

Subject areas

- Biochemistry
- Biology
- Chemistry
- Geography
- Geology
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- Psychology



UniServe•Science News

Newsletter of the Science Software Clearinghouse

Vol. 3, March 1996

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From the Director

Dry Labs (with a dash of bitters)

Every university in the country is facing pressure to increase teaching efficiency. Our funds are being cut, our student numbers are going up, and we are all being expected to do more administration. If we are to continue to have the money, and more importantly the time, to do our research we must find ways to streamline our teaching, if possible without sacrificing quality. Of all the teaching we do, experimental laboratories are the most expensive. Equipment is costly, staff : student ratios are high, and community groups worried about safety and ethical issues have to be satisfied. Who of us has not toyed with the idea of replacing at least some of our experimental ('wet') laboratory teaching by something more automated?

Bring on 'dry' labs!

There is no question that people can be taught useful skills, and taught them well, by the use of computer simulations. Are not all our airline pilots trained on flight simulators long before they are let anywhere near a real jumbo jet? And have not most of us seen computer packages which train the most ham-fisted student to

Continued page 2

Dry Labs Workshop

April 12, 1996

University of Sydney

See page 19 for further information

*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

acquire necessary laboratory skills - like, as just one example, the splendid *Virtual Microscope* developed by the Open University. And these are getting better and better, as computers increase in speed and graphical power. It won't be long now before we have virtual field trips, designed along the same principles as *Doom*[®] employing millions of (real) images. Is it any wonder that some departments in this country have already taken the decision to replace some of the costly and time-consuming laboratory experience they previously offered their students, with some kind of IT package? And is it any wonder that even more departments are asking themselves if this is the way they should be going?

But there are worries about this trend. Experiment is, after all, the very keystone of science. That is how scientific knowledge differs from other kinds of human understanding — all our theories must be tested against what happens in the real world, in real experiments. Therefore if we give physics students an exercise to test whether a simulated radioactive source decays in a random manner, what will they have discovered at the end of it? Certainly not that real quantum events are indeterminate. Or if psychology students learn, by patient keyboard manipulation, to “train” *Sniffy the Virtual Rat* to perform some action in response to an external stimulus, what exactly has been

established? Certainly not that Skinner's theory of learning by operant conditioning can be applied to real rats (let alone people). In either case the student has simply discovered something that the software designer coded into the program. There are many, many academics who harbour the gravest of misgivings about simulated laboratory experiences.

I personally believe that we cannot afford to keep teaching experimental science as we have done in the past to all our students. I also believe that, if we do replace it with something else, we must not throw out the very thing that makes science science. These are issues that need to be brought out into the open and discussed. Therefore UniServe Science will hold a one day workshop devoted entirely to the subject of DRY LABS. It will be held at the University of Sydney on April 12. It will bring together academics from all round the country from departments which have successfully replaced some laboratory teaching with different experiences. They will describe how they organized the exercise, what problems they faced and how successful they feel it has been. You can pick their brains and decide if it would work in your department, and maybe even take some software back with you.

So be there on April 12.

Ian Johnston
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Aims

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

Information Technology in tertiary science teaching

Review of UniServe•Science

The clearinghouses will be reviewed at the end of June 1996 by CAUT. We will be asking you over the next few months for your comments on our performance. Anybody who wishes to make a comment please contact Dianne Chambers (BioSciCH@extro.ucc.su.oz.au) or Mick Pope (PhySciCH@extro.ucc.su.oz.au).

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Article

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This project was funded by a 1994 CAUT grant.

Teaching writing skills in the science curriculum

The development of good writing skills is currently being targeted by many institutions of higher education as part of their brief to include teaching transferable (generic) skills to undergraduate students. Our project aimed to improve the writing skills of first year science students and was included within a first year biology course characterised by large student numbers and diverse student backgrounds. The teaching of writing skills was integrated with the teaching of biology so that the purpose of learning how to write well, and the value placed upon written communication, was quite explicit.

Types of written work appropriate for mastery by a first year biology student were first identified, after which a series of teaching and learning materials was developed for incorporation into the laboratory component of the course. These teaching materials began with a very structured teaching approach whereby the emphasis was on communicating the learning goals to the students and then progressed to giving the students opportunities to learn about the writing tasks, assessment, and feedback. The first part of the course thus had a distinct awareness-raising component, and had to dispel myths such as “but we did science so that we wouldn’t need to write and use spelling and grammar”. From the outset students were encouraged to discuss their ideas about good writing and in this way identify the criteria on which assessment would be based (always a key focal point for the students!). This process gave students confidence in their current abilities and allowed them to learn and practice communication skills in an informal setting.

Once this groundwork had been completed, the formal teaching input decreased as students put theory into

practice in a number of writing tasks, such as short written quizzes and laboratory reports. These writing tasks were of increasing complexity and also required more complex use and application of the students’ expanding biological knowledge. Students received individual formative feedback and discussion sessions after each task and were encouraged to progress and improve their writing by applying this feedback in subsequent tasks.

Since the structured teaching input decreased as the course progressed, students were expected to become more independent in their learning and practice of writing. This was promoted by making them aware of assessment criteria and methodology, and involving them in self and group assessment of pieces of writing. Group or peer assessment (where marks were allocated) was very unpopular with the students but they found that giving each other feedback on pieces of writing (with no marks allocated) to be a useful learning experience.

Students were also provided with a number of ‘self-help’ materials associated with the various writing tasks for independent study. These included explanations of ‘How to write...’ and models showing appropriate and inappropriate written answers. Similar models were also used to demonstrate the way in which the assessment criteria would be applied to pieces of writing. Students tended to use these materials in a variety of ways depending on their level of competence and confidence in both writing and the biological material. Having access to these materials greatly increased their expectations in terms of provision of a greater range of support materials in the future, which could be seen as both a positive and potentially negative learning outcome!

Student evaluation of the program has been very positive (with the exception of peer assessment) and students who have finished the course have indicated that they found the program useful in improving their writing and would like similar teaching or materials for writing tasks in higher years. Objective measurements of improvements in writing skills have proved difficult, since so many variables are involved, but staff feedback suggests that the increased awareness and value placed on writing by students has been reflected in their written work.

First year biology teaching staff have been involved in discussions on the project since its inception and have provided continued constructive feedback through questionnaires and workshop sessions. While they have been positive about both the aims, the teaching of writing skills, and its effect on student writing there is an underlying concern that there is a need for more training of staff in this area and that there is insufficient time for assessment and giving feedback. The former may be addressed by the provision

of a comprehensive teaching package which is being prepared and will be available in mid-1996 (contact the authors for further information).

Since this article is lurking in a software newsletter it seems appropriate to make mention of technology and the teaching of writing. Potentially some of the student learning material could be incorporated into a self-help package on computer to be accessed by students in libraries or at home. However, the teaching and development of communication skills requires an interactive component which caters to the individual as both teacher and student, and fosters learning and practice by example. Components of the teaching such as assessment and feedback, which require intensive time and funds for marking, would be prime areas for computer use. However, development of software capable of language evaluation is presently in its very early stages.

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New Services from UniServe•Science

UniServe•Science database now searchable over the World Wide Web

The UniServe•Science database of resources for use in teaching science at the tertiary level is now available for searching via the World Wide Web. This allows you to specify the discipline, area of interest, the year level, and the platform (Mac, Windows, DOS) and have returned a list of teaching materials that fits these criteria. Clicking on the item of choice leads to further information about that product — a description, requirements, supplier details, *etc.* and, for an increasing number of products, an evaluation of the product.

Access is via the Web page at <http://www.usyd.edu.au/su/SCH/publications.html>

Mailing Lists of Academics in your field

For each of the disciplines UniServe•Science covers we have set up a 'majordomo' list for interested persons. These lists put teaching academics who are interested in using New Technologies in contact with each other. Any mail sent to the list's address will be sent to all members of the list, thus enabling a discussion group. To join a list send email to majordomo@uniserve.edu.au with the following command in the body of the email: 'Subscribe listname YourEmail@your.email.address', (no inverted commas). The list names are:

biochemistry-science	biology-science	psych-science
chemistry	physics	geography and geology.

To subscribe to the biology list I would thus send the message 'subscribe biology-science dchamber@extro.ucc.su.oz.au' (no inverted commas) to majordomo@uniserve.edu.au. Email to be distributed via these lists should be addressed to Listname@uniserve.edu.au. A message sent to all on the psychology list would thus be sent to psych-science@uniserve.edu.au. Contact Dianne Chambers for further information.

Article

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Organic Chemistry Software from Tasmania

Organic chemistry at the University of Tasmania has long been taught to undergraduates with the aid of computers and some of this software has been released shareware. One such package called Torganal is a simulation of qualitative organic analysis. Another, Taspecpmr, is a demonstration version of one of a set of programs used to produce electronic slides for a lecture course on organic spectroscopy. Both are suitable for use at about the second year level of a university chemistry course.

Torganal

Qualitative organic analysis involves identifying an unknown compound. Why simulate this procedure? Identification of unknown compounds

plays an important part in most organic chemistry laboratory courses. Since there are many millions of compounds and a wide variety of possible chemical reactions and measurements that could be made this can be daunting for a student. To identify an unknown compound a small number of reactions and measurements has to be selected in a logical manner, carried out in the laboratory and then interpreted. Students

therefore have to plan a logical approach, use chemical reactions, and obtain and interpret physical measurements including spectroscopic data. By using a computer simulation of this process students are able to discover and rehearse the strategy of identifying an organic unknown in a situation free from the additional uncertainties of performing unfamiliar laboratory work and then relying on the results. Once a logical approach has been developed, identification of an unknown compound can be undertaken in the laboratory with more confidence and efficiency. This program is designed to

enhance, and certainly NOT replace, practical chemistry laboratory work.

Organic compounds are identified usually by determining the functional

group(s) present and then selecting the correct compound from those listed in a table of compounds having that functional group. Functional groups are mostly determined by a combination of chemical tests and interpretation of spectroscopic data. Many of the chemical 'functional group tests' can be arranged logically into a hierarchy where a more general test is to be done before a more detailed one. Hence, the more specific one should

only be performed if the more general one has given a positive result. For example, a test for a nitro group should only be done if nitrogen has been shown to be present and should not be attempted if it has been revealed that nitrogen is absent. Even if there is no prescribed general test, the test in question may be precluded by the result of another test which has already been disclosed. To take an example, it is inappropriate to perform a test for a phenol if this functional group is precluded by an infrared spectrum which has been revealed. A computer program which simulates the process of organic

"I would strongly recommend this program as a very useful precursor to an organic unknowns exercise in either 2nd or 3rd year." DG Hewitt - Chemistry in Australia, page 226, May, 1993.

"...TORGANAL would be a useful resource for anyone who wishes for software to support courses on organic analysis. It is user friendly, well structured and clearly presented. ...it represents excellent value for money..." M. Atlay - Software Reviews, pages 20-21, vol 7, 1993 (CTI Centre for Chemistry, University of Liverpool).

analysis can encourage a logical approach by checking that these requirements are met; furthermore should the response not be understood then context sensitive help can be given.

"*Torganal*" — *Tasmanian organic analysis* — has been developed to meet these requirements. The simulation is designed to be used as a pre-laboratory exercise and not to replace the actual laboratory work of identifying organic unknowns. The major aim is to encourage students to develop a logical approach by allowing them to explore the interrelationships between tests, and between tests and revealed data (including spectra). The program is easy to use with pull-down menus. A mouse may be used to minimise keyboard activity. Customisation of the program by the supervisor is possible.

Each year *Torganal* is utilised by hundreds of students throughout the world since the program is in use in numerous universities in Australia and overseas. The first shareware version (3.10) of *Torganal* was made available in January, 1992 and version 4.0 has just been released. The shareware version is fully functional. Institutions (or individuals) wishing to use the program have to pay a fee and then receive a registered copy (and other material).

Taspec-pmr

Computer based material has also been developed as an aid to lecturing organic chemistry at both first and second year level. This takes the form of 'multimedia' electronic slides for display in a lecture theatre on a large screen using a video projector or LCD panel and overhead projector. The slides have been used for several years as visual aids for a lecturer who can provide accompanying verbal explanations. Although they are not intended for direct use by students without the associated lecture course, the slides are sufficiently self-explanatory to allow them to be used independently.

The slides have been carefully designed

to be visible under projection conditions. They have a consistent appearance and style. Minimum use has been made of (what I consider to be) distracting gimmicks. Many of the slides use the 'build' principle whereby new information appears to be added to the previous slide thereby allowing progressive development of a topic. Since each module is also made available to students in the course for private study (either in the department's computer laboratory or for copying to a floppy disk for use elsewhere) one important design criterion has been to make each one a self-contained program (executable file) and limited in size to < 1.4 MB.

The slides are in the form of sets of programs. A demonstration version of one of these has been released as shareware. *Taspec-pmr* (tpmrj20.exe) is one such program from a set for teaching a nine lecture course of introductory spectroscopy to second year organic chemistry students. The particular program is devoted to a brief introduction to nuclear magnetic resonance spectroscopy that is followed by a detailed look at proton magnetic resonance spectroscopy. The complete set of seven spectroscopy programs containing over 250 slides is available for purchase. A similar styled set of two programs about organic stereochemistry (over 80 slides for three lectures) is also available. Other topics are in the course of development and refinement.

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TORGANAL

Requirements: PC; DOS (also runs under Windows); 640K RAM; EGA graphics. The shareware version may be downloaded from the SimTel repository: archie.au/micros/pc/SimTel/msdos/chemistry/torg400.zip

Cost: Site licence:\$200; \$20 for individual students; Trial version: free.

TASPEC-PMR

Requirements: PC; Windows; VGA graphics. The shareware version may be downloaded from the SimTel repository: archie.au/micros/pc/SimTel/win3/chem/tpmrd20.zip

Cost: Demonstration version: free; Spectroscopy programs: \$100 (set); Stereochemistry set: \$50.

Article

Peter H. Schalk
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Heijman

ETI's Taxonomic *Linnaeus II* Software A New Tool for Interactive Education

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Introduction

Protecting the world's biodiversity depends on reliable identification of species and readily accessible documentation. High quality taxonomic and biogeographic data are imperative to study biodiversity and to monitor changes in our biological environment. The number of experienced taxonomists is decreasing rapidly, however, and the number of students in taxonomy and systematics has reached an unprecedented low level. On the other hand the demand for validated taxonomic and biogeographic data is increasing. Estimates of the earth's biological richness vary from 20 to 40 million species or more, while only about 1.4 million species have been described. New specialists are needed to deal with the inventory of the biodiversity and training and recruitment programs should be high on the priority list of the universities.

At present access to species information and identification keys is limited by the fact that literature is scattered over a vast amount of sources. Scientists in developing countries in particular are restricted in their jobs. Electronic information systems can complement the traditional libraries and provide an answer to ensure world-wide accessibility of data and allow easy updating and cheap distribution of data.

The Expert-center for Taxonomic Identification (ETI) at the University of Amsterdam developed a user-friendly standard computer tool (*Linnaeus II*) that combines the functionality of an interactive multimedia database, computer guided identification, and a geographic information system. It provides a standard for electronic publishing of species monographs. International networks of ETI-Partners use *Linnaeus II* software to create up-to-date taxonomic monographs or regional biodiversity information systems which are released on

CD-ROM. These CDs form the backbone of a modern digital library: the World Biodiversity database CD-ROM Series.

Linnaeus II Software

The *Linnaeus II* interactive software was developed by ETI to facilitate biodiversity documentation and species identification. This fully multimedia software package is used world-wide by scientists to build — on their own personal computers — species information and identification systems that can be easily updated and published. The software package is continuously updated and expanded with new modules and more functionality in response to continuous feedback from its users. The modern modular set-up of this ETI software shell warrants easy maintenance and a maximum of flexibility. It runs on Windows and Macintosh computers and produces compatible files that can be easily exchanged and combined.

Linnaeus II now consists of the following hyper-linked modules.

- A multimedia databases where species (and higher taxa) information is stored. The database can hold text, pictures, sounds and videos, to give the user maximum freedom in tools to describe the taxa. Apart from a free text search and an entry via a taxa list the information can be accessed through a number of tools. For identification three different tools have been devised: an interactive illustrated dichotomous key, a multiple entry key for fast identification of for instance incomplete species, and an interactive pictorial key. The latter two allow also non-experts to identify specimens.

- A geographic information system allow the user to store biogeographic (distribution) data, which are of importance for determining the biodiversity of an area. The interactivity of this geographic system allow for a geographic search through the databases. A geological key is presently under

development; this will allow storage and historical searches on fossil species.

All modules of the software are hyper-linked to an illustrated glossary of terms so that technical terminology can be explained on-line without hampering the progress of the identification or preventing laymen to use the system. An easy to use hyper-linked reference database completed the system with all literature references for further study by the user.

Educational use

Apart from its application in taxonomy and biodiversity documentation studies by specialists, *Linnaeus II* is now increasingly being used for educational purposes. It allows students to experiment with the computer with making taxonomies, species descriptions, interactive distribution maps, and various kinds of identification keys. Students can experiment with a modern interactive computer tool to structure biological information and handle complex data sets and at the same time get the feeling for a new way of 'publishing' electronically.

In 1995 several teachers in The Netherlands and in the UK, experimented with *Linnaeus II* in education for tertiary students and were thrilled about the possibilities of this tool. It makes teaching taxonomy and systematics more practical and applied than before. Giving students experience with the 'think work'

and practicalities behind making various identification keys was considered very useful. Comparing the results and different solutions of the students experiments offers good ground for discussions.

The various ETI CD-ROMs offer extensive data sets from which materials for experimental work can be drawn. The CD-ROM systems are equipped with export functions so that selected part of the data they contain can be taken off and used for making, for example, an information system and keys to completely different taxonomic groups.

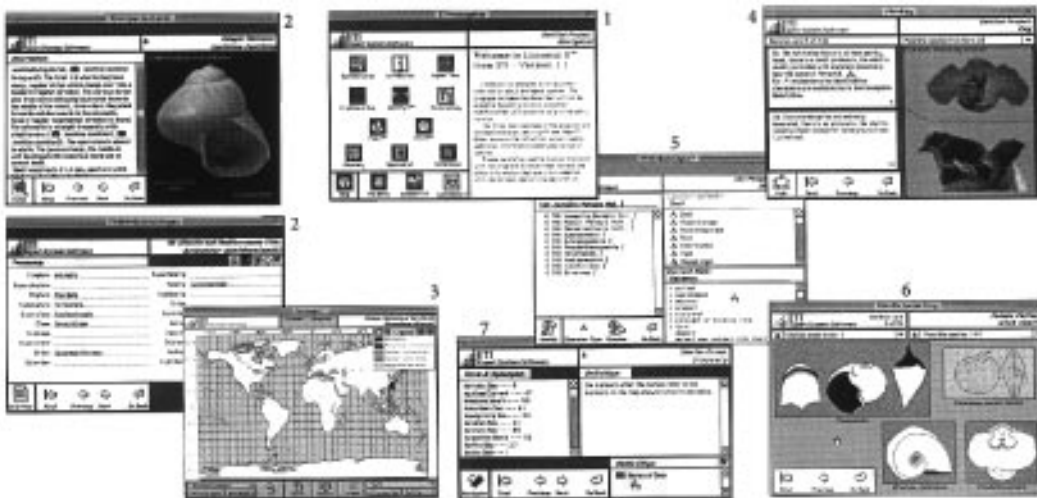
Peter H. Schalk & Rob P. Heijman
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ETI-Partners who work together with ETI on documenting the earth's biological richness receive *Linnaeus II* free of costs as they deliver species data to ETI's World Biodiversity Database. For all other users the *Linnaeus II* package is available for US\$949. Educational institutions may buy the package with an educational discount of 40%.

CD-ROMs in the *World Biodiversity Database* series include: North Australian Sea Cucumbers (1994), Turbellarian Families and Genera (1995), Birds of Europe (1994), Sea Mammals of the World (1995), Lobsters of the World (1995), Fishes of the North-Eastern Atlantic and the Mediterranean (1994), Five Kingdoms: Life on Earth (1995), Protoctist Glossary (1995), Marine Planarians of the World (1994), Pelagic Molluscs of the World (1995), *Linnaeus Protist* (1995).

Requirements: Windows or Macintosh platforms

Distributor: In Australia ETI products are distributed by DA Electronic Media, 648 Whitehorse Road, Mitcham Vic 3132, Tel: (03) 9 873 4411.



Some examples (screenshots) from the *Linnaeus II* program. Presented are (1) the navigator, (2) parts of the taxonomic database, (3) the geographic information system, and the identification keys: (4) traditional key, (5) IdentifyIt, (6) pictorial key, (7) the on-line glossary.

Review

John O'Byrne is a lecturer in the School of Physics at the University of Sydney

Raytrace

An interactive tool for teaching geometrical optics

Raytrace is clearly targeted as an educational tool. It is not a general purpose ray tracing program and does not provide some of the capabilities of such programs. Nevertheless, the facilities it provides are quite impressive and it could be a very useful teaching tool if used intelligently.

The program can be mastered by a course instructor with a day or two of practice (familiarity with CAD software may help). However, in my opinion it is too complex to present to an average first or second year university student for a brief laboratory or tutorial session. It would be suitable if the student has enough time to master the basic operation of the program, as in some form of project work. However the scripting capabilities illustrated in the demonstration provided with the program provide a means of tailoring the extensive program capabilities to the student capabilities. The students could do most of the work by following the directions provided by the script. The script would also allow some of the most time consuming details to be simply provided. The scripting is a new feature documented in the on-line help, but not yet in the manual. It is essential that it be comprehensively documented to allow instructors to use it.

Generating shapes such as lenses is a little tricky. Drawing the curves is somewhat non-intuitive and there is plenty of room for students to make a mistake and waste considerable time overcoming it. These more complex figures could be better drawn by a script or simply provided in a new library generated by the instructor. The other obvious way to overcome these drawing difficulties is to specify a figure using

numbers (e.g., surface radii, spacings) provided in an input file. This capability is common in general ray tracing programs, but would still be a valuable addition to Raytrace for those circumstances where it is actually easier than drawing the figures.

One other small addition would be an explicit menu item to cancel any current operation. Although ESC will do this, you need to know this and there is no menu item the user can find corresponding to it.

Having mentioned some reservations, it would be wrong to leave the impression that *Raytrace* is not an excellent program. Among its most attractive features is the ability to move rays or sources or change refractive indices and immediately see the effect, including changes in distances and angles. Another is the ability to trace around an object and see the corresponding aberrated image traced out.

In summary, *Raytrace* can be a valuable teaching tool if implemented with appropriate assistance for the inexperienced student. It provides many more features than the limited programs which we currently use in our first year laboratory (based on the CT programming language). It is also better suited to demonstrations in lectures than the general ray tracing program we have used to date.

John O'Byrne

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Requirements: PC running Windows® 3+
Author: Dr Ian Moore, Queensland University of Technology
Cost: \$95
Supplier: IME Software, PO Box 1133 Toowong QLD 4066

See page 19 for further information on the Dry Labs Workshop - April 12

Biology of Australian Flora and Fauna

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This material is designed to accompany the new biology text by Knox *et al.* 1994, a text written with Australian tertiary classes in mind. The Workbook covers 10 topics ranging from the evolution and conservation of koalas to arid and alpine zone ecology to plant physiology and greenhouse gases. Four of these topics are chosen for a self paced unit on the CD-ROM. These are:

- *Life at the Edge of the Sea*
 - an investigation into ecology and physiology of species of mangroves and intertidal organisms.
- *Sclerophylly*
 - a survey of the anatomy and adaptations of sclerophyllous plants.
- *Greenhouse, carbon dioxide and plant growth*
 - analysis of carbon dioxide in geological and historical time, the photosynthetic pathways and plant structure.
- *Management and Conservation of the Helmeted Honeyeater*
 - a summary of the ecology and conservation status of this restricted species and a game to illustrate conservation strategies.

The CD-ROM aims to cover a range of subjects such as evolutionary history, structure and physiology, human impact and so on and to promote study skills. This latter aim is achieved by directing users to make records in the space provided in the workbook. Each unit consists of a set of pages on a clearly defined topic, which can include questions which trigger responses immediately, interpretation of data, as well as illustrations which have links to more pages from the structures visible. For example, clicking on a particular part of a diagram of a mangrove transect displays a photo of a particular named species of mangrove.

For the most part the package is well integrated, but is subject to the shortcomings of HyperCard such as slowness of response to the position of the mouse pointer. At a resolution of 640 by 480, some of the pictures are a little grainy but not to the stage of not being useful. I tried the package on several monitor sizes and computers and had no problems provided the specified settings were adhered to. In some places the text overflowed the windows, and the terminology was not consistent but these are not serious shortcomings. I found one spelling mistake.

I suffer from being a traditionalist, and think that the basics of biology need to be grasped before approaching the issues that the package addresses. If a student was familiar with biology of arthropods in a general way, I feel that the impact of the section on the intertidal barnacles, for example, would be greater. I see this package as a mechanism for broadening the outlook of students, but am less convinced that it is the primary tool for enhancing teaching and learning. This package will not replace going out and getting one's feet wet on a rock platform, preferably in the company of a good field biologist.

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Ladiges, P., Gleadow, R. & Handasyde, K. 1995. Biology of Australian Flora and Fauna. CD-ROM and Workbook. McGraw-Hill Book Company Australia Pty Limited. ISBN 007 470230 0

Requirements: The package is restricted to Macs (LC and later) with 14 inch monitors and 256 colours. The software is a HyperCard stack, and a HyperCard player and QuickTime are included on the CD-ROM.

Cost: \$1500 site licence.

Review

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Macquarie
University

InSights 2 (Color)

The package contains the following 10 self-contained modules on visual perception: Stereograms (which uses red-green glasses - one pair supplied); Additive Color Mixture; Illusions and Aftereffects; Mach Bands; Stereopsis and Depth; Contrast Sensitivity; Spatial Vision; Color Arrangement Test; Form and Motion; and Feature Analysis (visual search). Real data can be collected in the experimental modules - Stereopsis and Depth, Contrasts Sensitivity, Color Arrangement Test, and Feature Analysis.

The package is a lot of fun. In using it with students in 1995, I found that even those who claimed to be terrified of things "scientific" were captivated by the excellent visual demonstrations. The *Stereograms* module contains ordinary picture, outline shapes, and random dot stereograms and, except for the pictures, disparity is choosable. This and the 18 demonstrations in the *Illusions and Aftereffects* module alone make the package worth its price. The *Form and motion* module makes accessible a range of demonstrations which cannot easily be explained merely with words.

One of the nicest things about the program is that it can be used at different levels. For example, the *Contrast Sensitivity* module allows one simply to demonstrate the contrast sensitivity function (the opening screen displays a contrast x spatial frequency envelope), to measure it using a crude adjustment method (using a window slider) or to measure it using a sophisticated two interval forced choice procedure. One problem with the latter - not foreseen by the authors - is that the two intervals are defined by beeps, as is the feedback on correct/incorrect responses. As a result, when one tries to run this experiment in a lab class, the result sounds like a bad

orchestra warming up and the students cannot tell which beeps define their interval or someone else's. It would have been clever to allow the user to choose the method of interval definition - visual perhaps (despite possible artefactual interference) or even to choose the beep frequency. The other problem with this experiment as well as some other modules - and as noted by Blake and Rose (1994) - is that there is no simple way of exiting once the experiment has started. It is therefore necessary to teach students that Control-Option-Command-Escape can be used to quit any Macintosh application.

"In sum, this is a terrific package which is easily worth the US\$169 for a site licence."

Perhaps the best module of all - especially powerful for teaching - is *Spatial Vision*.

Normally, students are not highly enthusiastic about Fourier analysis and synthesis. Here they can import all sorts of supplied PICT images and filter them with a two-dimensional fast Fourier transform using low pass, high pass, notch and bandpass filters, all of variable width. It is a particularly useful way to demonstrate the fundamental and harmonics of a square wave and to show that different spatial scales provide different kinds of information (low pass: overall shape; high pass: edges). One menu also allows blocking of faces and students are interested to discover that blurring the eyes restores recognition and to hear that this is why the blocked faces on TV news programs now jiggle to disable this recognition ploy. It is worth reiterating the disappointment voiced by Blake and Rose (1994) that there is no inclusion of orientation-domain variability, although it is possible to make one's own set of grating PICTs with different orientations and frequencies for import into the program.

There is very little positive which can be added to the excellent and detailed

review of *Insight 2 (Color)* by Randy Blake and David Rose (Blake and Rose 1994) . They also mention some of the program's difficulties which are, however, relatively minor compared to its strengths. Because their review covers all of the modules fully, only some were discussed here.

The Blake and Rose review points out that some modules will not run with certain control panels. While this is true, I have also found that the *Feature Analysis* module will not run on a Centris 660AV even when all the extensions are turned off. Everything runs perfectly, however, on the very cheap and value-for-money Macintosh LC630 which is the laboratory machine I use. A maths co-processor is required only for the *Spatial Vision* module which will still run on a Mac 8500 using a software FPU, albeit very slowly.

If the on-line help and information is a little difficult to navigate, it is easy to print out a complete manual, complete with pictures of the screens (using the print screen command — Shift-Command-3). In sum, this is a terrific package which is easily worth the US\$169 for a site licence.

Peter Wenderoth
peterw@vision.bhs.mq.edu.au

REFERENCE:

Blake, R. and Rose, D. (1994) *Perception*, **23**: 1102-1104.

Requirements: Macintosh computer with at least 3.5 MB of space on its hard disc, 2 MB RAM, System 6.05 or higher (4 MB needed if using System 7), HyperCard 2.0, 13" colour monitor, several features of the program require a maths co-processor.

Authors: John Baro & Stephen Lehmkuhle, University of Missouri, St. Louis

Distributor: Intellimation Inc., Dept 5CKF, 130 Cremona Drive, Santa Barbara CA 93116, USA
email: intellIFM@aol.com Tel: 1 805 968 2291
12 pp + software.

Cost: Single copy US\$39, site licence US\$169

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/>

Intellimation Inc.

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

Cool Springs Software

PO Box 130, Woodsboro, Maryland 21798, USA
Tel: 301 -845-8719 email: Coolspring@aol.com
<http://home.aol.com/coolspring>

Brooks Coles Publishing

511 Forest Lodge Road, Pacific Grove, CA
93950-5098 USA.
email: info@brookscole.com
<http://www.brookscole.com/brookscole.html>

Visual Systems

PO Box 4121
Eight Miles Plains
Qld 4113
email: siltala@mail.powerup.com.au
<http://www.visualsystems.com>

UK Earth Science Software

Consortium

Central Unit, Department of Earth Sciences
University of Manchester, Manchester M13 9PL
UK. Tel: 0161-275-3820/3833 Fax: 0161-275-
3947, email: ukescc@man.ac.uk
<http://info.mcc.ac.uk/Geology/CAL/index.html>

CTI Catalogues of software can be accessed in most cases via their WWW pages (URLs above) or can be purchased by contacting the CTI centre relevant to your field of interest.

Review

Ian Montgomery
is a Post-
Doctoral Fellow
in the
Quantitative
Training Unit
for Fisheries in
the Institute of
Marine Ecology
at the University
of Sydney

Fish Farm

A computer simulation of an aquaculture enterprise

Fish Farm is an excellent computer simulation of an aquaculture enterprise in South Carolina. Being a simulation the farm may be regarded either as a laboratory or as a commercial venture. This means you can run the program primarily to discover the best environmental and feeding conditions for growing a particular species of fish, or to see how much money you can make (or lose) under selected conditions.

The primary aim of *Fish Farm* is to teach the value of using the scientific method in tackling problems of some complexity. There are several controllable variables (stocking density, protein content of food, aeration and ground water circulation) and constraints (availability of ground water, natural variations in temperature) which determine conditions (oxygen, temperature, ammonia) and lead to varying degrees of growth, fish kills and epidemics. Students start by making intelligent guesses with a species about which something is known (the Channel Catfish). Typically, this leads to big financial losses, humility and renewed respect for the scientific method. The way out of this is to plan a series of carefully controlled experiments varying a single factor at a time to determine the optimum conditions for growing a species. There is a choice of 26 'unknown' species in addition to the Catfish.

The program is well designed to guide users through it without making it too easy. It provides good feedback on the simulations. Data from experiments are collected and on-screen graphs may be produced. The results of the experiments

are augmented with comments about what has happened and the progress of an experiment is accompanied by messages reporting events such as fish deaths. The success of the experiments is clearly measurable in terms of fish growth, fixed and variable costs and the resulting bottom line.

The documentation is very good indeed and is divided into separate manuals for the instructor and for the students. Students are given a structure to tackle experiments but the degree of assistance is measured to encourage students to think for themselves and develop problem solving abilities.

The review copy was the DOS version but it is also available in Macintosh and Apple II versions. The reviewer is considered a Macintosh fanatic by his peers, but is happy to report that the DOS design is remarkably good. The screens are well laid out; it is easy to navigate around the program and the graphs are fine for a text-based interface.

This is a professionally produced product. It is highly recommended. Not only does it achieve its objectives easily and elegantly, it is also great fun to use.

Ian Montgomery
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Platform: Available for Macintosh and PC (DOS).
Cost: \$150 plus \$14.95 for instructors manual (the latter available only direct from Addison-Wesley Benjamin/Cummings Publishing Company).
Requirements:
PC: XT, Model 25 or 30 with 256 K graphics card; DOS. Available in 3.5" or 5 1/4" disks.
Macintosh: Low level Macintosh.
Author: Robert J Kosinski
Supplier: Addison-Wesley Benjamin/Cummings, A1/6 Byfield Road North Ryde NSW 2113 or through your campus book store.

Teaching data analysis techniques

Les Kirkup is a Senior Lecturer in the Department of Applied Physics at the University of Technology, Sydney.

Introduction

Fundamental advances in the physical sciences rely heavily on the insights that carefully designed experiments can provide. Much insight is gained by extracting, evaluating and analysing data from experiments. We want our students to develop confidence and facility in handling experimental data early in their undergraduate careers. Equally, we recognise that teaching data analysis techniques represents something of a challenge. In the first place students often perceive the study of such topics as 'outside' the mainstream of the courses "I want to be a chemist - I don't want to play with numbers!". Additionally, much material available for teaching analysis techniques describes contexts which have little to do with science and, due to the overseas origin of the material, sometimes reveals a distracting national 'slant'.

Development of an integrated teaching package

With the support of a CAUT grant, our aim is to re-evaluate the teaching of data analysis techniques and, in particular, to create a package which exploits contemporary media available in the most appropriate manner for improving teaching and learning. For example, a short video can be an excellent way of introducing a topic and for offering context rich situations in which particular analysis techniques are used. By contrast, a video is generally less appropriate when the minute details of the derivation of some pivotal equation are to be discussed. A very important analysis technique used in the physical sciences and the first to be treated through this work is that of 'least squares' for curve-fitting data points. The various elements that make up the package (entitled *Where do you draw the line?*) were trialed with students in 1995. The package consists of:

- **A video** offering an overview of the technique of least squares beginning with an illustration of the comparative worth of qualitative and quantitative knowledge in the physical sciences. The technique is described graphically and non-mathematically. The video is suitable for use in the classroom as well as for self-study by the student.
- **A student booklet** expanding upon and consolidating details presented in the video. In particular the booklet provides necessary background information and introduces unweighted and weighted least squares as well as the role of residuals in establishing 'goodness of fit'. The booklet also acts as a signpost to reference material which will assist in understanding specific points raised and is a resource of useful equations and worked examples. The use of spreadsheets for least squares analysis (with examples and exercises) is also dealt with at some length.
- **An instructors booklet** containing suggestions for use of the package as well as answers to most of the problems/exercises appearing in the student booklet.
- **A disc for PCs** containing examples of spreadsheet layouts (using Excel 5) for least squares analysis as discussed in the students booklet as well as data in ASCII format that may be read by any spreadsheet.

Conclusion

As scientists we find the analysis of experimental data an absorbing and rewarding occupation. We wish for our students to experience similar dividends when analysing experimental data and to communicate in a more compelling manner the role that data analysis plays in the professional life of a physical scientist. Accordingly, we have developed an innovative mixed media package sympathetic to the needs and interests of physical science students. Though the elements mentioned here have been trialed, it is too early for a thorough evaluation of responses to the innovations. First responses from students and staff to the developments have been favourable, but a long term evaluation of the impact on learning and teaching in this important area remains to be done.

Les Kirkup
kirkup@phys.uts.edu.au

It is anticipated that the package will be available for evaluation by May 1996.

David Day, Mark Arundel and Sue Bennett are part of the 'Oxidate Phosphorylation' development team at the ANU

This project was partially funded by a CAUT Grant (1993) with some equipment supplied by Apple University Development Fund.

Oxidative Phosphorylation

A Simulated Experiment

Growing class sizes and declining resources in tertiary education have made support for traditional wet practicals increasingly difficult. In an effort to address the reduction of resources and extend the design of undergraduate experimental work the Division of Biochemistry and Molecular Biology at the ANU has developed a series computer-based laboratory exercises and research projects. These are undertaken over two weeks in usual laboratory sessions.

The software has two main parts - an interactive tutorial and a simulation of the data collection process. The software also includes a reference section, calculator, notepad, and log-in facility.

The program begins with an illustrated and animated introduction to mitochondrial metabolism and ATP synthesis providing reinforcement of concepts met in lectures and tutorials. This is followed by an exercise in calculating the quantities and volumes of reagents for media preparation which the students must complete before moving to the next step. Feedback and optional hints are provided to assist them. The final section of the introduction describes the set up and operation of the oxygen electrode through illustrated text and QuickTime movies.

The second part of the program emulates the collection of data in the traditional laboratory-based practical. Second year students are guided through a set of six simple experiments which illustrate the oxidation of various substrates by mitochondria and the effects of various inhibitors and uncouplers. Rates of oxygen uptake can be calculated from the recordings generated on the screen. This version of the simulation is aimed at biochemistry students studying bioenergetics for the first time.

A more advanced version of the simulation provides access to the full range

of menu options allowing the selection and addition of mitochondria and reactants in any order or quantity. This is used by third year students to design their own experiments with the program responding realistically to virtually any imagined assay that can be preformed with isolated animal mitochondria. A series of unknown compounds has been built into this version and students are required to design a set of experiments which will lead to a positive identification of the compounds.

The software has been trialed with groups of students at the ANU, the University of Western Sydney, and James Cook University. Evaluation in the form of questionnaires and group discussions was carried out with the assistance of the Centre for Educational Development and Academic Methods at the ANU. The results were very encouraging.

The questionnaires indicated that "When comparing the instructional software in this unit with others that the students have used, 74% of the students rated it as excellent or very good whilst 94% either agreed (52%) or strongly agreed (42%) that the software in this unit was a valuable learning resource. Overall comments were laudatory of this innovation...". In a group discussion held at the ANU students were highly positive about the value of the animation for improved visualisation and the opportunity to conceptualise the process without the pressure of data collection.

We recommend that the simulation be used in conjunction with a demonstration of the real equipment and material which allows students to appreciate the technical difficulties which the simulation removes.

David Day, Mark Arundel and Sue Bennett
sue.bennett@anu.edu.au

For further information on this package contact:
Mr Mark Arundel, Multimedia Coordinator, c/-
BaMBi, Australian National University, Canberra
ACT 0200

The Osmosis Program

Susan Fyfe
Georgina Fyfe
Nick Jenkins
Rod Kevill
Rob Phillips
Angela di
Georgio
are in the
Human Biology
Department at
Curtin
University of
Technology

The CAUT funded project 'the Osmosis Program' was developed for first year Human Biology students studying at Curtin University in the division of Health Sciences. With over 1,000 students undertaking Human Biology in their first semester, the students' background, especially in basic chemistry was very diverse. This, combined with effective but difficult practical material, resulted in many students performing poorly in the part of the unit dealing with osmotic concepts.

The program aims to allow students to master basic chemical principles needed to understand osmosis (the movement of water in and out of cells) and to generate their own data in the laboratory simulation. The *Osmosis* program was built using Supercard[®], incorporates a self-paced background tutorial and a laboratory simulation utilising interactive animation and colour graphics, and comprises three modules:

The Background Tutorial

- with self-testing option and feedback, provides opportunities for students to calculate the osmolarity of solutions and thus determine tonicity. Students lacking confidence in basic chemical concepts may work through a section of basic chemistry to help them master required skills. The Background Tutorial also contains a review of membrane transport and a section on graphing techniques.

The Laboratory

- provides
 - (i) a dialysis bag experiment where students can fill a cylinder and a dialysis bag with different solutions and predict the effect
 - (ii) observation of the effect of hypotonic, isotonic and hypertonic solution on a red blood cell suspension
 - (iii) a quantitative analysis using colorimetry of red blood cell haemolysis under conditions of differing osmolarity.

Post Lab

- where students can check the results obtained in the lab section.

The *Osmosis* program has been fully integrated into the first year Human Biology unit at Curtin University since 1994. Students are introduced to the computers in their second week of semester and are given three to four weeks to master the background material, mainly in their own time. Students then attend the laboratory with their regular lab group and tutor, complete the simulation module and discuss their results.

There have been some major advantages in using interactive multimedia for this laboratory work:

- Students with little background in chemistry have a comprehensive set of materials to help them master concepts and carry out calculations. This has relieved pressure on both part-time and full-time staff for help in this area. Students who are familiar with the concepts can quickly test their knowledge and may require only 30 minutes using the program. Many students without the pre-requisite chemistry spend up to six hours using the program.
- The laboratory component is carried without using consumables and extra technical help.
- Tutors have more time to help individual students and explain the results in the lab time. Discussions during the lab are more focussed and students are less distracted by complex benchtop techniques.
- Students are introduced to on-screen technology and interactive multimedia within a framework of learning and skill acquisition.

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<p>Availability There is a sampler on the Curtin Web Page at the following site http://www.curtin.edu.au/curtin/multimedia/ Requirements: Macintosh computer.</p>

Broader skill requirements of science graduates

This project was funded in 1995 by a CAUT grant to Ray Sleet (Chemistry), Paul Hager (Education) and Peter Logan (Physics) at the University of Technology, Sydney. Malcolm Hooper (Chemistry Department, University of Sydney) was also a major contributor to the project.

The title of this project was 'Enhancing the broader skill requirements of science graduates'. The aims of the project were to enhance students' critical thinking skills, to foster their abilities to work co-operatively with their peers and to assist in the development of their communication skills.

About 60 critical thinking tasks in chemistry and physics have been developed which are designed to foster the critical thinking abilities identified by Ennis (1991). Unlike typical paper and pencil problems in textbooks, the critical thinking tasks developed in this project have missing data; some of the tasks contain irrelevant data and in many of the problems, part of the problem has an open goal in the sense that there is not a unique answer to that part of the task. Other critical thinking tasks are creativity exercises which have wholly open goals. In the tasks which are creativity exercises, students are given some information and they are asked to deduce or calculate as much additional information as they can. Some of the critical thinking tasks have been developed from information and/or ideas obtained from critical incident interviews with scientists in private and government organisations. In fact most of the tasks relate to applications of chemistry and physics in everyday life. For example, there are tasks about the production of analgesic tablets; the analysis of calcium tablets for the prevention of osteoporosis; the design of a solar water heater; hairsprays; hydrocarbon fuels and the use of radionuclides in nuclear medicine.

Most of the tasks have been trialed with first year university students who have attempted them in groups. Some of the tasks are appropriate to be attempted by groups during a 3-hour laboratory session instead of experimental work. The longer or more demanding tasks are suitable

as assignments to be attempted by groups outside scheduled class times. Issues relating to the structure and maintenance of a well-functioning co-operative group have been investigated by Heller *et al.* (1992) and Heller and Hollabaugh (1992). They investigated the teaching of physics problem-solving through co-operative grouping. Several recommendations from their research have been adopted in our project. For example, in accordance with their work, in our project, with few exceptions, there were three students in each group. Each member in a group was assigned a specific role for each task and, following the recommendations of Heller and Hollabaugh (1992), the roles chosen were the manager, the sceptic and the checker/recorder. We have prepared a comprehensive student hand-out which contains advice about solving the critical thinking tasks in a co-operative group. There is advice in the hand-out to enhance the working relationships within a group and to foster the dispositions of a good critical thinker.

Ray Sleet & Peter Logan

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REFERENCES

- Ennis, RH (1991) Critical thinking: a streamlined conception. *Teaching Philosophy* **14**: 5 - 24.
- Heller, P, Keith, R and Anderson, S (1992) . Teaching problem solving through cooperative grouping. Part 1: Group versus individual problem solving. *Am J Physics* **60** (7):627-636.
- Heller, P and Hollabaugh, M (1992) Teaching problem solving through cooperative grouping. Part 2: Designing problems and structuring groups. *Am J Physics*, **60**(7): 637-644.

The critical thinking tasks will be published in a book entitled *Broader Skill Requirements of Science Graduates*. It will also contain ideas on designing tasks to foster particular critical thinking abilities and will have information about co-operative groups and the development of communication skills. Copies of the book will be sent to university libraries in Australia and to UniServe•Science before July 1996.

Some observations on the use of IT in teaching at some US universities

On a recent visit to the USA, as a participant in a very useful study tour organised by Management Frontiers, I was asked by my UniServe•Science colleagues to inquire about IT-related work in science education among the teaching staff I met at the selected universities and higher education centers (I'm using the correct spelling!) visited. I have few general comments, since my overall impression is that IT in education in the USA shows as much variation as here but more money is spent (\$60M for Annenberg/CPB project alone). I was impressed by the level of involvement of the *American Association for Higher Education* in IT-related developments and suggest that interested readers contact Ellen Shortill there (email: shortill@clark.net). She is the program coordinator for technology projects. The AAHE's *Change* magazine is also directly relevant to IT in teaching issues.

At the University of Maryland, College Park, as well as meeting Jim Greenberg, Director of the Center for Teaching Excellence, I also had a demonstration of their electronic classroom by Kent Norman, a psychologist who has several WWW publications that may be of interest. Drew University has, for 11 years, issued each new student with a computer plus accessories (now including Web access) and its staff have considerable experience in learning how to cope with the pace of change in hardware and its cost implications. Bob Fenstermacher (rfenster@drew.edu) is a physicist there with long experience in utilising IT in lab and other classes and in evaluating available software, including computer simulation material.

At the New Media Center at Princeton, I was able to ask about some general issues, eliciting regret that there was yet to be developed in the USA reasonable 'clearing house' type evaluation on networkable materials and that network-specific barriers to importing others' packages was still a problem. Further relevant comment came from Janet Daly at MIT's Academic Computing Center, on web servers: "There is a tendency to forget the 'least common technological denominators' of the audience and to produce overly complex web pages. *There is a need to promote design and technology simplicity.*"

Finally, it is clear to me that the 'Design' above must rest upon a sound underlying instructional design and that this aspect of many high-tech aids to teaching and learning at university level is not well appreciated. The message that it must be was reinforced at all places I visited.

John Mack
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Some links of Interest

The laboratory of Automation Psychology:
<http://www.lap.umd.edu/>

HyperCourseware: A set of interlocking modules for interactive teaching and learning in the electronic classroom and beyond.
<http://www.lap.umd.edu/hcwFolder/hcwHome.html>

The Switched-On Classroom: Teaching in the Switched-On Classroom: An Introduction to Electronic Education and HyperCourseware (a WWW book).
<http://www.lap.umd.edu/SOC/sochome.html>

The Psychology of Menu Selection: Designing Cognitive Control at the Human/Computer Interface (a WWW book).
<http://www.lap.umd.edu/pomsFolder/pomsHome.html>

Report from the Field

*Ian Johnston is
the Director of
UniServe•Science*

CTI/TLTP Conference

For those who are not aware, there are two important government funded, IT-based tertiary education initiatives happening in the UK. These are the CTI (Computers in Teaching Initiative) scheme (established 1990), which acts as a software clearinghouse network and on which UniServe was modelled; and the Teaching and Learning Technology Project (TLTP, established 1993) which brings together consortiums of universities to develop teaching software.

Ian Johnston attended the annual CTI/TLTP conference in November last, at Heathrow*, England. A number of items emerged which are of relevance to UniServe•Science. Firstly the UK Government has guaranteed funding for the CTIs for the next five years, relieving

them of a great cloud of uncertainty. It should be remembered that our government, through CAUT and DEET, has only funded the UniServe network for two more years. Secondly, the UK Government is setting up a similar scheme to service the Further Education sector (read TAFE) on exactly the same lines as the CTI. Perhaps our government might do likewise?

The biggest part of the conference was an exhibition of the current state of all the TLTP software packages — of which there are 20 which are useful in the sciences. If you want further information please contact us.

Ian Johnston

* Why do others get to go to conferences in Bali and Honolulu, and I get to go to Heathrow?

Dry Labs Workshop

Workshop Theme: This workshop is designed to explore the questions involved in attempts to make the teaching of experimental science in 'wet labs' more efficient by the use of 'dry labs', which may consist of simulated laboratory experiences or structured tutorials (often computer-managed). Issues to be addressed are those which are common to all the sciences and include: logistics and problems involved with setting-up; teaching effectiveness and student response; and the intellectual appropriateness of this approach. The speakers for the workshop sessions have had experience in the implementation and/or design of computer-based material for use in 'dry labs'.

Those who have agreed so far to lead these sessions include: Rob Capon (University of Melbourne), Michael Nott (University of Melbourne), Fred Pamula (Flinders University), Mark Arundel (ANU), Audrey Wilson (University of Wollongong), and Rob Learmonth (University of Southern Queensland).

Where: University of Sydney

When: April 12, 1996. 9.30am -5pm.

Proposed Time Table:

Sessions:

9:30-11:00 am Welcome & Keynote Talks - 'Multimedia issues and scientific concerns'

A: Dry Labs in a Chemistry Department

B: Dry Labs in a Biology Department

C: Dry Labs in Biochemistry Departments

D: Pre-Lab sessions

11:00 - 11:30 am Morning Tea

11:30 - 1:30 pm Sessions A & B

1:30 - 2:30 pm Lunch

2:30 - 4:30 pm Sessions C & D

4:30 - 5:00 pm Summary discussion

Cost: UniServe•Science will meet the workshop costs and some travel assistance may be available.

For further information: Call Mick Pope on (02) 351-5783 or email him at PhySciCH@extro.ucc.su.oz.au or visit <http://www.usyd.edu.au/su/SCH/workshop/drylabs>

Calendar of Coming Events

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

CiP 96, Computers in Psychology

CTI Centre for Psychology, University of York,
UK. 25th- 27th March 1996
Tel: +44 (0)1904 433154
Fax: +44 (0)1904433181
email: ctipsych@york.ac.uk
<http://www.york.ac.uk/inst/ctipsych/web/CiP96call.html>

Education Conference, 1996

National Convention Centre, Canberra,
April 9-12, 1996
Tel: (06) 2056594
Fax: (06) 2059387
email: dreaming@spirit.com.au
<http://www.spirit.com.au/acec96/>

EdMedia 96

World Conference on Educational Multimedia and
Hypermedia Boston, USA June 17-22, 1996
email: aace@virginia.edu

Slice of Life - Multimedia in Health Science Education

Copenhagen, Denmark 19-23 June 1996
Fax: +45 35 32 61 50
email: mhse@odont.ku.dk
<http://www.odont.ku.dk/mhse/mhse.html>

12th Australian Institute of Physics Congress

University of Tasmania, Hobart 1-5 July 1996
email: mures@hba.trumpet.com
<http://www.utas.edu.au/docs/physics/>

M²E² A conference on Multimedia in Education

IEEE 2nd International Conference
University of Melbourne, 3-5 July 1996
email: f.crusca@eng.monash.edu.au
Tel: (03) 9 775 3255
Fax: (03) 9 776 8821

The Australian Computers in EdTech96: Learning Technologies: Prospects and Pathways

University of Melbourne, 7th-10th July 1996
Tel: (03) 9 990 51340
Fax: (03) 9 990 51343
email: maureen.kemp@adm.monash.edu.au
<http://www.meu.unimelb.edu.au/EDTECH96/>

Chemistry: Expanding the Boundaries

14th International Conference on Chemical
Education, University of Queensland, Brisbane,
14-19 July 1996
Tel: (07) 3365 6360
Fax: (07) 3365 7099
email: ChemEd96@ceu.uq.oz.au

1996 HERDSA

Different Approaches: Theory and Practice in Higher Education

Perth, Western Australia, 8 - 12 July 1996
Tel: (09) 380 1502/1427
Fax: (09) 380 1156
email: smann@csd.uwa.edu.au /
tmaitland@csd.uwa.edu.au
<http://www.uwa.edu.au/csd/HERDSA/>

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>