a lot more from them in the future.

UniServe•Science was set up by CAUT in 1994 as a three-year trial, to see if an Australian network of clearinghouses was viable, based on the CTI (Computers in Teaching Initiative) network in the UK. Our business has been to serve the needs of tertiary teachers of science. We are a clearinghouse of teaching materials: a lot of our work is electronic, but a lot of it is paper-based as well. From the start we have concentrated on IT materials, though not excluding other aspects of teaching. Our role is to disseminate knowledge about these materials: we do not develop nor distribute the materials themselves. Put simply, our role is to tell teachers of science what is out there that can help them in their teaching, and whether it is any good.

We are proud of what we have achieved in the past two years. We have set up a website and a searchable database containing information about nearly 3000 pieces of teaching software.

Continued inside front cover

From the Director

We have produced catalogues for each of our sciences, in both paper-based and electronic formats. We have sent out regular newsletters containing information about and reviews of teaching materials, as well as reports of CAUT projects and other items of interest to teachers. We are particularly pleased with the two workshops we have run (see page 4 for a report of the most recent one). We have conducted surveys about what is happening in science teaching throughout the country, and disseminated the results. And we have cultivated a network of personal contacts in departments everywhere and, we believe, seeded a feeling of community between tertiary science teachers.

There are still things we have to achieve during the coming year. We need to arrange for more evaluations of the teaching materials in our database, so that we can add value to the information already there. Be prepared for us to get in touch with you throughout the year to ask you to help. We are considering producing discipline specific leaflets ("QuicKards") with details of and opinions about software currently being used in undergraduate teaching in Australian universities. Following discussions at the recent workshop, we will consider setting up exam question banks to be shared by teachers who contribute material to those banks. They will be on the web and searchable. We will, of course, continue to produce our newsletters and catalogues, to add to the database, and to conduct our surveys. But perhaps most importantly, we need to become more widely known than we are. We cannot really be much help to teachers if they have never heard of us. So this year we will be marketing ourselves more aggressively.

The big question is: have we done a good job so far? We have a reasonable idea about some statistics. We know how many visits our website has had, and we know how many academics have attended our workshops, and how many correspond regularly with us. In the middle of 1996 we had to prepare a report to CAUT. We called in an overseas consultant (Dr Jonathan Darby, the then director of the CTI network Support Service in Oxford) to do an audit of our activities. That audit had suggestions to make but was, over all, exceedingly positive. We also received a most supportive report from the Committee of Australian Deans of Science. As a result we received our final funding instalment.

But where do we go from here? It is a matter of concern to us that our original funding was only for three years. If we are to survive past 1997, then we will need to find other sources of funding. It seems to us that the kind of service we provide cannot, even in principle, be self-funding. So we will try all the sources that we know about, and in this endeavour your input could be most useful. We would like to hear what you think about how we have performed and what we should do in the future. But above all we need evidence that the community of tertiary science teachers does really understand what we are doing, and is willing to say so.

If you think we should survive, please write and tell us so.

Ian Johnston

director.science@uniserve.edu.au

Aims

• collecting and disseminating information about ...

• advising on an promoting the use of new technologies in ...

• publicising ne developments in ...

• encouraging communication about ...

Information Technology in tertiary science teaching

UniServe•Science PERSONNEL

Director: Dr Ian Johnston
Co-director: Dr Mary Peat

Deputy directors:
Professor David Patterson
Professor Tony Haymet

Educational technologists:
Mark Nearhos (Biological Sciences)
Anne Fernandez (Physical Sciences)

Correspondence to:

The Editor, *UniServe•Science News*
UniServe•Science (F07)
University of Sydney NSW 2006
Tel: (02) 9351 2960
Fax: (02) 9351 2175
BioSciCH@mail.usyd.edu.au

Notice

*Tim Marples is
the Director of
Uniserve
Australia*

Putting You in the Picture

A Workshop to help you to work with images

In July this year several of the organisations in the UniServe Australia network are combining to run a workshop on how to find and manipulate images to enhance teaching materials. The workshop is intended for academics who are not skilled in the use of IT and image handling packages, to enlarge horizons by presenting demonstrations in a range of disciplines. There will be demonstrations and hands-on experience in a computer lab.

The workshop will last one and a half days, and it will be held at the University of Newcastle on Tuesday July 15 and Wednesday July 16. It is being hosted by UniServe Health and sponsored by the Uniserve Australia Coordinating Centre and UniServe•Science. Keynote speakers from a wide range of disciplines are being invited to give lecture demonstrations. The aim is to present practical exhibition of innovative ways of finding, handling and manipulating images to stimulate teachers to enhance their teaching materials. A fee of \$75 will be charged to help cover some of the costs of the workshop. This will include the production of a paper-based proceedings which will be posted out to all participants.

To encourage academics to attend the workshop, some limited assistance will be offered towards travel expenses. The amount of this support is limited to \$150 each to attendees from southern Queensland, NSW border, Melbourne; and \$250 for attendees from further afield. Note that travel support is against airfares only. If you are in further need of support to allow you to attend you might apply to your faculty. We will be informing Deans of the workshop. Depending on the demand for this workshop, travel support may have to be restricted to one per faculty.

The details of the program and application forms for registration and travel assistance are available on our web page

<http://uniserve.edu.au/uniserve/coord/workshop/>

These pages are under development and should be checked occasionally as new information is being added all the time. There is also a link to a web page listing hotels and motels in Newcastle.

Tim Marples
director.uniserve@uniserve.edu.au

UniServe•Science Publications

<http://www.usyd.edu.au/su/SCH/publications.html>

- **UniServe•Science News** is also available online and in Portable Document Format (PDF);
- **UniServe•Science Catalogues** of resources for Biochemistry, Psychology, Chemistry, Geography, Geology, and Physics (available in PDF);
- **Proceedings of UniServe•Science Workshops**
Proceedings of the Dry Labs Workshop (available in PDF), Proceedings of the Computer Based Assessment Workshop will be available soon;
- **Searchable online database of tertiary science teaching resources**
Over 3000 items are searchable by discipline, year level, platform (Mac/PC) or any keyword.

The Uniserve•Science Computer Assessment Workshop

Over the last decade or so the introduction of computers into mainstream teaching has spawned a number of sophisticated packages capable of providing Computer Based Assessment (CBA) on a large scale. In Australia a few university science departments have been using CBA in their mainstream teaching for some years. It seemed to us at UniServe•Science that a discussion of the ways in which computers could be used in assessment would be timely. We invited representatives from several disciplines to share their experiences, and we put on our second workshop devoted to this subject on February 14, 1997.

What transpired at the workshop

The workshop was planned to be as hands-on as possible so that everyone attending could gain some experience of what was actually being used in science departments throughout the country. There were to be six sessions. In the end, one of the planned presenters fell sick, and only five presented — Fred Pamula, Department of Biology at Flinders University; Halima Goss, Teaching and Learning Support Services, Queensland University of Technology; Peter Ciszewski, Department of Biophysical Sciences and Electrical Engineering, Swinburne University of Technology; Roger Lewis, Department of Physics, University of Wollongong; and Sue Fyfe, Department of Human Biology, Curtin University of Technology.

In the middle of this, we felt that it was important to have a plenary speaker, to remind people of the pedagogical issues involved in this kind of assessment. Professor Royce Sadler, from the Faculty of Education, Griffith University, presented these issues in a clear and concise manner. His talk was singled out by many in their final evaluation forms as the highlight of the workshop.

On the day, there were a few technical difficulties with some of the software. There were some problems with the

timetable because the weather delayed planes into Sydney by half an hour. But over all we believe the workshop was a success, and what was most appreciated by many of those attending was the chance to get to talk with others doing similar things.

Outcomes of the workshop

When registering for this workshop, members were asked to fill out a short survey form concerning the use of CBA in their home departments. This provided us with information to start formulating questions that the workshop might address. Then throughout the day, and at the final wrap-up session, these questions were discussed in open forum. The questions that raised most interest were the following.

(1) Degree of usage of CBA.

Of the 67 members attending the workshop, representing about 50 different science departments, 24 stated that they used some form of CBA in their (different) home departments. There were some 170 science departments who were not represented at the workshop, of course, but we have reason to believe, from surveys that we have done in the past, that the number of those who do use CBA but who were not at our workshop is a small number at most. Furthermore the *relative* use of CBA among the different science disciplines is very similar to what we have found elsewhere, viz that Biology and Chemistry are the main users of IT in their first year teaching.

(2) Feedback vs marks.

Like most things in computer aided teaching, there is a lot of work involved in developing and using CBA. The question which worries us all is: will the students use it? One's natural reaction, based on years of teaching experience, is that if you do not make it worth marks, they will not

Article

do it.

One cautionary tale that surfaced during the workshop concerned physics students at QUT. Three years ago they were part of the campus wide CBA system that Halima Goss described in her presentation. It was compulsory and the participation rate was essentially 100%. Then a student survey suggested some of the students were unhappy about the inconvenience of the centralized system. The department chose to make it optional. Participation dropped to 10%.

At the wrap-up session at the end of the workshop opinions were expressed that in well designed systems, students have proved that they will work without the carrot of marks. Nevertheless of the 24 departments represented at the workshop which use CBA, 9 of them use it purely summatively and another 12 use it formatively as well as summatively. Only 3 use it purely formatively.

(3) Questions of security.

Opinions were widely divergent on this issue. Some departments adopted the attitude that a lot of thought must be devoted to keeping databases with student marks in them as inviolate as possible, but that it did not matter overly if students found out about some of the questions that were likely to be asked. Others felt that the development of good questions was a time-expensive business (the figure of one-and-a-half hours for a multiple-choice question was quoted by Royce Sadler in his plenary talk) and their usefulness was severely compromised unless security could be guaranteed.

(4) Cost effectiveness.

The biggest question, at least in the view of the bean-counters, is whether CBA can save money. Some institutions (Swinburne University of Technology and the University of Adelaide) claim that they have demonstrated savings in their part-time teaching budgets. Others argued that it is naive to expect that real money will ever be saved, especially when the replacement cost of computers and the time investment in

developing questions is properly taken into account; and we should focus our attention on increasing the quality of learning. CBA can relieve teachers of some of the drudge work and leave us free to put effort into what only we, as academics, can do. And then, even if there is no net saving of money or time, the whole exercise will truly be worthwhile.

Conclusions from the workshop

The most important conclusion that arose concerned the question of sharing the cost of using CBA. Writing questions for use with these systems needs a lot of time and energy, and it takes even more time and effort to evaluate whether or not they select out those students who understand our subject as we would like it to be understood. Those departments who have been using CBA for some years have built up item banks of these questions. Those who want to start using CBA are faced with the daunting task of building up their own from scratch, unless we can *share* our item banks with one another.

As has been alluded to in the editorial of this newsletter, UniServe•Science finishes its initial funding period at the end of 1997, and needs to consider future directions carefully. Perhaps we might capitalize on the goodwill that has been generated at this workshop and arrange for the establishment of nationwide item banks in which all those working in CBA may share. We will be actively exploring this idea during 1997.

Ian Johnston and Mary Peat
director.science@uniserve.edu.au

Open Learning

The Challenges Ahead

Much has recently been made of open learning, but what do we mean by the term. To some it means distance delivery, to others it means flexible access and to others the term is synonymous with a way of teaching that meets the needs of the learner *i.e.*, open and flexible. In this discussion, of the potential value of open learning in science education, let me start by clarifying the term 'open learning'. I prefer to use the definition used by Paine (1989) which is to look at "... *open learning as both a process which focuses on access to educational opportunities and a philosophy which makes learning more client and student centred*". This means that not only is access to education made more equitable, but also that the learning experience itself is more flexible.

Recent reports commissioned by the Australian Government (Baldwin 1991; Candy *et al.* 1994) have acknowledged the necessity for a greater emphasis to be placed on meeting student needs in tertiary education, in order to produce graduates equipped for the workplace. There is no shortage of literature identifying criteria for, and characteristics of teaching, which is considered effective in maximising student learning and achievement (Ramsden 1992; Stubbs and Maddison 1991), but there is little specific research evaluating and assessing the results of such teaching strategies. This is particularly evident in the application of this approach in science education.

Science undergraduates in Australia are, being increasingly exposed to novel and innovative teaching and learning experiences (Clark and James 1993; Pollard 1993). They are being required, moreover, to develop not only discipline-specific skills, but also generic and transferable skills. Students have to adapt to this new learning environment and so too do lecturers. How effective student-centred teaching, which underpins the philosophy of open learning, is in producing science graduates of the calibre required by employers is largely unknown. How students, staff, employers and funding bodies perceive the effectiveness

of such strategies is also largely ignored. Yet all of these factors must be taken into account when evaluating or assessing the effectiveness of innovative science courses. What we can be sure of, however, is that an academic interested in embracing the philosophy of open learning will face challenges, which are yet to be proven worthwhile.

In a true open learning environment the learner is now responsible for, and in charge of, the learning process. The new role of the teacher is to be "... *increasingly less the carrier of information, but more and more the tutor who stimulates and promotes a communication process between himself and the student and between the student and the learning materials.*" (Van Enckevert and Leibbrandt 1988). The focus is on the students' learning, not on the instructors' teaching. Student centred learning activities that foster deep learning require innovative assessment strategies. Where possible, students should be involved in the assessment process as this helps them to develop the ability to make judgments, in particular about themselves and their work (Brown *et al.* 1994).

Any course development must not only meet the objectives of how students learn (Nussbaum and Novick 1982; Piaget 1983) but also take into account the students' motivations, priorities and preferences. Together with the note-taking and information gathering skills, traditionally taught to the students, it is now necessary to include such skills as group work and presentation skills in this training. The learner requires immediate and continual feedback about their progress which results not only in a sense of achievement but also provides a validation of the learning strategy adopted by the student (Clark 1994).

Although we seek to develop the students' ability to be independent learners, the tutor does not become obsolete, rather he/she must be the supportive and motivating influence in the development of the students' autonomy, being aware of the

Sharon Fraser is a Research Assistant in the Faculty of Science and Technology, School of Biological Sciences, University of Western Sydney Nepean.

Article

individual learning needs of each student and prepared to help with the students management of their learning.

Science education lends itself to innovative teaching techniques. Problem based learning (Feletti 1993), multimedia packages (Harper 1996), the use of concept mapping (Ault 1985, Clark & James 1993) and group learning (Kennedy 1996; Sleet & Logan 1996) are all being used in undergraduate science education and receiving positive feedback from the students. However, student centred teaching strategies, which hand over the responsibility and control of the learning process to the student, actually require a very motivated member of staff. A great deal of work must be put into the development, establishment and maintenance of the teaching strategy to be implemented. The lecturer needs to ensure that the students have adequate skill to get the most from the innovation.

All this requires a commitment of time, energy and resources. Will this mean that the staff member's research load and other commitments to teaching, need to be cut back and further staff development training undertaken. Are institutions willing to fund this new approach to the teaching/learning relationship? Is there a risk that open learning and its tools are seen by some "economic rationalist" as a means of cutting the cost of higher education perhaps by reduction in staff? There is no doubt of the strength of the educational arguments supporting the establishment of student centred teaching, but without well structured evaluation of the effectiveness of individual strategies and their institutionalisation, is it reasonable to expect an academic to make the necessary sacrifices?

Sharon Fraser

s.fraser@nepean.uws.edu.au

References

- Ault, C.R. (1985) Concept mapping as a study strategy in earth science. *J. Coll Sci Teach* 15; 38-44.
- Baldwin, P.J. (1991) *Higher Education: Quality and Diversity in the 1990's*. Australian Government Printing Service, Canberra.
- Brown, S., Rust, C. and Gibbs, G. (1994) *Strategies for diversifying assessment in higher education*. The Oxford Centre for Staff Development. Oxford, UK.
- Candy, P.C., Crebert, G. and O'Leary, J. (1994) *Developing lifelong learners through undergraduate education*. Australian Govt Printing Service, Canberra.
- Clark, R. (1994) Student opinion of flexible teaching and learning in higher education. (in) Wade, W. *et al.*, (eds) *Flexible learning in higher education*. Kogan Page, London.
- Clark, I. and James, P. (1993) The use of concept maps in the teaching and learning of structured geology (in) Bain, J. *et al.*, (eds) *Promoting teaching in higher education*. Reports from the National Teaching Workshop. V.R.Wood, Govt. Printer, Qld.
- Feletti, G. (1993) "Inquiry based and problem based learning: how similar are these approaches to nursing and medical education?" *HERD* 12(2), 143-156.
- Harper, B. (1996) Exploring the Nardoo: multimedia reporting in science problem solving *UniServe•Science News* 4.
- Kennedy, B. (1996) Improving student learning *UniServe•Science News*, 4.
- Nussbaum, J. and Novick, S. (1982) Alternative frameworks, conceptual conflict and accommodation: towards a principled teaching strategy. *Instructional Science*, 11, 183-200.
- Piaget, G. (1983) Piaget's theory. (in) Mussen, P.H. (ed.) *Handbook of child psychology: Vol. 1. History, theory and methods*. New York. John Wiley and Sons.
- Pollard, J. (1993) Developing physics understanding through guided study. (in) Bain, J. *et al.*, (eds) *Promoting teaching in higher education*. Reports from the National Teaching Workshop. V.R.Wood, Govt. Printer, Qld.
- Ramsden, P. (1992) *Learning to teach in higher education*. London. Routledge.
- Sleet, R. and Logan, P. (1996) Broader skill requirements of science graduates. *UniServe•Science News* 3.
- Stubbs and Maddison, (1991) Improving teaching quality in higher education. *Edn Today*. 41(1).
- Van Enckevert, G. and Leibbrandt, G.J. (1988) The open university of the Netherlands. (in) Abrahamson, K. *et al.*, (eds.) *Adults in the Academy*. Stockholm.

Biochemistry Assessment Surveyed

John C. Swann,
Senior Lecturer,
Department of
Cell and
Molecular
Biology, Faculty
of Science,
University of
Technology,
Sydney

My study leave or professional experience program (PEP) in 1996 afforded me the opportunity to indulge a long standing interest in how we assess our undergraduate students in biochemistry. I was based for the semester in the School of Biochemistry and Molecular Genetics at the University of New South Wales, but made visits to 25 Departments or Schools teaching biochemistry and related topics (including chemistry, physiology and pathology) in 14 Australian Universities. I discussed with academic colleagues their favoured assessment practices and inquired about how they are adapting their teaching and assessment to the opportunities offered by new educational tools and the challenges posed by dwindling resources. In several Universities I gave seminars or conducted group discussions, in others I met informally with academic staff. Through literature research and contact with university centres for educational enhancement I also looked into assessment strategies popular in non-science disciplines, and considered their potential applicability to biochemistry.

I found consensus that assessment is most worthy of attention, but usually neglected amidst the daily pressure of things required for survival and advancement in the current climate. With few exceptions, assessment in undergraduate biochemistry subjects relies heavily on a traditional written theory exam, perhaps supplemented by a semester test, these contributing around 50-80% of the mark. Practical work is recognised as important but only rated 10-30% because it needs considerable resources to assess true practical skills. The remainder of the assessment, up to 20%, generally involved assignment or project work. Within this category, and especially in the final year, fell innovative ideas such as a critique of a scientific paper within a small group, poster presentations on a group laboratory project, metabolic case studies, or critical evaluations of the biochemical bases for advertised claims about products such as nutritional supplements. Assessments involving oral presentations by students were felt to be very successful in promoting active learning by the presenter but probably not by the audience.

Assessment that is weighted towards the exam can be defended as efficient, unbiased and having good authenticity by throwing each student on his/her own resources. However, we recognise that this type of regime drives students towards undesirable forms of learning by rewarding primarily short term recall of factual information. Assignment or project tasks of the type mentioned above that can steer the student towards independent learning, critical and problem-solving approaches and self-management were set in most courses, but generally given low weighting because they are difficult to assess accurately. No department that I visited has fully embraced problem based learning, and it was generally felt that limited resources and the difficulty of being out of step with a student's other subjects militated against this practice. However, most academics teaching biochemistry agree that the subject can lend itself to incorporating elements of problem based learning.

Clearly assessment must be kept in perspective, the right tasks being chosen to harness assessable activities in support of worthwhile interaction between student and course material, whilst not overloading the student or the academic. It can be frustrating to the student who wishes to undertake deeper learning in some aspect of a course to be enslaved by the need to keep abreast of a myriad of assessment tasks; likewise it is counterproductive for academic staff to be continually deluged with correcting and marking. These factors directed my focus particularly towards exploring *peer assessment*, *self assessment* and *computer-aided assessment* in the search for an enlightened solution to the seemingly contradictory aims and needs of assessment.

Peer assessment was used sparingly in the places I visited, and mainly for oral presentations. Those who had tried it felt it had educational value but were reluctant to assign much weight to peer gradings. Self assessment allied to computer-aided learning is used with success in some departments. Though mainly employed for purely formative assessment, no grades being recorded, it represents a valuable learning resource for students and once set

Article

up does not require excessive maintenance. There was caution about deriving numerical grades from self assessment. Nevertheless, both peer and self assessment have undoubted potential to promote useful learning and personal development skills. Computer-aided assessment is often thought of among biochemists as synonymous with objective testing, and few expressed enthusiasm for multiple choice tests beyond their efficiency for large classes. However, I saw sufficient evidence of objective tests designed to encourage deductive reasoning rather than recall, to convince me to pursue this area further. Questions based on the applications of biochemical knowledge to the interpretation of experimental data seem particularly suited to "thinking" objective tests. A good example is given by Tamir (1991), who incidentally proposes an interesting compromise in the perennial debate about negative marking in objective tests. We are also just beginning to see the impact of the world wide web in broadening the scope of assessment tasks that students can be asked to undertake on line, and this will be an interesting field in which to be involved.

A notion that surfaced in discussions in various places was that of setting up internet links to allow biochemistry academics to disseminate assessment ideas and draw on tasks and experiences contributed by colleagues. I hope to take this idea further, capitalising on contacts made during this project.

My www version of this report provides a link to an embryonic "Directory of Biochemistry Assessments".

John Swann
john.swann@uts.edu.au

A world wide web version of this report may be found at: http://www.science.uts.edu.au/~jswann/PEP_Report.html

Reference

Tamir, P. (1991) Multiple choice items: how to gain the most out of them *Biochem Ed* 19, 188-192.

Acknowledgments

I am most grateful to Professor Ian Dawes for allowing me the resources of his School to conduct this PEP project and Associate Professor Mike Edwards, also of the School of Biochemistry and Molecular Genetics, University of New South Wales, for his collaboration and helpful discussions throughout. I am also indebted to academic colleagues, too numerous to mention individually, throughout Australia for hosting my visits to their departments and being so generous with their precious time.

... ..

Conference Update

WebNet World Conference 97

Oct 31 - Nov 5, 1997. Toronto, CANADA
The second World Conference of the WWW, Internet and Intranet is an International conference organised by the Web Society and the Association for the Advancement of Computing in Education (AACE).

Topics include Authoring Tools, Distance Education, Educational Multimedia, Web Page Design Tools, Psychology of Web Use, Social and Cultural Issues and Computer-Human Interface Issues.

For further details see their site at

<http://www.aace.org/conf/webnet>

International Conference on Computers in Education (ICCE 97)

Dec 2 - Dec 6, 1997. Kuching, Sarawak, Malaysia.

This conference is organised by the Asia Pacific chapter of the association for the Advancement of Computers in Education. It is mainly concerned with current state-of-the-art and real-world deployment of educational technologies. Major tracks of the conference are: Teaching-Learning Strategies and Environments; Technologies and Innovative Applications; Education Reform and Support; Social and Cultural Issues.

<http://www.icce97.unimas.my>

Confessions of a Modern Luddite

A Critique Of Computer-Based Instruction

George Bodner,
Department of
Chemistry,
Purdue
University,
Indiana, USA.

The Luddite legacy

Mention of the shire of Nottingham usually evokes the image of Robin Hood. But Nottingham also produced, in 1811, another mythical figure, Ned Ludd. Although the existence of "King Ludd" is questionable, the agrarian revolt associated with those who claimed to be his followers was real and the "Luddite" movement spread rapidly through northern England. By 1813, the Ludds represented a serious enough threat to justify a series of trials in Yorkshire that resulted in hangings and transportations. The Luddite movement resurfaced in 1816, during the depression that followed the Napoleonic Wars, but a combination of vigorous repression and economic recovery led to its demise in 1817.

In 1830, "The Society for the Diffusion of Useful Knowledge" felt compelled to publish an eight-page pamphlet entitled "An Address to the Labourers, on the Subject of Destroying Machinery", which reflected conventional wisdom among proponents of the industrial revolution at the time. After surreptitious replacement of a few words here and there, it also reflects conventional wisdom among proponents of the information highway that is supposed to transform society at the turn of the 21st century.

"The word Machine seems to convey to your minds, some contrivance necessarily attended with mischief to the Poor; whereas in truth, the word Machine means the same as Tool or Instrument ... Man...as soon as he feels...the necessity of finding food...first invents the most simple tools; the hoe, the spade, the rake, the axe, the flail. As men...extend their knowledge further, they contrive other machines,...the wheel, the cart, the plough all of which are intended and used to ease his toil and abridge his labour... In following the course you are now pursuing, you are driving men back to their savage state, when they lived upon acorns and roots, and had no machines nor tools at all, a great demand for labour, and very little to eat."

In these more enlightened times, we no longer hang opponents of technical revolutions or even transport them to foreign lands because all we have to do is

whisper the accusation: Luddite! Thus branded, these individuals automatically become ignorant, naive, backward, destructive people, who are opposed to 'progress'. However the insight provided by historians who have studied this movement shows that it was not the new technology to which the Luddites objected, but the societal changes that were being imposed on them from above by proponents of this technology. It was not the threat to full employment that concerned them, but the threat to the traditional wages a labourer could earn. They did not ask for a return to old fashioned work, but to "full fashioned work at the old fashion'd price".

Luddites in the age of computers

It would be a mistake to conclude from either the title or contents of this article that the author is opposed to computers. The first thing he does when he walks into his office, after turning on the lights, is to turn on a computer. It would also be a mistake to presume that, by labelling himself a modern Luddite, the author wishes to destroy the computers in our school and universities, or even remove them from the classroom. There is abundant evidence that computers can play a role in teaching and learning.

Instead, like his predecessors, this Luddite would like to concentrate on carefully selected targets, to remind the reader that any critical analysis of computer-based instruction would conclude that its use does not necessarily improve the teaching/learning environment.

Should instructional equipment carry a warning label?

Firstly, a cautionary tale. A year-long course in organic chemistry was presented in computer-projected format with many graphics and simulations, particularly of molecular structure (Casanova and Casanova, 1991). Printouts of the screens were distributed as notes and computer materials were made available for individual study. Students took very few notes, but class participation (questions, comments, discussion) was unusually high, better than the lecturer had experienced in thirty years of teaching. Students liked the course and believed that

Article

they understood the subject well.

A control class was taught by classic techniques. Both lecturers shared similar teaching philosophy and standards. The same textbook was used in both sections, pacing was similar, and the final exam was the same.

In the final exam given at the end of the first quarter, the average score for the 30 students in the control group was 125 out of 200, whereas for the 29 students in the experimental group it was only 88 out of 200. When the test questions were sorted into categories, the experimental class was found to have done worse on all categories, even those topics that were visually intensive and potentially better understood with computer presentation.

The instructor concluded that the "electronic blackboard" allowed for the presentation of substantially more information in the time, but students had trouble absorbing the added information. They had to invest more time in the course, and the professor took three to four times the normal time to prepare each lesson. He concluded:

"... introduction [of the electronic blackboard] into the lecture has more profound consequences than would first appear, and a warning label should limit its use to those tasks it does best".

Questions for authors and implementors of CBI

There are many such cases on record, but, because few people want to be associated with stories of failure, the author will transform case histories of "less than successful use" of computers into a series of questions that both authors of CBI programs and potential users of these programs might consider.

Does the program teach skills that you value?

In every field of science one can find examples of beautiful programs on which students could spend hours developing skills that earn them less than 1% of the marks for the course. If they do this they will have less time to develop other skills, which might be more likely to earn them marks. When choosing (or designing) software it is useful to remember that it carries a hidden message to students, who believe that we wouldn't have spent all this money unless the content of the programs we assigned was important.

Does the program teach skills with which your students have difficulty?

It is common to come across experiments done to evaluate CBI programs in which only modest changes in student performance were observed because the students did reasonably well on the test questions even before they used the program.

Do we need a computer to deliver instruction?

The computer has revolutionized the development of instructional materials, but that doesn't mean the computer also has to be used to *deliver* this instruction. For the instructor, funds spent on purchasing computers to deliver instruction aren't available for upgrading laboratory equipment. For students, a computer-generated handout can be studied whenever and wherever they choose; it doesn't require a special trip to the computer lab.

Are the computers being used to do something that requires a computer?

The cost of computers can be justified when they are used to do something that can best be done with a computer, such as collecting real-time data, doing extensive calculations, manipulating massive data bases, storing and retrieving information, and so on. All too often, however, computers are being used to deliver instruction that could be presented almost as well with a two- or three-page handout at a cost about five orders of magnitude smaller.

Are the computers being used to do things you would use a computer to do?

There are 50 faculty members and more than 300 graduate students in the Department of Chemistry at Purdue. Virtually all use computers — to collect, store, or manipulate data, for molecular modelling or other calculations, for email and the Web access, for word processing, and even for playing games. None of them use the computer the way CBI programs ask students to use the computer to learn conceptually difficult material. Perhaps the optimum way of using computers with students is to use them as productivity tools, the way we use them.

Do the students have difficulty navigating through a CBI program?

Studies of student use of CBI programs suggest that students often get lost, or

Article

disoriented, while navigating their way through the program. Navigation problems are often the result of programs that try to do too much. Because they can link many topics, developers of software programs often believe that they should link these topics.

Is the program a first draft or a finished product?

Because of the time and effort that goes into writing a CBI program, they often have a stronger resemblance to the first draft of a textbook being considered for publication than they do to the third or fourth edition of a popular text.

Does the program feature things that can be done or things that should be done?

Consider two software packages. One randomly selects an organic compound from examples stored in its memory, displays the structure, asks for the correct IUPAC name, and then tells the students whether they were right or wrong. The other allows the student to enter virtually any compound they could imagine, asks them to propose its name, analyzes the structure to determine the IUPAC-approved name, and then analyzes the student's answer to determine what errors have been made. The second would be the program that does what should be done, not merely what can be done, and it is one that this author would gladly purchase.

Are the students using computers because they want to, or because they have to?

The author is familiar with a variety of

programs that represent excellent course supplements. Some are particularly useful for weak students, struggling with the course. Others provide a challenge to strong students, who might otherwise be bored. But these programs aren't equally successful when they are required of all students in the course.

Conclusion

Hippocrates (460-377 B.C.) is the source of the Physician's Oath, which includes the notion that: "*I will use treatment to help the sick ... but never with a view to injury and wrong doing. ... to help the sick, and ... abstain from all intentional wrong-doing and harm.*"

When implementing computer-based instruction, we should strive, above all else, to ensure that we don't interfere with the students' progress through our course. This can only be achieved by recognizing that any change in an instructional environment will have both positive and negative effects. By reflecting on what happens when we make changes in our course, we should be able to find ways to maximize the positive effects and minimize the negative effects of these changes.

George Bodner

gmbodner@vm.cc.purdue.edu

Reference

Casanova J and Casanova S L, *EduCom Review*, 1991, **26** (2), 31-39.

Resource List

UniServe•Science aims to provide an easy means for academics to access information. Part of this aim is to provide referral to other services that offer information to academics. Listed below are contact details of a sample of information services you may wish to know about.

CTI Biology

email: CTIBiol@liv.ac.uk
URL: www.liv.ac.uk/ctibiol.html

CTI Chemistry

email: CTIChem@liv.ac.uk
URL: www.liv.ac.uk/ctichem.html

CTI Geography (with Geology)

email: CTI@le.ac.uk
URL: www.le.ac.uk/cti/

CTI Physics

email: CTIPhys@surrey.ph.ac.uk
URL: www.ph.surrey.ac.uk/cti/home.html

CTI Psychology

email: CTIPsych@york.ac.uk
URL: www.york.ac.uk/inst/ctipsych/

Intellimation

Dept 5CKF, 130 Cremona Drive,
Santa Barbara CA 93116, USA
email: intellLFM@aol.com
Tel: 1 805 968 2291

BioQUEST Curriculum Consortium

Department of Biology, Beloit College,
700 College Street, Beloit WI 53511, USA
email: bioquest@beloit.edu
URL: www.beloit.edu/~bquest/
Tel: (608) 363-2743 Fax: (608) 363-2052

Continued on Page 15...

Review

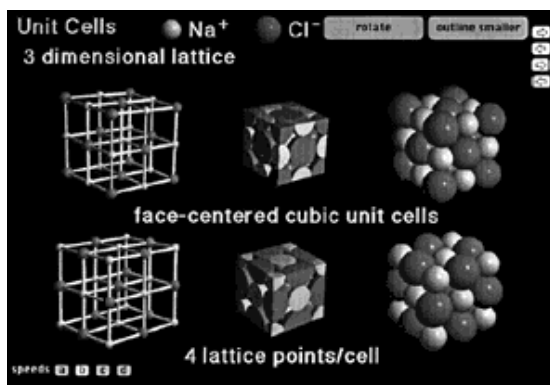
Rowan
Hollingworth,
Assistant
Lecturer,
Department of
Chemistry,
University of
New England

Chemistry Teaching Graphics Ver 1.1 General & Organic

The two CD ROM's contain graphics and animations of chemical concepts developed at the University of Washington. They are designed to be used by a lecturer or by small groups of students at a computer monitor. The author states that there have been highly favourable responses to the graphics from both students and staff, at a number of test sites. The reviewer has not tested them on students yet.

On my Mac Performa 5200CD (16Mb recommended) there were no problems, when all other programs were removed and virtual memory was off. There were frequent crashes otherwise. The 25 page manuals on disk (and an explanation page contained in each module) give full details on memory and other requirements.

The General Chemistry disk contains modules on matter, atomic structure and orbitals, bonding, intermolecular forces, gases, solids and crystals, reactions and thermodynamics. The Organic Chemistry disk contains the following modules: introduction, bonding and molecular orbitals, organic bonding, intermolecular forces and properties, conformation and stereochemistry, organic reactions,



This diagram, like many others, is built up in several steps. The lattices can be rotated.

peptides, proteins and other complex and biomolecules.

All the modules are completely stand alone units and can be copied onto a hard disk for more convenient presentation in a lecture. Navigation through a module is very easy. There are forward and backward buttons, as well as a navigation menu to take you immediately to certain points. Some modules have an additional page with a full flow diagram of the module, from which you can click to any screen directly.

My only criticism in this regard is of the presence of a next screen topic button at the top of the screen, which competes in prominence with the graphics labelling that particular screen. This can be confusing at times and I would prefer all the navigation buttons perhaps in a bottom bar, clearly away from the screen topic information. Sometimes the screens can become rather cluttered at the end of sequences, so it will be necessary for the lecturer to explain clearly each step along sequences.

Of course, it is vital for a lecture presentation, that the lecturer is very familiar with the flow of the graphics and has prepared integrated discussion and questions to accompany the graphics at relevant points. It is then easy to jump to particular sequences, repeat animations or show alternate models in response to student queries. In fact, I thought one of the strong points of the graphics, was the number of representations or models available to illustrate many concepts.

Additional modules of models and exercises, with their own comprehensive 20-30 page manuals are available for each disk. These contain a range of model files in standard "pdb" format to be used with the freely available

Review

RasMol program.

The two CD's then are the result of a dedicated effort to produce good computer graphics to improve lecture presentations.

As is usual with these detailed resources, a significant commitment from the lecturer is required to use them to their full advantage. Given the time to do this, I believe lectures can be considerably enhanced. I recommend the two CD's

highly.

Rowan Hollingworth
rholling@metz.une.edu.au

For further details on this package, contact the supplier Jacaranda Wiley, PO Box 1226, Milton Qld 4064 Tel: (07) 859 9755 http://www.wiley.com
--

.. . . .

Planetarium software: a comparative review

A Planetarium package is a sky visualising program, that simulates the movements of the stars, planets and other objects across the night sky. The benefit is obvious, no excursions required. Students and teachers have access to the visible universe on their desktop.

The quality varies widely in terms of what is available, especially in the shareware/freeware category. The older it is, in general the poorer the quality, due to the limited display and processor power that the early versions had to contend with.

The basic features these days include: toggles, labels, constellation lines, etc; zooming in and out; animation; set location of observer; limit stars by magnitude; mouse driven; click on object for information, eg. a star's magnitude.

A quick straw pole of Australian academics revealed how they considered them useful to:

- give a basic knowledge of the sky: constellations etc (1st yr);
- visualise the sky as a sphere rotating about an axis through the poles (1st yr);
- generate finding charts for observing (4th yr);
- learn how the constellations and planets and the moon move across the sky, using the ability to quickly change the time of observation within the program;
- explore astronomical phenomena
- demonstrate the changing aspect of the night sky in lectures.

What can be learned depends in part on

the features provided, but also on the imagination of teacher or student. Whilst no replacement for observations, it can be a cheaper alternative for undergraduate classes.

A rough comparison was done with the following scale used;

*=poor, **=average, ***=good & 1/2 in between.

This was judged on content (information available), manuals and online help, interface (menus, pop-lists, mouse button use), and screen issues (animation speed, toggles). Short comments list the pros and cons of the packages. As one would expect, Windows programs tend to be better than the DOS equivalents as these were written later for machines with better graphic and computational capabilities. However, not all of the Windows programs make the most of what is available to them.

Earth Centred Universe* **

Pros: select & zoom, click on object for information, onscreen angular separation measurements, telescope driver, centering view on object.

Cons: not able to automatically reset time/position after animations, some features disabled in shareware.

Home Planet* **

Pros: satellite tracking, telescope or horizon display, huge object catalogue - linked to displays.

Cons: manual setting of time zone in autoexec.bat, multiple windows a

Mick Pope was the Educational Technologist for the Physical Sciences with UniServe•Science and now works for the Bureau of Meteorology, Melbourne

Review

nuisance, no printing facilities.

CyberSky **

Pros: easy to use interface, printing

Cons: content poor, no star labels, no zoom feature.

Mystars! **

Pros: can add locations and comets, extinction effects near horizon included

Cons: constant registration reminder, animation interface awkward, update patch doesn't work.

Planet Watch **

Pros: very simple interface.

Cons: not full sky - ecliptic only with planets motion, prints ephemeris only.

SkyGlobe (Win) ***

Pros: excellent zoom feature (object labels appear as you move in), 'turbo' zoom and pan, printing maps.

Cons: too many buttons - cluttered screen, no information on objects.

Astro * 1/2

Pros: can print or produce gif output, neat button interface, zoom feature.

Cons: no labels for stars.

Starry (Starry Nights) **

Pros: can label objects manually, prints charts, select object to centre, drawing feature with mouse.

Mick Pope

m.pope@bom.gov.au

downloaded as shareware or freeware from the following sites (at the time of writing).

Earth Centred Universe

<http://fox.nstn.ca/~ecu/ecu.html>

Home Planet

<http://www.fourmilab.ch/homeplanet/homeplanet.html>

CyberSky

<http://www.astro.ucla.edu/staff/stephen/chp.html>

Mystars!

<http://www.synapse.net/~dpatte/>

Planet Watch

<ftp://archie.au/pc/SimTel/msdos/astromy/plnwch20.zip>

SkyGlobe

<ftp://archie.au/pc/SimTel/msdos/astromy/skyglb36.zip>

Astro

<ftp://archie.au/pc/SimTel/msdos/astromy/astro202.zip>

Starry Night

<http://www.siennasoft.com/mainmenu.html>

Some other interesting programs are:

Skyplot

<ftp://archie.au/pc/SimTel/msdos/astromy/skyplot.zip>

Dance of the Planets

<ftp://archie.au/pc/SimTel/msdos/astromy/dance13.zip>

StarWorks2

<ftp://archie.au/pc/SimTel/msdos/astromy/tarwrk2.zip>

Starview

<ftp://archie.au/pc/SimTel/msdos/astromy/starview.zip>

The programs reviewed can be

Resource List (...continued from page 12)

Geo-Slope International

#1830, 633-6th Avenue S.W.
Calgary, Alberta, Canada T2P 2Y5
email: info@geo-slope.com
URL: www.geo-slope.com

The Digital Chemistry Company

PO Box 332M, Manunda,
Cairns 4870, Qld
email: digichem@internetnorth.com.au
URL: www.digichem.co.uk

Slice of Life

EHSL#589, University of Utah, Salt Lake City, UT
84112-1185, USA
email: slice@slice.med.utah.edu
URL: medstat.med.utah.edu/sol/about/index.html

Molecular Simulations Inc.

4 Glen St, Milsons Point, NSW 2061
email: solutions@msi.com
URL: www.msi.com

MacMolecule v1.7

Gareth Denyer,
Senior Lecturer,
Department of
Biochemistry,
The University
Sydney

MacMolecule is a program for examining 3-D molecular models. It takes up little room on the hard disk (165 K) and, although it prefers to have 2 MB of free RAM available, it is unlikely that you'd ever be loading large enough structures to justify this sort of memory consumption.

The interface is straightforward: one simply opens *MacMolecule* files (which obviously contain the atomic co-ordinates for the molecule of choice) and what pops up on your screen is a 3-D, ball-and-stick graphic of that compound. The picture can be rotated and viewed from any angle and the representation of the molecule can be changed in space-filling or wireframe. Even the shading on the molecule can be altered by manipulating the direction of the 'light source'. The normal **File** menu options such as **Save As..** and **Print** enable the picture to be captured for future reference, and a **Computer-Controlled Rotation...** feature allows you to sit back and enjoy a customised animation/tumbling sequence. Many simple inorganic molecules are supplied with the program (eg, water, ammonium ion, hydrogen cyanide, etc) and the program is capable of showing large bio-molecules (eg, triose phosphate isomerase, transfer RNA, etc).

Obviously it is useful for students to be able to visualise the 3-D structure of molecules, particularly complex biological compounds. However, when viewing simple inorganic molecules, *MacMolecule* does not appear to offer any advantages over 'real' kit-build structures. True, a *MacMolecule* picture can be saved and printed (and, of course, even computer-projected during lectures) but that's about it. Just how useful can 25 different views of a chlorate ion be?

Moreover, frequently the pictures actually mislead the viewer. For example, molecules like HCN and CO₂ have interesting triple-

and double-bond systems, yet every bond in a *MacMolecule* graphic is a simple stick of uniform thickness.

MacMolecule was written in 1991 and molecular graphics have come a long way since then. Although the application is capable of showing macromolecules it is not possible to actually DO anything with the graphic (besides simple rotation). This limits the software to a slide show curiosity rather than a dynamic teaching tool. It is not possible to perform many of the operations that are trivial with other molecular viewers such as RasMol (which, incidentally, only requires 1 MB of free RAM!).

For example, it is not possible to label sections of the molecule, rotate individual bonds, zoom-in on interesting structures, measure bond lengths and angles, open more than one molecule at once, open file formats other than *MacMolecule*, download graphics files from Internet databases, etc (the list is almost endless). It is not even clear how one would create a *MacMolecule* file. Simply, *MacMolecule* is to RasMol what a calculator is to a modern computer.

MacMolecule would be useful if showed intra-molecular features like sigma- and pi-bonding (something which many students find hard to visualise), or if it could play animations of simple inter-molecular interactions (eg, some students find it difficult to see how H₂O molecules interact in ice and water).

Until then, if you want to show your students molecular models, use RasMol.

Gareth Denyer
G.Denyer@biochem.usyd.edu.au

Interactive animation for developing weather map interpretation skills.

Mean Sea Level charts (commonly known as weather maps) are a fundamental way of representing meteorological information. They are widely used in the teaching of introductory courses in meteorology as a means of explaining weather phenomena. However, research (Lowe, 1993a, 1994) has shown that beginning students of university level meteorology typically lack the specialised visual interpretative capacities required to use these displays effectively in their learning. These deficiencies arise because the students know little about the distinctive characteristics and dynamic behaviour of various major meteorological features. Therefore, when presented with a static weather map, they have a poor appreciation of meteorologically-important patterning that gives meaning to the map's markings and how such patterning alters over time. The problems that diagrammatic material pose for beginning students of technical domains are probably widespread across a range of different subject areas because of the specialised, abstract nature of such representations (Lowe, 1993b). It is therefore likely that the explicit teaching of specific visual literacy skills as embodied in this project should be extended into graphic-rich scientific domains other than meteorology.

This project allows students to explore dynamic weather map sequences that are based on highly typical Australian summer patterns. It aims to help students develop the capacities necessary to make meteorologically-reasonable predictions of how weather map patterns change over time. The package is made up of 6 modules that treat different aspects of weather map structure and dynamics. The early modules deal with nature and behaviour of key structural components of meteorological patterns. A qualitative treatment is used to introduce students to the identity, position, shape, size, organisation, movement and internal changes of these structures.

Identifying the Features

The first module of the package deals with readily-apparent features (such as pressure cells and fronts) while the second concerns more visually-subtle aspects (such as troughs and ridges). To ease the visual information load on the learner, individual feature types can be selected and their animation followed in isolation from the rest of the meteorological pattern. The local or wider context can be added later when the learner feels ready to cope with more information. In the second module, students learn to detect the tell-tale signals (such as isobar inflections) that indicate the presence of a trough or ridge and hence identify the axis of such a feature.

Constructing and Altering

The third and fourth modules introduce the skills required to arrange meteorological features on a map and alter them appropriately with the passage of time. In module three, learners construct a simplified weather map structure by adding shapes representing the main features to a blank map. Different clues are available to guide the construction process. Module four presents learners with a simplified weather map structure (of the type constructed in module three) and challenges them to alter it to show how the pattern would have changed over various time periods.

Contouring and Predicting

The final two modules deal with processes involved in drawing weather map patterns. In module five, learners are presented with a synoptic chart from which an isobar has been removed. Their task is to supply the missing isobar by shaping a given line to the contours that should be present according to the missing isobar's context. The learner uses special shaping tools to introduce contours into the line so that it has the form and position expected of the missing isobar. The final module

CAUT Report

requires the application of what has been learned in the previous modules. Using the information on a given synoptic chart (the 'original'), the learner's task is to produce a prediction of the pattern on a subsequent chart. As well as having reference to the original chart, the learner takes a number of restricted glimpses of small areas of the subsequent chart. These glimpsed fragments are then printed off and used as a basis for completing the prediction.

Evaluation and Field Testing

During first semester 1997, there will be a trial of this package with beginning meteorology students at Murdoch and Curtin Universities. It will be used both for lecturer-directed classroom teaching and as a learning resource for use by students outside of class time. Preliminary testing has shown that the open-ended exploratory characteristics of the package allow students to shape their learning activities in a highly individualistic manner. Further testing will investigate which learning

strategies result in the most productive outcomes from the package. Merv Lynch, School of Applied Physics, Curtin University, also worked on the project.

Ric Lowe

lower@educ.curtin.edu.au

References

- Lowe, R.K. (1993a). Constructing a mental representation from an abstract technical diagram. *Learning and Instruction*, 3, 157-179.
- Lowe, R.K. (1993b). *Successful instructional diagrams*. London: Kogan Page.
- Lowe, R.K. (1994). Selectivity in diagrams: reading beyond the lines. *Educational Psychology*, 14, 467-491.

.. . . .

Interactive Teaching & Testing Tutorials for First Year Chemistry

This project was supported by CAUT in both 1994 and 1995. The material produced is now known as ChemCAL. Its integration into a mainstream chemistry course at Melbourne University followed the sequence:

in 1994:

The interactive computer-based tutorial packages, integrated with a traditional lecture & laboratory program, were developed and trialled with a class of 150 students, for two one semester units at Melbourne, 161 & 162. Each unit consisted of 39 lectures, 18 hours of laboratory work & 30 hours of workshops & tutorials. The material produced consisted of over 36 (18 per semester) one-hour modules of self-paced tutorial &

workshop material using on-screen video & animations, a range of student question formats & several levels of direct feedback to students including Hints & Explanations of the question material. The package was prepared using a new Hypercard-based authoring platform, TutorialTools. The software included built-in logging of all student activity; in addition, direct student feedback is solicited & recorded on all aspects of the material. The package thus provided, for a whole course, self-paced workshop/tutoring material with detailed feedback to both course supervisors & students.

*A/Prof Peter T. McTigue,
Director,
Multimedia
Education Unit,
The University of
Melbourne*

in 1995:

Additional material was written so that the interactive content of the packages

CAUT Report

covered all of the content covered in the lectures. The 162 group was then split into two streams, 162S ('special'), a small volunteer group, & 162N ('normal'). 162N was taught in the same way as the 1994 162 group. Course delivery for the 162S group was primarily by 25 self-paced interactive packages with lectures reduced from 3 per week to one per week. The single lecture was used both as an 'organiser' lecture & as an opportunity to provide help to students based on their feedback collected from the interactive CAL sessions of the previous week. Small group face-to-face contact in laboratory classes & as a component of workshops was unchanged. Full student evaluation, scaled to student performance in the 161 unit in which all students had the same experience, indicated that student performance in the traditional end of semester written test was the same for both groups. However, students showed a strong liking for the computer-based delivery. A fair sample of the responses to a question asking what it was that students liked most about 162S, elicited the following anonymous responses:

I found the computer sessions and the chalk n' talk sessions the most productive parts of the course.

The flexibility of the 162S course was a big plus. Having more problem-solving experience was also an advantage.

162S allowed me a lot of flexibility in getting my work completed. The cal lab sessions in general were very good. It was good to be doing actual questions whilst learning the new theory. It reinforced the information and aided in understanding difficult concepts.

Not having lectures.

The workshops were generally good. The material most of the time were presented clearly and if the matter arose the lecturer in charge of the workshop was willing to answer question. The chalk and talk sessions have helped with the understanding of the topics being covered. The videos were also good.

The flexibility of the timetable was the biggest advantage of the course as well as being able to go at my own pace. Often in

lectures once you lose the 'plot' you are lost for the rest of the lecture.

I liked the flexibility that the computer provided both in that one could work through the tutes at one's own pace not at that of the lecturer and that one could do the tutes whenever time arose and do many in one long session. This helped concentration and enabled much more efficient learning. It was also great how we were tested as we went through the material.

in 1996:

The 162S model was extended to the whole of the 162S class. Results are still being evaluated, but there are no data to suggest that the reduction in the number of formal lectures leads to any significant reduction in student learning.

The material was also used extensively in providing a first year chemistry course at the Cairns campus of James Cook University. Results are still being evaluated.

Team members:

A/Prof Peter T. McTigue, Director, Multimedia Education Unit, The University of Melbourne

A/Prof Peter A. Tregloan, School of Chemistry, The University of Melbourne

Dr. Carmel McNaught, Academic Development Unit, Latrobe University

Dr. Quentin Porter, School of Chemistry, The University of Melbourne

Mr. Paul A. Fritze, Multimedia Education Unit, The University of Melbourne

Peter McTigue

p.mctigue@meu.unimelb.edu.au

Calendar of Coming Events

If you know of other relevant conferences, let us know so that we can publish the details

CAUSE in Australasia '97

Information Technology: The Enabler

13 - 16 April, 1997 Melbourne

URL: www.unimelb.edu.au/CAUSE/

email: prcc@mail.austasia.net

ED-MEDIA 97

Educational Multimedia and Hypermedia

14 - 19 June, 1997 Calgary, Canada

URL: aace.virginia.edu/aace

3rd International Conference on Computer-Aided and Distance Learning in Meteorology

1 - 9 July 1997, Melbourne

Tel: (03) 9646 4122 Fax: (03) 9646 7737

email: convnet@peg.apc.org

URL: www.dar.csiro.au/pub/events/assemblies/info.html

Putting You in the Picture

A workshop to help you work with images

July 15 - 16, 1997. Newcastle

URL: Uniserve.edu.au/uniserve/coord/workshop/

email: director.uniserve@uniserve.edu.au

Online EDUCA Asia

International Conference on Technology Supported Learning

September 1 - 3, 1997 Singapore

URL: www.online-educa.com

email: icefsin@cyberway.com.sg

International Conference on Computers in Education

December 2-6, 1997 Kuching, Sarawak, Malaysia

URL: www.icce97.unimas.my/html/icce.html

ASCILITE '97

Reflections on Learning with Technology

December 7 - 10, 1997 Perth WA

URL: www.curtin.edu.au/conference/ASCILITE97

PBL Conference 1997

Bi-annual Conference of The Australian Problem Based Learning Network

December, 1997 Brisbane

email: alpj1@cc.newcastle.edu.au

UniServe Sites

Co-ordinating Centre

Dr T. G. Marples, Director

UniServe Australia

Chifley Building

ANU, Canberra, ACT 0200

email: director.uniserve@uniserve.edu.au

<http://uniserve.edu.au/uniserve>

Engineering

Department of Civil and Mining Engineering

University of Wollongong

Northfields Avenue

Wollongong NSW 2522

email: director.engineering@uniserve.edu.au

<http://engch.uow.edu.au/clearinghouse>

Humanities and Social Sciences

ultiBASE (business, art, society and education)

FSSC

Royal Melbourne Institute of Technology

Vic 3001

email: director.humanities@uniserve.edu.au

<http://ultibase.rmit.edu.au/>

Law

Dr B Moles

UniServe Law

Chifley Building

Australian National University, ACT 0200

email: director.law@uniserve.edu.au

<http://uniserve.edu.au/law/>

Medicine, Health Sciences and Nursing

UniServe Health

Medical Sciences Building

Faculty of Medical and Health Sciences

University of Newcastle, NSW 2308

email: info@health.uniserve.edu.au

<http://health.uniserve.edu.au/>

Science

UniServe•Science (F07)

University of Sydney NSW 2006

Tel: (02) 351 2960

Fax: (02) 351 2175

email: director.science@uniserve.edu.au

<http://www.usyd.edu.au/su/SCH>