

Menu-Driven Assessment in Psychology

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Psychology at the University of Sydney has an enrolment of approximately 500 students in second year, so ways are being sought to cut down marking loads, and, at the same time, assess students appropriately but more efficiently. One of our teaching laboratories has 18 Macintosh Performa 5200s, networked to a remote server. For each individual strand in the second-year course (e.g. Cognitive Psychology) we run 18 - 20 tutorial groups per week, with tutorial sizes varying between 10 to 30 students. More students than machines in many tutorial groups means that we have to assess one half of a group in the first half hour of an assessment tutorial and the remaining students in the second half hour.

We have been programming various test and item formats with Macromedia Authorware and are still in the process of developing reliable security procedures for test administration and storage of test results. After a welcome screen, the tutor is required to type in a password for each machine, otherwise the test will not load. Passwords are changed regularly during the course of a week's assessment. Students are then required to enter their Student Identification Number and place their ID Cards on the desk beside them. The SID number appears on the top right of the screen throughout the test and the tutor can then walk around checking that the SID number, ID card and student all correspond.

Before starting the test, the tutor demonstrates each type of test item on an overhead data projector, and when he/she is satisfied that students understand the test requirements, students are allowed to proceed to the "Instructions Screen". Some items are straight multiple choice, and throughout the test, the student is provided with the time remaining and the number of questions to be completed in the bottom-right corner of the screen. Other items require the student to insert appropriate words in paragraphs by dragging them with the mouse into marked positions. We have experimented with various scoring procedures in these items e.g. subtracting marks for incorrect placements etc. Words can be dragged backwards and forwards at will and words snap into position and a tone sounds when placement is made. A "Reset" button resets all words back to the word bank on the right. Another item type we have used is the placement of appropriate data functions within x-y axes. Students drag a function into the axes where it expands - see Figure 1. If the student, on seeing the expanded function, wishes to change a choice, the question can be reset and a new choice made.

Figure 1.

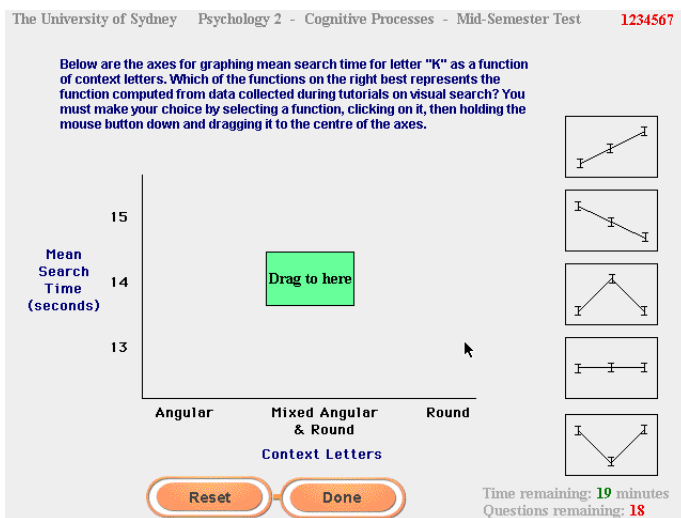
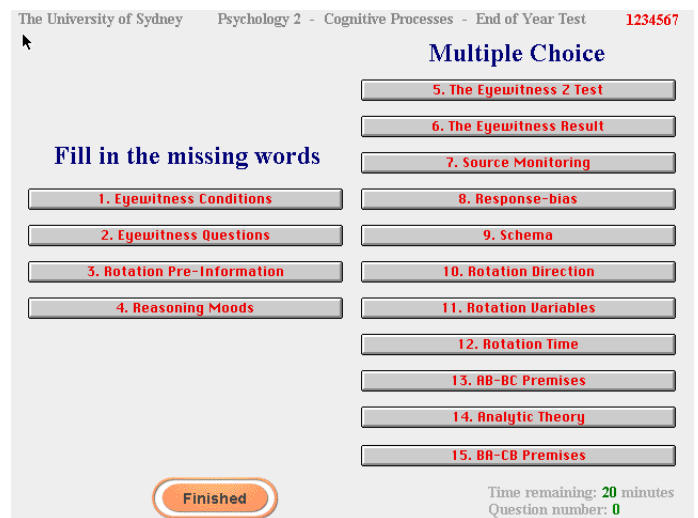


Figure 2.



A test format that students seem to like is to have a main menu with button choices for all questions as in Figure 2. The student can then (just like in a paper and pencil test) choose to do the test items in any order. On completion of an item, the student is returned to the main menu for another choice of question. Revisiting a question automatically resets it. Buttons for completed items change their colour to "Green", and items yet to be completed remain in red. On completion of the test, students are given their score which is also written to the computer's hard disk as a text file and sent to the remote server. As an added protection, we require the student to check and sign a sheet for the test result in the presence of the tutor. The data files can be opened in a spreadsheet for item and test analysis.

QizMacro: A Word 6 Macro to compose a quiz file for VizQuiz

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VizQuiz (J Chem Ed: Software, Number 1, October 1995) is an inexpensive computer based quiz which allows for a range of questions, hints, video clips, animation and remedial help. It is applicable over all disciplines. It can be used in both a quiz mode or a study/review mode.

Student access can be controlled via their ID number and quizzes can be generated individually providing the data bank is large enough. Overall it is user friendly and professional in its appearance.

The main drawback to using it, is the need to generate a reasonable size database (it comes with some questions based on the World of Chemistry text). Entry of data is via a text file but a mark up language has to be used to enter special characters. This makes its application somewhat unwieldy. We have written a macro, QizMacro which allows for the test file to be written in Word 6 or 7 on either a Mac or a PC in WYSIWYG and to translate the Word file to the appropriate text file for VizQuiz.

Development of Computer Assisted Learning Tutorials in Biochemistry - Foundation for Computer Based Assessment.

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Background

Students entering the BPharm course are required to undertake a compulsory four year course. Many students come from a physical sciences background and often have problems with the biological components of the course taught by the Department of Pharmaceutical Biology & Pharmacology. The department teaches the Physiology, Biochemistry and Pharmacology components of the BPharm course. To assist students several additional face-to-face tutorials are offered by lecturing staff. Recently, the department has been investigating the feasibility of incorporating CAL tutorials within the course to encourage self-directed and self-paced *formative learning*. CAL drill & practice quizzes in Physiology and CAL tutorials in Biochemistry are being developed using Asymetrix Toolbook II Instructor.

Biochemistry

The Biochemistry component of the BPharm course is short and intensive. The students are required to develop a good knowledge of general biochemistry principles which they apply in other subjects (eg. Pharmacology, Microbiology and Medicinal Chemistry). Initially, two types of CAL tutorials are being designed for formative assessment. Later it is hoped to incorporate the CAL tutorials into the summative assessment procedure.

Module Approach

The aim of these formative assessment tutorials is to address perceived areas of difficulty. Many students have difficulties understanding concepts which is exacerbated by the short and intense nature of the biochemistry component. Thus the modules need to be designed with a simple and clear underlying thread. Links to more detailed explanations will be included (eg. biochemical and pharmacological and, eventually, an additional link to a pharmacological glossary on drugs). Feed-back will be by way of self-testing using true-false, multiple choice and fill in word questions. Sample modules will be developed and trialed this year. Following student feed-back, appropriate modifications will be made. The modules will then be incorporated more directly into the course.

Case History Approach

The aim of these exercises is four-fold. Firstly, the students are exposed to some medical conditions that have simple biochemical explanations. Secondly, they are encouraged to work out these explanations (problem-based approach). Thirdly, they obtain immediate feed-back on the relevance of biochemistry to the study of pharmacy. Fourthly, it will provide an opportunity to incorporate some computer based assessment within the course. In this approach a short case history is written about a condition. Further notes are available for the student which will also contain links to an attached glossary for additional information (particularly regarding drug therapy). A short quiz follows containing questions in multiple choice, true-false and write in format. The case histories will be run on a trial basis this year and summative assessment will be incorporated next year.

Experience with a single Computer-marked Physics Assignment

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It is a relatively simple matter to write a computer program which sets a question, then tells the student whether or not his or her answer is correct. In physics, such a program is no substitute for the traditional hand-marked assignment, in which the marker provides feedback as to the nature and seriousness of any errors in reasoning, distinguishes between reasoning errors and mathematical or arithmetic errors, and perhaps adds comments on the approach which has been used. Writing a program which will emulate the human marker fully would be a very difficult task, and may well be impractical.

The author has been using a program which is a useful compromise. It is restricted to questions that have numerical rather than algebraic solutions. It is aware of the mistakes that a student is likely to make, and compares the student's answer both with the correct result and with the results the student would get for each of the known likely mistakes. It then gives appropriate feedback. Students are encouraged to repeat the problem (with changed numerical values) and improve their mark, an unwelcome procedure when marking manually.

The Assignment:

The assignment is based on understanding phase and phase constant in simple harmonic motion. Some of the questions are directly numerical, others involve estimating the phase of a sine curve that has been plotted on the screen, moving the graph of a sine curve on the screen until it agrees with a specified sine function, or estimating the phase difference between two curves plotted on the screen. Much of the focus is on understanding the consequences of the fact that the arcsine and arccosine functions are multivalued. A good student should complete his/her first attempt in about 30 minutes, subsequent attempts will be quicker.

Observations:

Subjective inspection of the student-results file suggests that many students can be placed into fairly distinct categories. Two significant ones are:

1. A group of students who make many attempts, over a period of a half to one hour, without achieving much, then there is a break of about an hour followed by one more attempt with an excellent result. The author likes to assume that these students finally convinced themselves that they needed to study their notes, and having done so, had no difficulty with the assignment.
2. A group who spend a lot of time — several hours — on the assignment, with marks that climb gradually during the first attempts, then show little consistency. Their best result is often around 40% to 60%, and they have obtained much worse results on many subsequent attempts. They presumably only half understand what they are doing and are wasting their time by making repeated attempts, rather than going back to the theory and thinking about the problem or asking for help. They are a cause for concern.

A serious effort has been made to survey students informally, whenever the author has been in a position to talk to them individually. All have described the program as useful, they have appreciated the feedback within the program, they have appreciated the opportunity to learn from their mistakes and try again (although this is not entirely consistent with the performance in category 2 above).

When asked whether they would appreciate some increase in the number of assignments handled in this way, the answer has generally been yes, but not always with a lot of enthusiasm. Two specific criticisms that have been given are:

1. They spent much more time than they would have with a conventional 'paper' assignment. The author's response is that if repeating the assignment meant that they got it correct, they will also have got more out of it; and if they fell in to the category 2 above, then they need to recognise their need for help or further study rather than making repeated attempts.
2. They find the need to read scales precisely irritating and accident prone, and dislike it. The author agrees that it would be unreasonable to force students to read scales accurately frequently, but as an occasional exercise, it is justified — and not exercised in conventional assignments.

Conclusions:

The author believes that the complete replacement of hand-marked assignments by computer-marked numerical ones will never be satisfactory but is pleased with the way this example has been accepted by students, and feels that a modest fraction of annual assignments in this format at the first year level is appropriate. A careful marker will inevitably be able to annotate errors that were not foreseen or not recognisable by the programmer, but this can be balanced against the ease with which a student can be allowed to try again, and can learn from doing so.

Assessment using Computers: the First Year Biology Way

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It has been shown (Entwistle et al, 1989) that an important contributing cause of failure in first year students is an absence of feedback on progress. In larger classes it is often difficult to provide individual feedback to students and it is recognised (Ramsden, 1992) that it is not always necessary for academic staff to give feedback if another option is available. In First Year Biology, at the University of Sydney, computers are used to offer a range of assessment tasks, and importantly they give students instant feedback on their performance. We have developed a laboratory-based quiz which has both summative and formative elements and a series of student self-assessment modules (SAMs) which offer formative assessment. Ongoing evaluation of both the quiz and the SAMs gives us valuable feedback which is incorporated into revised versions. Student response is strongly supportive and they appreciate the user-control they have when using our packages, the instant feedback available to them and the non-confrontational method of obtaining feedback.

The aim of the **computer delivered and marked quizzes** is to provide self-assessment of progress, motivation to work steadily on understanding and mastering the subject matter, feedback on personal progress and comparison with their cohort continual as well as summative assessment towards a final course mark. In addition teaching staff can monitor student progress. The quiz program was developed "in house" and written with HyperCard (by Rob Mackay-Wood). The quiz consists of 5 - 6 multiple choice questions on the previous week's laboratory work and 2 - 3 questions which test students' ability to interpret and analyse information. There are five versions of each question, many with images. The program randomly selects and displays eight questions. The student is presented with the stems of all eight questions on the screen and can select the order for answering. Previously answered questions can be reviewed and the answers changed if required. The student controls when the answers are ready for marking by activating a "Finished" button. The answers are marked and a scrollable summary screen presents the student with personal access information, the questions asked, with references to figures used, the correct answers, the student's responses and the student's score. All of this information can be saved on the student's personal disk. Students access the quiz with their SID and password, and are not allowed a second attempt. Printed versions of the quiz figures are available in the resources room. Student performance is recorded on a database and weekly histograms are published, allowing students to compare their performance with the rest of the cohort.

The **Self Assessment Modules (SAMs)** aim to draw together related parts of the course, to help students make connections between topics in biology and to promote a deeper learning strategy, whilst providing an enjoyable feedback and reinforcement session. They enable students to take a series of formative tests that help them monitor their level of understanding of major biological concepts. These modules are used by students individually or in groups (allowing for peer discussion, cooperative learning and team work). Each SAM is designed as a series of mini-lessons, which consists of questions identified under Bloom's taxonomy as being of different cognitive complexities. These are presented as four levels of complexity. There is an entry point for each mini-lesson which acts as a barrier to progression if the student is unable to successfully complete it. This entry point is a set of five true/false questions, allowing students with 80% correct to proceed and denying further access to those students with less than 80% correct. Once passed the barrier the student may choose to complete the mini-lesson levels of difficulty in any order. Within the mini-lesson at each level, there is a variety of question formats such as: drag and drops, where text or objects are moved into a correct location, multiple choice, and short paragraph writing questions which compare with sample answers. The program allows students to know where they have been, how much they have done and how well they did. At any time they can ask for a progress report. The students log in with an identification number, which allows them to revisit a SAM within seven days of previous use. The question formats for each level have been created into templates into which content can be inserted. **Evaluation** of template design during development by an instructional designer has been an ongoing part of the formative evaluation process, as well as input on screen design by peers. Student perceptions are being investigated using focus groups, observation of students use of modules, end of module log-out questions and qualitative and quantitative questionnaires.

References

- Entwistle NJ, Hounsell CJ, Macaulay C, Situnayake G and Tait H, (1989) *The Performance of Electrical Engineers in Scottish Education* Report to the Scottish Education Department, Centre for Research on Learning and Instruction, Department of Education, University of Edinburgh
Ramsden P (1992) *Learning to Teach In Higher Education* Routledge Press London and New York

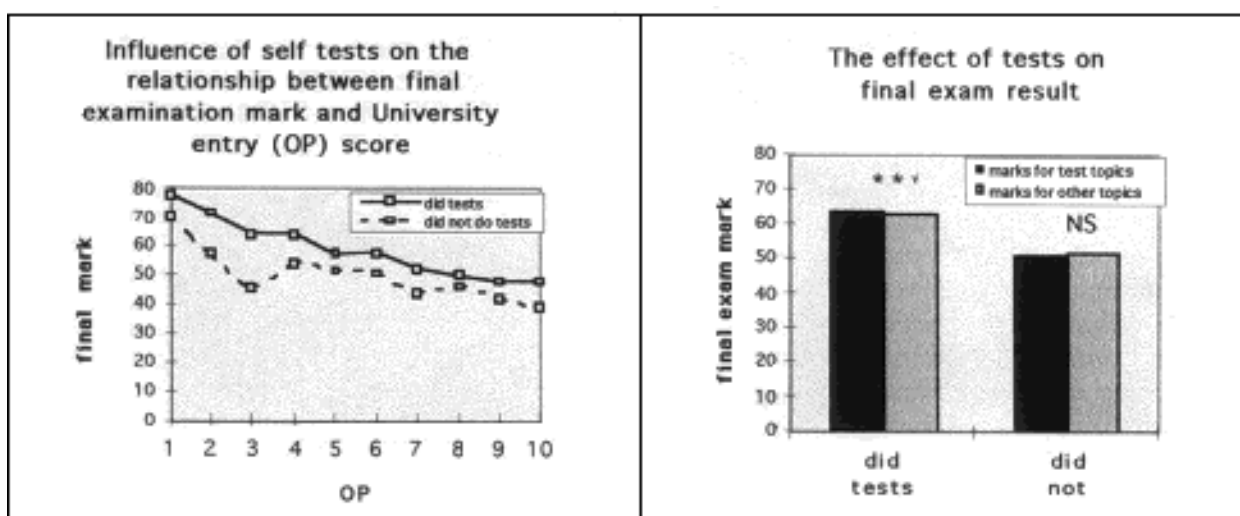
Experiences with Computer Based Assessment

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Since 1994, we have used CBA for both formative and summative assessment in first and second year subjects, using our departmental network and Macintosh computers. In 1997, Web based formative tests will be used in several subjects, particularly in first year subjects with enrolments of 800-1400 students. The tests used to date have been simple best of five MCQ but the Web based tests will have additional question types.

An Authorware program for simple tests was written as part of a CAUT project in 1994 and used for summative assessment of self directed learning modules in second year subjects. The shell was modified for formative assessment in a first year subject with 1300 enrolled students in 1996. These self tests covered lectures in cell and neuro-physiology, topics which students were known to find difficult. Tests consisted of ten multiple choice questions, each question selected randomly from a bin of six. Feedback to students was provided both as a score and as comments explaining the correct responses and level of difficulty. Students could comment or ask questions about the tests through the subject's Web based bulletin board.

Students were required to log on. Data which provide information about use of these tests have been collected and related to student performance. As anticipated, the most successful students made the greatest use of tests, 90% of students who obtained the top grade in the end of semester examination using them whereas only 41-46% of borderline students who received a conceded pass had done them. In part, this reflected inherent ability and motivation but use of the tests was found to significantly improve final examination mark.



The following table summarises student use of the tests:

	Test 1	Test 2
cumulative openings	6819	4416
no. of students	770	710
average no. of openings	8.8	6.2
average % correct	64.0±22.2	65.1±23.3
average min. spent per test	7.0±4.3	6.7±4.1

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