

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



# UniServe•Science News

Vol. 5, November 1996

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## From the Director

### Assessing computer assessment

On page five of this newsletter are preliminary findings from some surveys we have conducted about how academics in science departments are using Information Technology in their teaching. Perhaps the most important finding is that, on the whole, we make very little use of Computer Managed Learning. Even though we are happy enough to use the computer as an aid in our teaching, we are reluctant to hand over control of our students' learning to computers and computer software writers. It seems a bit perverse that, in times when our teaching loads are increasing and the cost of teaching must come more and more into question, we are embracing the uses of IT in teaching which involve add-on costs to traditional methods and not paying much attention to employing computers in a way which might actually save money and time.

A good case in point is in how we assess students' progress. Currently the only kind of formative assessment most science departments use with their large first year classes is to set homework exercises. These are (sometimes) marked and returned with comments (ideally soon after they are handed in: in practice, often much later). The same exercises may contribute a small fraction to summative

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**Teaching undergraduate science through 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*

assessment, but this is more usually done by means of end-of-semester, unseen, written examinations. The marking of these homework exercises and examination scripts is a chore which is expensive, time-consuming and (all too often) depressing. When budgetary pressures force us to cut back somewhere it is often the homework marking that goes first — thus depriving students of virtually the only feedback we ever give them. Surely if any part of our teaching should be (at least partly) automated, it is assignment and examination marking.

Nevertheless we academics remain unconvinced. All too often we have a naive view of what computers are capable of doing in this area nowadays. Many of us remember, cringingly, the PLATO packages of a decade or so since, which marked you wrong if you said that the velocity of a body at rest was 0 m/s instead of 0.00 m/s. Many of us still think that multiple choice questions are crude instruments more suited to the kindergarten, to which any half intelligent students can guess the right answer by grammatical clues alone. And how often have I heard it argued that no computer can ever judge as well as a real person whether a student understands something, even though in practice the real person might have to mark hundreds of three-hour scripts in a few days.

Nowadays, computer based assessment (CBA) can be very sophisticated indeed. It can encompass forms such as: true/false selection, matching items on a list, multiple choice, multiple completion, assertion/ reason choice, best answer, word/phrase/ number matching, image selection. For a good review of what is possible, have a look at Newsletter 7(1) of the CTI Centre for Biology ([www.liv.ac.uk/ctibiol.html](http://www.liv.ac.uk/ctibiol.html)). There really is no reason to believe that CBA cannot make a valuable contribution in the assessment we do of our students. It may not be able to take over completely but it can certainly help.

In Australia a few university science departments are using CBA in their mainstream teaching. We at UniServe•Science believe it would be useful to bring representatives from those departments together to share their experiences with anyone else who is interested. Therefore we are planning to hold a second workshop, and devote it to this topic. We had initially planned to do this in October 1995, but the response from departments was that it was too near the end of the year and everyone was too busy. So we will hold on February 14 1997. Put it in your calendar of musts for next year. See below and check the web site for further details.

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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 ...*
- innovative tertiary science teaching*

### **'ASSESSMENT USING COMPUTERS' WORKSHOP**

*14 February 1997 at the University of Sydney*

Cost: \$50 towards costs of the day. A travel subsidy will be available to some participants.

To register your interest please email [PhySciCH@extro.ucc.su.oz.au](mailto:PhySciCH@extro.ucc.su.oz.au)

For further information visit <http://www.usyd.edu.au/su/SCH/workshop2/info.html>

This web page will be updated as information becomes available.

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# Teaching Undergraduate Science Through Problem Solving

The real world of the practising scientist is a world of problem solving. Choosing an effective and efficient experimental pathway to solve such problems is also, in itself, a problem-solving exercise. Which protocol of an array of possible protocols will best meet your needs? How much will it cost? How long will it take? How feasible is it in your laboratory and, most importantly, will it give you a solution? A whole series of questions need to be answered before the wise scientist proceeds. In this real world of science, the practitioner uses a range of approaches: peer discussions, reading the research literature and technical material and trial and error, to name but a few.

How then do we prepare our undergraduates for this real world of practice? The majority of undergraduate science courses in Australia, particularly in the earlier years of the program, are taught through a didactic approach with lectures, tutorials and structured laboratory "experiences". Even in the latter years of the course, the laboratory experience is still fairly structured, presumably with a view to not only providing students with a set of marketable competencies, but also to provide them with what the academic perceives to be skills appropriate to the discipline. To complicate matters, the knowledge-base, and indeed the technical competency, of science is continuously expanding, making the task of designing science, and, in particular, laboratory programs even more difficult.

In our science courses we strive to develop strategies which provide students with the wherewithal to meet the needs of their future workplace. We try to ensure students acquire, not only a sound knowledge base but a set of valuable laboratory competencies. Nevertheless

we need to achieve more, we need to instil in these students the capacity to extend beyond what we have been able to offer in their course work, to develop the skills of life-long learners.

In the B.Sc. (Biological Sciences) offered by the University of Western Sydney, Nepean campus, we have had the opportunity to develop a degree course with these ideas in mind. The course itself only commenced in 1992 with 40 students. This small number made it feasible to try different approaches to enhance student learning. One such approach has been the development of a third year subject in Immunology in which the laboratory activities are completely directed at investigating a real world problem and the content areas are derived from current research literature.

The structure of the subject aims to develop a learning environment which is student-focused, not teacher-focused, and has three components: (1) Review of research literature; (2) Presentations by researchers in the field; and (3) Problem-solving approach to developing laboratory competencies.

In component 1 students, working in pairs, are required to access a research paper in three major designated areas of Immunology. They then analyse the conceptual framework and rationale of the paper, critically evaluate the methodology, and examine the results. Each pair is required to present a five to 10 minute oral critique of each paper to the class; and all students are required to write a review of all three major areas of the course, incorporating information from papers presented in class.

Component 2 of this subject consists of guest lectures presented by researchers in Immunology, the intent of this component being to bring together the student reading and analysis of research literature and

their own experience in developing experimental protocols.

Component 3 is concerned with developing in students an appreciation of their laboratory activities through a problem-solving approach. Students are provided with a set of problems which are either concerned with immunological function or require an understanding of the use of immunological methods. Again students work in pairs, investigate possible experimental solutions, discuss it with their lecturer and each other and finally set up and undertake their experiments, from go to whoa, including ordering and preparing all their own materials and cleaning up!

Early on it became clear that students needed a resource base which would focus their thinking and provide them with guidelines as to the appropriate use and value of specific experimental techniques. Whilst students undertaking the program had already been exposed to a range of laboratory experiences, it was apparent that they needed some direction in how these experiences/techniques could be applied in different situations. As a consequence, as well as developing a series of problems, support material was developed using a worldwide web browser. This support base consists of theoretical material related to immunological structure, function, and dysfunction; practical exercises with pictorial outcomes, relating to the exploration of this theoretical base and a series of references for each topic area.

The use of the web browser permits access from this document to the wider information network of the web. This aspect of the material ensures that the database maintains its currency and with continued updating of the text, continues to be a useful, relevant resource.

In total this approach is designed to develop students skills in:

- i) Problem conceptualisation and evaluation.
- ii) Accessing research literature
- iii) Evaluation of different laboratory methodology
- iv) Peer discussions
- v) Design, implementation and evaluation of laboratory outcomes

This subject has now run for three years, each year and each group of students has been different. The problems have evolved and the web-based support material is still growing as more experimental material and results are added. The delivery of this subject is an intensely personal experience, I have benefited as an academic as this approach maintains my currency in the research area. However, I am no longer totally in control of the subject, it is driven by the students needs and ideas and, just in case you think this approach can't be used by others... in 1996, as I was on study leave, the subject was directed by an immunology researcher, external to the institution, her enthusiasm and satisfaction matched mine.

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## **UniServe•Science Publications**

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

• *UniServe•Science News* is also available online and in Portable Document Format;

• ***New catalogues now available***

The 1996 versions of Biochemistry, Psychology, Chemistry, Geography, Geology, and Physics catalogues of resources are now available for downloading (in Portable Document Format);

• ***New improved searchable database online by the end of November 1996***

From late in November 1996 we will be serving a more comprehensive and faster database. There will be over 3000 items in the database and performance in searching over the Web will be improved through the use of new search software.

# The Place of Information Technology in University Science Teaching in Australia

We at UniServe•Science have always seen it as part of our brief to gather information about what our clients are doing with IT in their teaching. In the past year we have conducted two broad surveys. In the first, we asked all our departmental contacts, by email, a number of open-ended questions. We got responses from 63%. Some months later, we interviewed by telephone contact persons in all 33 of the university physics departments in the country to get more detailed information. We hope to do the same thing with the other disciplines soon. Nevertheless it is worth reporting here what we have found out so far.

The first observation to emerge was that there is a fair degree of what might be termed general 'IT literacy'. Some 80% of all responding science departments

claim they make 'significant' use of IT in their regular teaching programs. Roughly 40% claim that they have active developers within their teaching staff who have produced significant outcomes. These numbers are more or less uniform over the science disciplines (Figure 1).

To get a feeling for the range of IT usage hidden in these figures, it is useful to categorize the responses. There have been many attempts over recent years to classify the various kinds of teaching software — Laurillard, for example, identifies at least nine independent categories (Laurillard 1993). In this context, however, it is more useful to concentrate on the *use* to which the software is put, rather than the software itself, and there are three readily identifiable categories of use of IT

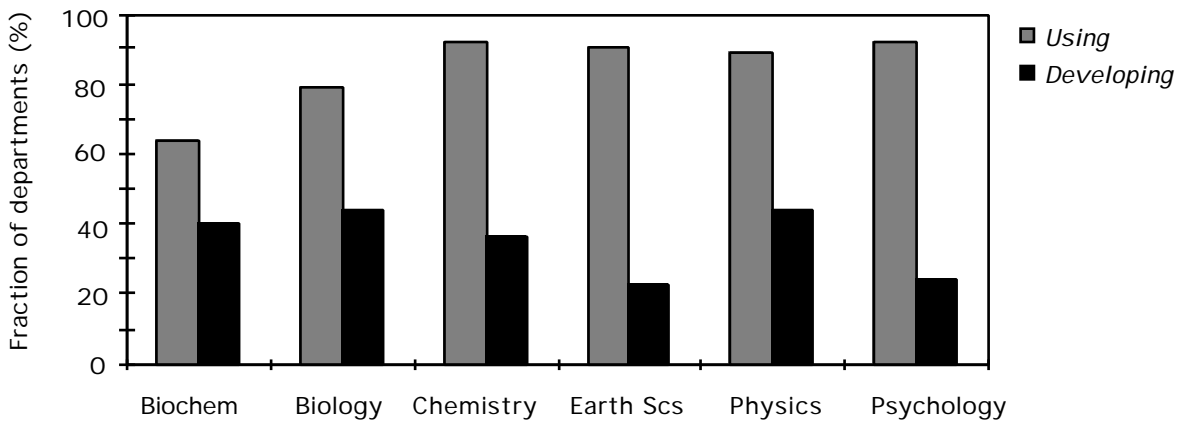


Figure 1. Science departments using and developing IT for teaching.

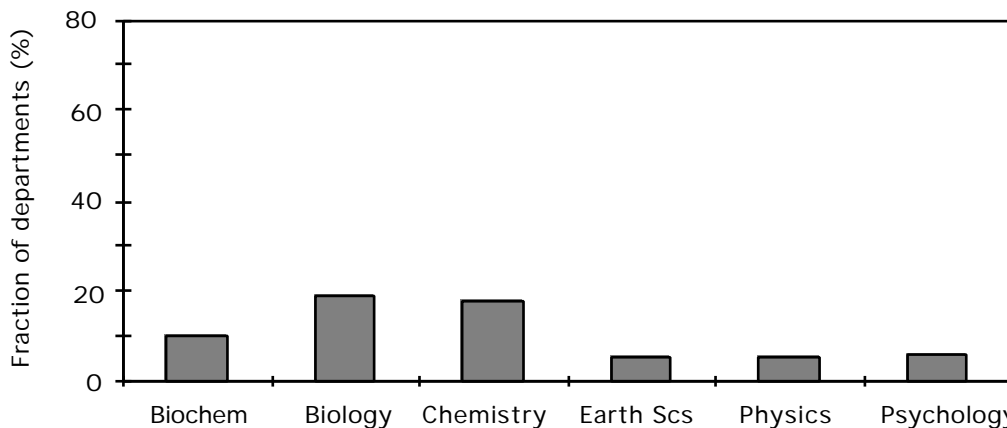


Figure 2. Science departments using Computer Aided Learning in first year teaching.

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(usually, though not exclusively, computers) in science teaching programs.

- **Pedagogical mode:** The computer is used *by students on their own* as an integral part of the *process* of learning. This use includes: CAL packages, computer managed instruction, 'pre-lab' packages and any pre-programmed use of hypermedia textbooks/encyclopedias and the like.

- **Expository mode:** The computer is used *by the teacher during lectures* as a teaching aid or resource. This use includes: computer presentations (PowerPoint and the like); resource compilations on CD or laser disk; in-class computer moderated demonstrations; one-off animations or simulations.

- **Apprentice mode:** The student, *under guidance from the instructor*, learns to use the computer in the manner in which they might use it in their profession. This use includes: statistical packages; model builders; data loggers; some 'dry labs'; simulations; programming languages; symbolic maths packages.

It goes without saying that there is overlap between these categories, and individual software packages may be used in more than one mode. Nevertheless the categorizations are worth making.

### Pedagogical usage

Responses to the first survey show that the fractions (expressed as a percentage)

of the various science departments who make significant formal use of IT in their first year teaching (Figure 2).

The total numbers are small but, clearly, two of the sciences (biology and chemistry) use significantly more IT in the pedagogical mode in first year teaching, than do the others. One might hazard that the reason for this lies in the pressures of increasing student numbers, and cuts in government funding. Or it might be that increased community concerns about student safety in anything to do with blood or hazardous chemicals, use of animals for experimentation, and availability of suitable specimens for laboratory work, have all made courses with 'wet' labs more difficult and expensive to run.

The same question was explored more thoroughly of physics departments in the second survey. The average number of *non-laboratory* teaching periods in mainstream courses which involved the pedagogical use of IT was estimated and is displayed in Figure 3 as a plot of the *fraction of teaching time* against department. For example, a department which give three lectures a week and one tutorial session during which students experienced computer managed problem solving, would rate 0.25. A weighted average mean figure for all Australian university physics departments was calculated by

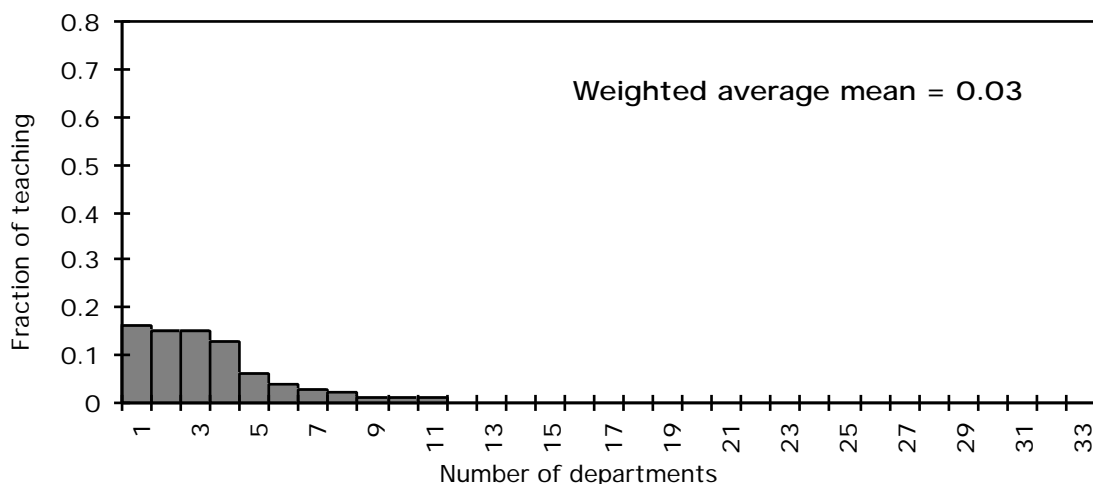


Figure 3. Physics departments using CAL in first year teaching

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multiplying the fraction by the number of first year students in each department, summing and dividing by the total.

There were only four departments for whom the fraction of teaching time involving CAL was significantly different from zero. Of these, three were using it for problem practice or assignment marking. Only the remaining one uses software packages to teach students new material. The conclusion seems to be that physicists do not trust the computer to teach their subject. By extrapolation the other sciences do not trust it much more.

### Expository usage

This mode of use shows rather unexpected fluctuations (Figure 4). What is most interesting here is that two disciplines stand out as using IT in this mode almost twice as much as the others. Perhaps this reflects the fact that both chemists and physicists think of theirs as a particularly pictorial branch of study, and have always had a tradition of using demonstrations during lectures. The closer look at these numbers over all physics departments again shows a very large variation from university to university (Figure 5).

The mean fraction of teaching which uses this kind of teaching (0.21) is very different from the fraction of departments who consider their use of such teaching enhancement “significant” (53%, Figure 4). This may reflect the fact that such use of IT is very time-consuming, and even a relatively small amount of such use requires what is judged to be a

significant amount of effort. It may also reflect a reluctance to devote too much time to an unproved method of teaching.

### Apprentice usage

The fraction of departments who use computers in their teaching of students in ‘apprentice’ or ‘professional’ mode, particularly in second and third years is quite remarkably uniform across the disciplines, all being between 25 and 30%.

When this question was asked no distinction was made between teaching students to use the computer ‘professionally’ in *lecture based courses*, and doing it in *experimental laboratories*. In the physics survey this distinction was drawn. The number of departments which teach ‘professional’ use of computers in lecture-based courses is quite small, and are not presented here. Departments which teach ‘professional’ use of computers in teaching laboratories are shown in Figure 6.

The numbers are reasonably large and remain significant across universities. By and large, those in charge of physics teaching laboratories have been swift to bring the benefits of computers as data loggers and analyzers and controllers to the experiments their students perform. Given the cross-discipline uniformity, it is tempting to suppose that the same is true of all science disciplines.

### Consequences for Tertiary Science Teaching

Right now, the biggest effect of IT on university physics teaching, and

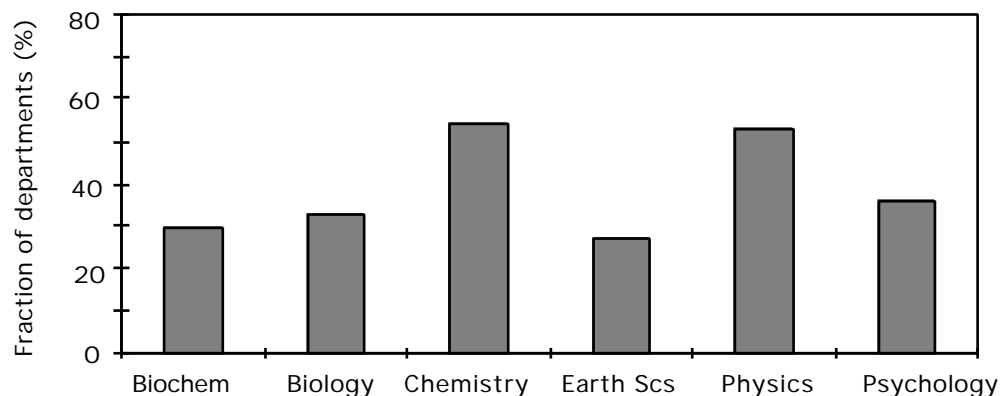


Figure 4. Science departments using IT as teaching aids.

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presumably all science teaching, has been in the “apprentice” or “pre-professional” mode — and most of that has been in teaching laboratories. For many academics, that is where the most interesting intellectual challenge is, and that kind of use is here to stay.

On the other hand the other relatively big use of IT, the expository mode, may not last. There are already indications that its use is being questioned, both for pedagogical and for budgetary reasons (Casanova and Casanova 1991). It is an expensive proposition for ordinary universities to provide facilities to enable instructors to mount an all singing/all dancing multimedia show for small classes of students. For departments with funding problems, such luxuries might prove well beyond their means.

The big challenge however must be in the pedagogical use of IT. Physics is exceptionally slow in this usage, but the other disciplines are not too far ahead.

This is unfortunate. The idea that no parts of our subject can be taught perfectly adequately by computer is surely short-sighted. There is a lot of research being done into how to teach science better. We probably already have the knowledge and the insight to enable us to construct well-focused and successful teaching packages. It cannot be long before the big software firms will realize there is money to be made in writing tertiary software. If we do not do the job, they will do it for us. Ask yourself this question. Who do you want to be teaching your students in the 21st century: you or Bill Gates?

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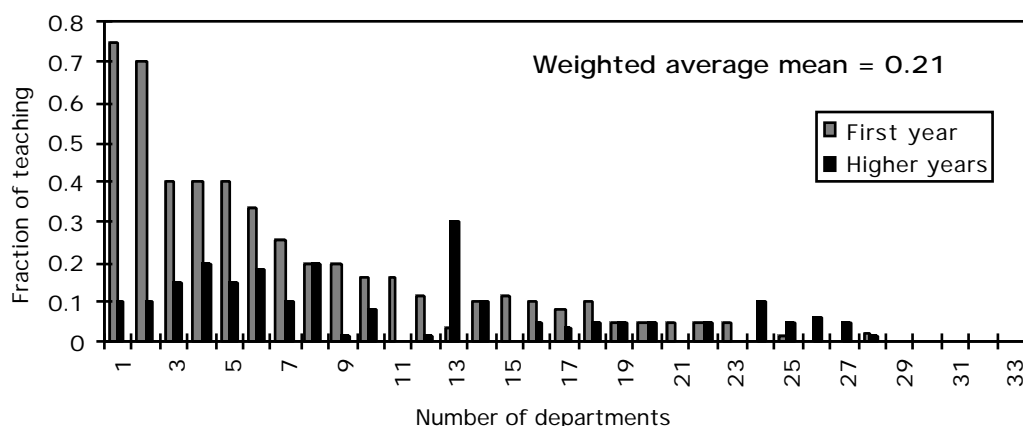


Figure 5: Physics departments using IT in expository mode in teaching.

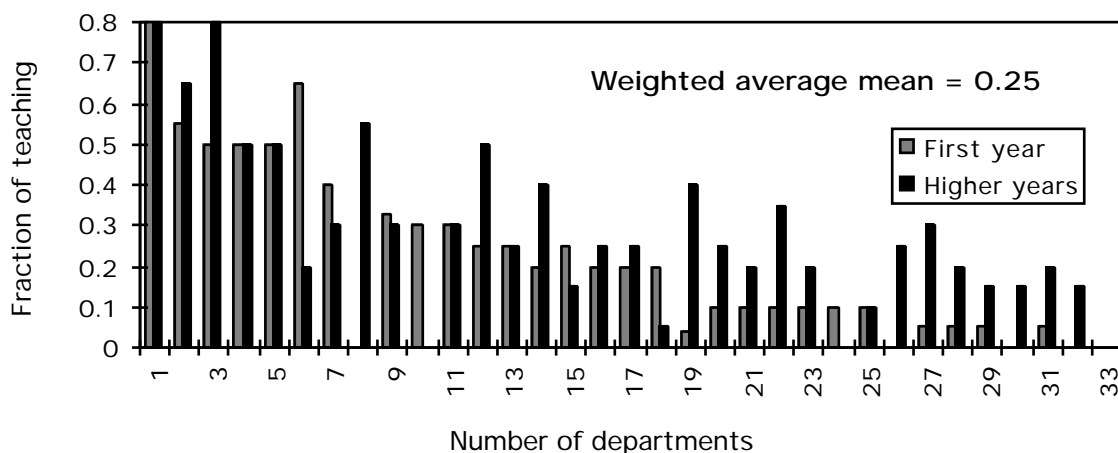


Figure 6: Physics departments using computers in teaching labs.

# Geography Teaching and the Internet

Recent explosive growth of the World Wide Web (the Web) means that the Internet has the potential to become a major vehicle for teaching. Increasingly, the Internet is not something out there to be surfed, and the Web not merely a forum for advertising or offering information. The Web is a powerful means of presenting and delivering course content and facilitating communication between staff and students.

The Web has many advantages over other elements of information technology (IT), including simplicity for the user, cross-platform operability and generic status: students do not need to learn, nor lecturers to support, many different software packages. The basics of establishing Web pages in hypertext markup language (HTML) are straightforward, yet the Web has the power and flexibility to meet many educational demands. For example, Web-based communications systems are quickly making proprietary computer-aided communications packages seem expensive and redundant, while the Web provides a means delivering interactive multimedia (IMM) content in vastly more cost-effective manner than specialist commercial software.

In GEOS114 *Global Crises: Technology and Survival*, a large (400+ students) first-year interdisciplinary Geography/Environmental Studies course unit at Macquarie University, we have experimented with several types of computer-assisted learning since the early 1990s. By using the Web we are now able to link these elements under a common interface, add others, and increase ease of use. The IT-based elements are tightly linked to lectures and a textbook written by the GEOS114 team (Aplin 1995) in a way designed to maximise their educational impact

(Laurillard 1993). In 1996, we have used the following Web-based components.

- *Text and graphics*, including course information, lecture support material, news and advice. Some of this duplicates hard-copy written material, but with the important addition of updates and colour graphics. It is feasible to include the full text of lectures, and in many respects it would be more efficient to do so. With some special exceptions, we have chosen not to: the strong feedback we have had is that most students prefer the security and human contact of the lecture (on audio tape for distance/external students) rather than being given access to the notes. Students who miss lectures probably wouldn't read them either!

- *A variety of practical exercises* supporting skills formation and conceptual development. Some involve simulation exercises with the underlying code written in C++ or Fortran, but delivered via the Web interface.

- *A multiple choice quiz*, originally written in C++ but now converted to a Web environment, increasing its useability and flexibility. This is a means of encouraging regular work by students, monitoring their individual and collective progress, and providing feedback to individuals.

- *An Internet Collection*, providing quarantined access to Internet sites of particular relevance to this course unit. The resource is especially valuable in fields where the scientific understanding is advancing and policy development occurring rapidly (it is much more up-to-date than any hard copy library can hope to be) and to represent the multiple viewpoints there are in many environmental issues. We have not allowed unfettered Internet access, both to save students time and to reduce demand on network links.

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- *An email system* allowing one-to-one communication between staff and students, and broadcast messages from staff to all students. Student-to-student links could be provided readily, but we do not offer email links to those not involved in GEOS114. This facility has been heavily used, and the enhanced communication has been valued by staff and students alike. While time-consuming for staff to deal with messages, they can be batched - unlike telephone calls or knocks at the door!

- *A bulletin board system* that supports group discussion, hypotheticals and, potentially, electronic tutorials. This asynchronous communication has advantages over conventional tutorials, including students ability to participate at a time convenient to them and to reflect on their contribution before making it. Potentially at least, this can empower the less assertive student, allowing them to make more a more effective contribution than in class (Harasim *et al.* 1995).

- *Two IMM packages*, on Forests of Australia and Atmospheric Crises. The former has been under development for several years using Authorware Professional, but can be launched on-campus from the Web (off-campus users have a CD-ROM version, the package being too large to run effectively on-line at current network speeds). This provides a polished interface and many valuable facilities. The second package has been developed in HTML and associated

scripts. While the interface is less elegant, the result is satisfactory and development costs are substantially less.

All these components except the quiz and the Forests of Australia package can be viewed at our web site which is found at [www.es.mq.edu.au/courses/GEOS114/](http://www.es.mq.edu.au/courses/GEOS114/). Some elements are still experimental, with further development needed (for example, in enhancing the bulletin board system). Detailed evaluations will assist this. However, it is already clear that the students, especially the 80+ accessing the material from off-campus, welcome the time and place-flexibility this mode of learning offers.

While substantial public money (via CAUT funds and Macquarie University Teaching Development Grants) and staff time have been invested in the two IMM packages, other components of GEOS114 have been developed with only modest investment. The Web has catalysed IT-based teaching development by removing many hardware and software constraints. It provides a means of achieving many of the touted benefits of IT in teaching and learning, much more economically than was previously possible. It offers an attractive way forward in our attempts to maintain teaching quality in a time of declining resources and to meet changing patterns of demand, particularly for more flexible learning opportunities. In a time of declining numbers of students interested in science, these are important considerations.

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# Creating CAL courseware with Microsoft Excel 5

Spreadsheets provide an easy way to develop computer assisted learning (CAL) courseware based on simulation models or databases. Students' learning can be greatly enhanced by investigating models of real life systems. These models can be of biological, chemical, physical, and socio-economic systems. Spreadsheets can also get students actively involved in problem solving.

In 1993 the CTI Centre for Land Use and Environmental Sciences produced a self-teaching tutorial on developing CAL courseware using the spreadsheet Microsoft Excel (*A practical introduction to creating courseware with Microsoft Excel* by Mary L Cuttle, Clive P L Young and Simon B Heath). This covered Excel versions 3 and 4. It showed how to use Excel's built-in features to create an effective user friendly interface so that the resulting CAL courseware was as educationally effective as CAL courseware developed in other software environments (see Young, Heath and Cuttle, 1994, *The CTISS File 17*, 54). The great attraction of this approach for lecturers, who have existing spreadsheet skills, is that with a small investment to enhance these skills they are able to develop educationally effective courseware from their own existing spreadsheet models and databases. The tutorial described how to improve the formatting of a worksheet, add text boxes and other graphic objects, create charts, and use dialogue boxes. It also demonstrated how to write simple Excel macros that can be run by clicking on a graphic object, such as a button.

Excel 5 has many new features that make it a much more powerful CAL development tool than previous versions. A new tutorial on creating CAL courseware with Excel 5 has recently

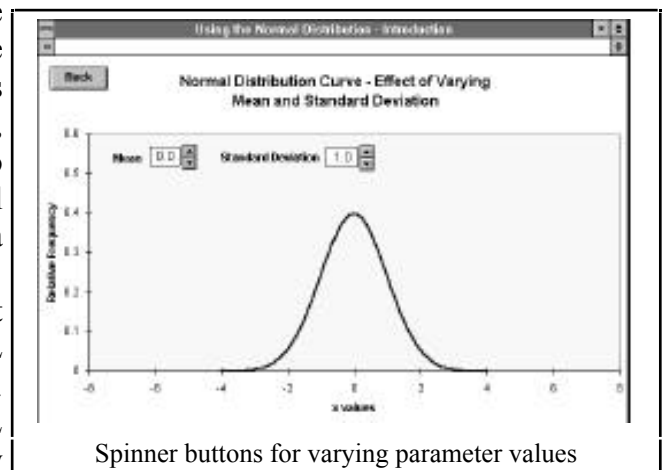
been published. *An introduction to creating CAL courseware with Microsoft Excel 5* has been developed under Project LoCAL (funded under the Teaching and Learning Technology Programme). This new tutorial is an update on the previous tutorial and is based around a new example. It shows how to take advantage of the following new features of Excel 5:

## On-sheet controls

In previous versions of Excel, the only type of control that could be placed on a worksheet was a command button or a graphic object with a macro attached to it. Also, no buttons or graphic objects could be added to a chart sheet. In Excel 5, a variety of controls can be placed on a worksheets and chart sheets. These include option buttons, check boxes, drop-down lists, list boxes and spinner buttons. Macros can easily be attached to these controls.

## Easier custom dialogue boxes

In Excel 3 and 4, custom dialogue boxes are defined by a dialogue definition table on an Excel macro sheet. However, editing a dialogue box or linking macros to the controls on a dialogue box through the dialogue definition table is not very straightforward. In Excel 5, graphical representations of custom dialogue boxes



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are saved in an Excel workbook as dialogue sheets, and making changes to a dialogue box or attaching macros to the controls is much easier.

### Menu editor

Excel 5 has a Menu Editor which makes customisation of the menu bar far easier than in previous versions. It is straightforward to add or remove menus and menu items, and a customised menu bar can now be saved with a file.

### Visual Basic for Applications programming language

Excel 5 has Visual Basic for Applications (VBA) as its macro language. This is a powerful programming language which can be used to control Excel objects, such as cells, buttons and charts. It is great advance on the original Excel macro language and can be used to develop very sophisticated custom applications. VBA procedures are entered on module sheets. These are far more convenient to use than the previous Excel macro sheets where code had to be entered into spreadsheet cells.

### New workbook structure

All Excel 5 files are workbooks which can contain several worksheets, chart sheets, module sheets and dialogue sheets. The names of the sheets in a workbook can be displayed on tabs at the bottom of the screen and users can move to a different sheet in a workbook by clicking on its sheet tab. Sheets can also be renamed so that their function is more self-explanatory. In previous versions of Excel, sheets had to be created separately and then grouped and saved as a workbook.

On completing the tutorial, *An introduction to creating CAL courseware with Microsoft Excel 5*, the learner will have created a CAL courseware module designed to help students learn about the normal distribution. The self-teaching tutorial takes the learner step-by-step through the development of the module. Learners will then be able to develop their

own applications using and adapting the ideas and features learnt with the aid of the tutorial. The tutorial is divided into the following five chapters:

1. *Building the Spreadsheet* - shows how to set up the main worksheet for the example and embed a chart in it.

2. *Improving the Interface* - shows how to improve the appearance of your worksheet by using graphic objects.

3. *Using Controls and Macros* - introduces ways of customising an Excel application with on-sheet controls and simple macros.

4. *Adding Dialogue Boxes* - gives examples of more advanced macros and shows how to use different types of dialogue box.

5. *Distributing Courseware* - gives details of ways that you can improve the useability of an Excel application and includes several useful macros.

Joanna Tidball  
clues@abdn.ac.uk

### *An Introduction to Creating CAL Courseware with Microsoft Excel 5*

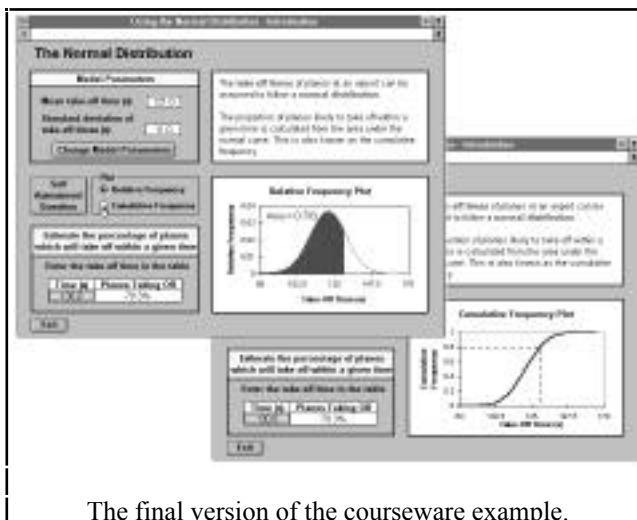
Cost: £25 (including postage and packing).

You can obtain your copy by sending an order to:

Centre for Computer Based Learning in Land  
Use and Environmental Sciences (CLUES),  
MacRobert Building,  
University of Aberdeen,  
Aberdeen AB24 5UA, UK

Tel: +44 1224 273755 Fax: +44 1224 273752

Email: CLUES@abdn.ac.uk



The final version of the courseware example.

## Review

Jenny Wilkinson  
is a Lecturer  
with the School  
of Biomedical  
Sciences,  
Charles Sturt  
University

# MedPics Image Library

About five minutes into using this package I was struck by how useful it would have been in some recent lectures I had given on the cardiovascular system. As I progressed through the rest of the CD all sorts of applications came to mind - the sign of a truly useful piece of software. This CD contains a series of images and text which cover the histology and pathology of each major organ system of the body. There are sections dealing with the cardiovascular, endocrine, gastrointestinal and reproductive systems. A third domain on haematology is to be added in the future.

A title page with 3-4 learning objectives and a list of images provides a menu for each system. Navigation is very easy and is based on forward/back arrows or icons across the bottom of the screen. These display pictures of organs, or if you want go back to the 'big picture', or title page, a TV set.

Screens follow the same format with an image, title, pathological or histological descriptions of the specimen and an icon to allow labels to be displayed. One or more of these page features can be hidden when used for self-testing. For example the user could test their diagnostic skills by hiding the title and labels and using just the image to determine an appropriate title for the specimen. In full quiz mode only the image is shown. While it is not possible to permanently disable the titles and labels this is still a useful review feature. The images themselves range from microscope sections to photographs of gross anatomical specimens and line drawings. In general the quality is very good particularly in the photographs. My only criticism in this area was that some of the photomicrographs were unclear and of insufficient magnification to be of much use. All images were labelled with their main features, here there was a bit of inconsistency. Labelling varied from lines to

arrows and circling of relevant areas - this was fairly clear but there seemed to be no consistent colour style. Sometimes lines were black other times yellow or red, not a major fault, just a bit distracting. Two things mar an otherwise excellent product. The first was the lack of scale bars on the photomicrographs and the other was the grey overlays used as labelling in a small number of images. These overlays totally obscured the image and would have been better replaced by the outlining of areas (this was the predominant way that large areas were indicated in images). The text accompanying the images was clear and concise. In the pathology section this text was made up of a pathology report followed by findings and impressions about the specimens. Descriptions of histological features accompanied the histology images.

Overall I was very impressed with this package and feel that it would be useful for any student studying histology and/or pathology and needing an overview of these areas. Being self-contained and so easy to use, this would be highly suitable as a stand-alone teaching tool. I can see this being a valuable addition to lab classes it could be used to supplement the 'live' material or to show items that are hard to obtain. This CD certainly wasn't what I had expected from the title - an image library. With objectives (simple, but useful), explanatory text, and labelling this is more a teaching package than a simple library of images.

Jenny Wilkinson

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<p><i>MedPics Series: Images Library for Medical Education - Histology and Pathology</i></p> <p><b>Requirements:</b> PC Windows: 386, 4MB RAM. Macintosh: System 7.0; 4 MB RAM; colour.</p> <p><b>Cost:</b> Histology \$685 Pathology \$685 both \$1195</p> <p><b>Supplier:</b> MathStat Software, PO Box 786, Mulgrave, Vic 3170 email: <a href="mailto:info@mathstat.com.au">info@mathstat.com.au</a></p> <p>URL: <a href="http://www.mathstat.com.au/">www.mathstat.com.au/</a></p> <p>Tel: (03) 9562 2766 Fax: (03) 9561 5524</p> <p>See also <a href="http://visiblep.com/medpic.html">http://visiblep.com/medpic.html</a></p>
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# Introduction to Remote Sensing Computer Aided Learning

Toni O'Neill is a Senior Lecturer in the School of Geosciences, University of Wollongong

The Remote Sensing Computer Aided Learning (RSCAL) modules *What is Remote Sensing?*, *Spectral Signatures* (covering basic concepts of remote sensing) and *Air Photo Interpretation* and *Multispectral Scanner Interpretation* (covering the more complex issues of interpretation) make up this introduction to Remote Sensing. The aims are clearly set out at the beginning of each of module. Each module has a number of menu items and the students can do these sequentially or choose particular topics to revise.

The sections are arranged logically and each builds on the previous section. I have found for the initial student practical it works best for the students to work through the suggested sequence. In the two interpretive modules the programming is more sophisticated, more use is made of animation and the modules are more interactive.

The instructional section (classroom) of each module is followed by a practical test on which the student is scored. The answer is scored as correct or incorrect and a short correct explanation is shown before the presentation of the next question. Students need to take care when answering questions as spelling errors are scored as incorrect and some of the more lateral thinking students often give technically correct answers which may be

scored as incorrect due to the limitations of the programming. Progressive test scores are shown on the student's screen and the final scores can be retrieved by the lecturer later. In the two more recent interpretive modules the test is in the form of a computer game. Students choose from three practical exercises structured as a remote sensing rally. Each rally occurs in a different geographical location (New York, Perth, or the Gold Coast) and a range of remotely sensed images are used. This allows for a range of different types of environments to be experienced as well as providing the challenge of unfamiliar geographical areas. In the *Air Photo Interpretation* module both vertical and oblique aerial photographs at a range of different scales are used. Landsat TM images as well as SPOT panchromatic 10 metre resolution and SPOT-XS, 20 metre resolution data are used in the *Multispectral Scanner Interpretation* module. Unfortunately the images as they appear on the screen are not as clear as they would appear on an image analysis screen. They seem to have lost resolution in the translation to the program.

I felt there was a little unevenness in the approach to *Digital Image Analysis* module. Whilst ratios and difference images are well done, image enhancement and spatial filtering are only briefly

**Module 1 - What is Remote Sensing?**

- The Science of Remote Sensing
- Data Capture and Analysis
- Remote Sensing Information Types
- Passive and Active Remote Sensing
- Scanner and Camera Systems
- Physical Processes of Remote Sensing
- Energy, Space and Time in Remote Sensing

**Module 2 - Spectral Signatures**

- Introduction
- What is a Spectral Signature?
- Identifying Vegetation, Soil and Water
- Spectral Characteristics of vegetation
- Spectral Characteristics of Soil
- Spectral Characteristics of Water
- Applications of Remotely Sensed Data

**Module 3 - Air Photo Interpretation**

- The Air Photo
- Air Photo Annotation
- Simple measurements from Air Photos
- Radial Displacement
- Air Photo Interpretation Clues

**Module 4 - Multispectral Scanner Interpretation**

- The Multispectral Scanner
- Scanner Platforms
- Image Annotation
- Image Interpretation
- Digital Image Processing

## Review

covered. This medium would be excellent for displaying how spatial filters work on pixels, lines and over whole regions.

I have used these modules in a second year introduction to remote sensing course over the last two years and have found that they are best used as an adjunct to lectures, to revise and back-up lecture materials. I program one supervised practical session using the units. Students then complete and revise the units in their own time. The students reaction to the use of these modules has been enthusiastic. There have been many positive comments on the ease of use, the interesting graphics, the interface and how the program has assisted understanding of some of the more difficult concepts. In 1995, 63 students responded to an evaluation questionnaire. The results of questions about the RSCAL software found that very few students have found difficulty in the use of these CAL modules.

The RSCAL units are an excellent resource for teaching introductory remote sensing. We use the *Air Photo Interpretation* module for first year Geography students and the other three modules in the second year Remote Sensing of Environment course. Student reaction has been very positive when initially introduced to the modules. They have fun using them and learn quickly. There has also been heavy use of the modules for revision before the final exams. I highly recommend these innovative learning modules for undergraduate remote sensing courses.

*Toni O'Neill*  
t.oneill@uow.edu.au

**Requirements:** PC running DOS, VGA graphics, colour monitor, mouse and 5MB free HD space.

**Authors:** Australian Key Centre for Land Information Systems (AKCLIS) and the University of Queensland, Computer Assisted Learning Unit. Edited by Dr Gail Kelly and Professor Greg Hill.

**Distributor:** AKCLIS c/o Dept of Geographical Sciences and Planning, University of Queensland, Brisbane Qld 4072 Fax: (07) 3365 6899

email: g.kelly@mailbox.uq.oz.au

**Cost:** \$185 (site licence by negotiation).

## Resource List

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

### CTI Biology

email: CTIBiol@liv.ac.uk

URL: www.liv.ac.uk/ctibiol.html

### CTI Chemistry

email: CTICChem@liv.ac.uk

URL: www.liv.ac.uk/ctichem.html

### CTI Geography (with Geology)

email: CTI@le.ac.uk

URL: www.le.ac.uk/cti/

### CTI Physics

email: CTIPhys@surrey.ph.ac.uk

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

### CTI Psychology

email: CTIPsych@york.ac.uk

URL: www.york.ac.uk/inst/ctipsych/

### Intellimation

Dept 5CKF, 130 Cremona Drive,

Santa Barbara CA 93116, USA

email: intellFM@aol.com

Tel: 1 805 968 2291

### BioQUEST Curriculum Consortium

Department of Biology, Beloit College,

700 College Street, Beloit WI 53511, USA

email: bioquest@beloit.edu

URL: www.beloit.edu/~bquest/

Tel: (608) 363-2743 Fax: (608) 363-2052

### Geo-Slope International

#1830, 633-6th Avenue S.W.

Calgary, Alberta, Canada T2P 2Y5

email: info@geo-slope.com

URL: www.geo-slope.com

### The Digital Chemistry Company

PO Box 332M, Manunda,

Cairns 4870, Qld

email: digichem@internetnorth.com.au

URL: www.digichem.co.uk

### Slice of Life

EHSL#589, University of Utah, Salt Lake City,

UT 84112-1185, USA

email: slice@slice.med.utah.edu

URL: medstat.med.utah.edu/sol/about/index.html

### Molecular Simulations Inc.

4 Glen St, Milsons Point, NSW 2061

email: solutions@msi.com

URL: www.msi.com

# Question Mark

*Question Mark* is a set of three applications for the construction and delivery of tests or surveys (*QM Designer* and *QM Presenter*), and for the reporting of user performance or responses (*QM Reporter*).

There are templates for a number of question styles to choose from within *QM Designer* ranging from simple multiple choice to more difficult questions that involve the ranking of answers in order of relevance. Each style has a number of variations, and graphics, movies or sound can be easily embedded into the questions to keep the test 'interesting'. All screen components of the questions are able to be edited allowing you to fully customise any style of question to suit your needs.

As well as creating questions in *QM Designer* you can create "Banks" of questions and store them in libraries. Libraries can be incorporated into a test either as a whole, with all questions being delivered, or partially, with selected questions being delivered. Either option allows the randomising of the questions. Libraries, when used as question banks, are a very time effective and powerful option.

Test delivery options include: setting a time limit, question sequencing, user information, feedback options and question retry options. Answer files are created if "Save to disk" is selected in the "Test Control" options window and can be password protected and saved on the local hard disk or on a mounted server volume.

*QM Presenter* is the run time application for the secure delivery of the "test" and *QM Reporter* produces reports on user performance. Reports can be simple "Name and Result" style or comprehensive reviews of user results question by question (useful for surveys). There is basic statistical analyses available within reporter and reports can be exported as Excel, DbaseIII or CSV text files.

In addition to the basic set of applications there are "Add ons" for added functionality. These include

additional security, different languages and *QM Web* for placing the surveys or tests on the Internet.

Tests or surveys can be printed if required and results can be entered manually into *QM Presenter* for analysis by *QM Reporter*. This is time consuming and is recommended only for small class/sample sizes.

The aim of any test generating software is to produce interesting questions with the minimum of programming effort. *Question Mark* it achieves this aim with the numerous styles of questions, smooth integration of media components and its ease of building and editing questions. *QM Designer* definitely falls into the intuitive category with very little need to consult the extensive manual. I must admit to looking up the manual for more complex operations, but generally I found button descriptions (when moving the mouse over the toolbar), and the online help adequate.

I would recommend this application to people interested in creating tests or surveys on the basis of the *QM Reporter* summary functionality alone but *Question Mark* is more than that. This is definitely a wheel that does not need to be re-invented.

Rob Mackay-Wood  
rob@bio.usyd.edu.au

**Requirements:** *Macintosh:* any modern Macintosh, including on the Power PC. System 6.0.7 or later is required.  
*PC:* mouse, Windows 3.1, at least 4 MB RAM; *Windows 95:* at least 8 MB RAM. The software works on all common networks that support Windows; *PC DOS:* To create tests: 640K RAM and a hard disk. To deliver tests: 512K RAM and a hard or floppy disk. To use graphics, you need a graphics display; *Question Mark* supports VGA, EGA, MCGA and CGA displays.  
**Distributor:** Question Mark Australia, PO Box 76 Fairfield Victoria Australia 3078  
URL: <http://www.qmark.com>  
Tel : (03) 9486 8344 Fax: (03) 9 486 7187  
email : [qmark@melb.alexia.net.au](mailto:qmark@melb.alexia.net.au)  
**Cost:** Question Designer \$1280; QM Guardian \$680; QM Web Converter \$550 (2.5x these costs for a departmental site licence).

Rob Mackay-Wood is a Courseware Developer with the School of Biological Sciences, University of Sydney

# Controlling experiments in Psychology

Experimental psychologists are increasingly reliant upon general-purpose computers for the collection of data in both teaching and “publication quality” research. A typical psychological experiment consists of the presentation of a stimulus, often visual, followed by the recording of the time taken to make some kind of response. On the face of it, the computer seems an ideal tool for this kind of situation, but there are nasty issues revolving around the accurate timing of visual events on a computer monitor and responses made on a keyboard which form potentially traps for the unwary. It often seems that the psychologist must either place very heavy reliance upon “experts” to solve such problems, or get on with the job of learning C++. Both of these strategies are costly, and should be unnecessary in a perfect world.

SuperLab by Cedrus comes as close to creating this perfect world as seems possible. Originally developed in a Macintosh environment, it has now been released for Windows as well. (This review is based upon SuperLab version 1.4 running under Mac OS 7.5.) SuperLab allows the experimental psychologist with virtually no programming skills whatsoever to create relatively complex designs involving visual or auditory stimuli and responses recorded either through the keyboard or serial port, without having to worry about the accuracy of either aspect of their

experiment. Visual stimuli can be locked to the vertical blank, and keyboard responses can be collected with plus or minus 1 ms accuracy.

The SuperLab interface requires only that the user can point a mouse and click. Visual stimuli are imported as PICTs, and a number of properties can be attached to them (for example their duration of display, what events will cause termination of the trial, what the correct response is, etc.). Auditory stimuli may also be incorporated as SNDs.

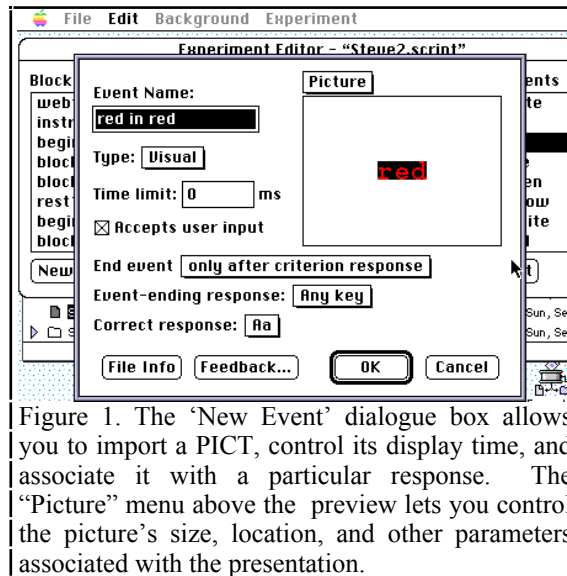


Figure 1. The ‘New Event’ dialogue box allows you to import a PICT, control its display time, and associate it with a particular response. The “Picture” menu above the preview lets you control the picture’s size, location, and other parameters associated with the presentation.

A “trial” is then created by connecting one or more stimuli together, for example a prime, followed by a delay, followed by an event that the subject must respond to. Then blocks of trials can be created by connecting trials together in a similar way. The order of trials can be randomised, although it is to be hoped that

the latest version of SuperLab has improved the procedure for seeding the random number generator. The experiment is saved as a “script”, and is run under SuperLab (with extensions switched off, of course).

SuperLab collects responses as required, and then very politely writes them out to an Excel spreadsheet compatible file, with indications of correct responses, trial type, etc. There is a facility to attach condition labels, to make summarising the data even easier. SuperLab will also save the experimental script as an Excel spreadsheet, making error checking straightforward. The

## Review

manual is brief, easy to read, and informative, but hardly necessary in most cases. Some demo scripts are included which provide a good starting point for the 'cut-and-paste' experimenter.

I have found SuperLab to be invaluable. I can get an experiment up and running very quickly, and feel comfortable that the job is being done right. What's more, I have found that students, some of whom could reasonably be described as computer phobic, have been able to create experiments with very little pre-training and almost no ongoing support. This has enabled us to complete some projects which could otherwise have fallen prey to the time constraints of contemporary academic life. Better yet, creating scripts in SuperLab has provided some individuals with just about their first positive interactions with a computer, and getting a script to work correctly has a positive effect on self esteem.

SuperLab is not the magic bullet for experimental psychology, and it is important for the user to know its limitations. For example there is no "case" or "if-then" structure, which means that it cannot cater for experiments which involve changing what is presented on the basis of responding. However, many experimental paradigms in Psychology do not require such flexibility, and SuperLab is an ideal product in these cases. As my students have recently observed: "Data makes everybody smile". Collect some, and you'll see they're right.

*Stephen Provost*

provost@psychology.newcastle.edu.au

Chris Eccelston's review of SuperLab can be found at:

<http://www.york.ac.uk/inst/ctipsych/web/CTI/DirTxt/reviews/superlab.htm>

The latest version of SuperLab for Macintosh is 1.68, and version 1.01 for Windows.

**Distributor:** A free demo disk can be obtained from [superlab@cedrus.com](mailto:superlab@cedrus.com). It is hoped that demos will be downloadable from [www.cedrus.com](http://www.cedrus.com) before the end of November.

**Cost:** AU\$699 (Education) for a single license: Five- and ten-user packs are also available.

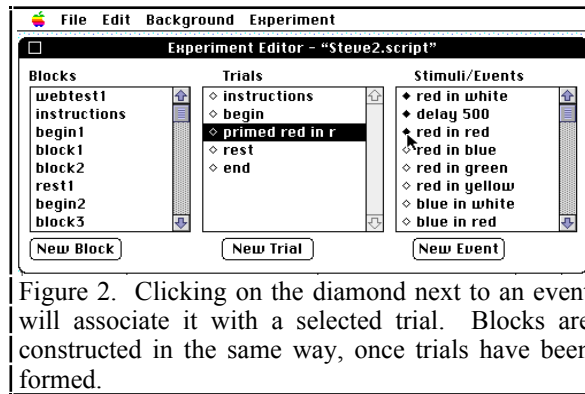


Figure 2. Clicking on the diamond next to an event will associate it with a selected trial. Blocks are constructed in the same way, once trials have been formed.

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## Conference Report

### MHSE 96: Multimedia in Health Science Education

The first Multimedia in Health Science Education Conference was held at the Panum Institute in Copenhagen in June 1996. This was held in conjunction with the 7th Annual Slice of Life Workshop. The videodisc *Slice of Life VII* was launched at the conference, it contains 44,000 images from over 200 contributors. All images can be used by multimedia developers for inclusion in software modules. The conference devoted more than 70% of the time for demonstrations and hands-on sessions. The occasion facilitated exchange of new ideas and new teaching models and designs. On the European scene there is a strong interest to develop teaching materials on a European scale. The European Union have talked of collaboration and all those attending the conference were invited to be involved. Much of the keynote addresses and discussions were about collaborative development of multimedia, in particular Andrew Booth (TLTP project 'BioNet', Leeds University, UK) gave a model for the project management of such a development. Goran Petersson stressed the importance of collaborative evaluation of materials.

*Mary Peat*

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Andrew  
Cheetham, John  
Rayner, and  
Susan Bennett.  
School of  
Electronics  
Engineering and  
Applied Physics,  
University of  
Canberra

# Understanding the Unobservable

## A Reconstruction of First Year Quantum Physics

*Understanding the Unobservable* is a Computer-Based Learning (CBL) package developed at the University of Canberra and designed to present first year quantum physics within an engineering context for students of electronic engineering and the physical sciences.

In traditional first year physics courses Quantum Physics is a notoriously difficult subject to teach at the introductory level. The main cause of difficulty is the non-intuitive, indeed in many respects counter intuitive, nature of many of the concepts presented. Traditionally this material is presented historically starting from Planck's explanation of black body radiation with applications such as lasers or semiconductors receiving cursory attention towards the end of the course. Unfortunately the conceptual framework of the material, and its vital importance to modern technology is usually lost in this approach. A further impediment to understanding, and even acceptance of the material, is that our students ask the question, why do engineers need to know

or understand this? With quantum effects playing an ever increasing role in modern electronics it is vital that first year students not only understand this material but also appreciate its importance in electronic devices.

This course begins with a number of engineering applications, such as solar cells for solar powered cars, which all ultimately rely on the semiconductor pn-junction. Understanding the operation of the pn-junction provides the trigger for introducing quantum physics via photons and the photoelectric effect. The course then proceeds through a series of six further modules working through the material presented below to arrive back at the pn-junction where a detailed experiment is carried out on solar cells.

The package is divided into the following sections:

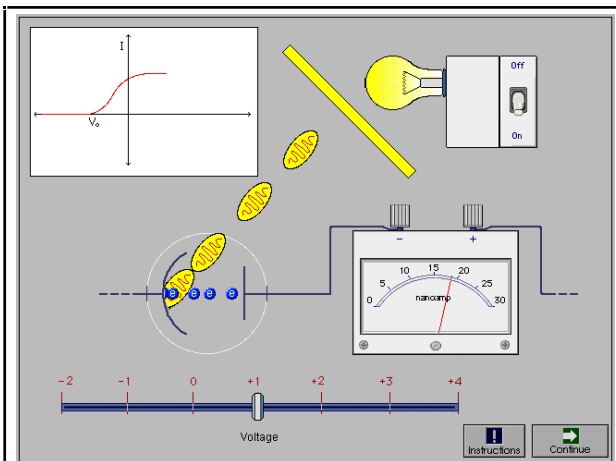
- 1: From Systems to the Subatomic.
- 2: Photons and Quantisation.
- 3: Atomic Spectra and Bohr Theory.
- 4: Further Quantum Effects and Implications.
- 5: Atomic Structure.
- 6: Energy Bands and Intrinsic Semiconductors.
- 7: Extrinsic Semiconductors and the *p-n* Junction.

An Interactive Multimedia format on CD-ROM was chosen for several reasons. It allowed us to show through animations the relationship between what was happening at the atomic level to the macroscopic observations. Additional benefits included the simulations of experiments, visualisation of mathematics, and the incorporation of practical applications as well as all the usual benefits of a self-paced, interactive presentation.

The project is now complete in that the package is being shipped to all Physics and Electronic Engineering departments in Australian universities. What remains to be carried out is an evaluation of the effectiveness of the course.

*Andrew Cheetham*

andrew.cheetham@canberra.edu.au



An example of a simulated experiment, in this case the photoelectric effect. Here the student can change the potential across the phototube using the slider at the bottom of the screen. As the potential is changed the current on the meter changes appropriately, the electrons flow in the tube (only if the light is turned on!) and the Current/Voltage graph is plotted. The student is asked to make certain observations for use later in the experiment.

# Calendar of Coming Events

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

## **ASCILITE '96**

*'Making new connections'*

2 - 4 December 1996, Adelaide

Tel: (08) 8303 5422 Fax: (08) 8303 3696

email: ASCILITE96@maths.adelaide.edu.au

URL: www.netspot.unisa.edu.au/ascilite96/

## **International Conference on Science, Mathematics and Technology Education**

*'Science, Mathematics and Technology Education and National Development'*

6 - 9 January 1997, Hanoi, Vietnam

email: qlc@lawson.its.utas.edu.au

## **Learning through Teaching**

5 - 6 February 1997, Perth

Tel: (09) 360 6418 Fax: (09) 310 4929

email: romana@cleo.murdoch.edu.au

URL: cleo.murdoch.edu.au/asu/staffdevt/

tlforum97.html

## **OzCUPE3**

*A Diversity of Approaches*

The Third Australian Conference on Computers in University Physics Education

2 - 4 April 1997, Brisbane

Tel: (07) 3864 2589

email: j.davies@qut.edu.au

URL: parma.QUT.EDU.AU/phys/ozcupe3/

## **CAUSE 97 in Australasia**

*Information Technology - The Enabler*

13 - 16 April 1997, Melbourne

Tel: (03) 9660 1790 Fax: (03) 9663 1750

email: knox@rmit.edu.au

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

## **ED-MEDIA 97**

*Educational Multimedia and Hypermedia*

14 - 19 June 1997, Calgary, Canada

Tel: 804 973 3987 Fax: 804 978 7449

email: aace@virginia.edu

URL: aace.virginia.edu/aace

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

1 - 9 July 1997, Melbourne

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

email: convnet@peg.apc.org

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

## **INTERACT 97**

*Discovering new worlds of HCI*

Sixth IFIP Conference on Human-Computer Interactions

14 - 18 July 1997, Sydney

Tel: (06) 257 3299 Fax: (06) 257 3256

email: interact97@acs.org.au

URL: www.acs.org.au/interact97

# UniServe Sites

## **Co-ordinating Centre**

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**

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) 9351 2960

Fax: (02) 9351 2175

email: director.science@uniserve.edu.au

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