Subject areas
* *Earth Sciences*
* *Life Sciences*
* *Physical Sciences*

UniServe Science

UniServe•Science News

Vol. 4, July 1996

In this issue...

From the Director 1
Ian Johnston, UniServe•Science

Articles

Exploring the Nardoo 3
Barry Harper, University of Wollongong

The Dry Labs Workshop 5
Ian Johnston & Mary Peat, UniServe•Science

Biocomputing at ANGIS: a 24 hour a day Dry Lab 7
Tim Littlejohn, Australian National Genomic Information Service

Reviews

Bacterial Growth 2 9
Gavin Ash, Charles Sturt University

CUPLE and STOMP 10
Mick Pope, UniServe•Science

Boltzmann 12
Hugh Powell, University of Adelaide

Atlas of Invertebrate Anatomy 13
Mary Peat, University of Sydney

CAUT Reports

Software in Psychology teaching 14
Steve Provost, University of Newcastle

Improving student learning 15
Barbara Kennedy, James Cook University

The Soil Investigation Kit 16
Marcel Chaloupka, University of Sydney

Survival skills for first year science students 17
Robert Loss, Curtin University

The First Year Experience 18
Richard James, University of Melbourne

Notes from the Field

CUBE 96 19
Dianne Chambers, UniServe•Science

Calendar of Events 20

UniServe Sites 20

From the Director

A community of university science teachers

On page 5 of this newsletter there is a report of the first workshop run by UniServe•Science — on the topic of 'dry' labs. Nearly a hundred academics from all over the country attended that workshop, and we should like to take this opportunity, up front, of thanking those deans of science who contributed to the travel costs of those who attended.

To me, as director, the most important thing to come out of the day was the feeling of community that seemed to have been engendered. The attendees came from all branches of science, from large universities and small, from all states of the Commonwealth. They had different needs and different experiences, but were united by their common professional interest in the teaching of science.

This commonality of outlook seems to me to be worth fostering. Anyone who has worked in the development of IT teaching materials is aware that it can be a very lonely business. All too often you are the only one in your department

Continued over

Exploring the Nardoo: Multimedia Reporting in Science Problem Solving

See page 3

UniServe•Science is funded by the Committee for the Advancement of University Teaching, the Faculty of Science, and the University of Sydney

From the Director

From page 1

interested in that kind of thing, and you are forever battling to get others to appreciate, and to use, what you are producing. Those who were at the workshop have now met one another. It is to be hoped that when they go back to their own departments they will use the contacts they have made to share the burden of what they are doing. In a very real way, we have all become part of a professional community.

The day ended with a wrap-up session. Two interesting items emerged in that session. Firstly there was the question of whether the replacement of 'wet' labs by 'dry' labs was right, *in principle*. Given that the workshop was focussed on the experiences of some departments which had in fact replaced some traditional 'wet' laboratory experiments by alternatives, it was especially interesting that, of all those who attended, and who were all there because (presumably) they were pre-disposed to look favourably on the idea of dry labs, not one believed that science courses should completely abandon the ideal of having students perform "real" experiments. Instead everyone believed that the proper job of the new technology was to *enhance* what students got out of laboratories, whether by pre-lab packages, or by streamlining analysis of results, or by better graphical representations of theoretical models — or by replacing some experiments.

The other thing that surfaced was the significance of the enormous costs of the new technology. There were many stories swapped of the severe strain it was putting on home departments. It may well be that the crippling expense of re-equipping computer labs every few years may yet sink the whole enterprise. But at least there seemed to be agreement that the financial burden of *developing* materials can be contained.

The way universities organize their teaching has often been likened to a cottage industry. Each teacher develops their own course from the ground up with little reference to what has gone before. In some respects this is a feature, not a bug. It guards against students' continuing to receive ideas and opinions that have passed their use-by date. But, because of the expense of the new technologies, we must join the industrial revolution. We cannot all afford to develop our own materials. We must get into the habit of working in consortiums and sharing the load. The fact that this workshop brought together many of the active developers in the country may make that goal just a little less remote, and perhaps UniServe•Science might be able to take a leading role in making such consortiums happen.

Ian Johnston
director.science@uniserve.edu.au

Aims

- *collecting and disseminating information about ...*
- *advising on and promoting the use of new technologies in ...*
- *publicising new develop-ments in ...*
- *encouraging communication about ...*

innovative tertiary science teaching

UniServe•Science Publications **at** ***http://www.usyd.edu.au/su/SCH/publications.html***

- *UniServe•Science News* is available online in html and in Portable Document Format (PDF is best for printing);
- Proceedings of the Dry Labs workshop are available (in PDF);
- Catalogues of teaching resources for Biology and Biochemistry are available (in PDF).

Note: *(i) If you have trouble accessing the web from your site we can email you a copy of the files or post you a disk;*
(ii) To view PDF files download the free Adobe Acrobat software from http://www.adobe.com.

UniServe•Science PERSONNEL
Director: Dr Ian Johnston
Co-director: Dr Mary Peat
Deputy directors:
Professor David Patterson
Professor Tony Haymet
Educational technologists:
Dr Dianne Chambers (Life Sciences)
Mr Mick Pope (Physical Sciences)

Correspondence to:
Dr Dianne Chambers
Editor, *UniServe•Science News*
UniServe•Science (F07)
University of Sydney NSW 2006
Tel: (02) 351 2960
Fax: (02) 351 2175
BioSciCH@extro.ucc.su.oz.au

Article

Barry Harper is with the Faculty of Education at the University of Wollongong

Exploring the Nardoo:
Multimedia Reporting in Science Problem Solving

Introduction

Current interactive multimedia technologies can represent ideas in almost any mediated form. Provided we can generate a comprehensible metaphor for the underlying knowledge structures, the student can roam through the resources creating their own meanings and understandings of the phenomena they encounter. This rich context allows the novice to work with authentic problems and practice. With graphical and visual display coupled with large databases of resources, it is possible to explore an information space in whatever sequence appeals as appropriate to the task. When raising the idea Florin (1990, p30) saw "information landscapes, …as virtual towns, or intellectual amusement parks. The analogy is quite intriguing and helps us to visualise many abstract concepts within a single metaphor".

However, within this context designers of multimedia learning environments have tended to be narrow in their view of how users will interact with the rich array of multimedia resources once a challenge, in the form of a problem to solve, has been posed. If students are to truly create their own meanings and understandings of the phenomena they encounter, designers need to incorporate user tools which will enable them to present their findings using the full array of resources contained in the packages. *Exploring the Nardoo* takes up these issues in presenting a rich information landscape that users can explore using an array of tools.

Problem Solving and Science Education

The aims and expectations of education imply that the process should foster in students the development of transferable, higher order intellectual skills and problem solving skills. They also imply deep and relational learning and the fostering of a positive disposition toward collaborative learning. While various strategies may be employed to foster each of these outcomes, none would seem to encompass the full spectrum more effectively than problem based learning.

By its very nature, problem solving is a student-centred, discovery-based strategy which challenges students to become active participants in the learning process. However, the extent to which this challenge is being taken up by students is very much dependant upon not only the enthusiasm of the instructor for this student-centred approach but also well designed teaching resources that support this type of approach. Even so, effective teaching is not necessarily related to effective learning.

***Exploring the Nardoo* and Problem Solving**

Support materials for instructors in using problem-solving strategies in science education have been developed in various forms. Interactive multimedia technologies have the potential, by integrating a variety of media, to offer rich resources for such teaching strategies

A new package, based on ecology, called *Exploring the Nardoo* incorporates problems that challenge students to become active participants in the learning process. By providing a metaphor relating to the real world, students are encouraged to apply scientific concepts and techniques in new and relevant situations in this ecology-based application, throughout the problem-solving process. In so doing, the learner is likely to become more interested in developing questions, ideas and hypotheses about the learning experiences encountered. As an alternative teaching/learning strategy in the development of inquiry and problem solving techniques this package incorporates high quality visual materials in the form of graphics, sound, text and motion video together with scientific measuring tools to aid in the construction of understanding.

Exploring the Nardoo provides the student with a flexible set of tools made available through a personal digital assistant (PDA; Figure 1) to assist in the problem solving process.

The process of using source material within the package in support of an investigation has been enhanced to allow the student to...

• decide precisely on the quantity and selection of text to be copied into their notes. This is either through making a selection and then ‘grabbing’ it into the PDA or by using a ‘drag and drop’ technique.

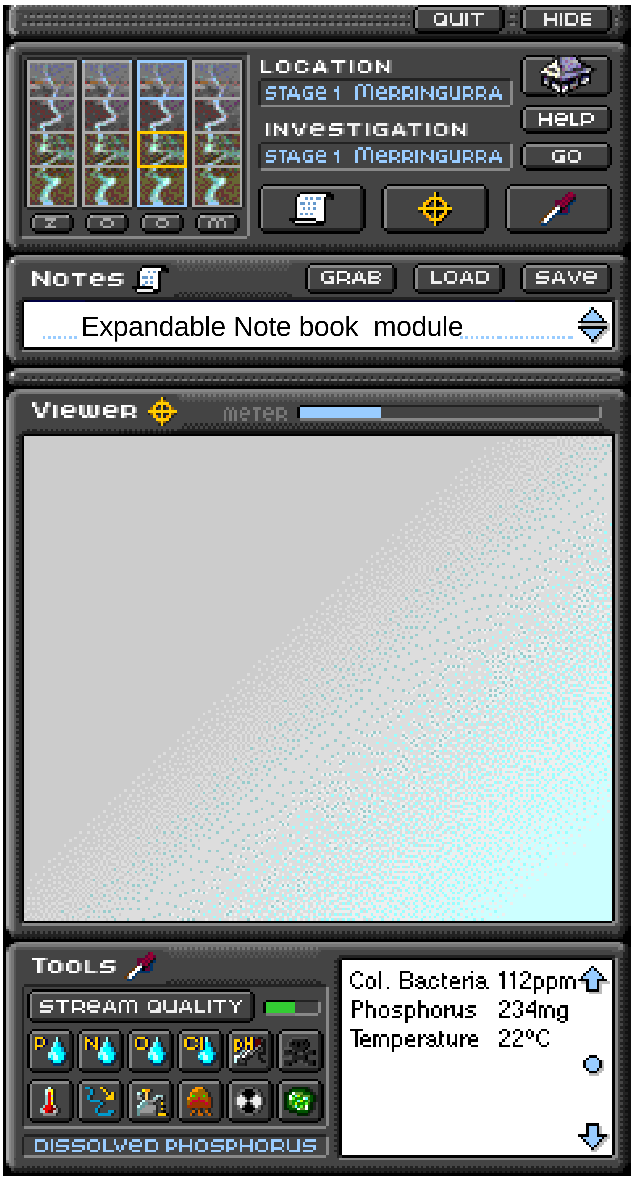


Figure 1: The Personal Digital Assistant Notebook

• use marker buttons as pointers to video, audio or picture information which can be displayed within the PDA’s viewer along with any linked information. For example, by copying a picture of a wombat into their notes, the student is able to move throughout the information landscape within the package and very quickly view the picture of the wombat as well as its associated text within the PDA’s viewer merely by clicking on the marker button within their notes. User defined portions of the reference text material displayed within the viewer is also able to be selected copied into the notes.

• gather video material and display it within the PDA thus increasing the student’s ability to be more selective in what they choose to use in response to an investigation.

• manipulate marker buttons and text within the notes areas, via ‘drag and drop’, to facilitate the re-ordering of ideas in the process of building an investigative response in the form of a report, explanation, procedure, *etc*.

• use text style tools, within editable text notes, providing the opportunity to use font colour, style and size as organising criteria within the notes. For example a student may recognise that a certain combination of text attributes is representative of newspaper clippings or they may choose to colour information they write or gather from a particular perspective in a special colour.

The joint combination of note book and viewer better equips students to view and then critically evaluate or compare different representations of the same information concept. By collecting different media representations of the same topic and ‘flipping’ between these representations at their discretion, the student has the opportunity to establish cognitive links between different media forms which compliment each other and support a central theme or information focus.

Continued page 19

Article

Ian Johnston is the director & Mary Peat is codirector of UniServe•Science

The 'dry' labs workshop

Why the workshop was mounted

On Friday, April 12, UniServe•Science held its first workshop, devoted to the topic of 'dry labs'. The original motivations were clear. Many science departments in this country are finding difficulty in maintaining their traditional teaching programs in experimental laboratories, whether because of pressure of student numbers and the cost of laboratory work, or difficulties posed by the use of hazardous chemicals or animal experimentation or radioactive substances. It has been suggested many times that first year students could be offered alternative experiences to some of their traditional 'wet' labs — perhaps simulated laboratory experiments, perhaps structured computer managed tutorials. There is, after all, no doubt that practical skills can be taught, and taught well, by computer simulations — teaching airline pilots or astronauts by flight simulators is an obvious example.

However there is sincere opposition to the very idea of 'dry labs' from many academics, which mainly centres round the key role that experiment plays in science. They argue that to take away from students the reality of experimental experience, is to denature the subject itself.

In order to judge which of these points of view we should be most swayed by, we need answers to these two questions:

(1) have any departments in this country introduced dry labs successfully, as a major, formal part of their teaching curriculum? and

(2) how did they solve the problems they must have faced?

That is why this workshop was organized.

What we saw at the workshop

The workshop began with overviews given by speakers from two different perspectives — from someone in a big multimedia unit (Jon Pearce, from the University of Melbourne's Science Multimedia Teaching Unit) and from someone with links to the scientific profession outside the University circuit (Rod Learmonth, who is a member of the editorial board of *The Journal of Biochemical Education*).

Next there were workshops run by two people who have been responsible for introducing a substantial program of computer experiences to first year students in their home departments, as alternatives to standard 'wet labs' — Rob Capon, School of Chemistry at Melbourne University, and Fred Pamula, Department of Biology at Flinders University.

There were demonstrations of particular packages which are being used as alternative-to-laboratory experiences, from Bill Loneragan (University of Western Australia) and Ralf Cord-Ruwish (Murdoch University). And lastly there were examples of materials designed to *prepare* students for traditional laboratory work — "pre-lab" packages from Audrey Wilson and Roger Lewis of the University of Wollongong.

What we learned from the workshop

Teaching effectiveness

For those who might not have been convinced already, it was clearly demonstrated that it is possible to develop new materials which contribute substantially to the learning experiences of students in the laboratory setting. It was shown that computers can bring to life difficult concepts, especially in the visualization of three-dimensional structures in chemistry, biology and biochemistry. They can offer a rich compendium of resources on which students can graze at their leisure, which should, in principle, lay down patterns of learning they will use for the rest of their lives.

At the same time it was stressed that

the development of these kinds of materials is inordinately time-consuming and costly. Were it not for the CAUT teaching development grant scheme, it is doubtful if many of the items on show would ever have seen the light of day. How the next generation of innovations is to be financed, or how any updating is to be achieved, is anybody's guess.

It was agreed however that the greatest area of deficiency at present lies in the evaluation of materials being produced. Flinders University takes steps to monitor how students perform in standard examinations after having been exposed to the new materials; but by and large the questions of whether the new materials really do improve learning is too difficult. Perhaps that is the next hurdle, and we can only hope that future teaching development initiatives will provide the necessary funding to ensure that research into student learning is part of the deal.


Workshop participants

Teaching efficiency

Perhaps the most striking fact that emerged from the workshop was that, of the 200 or so university science departments in Australia, only a very small number indeed (of order 10) have actually *replaced* wet labs with dry labs. Of particular interest were the two examples where the first year practical (wet) laboratory teaching has been cut in half, and 50% of the time formerly allocated to that is now filled with computer-centred experiences. These are mainstream courses, taken by the majority of first year students in those institutions. The question begged to be answered: how did the two developers persuade their host departments to allow this Trojan horse into their midst?

There seemed to be two major considerations.

(a) The Melbourne model was careful to single out for replacement, only those particular learning exercises which didn't necessarily belong in a laboratory in the first place (construction of molecular models). "Real" laboratory experiments were left alone.

(b) The Flinders model took care to identify experiments which are particularly expensive (*e.g.*, spectrophotometry) or dangerous, and to replace those. Again, the safe, inexpensive "real" experiments were not touched.

Perhaps it was this concern for the sensitivities of their colleagues which won the day.

In both cases, the projects were carried out because of the enthusiasm of particular persons, and the question must be asked: what will happen to those courses when those people leave, or go on sabbatical or move on to different teaching duties? With many teaching innovations, when the person responsible bows out, the innovation is often allowed to stop, simply because that is the easiest thing for the host department to do. In these two cases, since the dry lab courses are a major component in the curriculum, it would in fact be quite expensive for the department to replace them. Perhaps these two do represent a permanent change to the way we teach science. Only time will tell.

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

Proceedings of the workshop are available in HTML and PDF from UniServe•Science's web site at http://www.usyd.edu.au/su/SCH or a paper version can be purchased for $5.00. Send cheque to:

Dry Labs Workshop
UniServe•Science (F07)
University of Sydney NSW 2006

Article

Tim Littlejohn, Head of the Australian Genomic Information Service

Biocomputing at ANGIS: a 24 hour a day Dry Lab

http://www.angis.su.oz.au

In the March 1996 issue of *UniServe• Science News*, Ian Johnston (Director, UniServe•Science) put out the cry: Bring on 'dry' labs! Ian was referring to the use of computer simulations for efficient and cost effective science education. "Dry labs" are a great idea for teaching, and Australia is fortunate in that it has a national 24-hour-a-day, on-line dry lab for molecular biology, genetics and genomics, known as ANGIS.

ANGIS is the "Australian National Genomic Information Service", a national facility that supports the computing needs of biologists. ANGIS provides a core facility with many databases and software packages wrapped under several consistent user-interfaces, accessed through the Internet. There are three interfaces that facilitate access to ANGIS: XANGIS, 2D ANGIS and WebANGIS. XANGIS is a graphical interface, requires X-windows software to be running on your PC or Mac, and can be quite hungry for bandwidth. 2D ANGIS can be accessed through a simple Telnet session, and is much more miserly in its bandwidth, although it offers a text-only interface. WebANGIS is the best of both worlds, offering the graphical, friendly interface of the WWW browser (e.g. Netscape) with the power of ANGIS at a relatively small bandwidth cost.

The primary role of ANGIS is as a research tool; however, a number of universities across the country also use ANGIS as a teaching tool. And this makes a lot of sense. The amount of genetic data being generated around the globe is growing exponentially. Numerous genome programs are adding to this growth, as is the increasing use of molecular-biology methods. Computers offer the only solution to handling this volume of information, resulting in the birth of a new discipline, "bioinformatics", the application of computers to solving problems in biology (the Australian bioinformatics community meets through ABnet, the Australian Bioinformatics Network; see http://www.angis.su.oz.au/ABnet/about.html).

From a biology teachers perspective, however, the real beauty of the ANGIS dry lab is that it is not a simulation . The software, databases and interfaces the students use are the very same ones used by the scientists in Universities, hospitals, CSIRO and industry. Thus, while bioinformatics classes have all the benefits of "dry-labs" in the sense used by Ian Johnston, they have the additional benefits of allowing the students to use the tools, and do the computer-based experiments, exactly as they will do when they graduate.

ANGIS is used to teach many concepts in biology: evolution, gene structure, genome organisation, genetic linkage and protein structure, for example. These concepts cross many discipline boundaries: medicine, genetics, zoology, biochemistry, botany, physiology, pharmacology, and many others. Dedicated genome databases allow academics to choose their preferred organism: the complete genomes of two bacteria and of the brewers yeast are available, and graphical genome databases for flies, worms, plants and humans are all accessible through ANGIS. The software tools residing on ANGIS are generally used to analyse molecular data (DNA and protein sequences, for example). However, many of these tools are not restricted to molecular or genomic data. For example, the genetic linkage software on ANGIS can be used on any sets of markers, and a phylogenetic analysis package on ANGIS ("PHYLIP") can cope with continuous traits derived from any method.

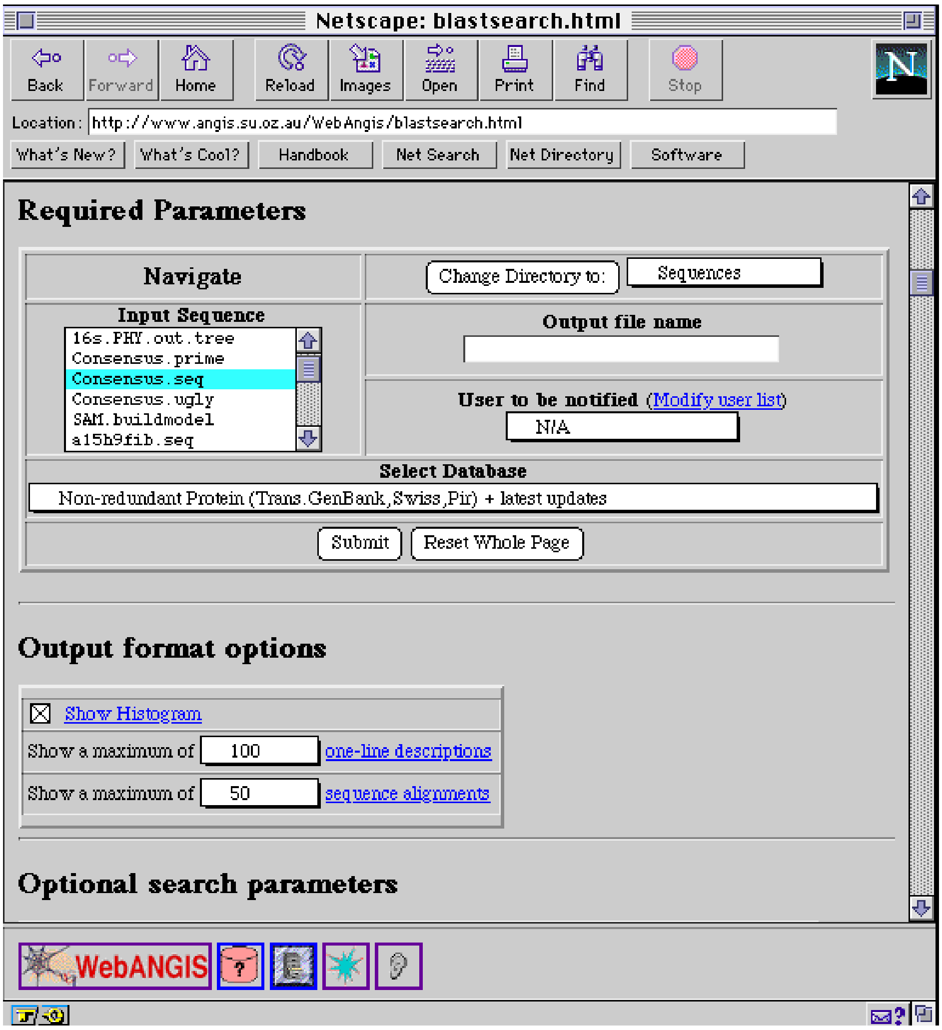
ANGIS supports its subscribers through telephone and email, offers training courses on use of the system, and provides documentation and printed tutorials. ANGIS is working with groups around the country that use the facility as a teaching tool so that it can closely meet the needs of educators. ANGIS also acts as a conduit between these groups, so that educators can communicate, share teaching material, and minimise duplication of effort.

As access to the Internet becomes even more widespread, and WWW browsers become the preferred tool for interacting with the Internet, resources such as WebANGIS will become a powerful tool for educators. Learning time can be spent on the biology, not on the software, as familiarity with the standard browser interface is assured. As the Internet creeps down the phone lines into student's homes, expect to see more and more students discovering and exploring their interests in biology in their own space and time through resources such as WebANGIS. In this way WebANGIS could be used for distance education, tele-classes, out of class assignments and other innovative teaching approaches.

Tim Littlejohn
tim@angis.su.oz.au

Australian Genomic Information Service
Building J03
University of Sydney,
Sydney, NSW, 2006
http://www.angis.su.oz.au
email: tim@angis.su.oz.au
Phone/Fax: 61-2-9 351 2948

Cost: For an academic department costs start at $1150/year. This includes access to all tolls, unlimited support, documentation, and access to courses and workshops.



Screen shot from the ANGIS web site.

Review

Gavin Ash is a lecturer in the School of Agriculture at Charles Sturt University

Bacterial Growth 2

A simulation of a microbiology laboratory class

Bacterial Growth 2, distributed by ScotCal Software, is a computer aided learning package designed for use by university students enrolled in first or second year microbiology. It is written using Toolbook and comes on two disks. It requires a 386 PC or better, a VGA monitor and *Microsoft Windows* 3.1. It covers the basics of bacterial growth in liquid culture in a dry lab situation.

The program is divided into several sections which can be accessed through a menu bar or icons down the left hand side of the screen. The student is introduced to the session through the aims and a library section which gives students an overview of the material to be covered. The practical is centred around the laboratory section in which the students can determine bacterial numbers and growth rates through a series of experiments. The students then use this information to determine the effect of parameters such as temperature, experimental duration and initial concentration of glucose on the growth of *E. coli*. Throughout this section students can export their results to their laboratory book. The students then use these results to answer a set of model questions which can be recorded and printed from within the program, or can be exported to a word processor. Throughout the program there is screen sensitive help and dialogue boxes which help students to complete the exercises successfully.

This is a very professional piece of software that includes a good software installer, well written and easy to understand manuals (both staff and student), a well set out interface that is easy to navigate and clear aims. Another good feature is that the manuals are supplied on disk so they can be modified and copied. The only criticisms of the software would be that some of the screens are cluttered (especially in the laboratory section), the quality of the video is poor (in the library section) and the *hot words* are not distinctive enough and so students may miss some of the information available. The system also tends to crash if there are other programs running in the background.

"This is a very professional piece of software that includes a good software installer, well written and easy to understand manuals (both staff and student), a well set out interface that is easy to navigate and clear aims."

Overall, this software would provide the basis for a useful tutorial and as an adjunct to a traditional laboratory session.

Gavin Ash
gash@csu.edu.au

Requirements: IBM compatible computer (386 or better); VGA/SVGA display; Windows 3.1
Author: Mike Taite, ScotCal Software
Cost: *Single user*: Student price (disks and A5 guide) US$59; Education price: US$149
Standard price US$189
Departmental Site licence: Educational price: US$449; Standard US$565
Institutional Site Licence: Educational price: US$599; Standard US$749
Supplier: ScotCal Software, 34A Watson Street, Aberdeen AB2 4QL, Scotland UK.
Telephone/Facsimile: +44(0)1224-620040
email: scotcal@dial.pipex.com
http://www.demon.co.uk/scotcal/index.html
Free demonstration version: A demonstration version of this package can be downloaded from the above web site or from UniServe•Science's web site at
http://www.usyd.edu.au/su/SCH/biol/bioldemos/bioldemos.html
CTI Biology review: Another review of this product can be found at
http://www.liv.ac.uk/ctibiol/lsec/october94/Bacterial.Growth.Review.html

Review

CUPLE & SToMP:

‘Complete’ First Year Physics Software Packages

Mick Pope is the Educational Technologist for the Physical Sciences at UniServe•Science

The common goal

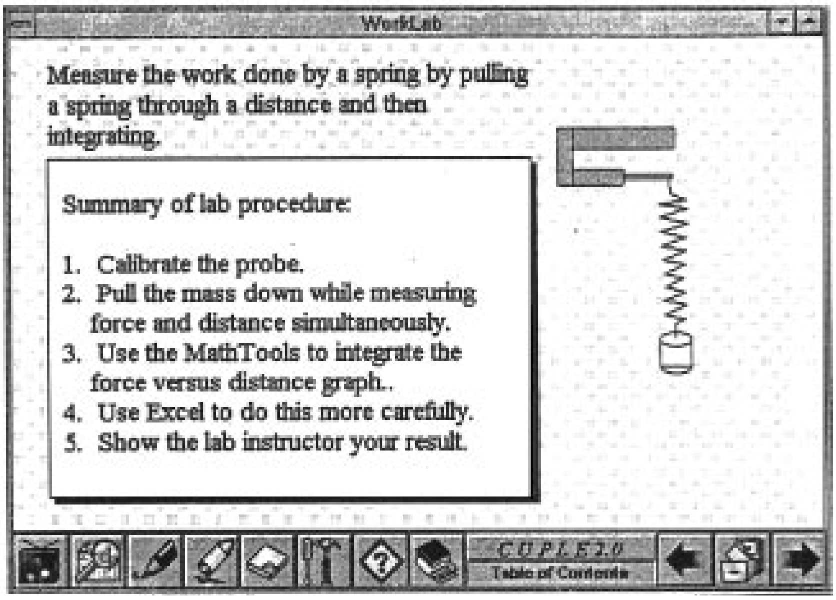
First year enrolments have increased with no increase in funding (even threats of cuts!) Evidence in physics education research suggests that traditional teaching methods may not be effective [see Wilson 1994 for references]. The CUPLE (Comprehensive Unified Physics Learning Environment) and SToMP (Software Teaching of Modular Physics) packages are designed to transform the traditional methods by offering a ‘complete’ first year course, either supplementing or supplanting traditional methods, and possibly saving money in the long term (Wilson 1994). Here, I compare and contrast the two packages.

Implementation

Both packages are hyperlinked, multimedia environments. CUPLE is designed to replace the lecture/lab/tutorial environment with a ‘Studio class’ (Wilson 1994). SToMP is designed to replace some lectures with private study, accompanied by introductory lectures (Bacon 1994). With both packages, the lecturer is not replaced, but moves “from the sage on the stage to the guide on the side”. Both packages have text editors, spreadsheets, graph plotters, digital video, simulations, *etc*. CUPLE can access tools such as videodisc players and motion detectors. SToMP is a hyperlinked textbook which leads students through the material, accompanied by questions embedded in the text and at the end of each unit. At the time of writing CUPLE (v 2.0) covers mechanics, gravitation, optics, waves, astronomy, modern physics (powers of ten and ‘Physics Today’), and electricity and magnetism, with thermodynamics being developed. SToMP (v 3.04) covers measurement uncertainty, and waves and vibrations, with optics and thermodynamics sections being developed. SToMP being the newer project lags behind in terms of content.

A comparison

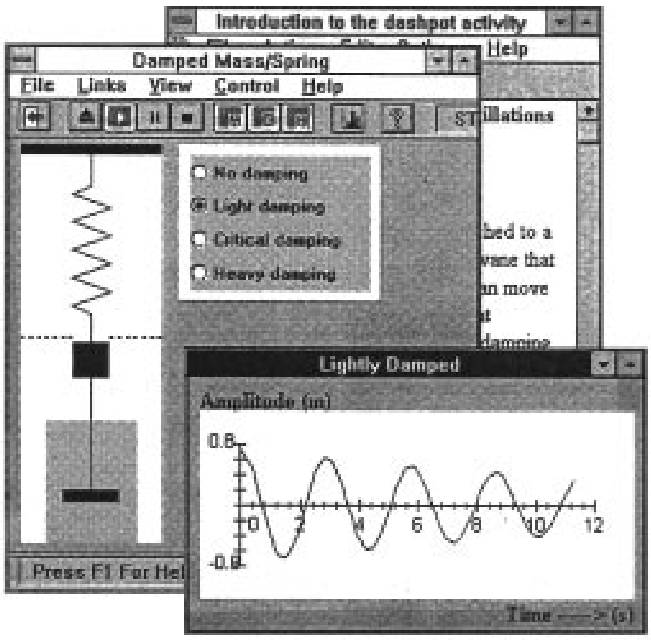
To compare these packages let us consider simple harmonic motion. SToMP considers this in five units, with text and simulations (mass and spring, simple pendulum and LC circuit). CUPLE has supporting text, simulations and lab materials (videodisc data of a pendulum and a motion detector based experiment of the mass/spring system). Both clearly state the necessary pre-requisites and learning goals. SToMP introduces the student to the basic terminology, and then guides them through a simulation of the simple pendulum, so that they ‘discover’



The CUPLE simple harmonic motion lab.

the correct relationship. There is no particular encouragement for students to use the tools provided (spreadsheet, plotting tools, *etc*.). CUPLE introduces the material with the same general discussion and a video of a spring. It introduces the mathematics first with accompanying questions. These questions prompt the student to use the calculator and plotting tools (which are hyperlinked to the page on screen). The relation between uniform circular motion and simple harmonic motion is shown mathematically and with a simulation. This introduces the concept of phase space and damping with only a brief description. SToMP shows the relation of uniform circular motion to simple harmonic motion mathematically and with many illustrations, including an effective animation showing uniform circular motion viewed at different viewing angles.

With both packages, the student is encouraged to interact with the systems under consideration, and divine the underlying relationships and the general principles of simple harmonic motion.. CUPLE has the advantage of being able to relate the 'real world' to the theory, whereas SToMP only uses simulations. Students are more likely to be able to relate data and graphs to the experiment because of the shorter time between performing an experiment and plotting the results. CUPLE also makes the tools more obvious to the student and shows them how to use them. The depth of material covered in SToMP is much greater than CUPLE and on the whole makes better use of the simulations. Sections of CUPLE (as with SToMP) are screenfuls of equations, which are tedious to read on screen, but SToMP has better support in terms of animations and pictures. SToMP crashed on occasion, but performs much better than earlier versions. CUPLE version 2.0 has eliminated problems with digital video that were in version 1.0.



A simple interactive activity from SToMP.

Conclusion

Both packages could be useful in teaching first year physics. Both call for a rethink of the way physics is taught at first year level. Proper use of CUPLE requires a complete re-fitting of the physics teaching environments, though no doubt it could be used well as a lecture demonstration or in a conventional lab. Used in Studio mode, it brings together all aspects of traditional teaching. SToMP could be used for revision or as a remedial tool, but if a good computer lab exists, it should be used to replace some lectures, QUT's experience with this is quite successful. This still leaves the problem of laboratories unsolved. Only time will tell how effective these packages can be, when more units are available and more institutions take the plunge.

References

Bacon, R.A., "The Teaching and Learning (TLT) Programme", *Computers in Physics Education*, **2**, 5 (1994)

Wilson, J.M., "The CUPLE Physics Studio", *The Physics Teacher*, **32**, 518 (1994)

CUPLE home page
http://www.physics.umd.edu/rgroups/ripe/cuple/cuple.html
SToMP home page
http://www.ph.surrey.ac.uk/cti/stomp/index.html

Review

Boltzmann

A kinetic molecular theory demonstrator

Hugh Powell is a lecturer in the Department of Chemistry at the University of Adelaide

The kinetic molecular theory of gases provides an excellent opportunity for the presentation of computer graphics, as it is based on the motion of molecules, and is simple enough to allow calculations of molecular trajectories on a reasonable time scale. *Boltzmann* simulates and displays the random motion of up to 200 hard-disc atoms in a two-dimensional box, or *arena*. From random starting positions and directions, and a single initial velocity corresponding to the selected temperature, the atoms move following Newton's laws of motion with no attractive interactions between atoms and perfectly elastic collisions. One can choose the number of atoms, their hard sphere radius and their temperature (mean kinetic energy). The program calculates the pressure generated by collisions of the atoms with the walls of the arena, as well as displaying the distribution of one of a number of quantities, such as the instantaneous speed and kinetic energy of the atoms. The volume of the arena is fixed, but an optional dividing wall allows simulation of the effect of doubling the volume, as well as simulations of effusion of the atoms through a small hole.

The most important part of the display, the square arena, rightly takes up a large portion of the screen, aiding visibility in lecture demonstrations. However, the choice of colours (red atoms against a black background) does not give very good contrast. The rest of the display is rather cluttered, containing all the various option buttons, as well as calculated and predicted properties. With 50 atoms, the simulations run sufficiently quickly for a demonstration only if rather high temperatures (ca. 1500 K) are chosen. This is presumably a problem with the chosen step length that could be easily remedied.

I trialed some demonstrations of the gas laws and diffusion suitable for our first-year course with a group of second year students. The response of the students was enthusiastic, with written comments including 'I wish we could have had this last year', 'The visual aid is like a second dimension for the lecture' and 'I think it is a great way to learn – almost entertaining!'. There were some reservations concerning the visibility of both the simulation box and the calculated pressure, mean speed, *etc.*

Similar simulations can be performed using the competitive package, *GASSIM*, from IME Software (for Windows). In this program, the colour of the atoms can be chosen so as to produce maximum contrast for lecture demonstrations. The program is also faster than *Boltzmann*, and allows more complex simulations including the effect of gravity and a variety of wall types. However, the fact that the temperature cannot be specified by the user is a considerable disadvantage for the sort of simulations appropriate to a typical first-year chemistry course. In addition, I found *Boltzmann* (US$125) much easier to use, so I would strongly prefer it over *GASSIM* (AUS$30) despite its higher price. Although the information sent by the developer stated lecture demonstrations were the primary purpose for *Boltzmann*, I felt that it would be equally suited to student-use in either tutorial or dry-lab situations. I intend to use *Boltzmann* in my first-year Chemistry lectures this year, and would certainly recommend anyone teaching first-year physical chemistry to give it a trial.

Hugh Powell
hpowell@pene.science.adelaide.edu.au

Requirements: 386 CPU; Windows 3.1; 430K RAM; colour VGA monitor.
Cost: US$125
Supplier: Trinity Software, PO Box 960, Campton NH 03223-0960 USA
Fax: 603-726-3781 Email: trinity@hfk.com
http://206.14.56.63/trinity.html

Review

Atlas of Invertebrate Anatomy

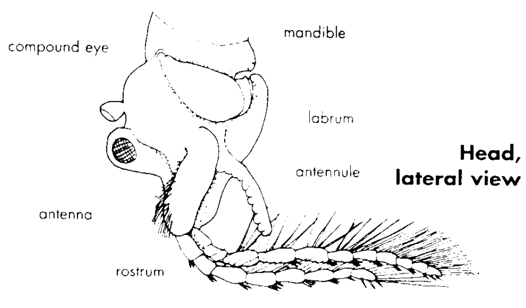
D T Anderson, UNSW Press, 1996.

This Atlas is a beautiful addition to the material available for students of invertebrate anatomy, development and phylogeny. The Atlas contains 82 plates totalling 475 fine biological drawings, many of them large format, of the external and internal anatomy of 80 species of invertebrates. All are newly-drawn from specimens and they are detailed and accurate and fully labelled. The plates of drawings are accompanied by notes on the classification, life cycle and habitat of each species drawn. The index is extremely useful to the student - it comes in two versions - an anatomical index which guides the user to developmental stages, mouthparts, histological sections and other kinds of views, and a conventional taxonomic index. The species chosen for the Atlas are the ones most studied in teaching laboratories; some are world-wide in their distribution, some are limited to Australia. The Atlas is written as a practical reference for all students of invertebrate biology. The author is an authority on the material, having published extensively in this area for 40 years. His books *Embryology and Phylogeny in Annelids and Arthropods* (1973) and *Barnacles* (1994) are internationally recognised treatises on the subjects.

Mary Peat

maryp@bio.usyd.edu.au

Atlas of Invertebrate Anatomy
Author: D T Anderson
Publisher: UNSW Press 1996
ISBN 0 86840 207 9
Cost: $34.95



Head, lateral view

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
CTIBiol@liv.ac.uk
http://www.liv.ac.uk/ctibiol.html

CTI Chemistry
CTIChem@liv.ac.uk
http://www.liv.ac.uk/ctichem.html

CTI Geography (with Geology)
CTI@le.ac.uk
http://www.le.ac.uk/cti/

CTI Physics
CTIPhys@surrey.ph.ac.uk
http://www.ph.surrey.ac.uk/cti/home.html

CTI Psychology
CTIPsych@york.ac.uk
http://www.york.ac.uk/inst/ctipsych/

McGraw-Hill Book Co
4 Barcoo St, Roseville, NSW 2069
Tel: (02) 417 4288
http://www.mcgraw-hill.com/

MathStat Software
PO Box 786, Mulgrave Vic 3170
Tel: (03) 9 562 2766 Fax: (03) 9 561 5524
email: info@mathstat.com.au
http://www.mathstat.com.au

Jacaranda Wiley Ltd
PO Box 1226, Milton, Qld 4064
Tel: (07) 859 9755
http://www.wiley.com/

Physics Academic Software
Prof John Risley
Department of Physics, North Carolina State University, Raleigh, NC 27695-8202 USA
email: Risley@ncsu.edu
http://pinet.aip.org/pas/pashome.html

International System Dynamics P/L
Andrew Beesley
20B/390 Eastern Valley Way
East Roseville NSW 2069
Tel: (02) 417 6227
email: ithink@mpx.com.au

CAUT - Committee for the Advancement of University Teaching
http://uniserve.edu.au/caut
email: caut@deet.gov.au

CAUT Report

Software in Psychology Teaching

Steve Provost is with the Psychology Department at the University of Newcastle.

In 1993 we (Steve Provost, Brett Hayes, Richard Heath, Andrew Heathcote, Don Munro, and Peter Pfister) received a grant from CAUT to develop and evaluate software for laboratory teaching in Psychology. At that time, the department did not employ any computer-based methods, other than the standard introduction to statistical packages in our 'Methodology' stream. We hoped to contribute towards the Department's teaching program, as well as raise awareness about the potential of computers in learning. The focus was on material for teaching developmental psychology, which we felt to be an area of need (*cf.*, Trapp, Hammond & Lucas, 1994, for confirmation).

Two 'products' emerged from this program. The first, *Object Search* was a straightforward HyperCard stack, designed to supplement lecture material, and incorporating text, pictures, and some QuickTime movies. Some of the concepts covered in this part of the subject were difficult to convey in a conventional lecture format, and the intention was to assist students understanding of these concepts with self-paced learning via the stack. The second product, *VisFix* was designed to simulate experiments investigating cognition in infants using the visual fixation task. It is normally impossible for students to gain experience in conducting such experiments, since they involve an infant subject. By simulating infant visual fixation on the screen and allowing students to act as experimenters we hoped to substantially improve their understanding of such procedures.

We bombarded the students with questionnaires both before and after their exposure to the software. The evaluation of the software was generally favourable, despite serious technological limitations in its implementation. Our expectation that students evaluation might depend upon their approach to learning (Richardson, 1990) was proved false. Evaluation was not correlated with performance in the subject assessment. A significant proportion of our second-year students (about 10%) agreed strongly with the statement "I am a computer phobic", and their evaluation of the software was correlated with their attitude towards computers in general. Three factors were identified in the student's attitudes towards computers, anxiety, educational value, and access. Interestingly, computer anxiety was positively correlated with a surface learning approach. Computer anxiety was reduced following experience with the stack, although students who reported being a computer phobic did not change their self-image.

The software is presently in use within the department. There are a number of difficulties concerning the effective use of *VisFix* in particular that we are seeking to address. The use of QuickTime and HyperCard makes it difficult to get screen display rates of sufficient speed to obtain a very realistic simulation of infant behaviour. Improvements in the base performance of the hardware (we now have a lab of PowerPC Macs) has provided some assistance. We are currently trying to re-write at least some of the code in C, and to make the program more modular. This should allow us to develop a more flexible product, which we hope will have some value to ourselves and other educators.

Steve Provost
provost@psychology.newcastle.edu.au

References

Richardson, J. T. E. (1990). Reliability and replicability of the approaches to study questionnaire. *Studies in Higher Education, 15*, 155-168.

Trapp, A., Hammond, N., & Lucas, L. (1994). Educational technology in UK university psychology departments: Part 1 - a survey of current practice. *Psychology Software News, 4,* 32-42.

CAUT Report

Improving student learning

Barbara Kennedy, Department of Psychology & Sociology, James Cook University.

This CAUT funded project focuses on 'interpersonal' rather than computer-based technology, and aims to develop science student's skills for working in teams. The ability to work effectively in a team has been identified as one of the most important transferable skills sought by employers, and one for which most university graduates are poorly prepared, especially in the sciences. At university, students primarily work individually in a competitive academic culture and often when group projects are assigned, students are given no guidance to facilitate effective team work. To draw a comparison with other skills-teaching, since we do not simply let students loose in a lab and hope they will eventually learn to use the equipment, we should also explicitly teach team skills, provide opportunities for practice, and give students constructive feedback on their performance. This project was embedded in the development of a third year research methodology subject in Environmental Studies which draws students from a variety of core science disciplines and in which students work in teams to conduct applied research projects.

> *"From the session I realise that everybody is different and will react differently to different situations. Therefore to have an effective group everyone must realise that everyone reacts and thinks differently this is why group work produces better results provided everyone cooperates."* Student comment

A teaching-design problem is to provide sufficient information and structure in a very short period, to students who predominantly lack a relevant knowledge-base. The next problem is to convince students, enculturated into particular ways of learning, that it is valid to learn through structured social interaction. Students who have a perception of university learning as acquiring facts in order to gain marks are reluctant to 'waste' time on learning team skills. Experience in group work at school also appears to be largely counterproductive.

Given the inappropriateness of lectures as a teaching strategy for skill development, a 'workshop' approach, supported by a student resource booklet was adopted. Students participate in activities exploring: meeting procedures, the superiority of group over individual product, individual differences and their impact on group functioning, two-way communication and the establishment of ground-rules and goals for group operation. Students are inclined to focus on the task itself, but are alerted to the need to simultaneously manage interpersonal (*e.g.* tolerance of others) and group-process issues (*e.g.* problem solving). Allocation of students to groups has proved more effective than self-selection and each group is allocated a mentor whose main role is to oversee the research process. Assessment combines individual marks for reflective note-book, literature review, and final examination with an individually-moderated group-mark for the project, thus integrating teaching aims and assessment format.

Substantial evaluative data have been collected. The most marked outcome of this project has been students' more comprehensive grasp of the research process. Student reaction has been mixed with most negative comments relating to the amount of time taken up by the research project and most positive comments relating to perceived relevance of the team skills to work. Some interesting findings relate to the learning strategies used by science students and an apparently greater reluctance by Australian (than European or American) students to recognise the need for leadership/co-ordination in group functioning.

Barbara Kennedy
Barbara.Kennedy@jcu.edu.au

A full CAUT report and teaching pack for interdisciplinary application will be available toward the end of this year.

The Soil Investigation Kit: A CAL Program for Soil Science

Marcel Chaloupka and Tony Koppi are with the Department of Agricultural Chemistry and Soil Science, University of Sydney

Nature and Structure of the Program

The Soil Investigation Kit has been designed to be learner focused and teacher driven. It places the student into a mimetic environment where the user engages in activities of exploration, physical testing, and information acquisition.

The Soil Investigation Kit is based on constructivist approach (as opposed to a instructivist, teacher centred approach) where the learner is engaged in problem-solving activities resulting in mental model building. The student control is a key factor in sustaining student stimulation and motivation. The Soil Investigation Kit can be broken down into four processes: Problem, Acquisition, Reference, Synthesis.

Problem

A horticulturalist wants to plant an orchard in one of four locations, the student is required to determine which site has the soil most appropriate for the orchard. Armed with the plant requirements, the student sets out to investigate the issue.

Acquisition

The student can visit five locations including a laboratory. In the field the student can dig pits, investigate the profile and take samples for the laboratory. Field investigations include identifying horizons, salinity, pH, texture, fabric and structure. Laboratory investigations include saturated hydraulic conductivity, pore space relations, bulk density. The student records results in a notebook.

Reference

The student can also refer to the reference section of the notebook to find information in solving procedural or conceptual problems. The notebook is also an information resource reference of soil science including general and detailed descriptions as well as videos and animations, illustrating how to measure the key properties and understand the concepts involved.

Synthesis

The synthesis stage is about the ability of the student to explain ideas and concepts in different perspectives. The Soil Investigation Kit encourages the synthesis by facilitating a question and answer process whereby the student is required to interpolate information from a quantitative to a qualitative viewpoint, *i.e.* the quantitative data must be qualitatively related to itself and to the requirements of the initial problem. This key-structured conversation is designed to dig deeply into the student's understanding. The synthesis stage starts with broad statements such as, "So your report shows that there is an A2 horizon at site two but what does that mean for my orchard?".

Conclusion

Interactive media only provides opportunities when users can learn to visualise and understand complex relationships in ways that are not possible in other media. Memorising and rote learning information for the sole purpose of reproduction is associated with surface learning and poor learning outcomes (Entwistle and Ramsden 1983; Watkins 1983). Alternatively, students that are engaged with the intention of understanding or seeking meaning are associated with higher quality learning outcomes and higher grades. It is thus the activities that are important, engaging the student in a learning activity where the action and activity evoke thought which leads to synthesis and understanding.

Marcel Chaloupka
m.chaloup@extro.ucc.su.oz.au

References

Entwistle, N and Ramsden, P. (1983). "Understanding Student Learning". (Croom Helm: London)

Watkins, D.A. (1983) Depth of processing and the quality of learning outcomes, Instructional Science 49-58

Robert Loss & Marjan G Zadnik are with the Department of Applied Physics, Curtin University

Survival skills for first year science students

This project originated from our observation of declining yearly retention rates, higher rates of withdrawal during semesters and an increase in the amount of time taken by many Science and Engineering students to complete their degrees.

As instructors in physics we identified that many students simply "drop out" or did not appear to achieve to their full potential. The causes of these are highly complex but several comprehensive surveys of our students identified factors such as the significant difference between the teaching and learning environments of secondary school and those at university, and a lack of sufficient personal organisational, motivation and other study and technical skills. Many instructors are often so busy dealing with content that they have little time to continually teach learning skills to students. Although many universities run short adjunct programs on study skills (typically 1 to 3 hours), research has shown that most of these are ineffective in the long term unless the skills are tied to specific courses.

In view of this situation we designed as a part of this project an innovative new unit ('Science Study Skills 101') to assist new students to develop appropriate work and study skills to enable them to improve their overall performance in their first year at university.

The unit was designed to:

- ease new student anxiety caused by differences between school and university;
- expose new students to a bigger picture and potential future directions in their discipline;
- develop skills for life long learning;
- improve new students' learning skills in all subjects;
- reduce student withdrawal rates;
- reduce the time taken by students to complete science degrees.

Now known formally as Science Study Skills 101 (SSS101), this unit is now a general elective at Curtin University and has been made a core unit in the Physics degree program. Science Study Skills 101 classes operate in small group workshop/ tutorial/ seminar mode and covers topics such as:

- familiarisation with university facilities, procedures, and structures;
- time management (*e.g.* work and study time tabling);
- effective learning techniques;
- written and verbal communication (report writing, seminar presentations);
- computer awareness (use of word processors, spreadsheets, graphics);
- examination preparation and techniques.

An important aspect of this unit is the contextual treatment of these topics whereby students use examples from concurrent science units. Student workload was minimised by having students submit assignments already being done for other units but prepared using the ideas and skills studied in SSS101.

A comparative study of the grades obtained in other Science and Engineering units by students taking SSS101 with students who have not taken SSS101 has not shown any significant differences in student grades. However, there does appear to be a small but significant improvement in pass rates and a reduction in withdrawal rates compared with previous years cohorts.

Robert Loss
rlossrd@cc.curtin.edu.au

The SSS101 Unit Outline and samples of the materials developed for the unit during the project can be obtained directly from the authors.

First year on campus

A report on Australian first year students

Craig McInnis and Richard Jamesare with the Centre for the Study of Higher Education, University of Melbourne

The quality of the first year at university is the subject of interest and action worldwide as universities become aware of the way in which the early undergraduate experiences establish lasting attitudes and approaches to learning. In Australia, there is a spreading realisation of the critical importance of the transition to university.

During 1995 we completed a CAUT commissioned study of Australian first year students, targeted at stimulating discussion of strategies for meeting their needs. We surveyed over 4000 first year students, interviewed a large number of students and staff, and analysed university policies and programs. The result is *First Year on Campus: Diversity in the Initial Experiences of Australian Undergraduates,* (available at http:// uniserve.edu.au/caut/ commproject/fye/FYEfront.html), and a forthcoming international conference, 'First Year in Higher Education: Transition to Active Learning', at The University of Melbourne, 3-5 July 1996.

Our research shows that first year students face many challenges: adjusting to different teaching styles, identifying standards and expectations, and managing workloads. For many students – too many in our view – their first experiences of higher education are not positive. Some anxiety and frustration in the early stages of the year is an inevitable part of an adjustment process to a new environment. But care must be taken to ensure that the level of challenge does not overwhelm and alienate students.

In *First Year on Campus* we suggest strategies for enhancing the academic and social experiences of first year students. Here are a few examples:

- Academics need to focus on ensuring that first year students have a good idea of what is expected of them, right from the outset. Clarity of purpose is a key factor in an effective learning environment.
- The quality and frequency of feedback on academic progress is probably more important during the period of transition than at any other time. First year students benefit from having early confirmation of their ability to succeed in higher education or a clear indication of their limitations.
- It is important for first year students to believe they belong to a learning community. Students learn better and are more likely to persist with their studies when they are encouraged to study together.
- One of the difficulties faced by students (and staff) is the ever expanding content of first year curricula. An overloaded curriculum can undermine the development of effective approaches to studying - we suggest academics consider reducing the course content.
- Poor study habits are often caused by uncertainty about how to learn in higher education. Plan to introduce first year students in the early stages to the ways in which they are expected to learn in your discipline. If you are an academic teaching first year courses, *First Year on Campus* is worth a look.

Craig McInnis and Richard James
r.james@unimelb.edu.au

This study was a commissioned project of the Committee for the Advancement of University Teaching.

The report can be viewed at CAUT's web site http://uniserve.edu.au/caut/commproject/fye/ FYEfront.html or obtained from CAUT.
CAUT can be emailed at caut@hed.deet.gov.au or telephoned on (06) 240 9635.

Notes from the Field

Dianne Chambers is the Educational Technologist for the Life Sciences at UniServe•Science

CUBE96

The virtual conference *Computers in University Biology Education 1996*, 'CUBE96', was held 22 April to 3 May 1996 and was hosted by the Computers in Teaching Initiative Biology (CTI Biology) of the UK. Registration was free and open to academics worldwide. This was the second Internet conference on computers in university biology education to be held, following the success of CUBE95 last year. The conference included papers on the use of the World Wide Web in biology teaching, a comparison of computer based learning with traditional teaching, and some descriptions of implementation of computers in biology teaching. CUBE95 was email-based with all correspondence going to all participants. This year's event took place entirely on the World Wide Web, using the HyperNews conferencing system. This allowed a number of papers and 'posters' (with images and links to other sites) to be made available on the web and for participants to make comments or ask questions of the authors with the ensuing discussion accessible by all participants. Although 'virtual conferences' lack the important (people) networking opportunities of a real conference, virtual conferences can be 'attended' cheaply and during semester!

The proceedings of CUBE 95 and CUBE96 are at http://www.liv.ac.uk/ctibiol/Events.html/

Exploring the Nardoo…

Continued from page 4…

Successful problem solving activities are reliant on numerous individual, social, and environmental factors. *Exploring the Nardoo* endeavours to assist students by providing some structures, or templates, upon which they can build their note taking or response writing activities. These are in the form of writing genre templates. Students may access the book containing these templates (as well as other organisational help on note taking, presenting and filing) from within the Water Research Centre – a metaphor with the information landscape of the package. Genre descriptions can be viewed and a genre template can be copied into the notes and used as a scaffold upon which to build or fill-in relevant information found whilst exploring the package.

To facilitate the re-ordering or repriori-tising of information Nardoo provides a separate, expanded form of the notebook. This device has been termed a 'text tablet'. It provides the editing facilities offered by the PDA as well as other features to assist with the restructuring of notes into a form more suited to small group presentation or a particular genre style. The text tablet provides a larger expanse of editable screen/document space into which student notes may be copied to and from the PDA notes module.

Conclusion

Exploring the Nardoo provides a rich information landscape with supportive tools for students to solve problems and investigate issues. The support tools allow multimedia reporting and are supported by several metacognitive tools for the writing process. These tools not only include details about genre but also templates to support the learners. The extent to which problem solving and student centred learning goals are achieved will be investigated and reported upon when the product is released to schools.

References

Florin, F. (1990). Information Landscapes. *In* S. Ambron, & K. Hooper, (Eds). *Learning with Interactive Multimedia*. Redmond: Microsoft. pp 28-49.

Barry Harper
b.harper@uow.edu.au

Cost: $185; additional copies on the same order are $40 per copy.
Distributor: Interactive Multimedia Pty Ltd, PO Box 772, Belconnen ACT 2616
email: nardoo@uow.edu.au **Tel**: 1 800 500 405
URL: http://www.immll.uow.edu.au
Requirements: Colour Macintosh, double speed CD-ROM drive, System 7.1 or better, QuickTime 2.1 (supplied), 2.5 MB RAM above System requirements.
PC version currently under development.

Calendar of Coming Events

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

CALISCE '96
Third international conference on Computer Aided Learning and Instruction in Science and Engineering
9-31 July 1996, Spain
Tel (+34)(43) 218000 Fax (+34)(43) 219306
email calisce96@si.ehu.es

CAUT National Teaching Workshops '96 - Creating Learning Opportunities
17-19 July 1996, University of Technology, Sydney
Tel: (02) 330 2314 Fax (02) 330 2217
email : clt@uts.edu.au
http://www.clt.uts.edu.au/ntwhome.html

Universities of the 21st Century: Education in a Borderless World
13-14 August, 1996, Singapore
email: annag@ccmail.idp.edu.au
http://www.idped.com.au/conf.html

Australian Society for Biochemistry and Molecular Biology and Australian Society for Plant Physiologists Combined Conference
29 September - 2 October 1996, Canberra
Tel: (08) 362 0009 Fax: (08) 362 0038
http://biology.anu.edu.au/Groups/Plantsc/socmeet.htm

Learning Environment Technology Australia - LETA '96
29 Sept - 9 Oct 1996, Adelaide Convention Centre
Tel: 618 239 1515 Fax 618 239 1566
email : conv@sapmea.asn.au
http://www.on.net/clients/leta/

The 1996 International Education Conference
1-3 October, 1996, Adelaide (part of LETA '96)
email: annag@ccmail.idp.edu.au
http://www.idped.com.au/conf.html

SciComm96
Fourth International Conference on the Public Communication of Science and Technology
November 11-13 1996, University of Melbourne
Tel: (059) 832 400 Fax (059) 832 223
email: scicomm96@scicomm96.unimelb.edu.au
http://scicomm96.unimelb.edu.au/SCICOMM96/

4th ACM International Multimedia Conference and Exhibition
18-22 November, 1996, Boston, Ma, USA
http://www.acm.org/sigmm/MM96/

ASCILITE '96 New Connections
Australian Society for Computers in Learning in Tertiary Education thirteenth annual conference.
December 2-41996, University of South Australia
Tel: (08) 303 5422 Fax: (08) 303 3696
http://www.netspot.unisa.edu.au/ascilite96/

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, Heath 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