



Staff and Educational
Development Series

COMPUTER-ASSISTED ASSESSMENT *in* HIGHER EDUCATION

Sally Brown, Phil Race and Joanna Bull

**COMPUTER-ASSISTED
ASSESSMENT
in HIGHER EDUCATION**

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This book is dedicated to Rex Stainton Rogers who was no fan of educational development but was known by his students as one of the most supportive, caring and erudite lecturers in the university system.

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Introduction

Interest in computer-assisted assessment is growing rapidly. It is increasingly accepted that assessment is the engine that drives a great deal of students' learning. It is also widely recognized that all processes used in assessing students' achievements need to be carried out in a highly responsible way, yet assessment is often regarded as the bane of academics' lives. With moves to widen participation in higher and further education, combined with reductions in the actual amount of resource per student to educational institutions, it is proving to be impossible to extend traditional assessment processes, practices and instruments to meet demand. In particular, it is difficult to provide students, by traditional means, with the quantity and quality of feedback that will enhance their learning, whether thinking of feedback on their evidence for continuously assessed coursework or for summative assessments such as exams.

At the same time, in most subject disciplines the use of information and communications technologies is expanding rapidly and students are learning a higher proportion of the curriculum using computer-based resources. Indeed, students' computer literacy is expanding rapidly as they make use of electronic sources and the Internet in the everyday course of their learning. The gap between how students learn and how they are assessed is widening. For students who have undertaken much of their learning with a computer keyboard, monitor screen and printer, finding themselves in a formal, silent exam room, able to communicate only by handwritten means, is a radical discontinuity in their educational experience.

This book profiles how computer-assisted assessment can help both staff and students by drawing on the experience and expertise of practitioners, in the UK and internationally, who are already using computer-assisted assessment. Collectively, their contributions in this book illustrate how computer-assisted assessment can help address the problems mentioned above by:

- reducing the load on hard-pressed lecturers and teachers by automating appropriate parts of the task of marking students' work;
- providing students with detailed formative feedback on their learning much more efficiently than is usually possible with traditional assessment;
- bringing the assessment culture experienced by students closer to the learning environments with which they are familiar and confident.

The contributions range from 'how we did it and what we learned by doing it' to 'what we need to think about to do it better'. A central theme pervading the contributions in this book is how computer-assisted assessment can enrich the learning experience of students, and help in our efforts to diversify assessment practices and processes, so that students are less likely to be disadvantaged by exposure to an unduly limited assessment culture.

2 *Computer-Assisted Assessment*

We have arranged the contributions in this book into three broad sections:

1. Pragmatics and practicalities of Computer-Assisted Assessment (CAA).
2. Using CAA for formative assessment.
3. Learning from experience.

The overlap between these three categories is wide. Several of the chapters could equally have been placed in any of these sections, but as far as was possible we have tried to structure the contributions into a useful review of issues related to computer-assisted assessment today. Each chapter in its own way reflects innovation in assessment design and practice and attempts to ensure that computer-assisted assessment (like any tool in the assessment toolkit) is as fair as possible, as reliable as practicable and is valid.

SECTION ONE: PRAGMATICS AND PRACTICALITIES OF CAA

In this, the most substantial section of this book, we have collected together a wide range of contributions that offer food for thought about how best to go about planning and implementing computer-assisted assessment.

We start this book about computer-assisted assessment with a wide range of declared reasons why it won't work! In Chapter 1, Jen Harvey and Nora Mogey explore the pragmatics of integrating technology into the assessment of students' work and address a series of reasons sometimes used by staff to justify why they feel they *can't* use technology to support assessment. The authors propose a range of strategies whereby each of these situations may usefully be addressed. Among the fears of staff thinking of implementing computer-assisted assessment are concerns about security issues. In Chapter 2, by Dave Whittington, technical and security issues are explored in the context of implementing computer-assisted assessment. This chapter is the first of several in the book to look at issues related to screen and question layout and question design and goes on to give suggestions on how to approach data protection legislation and data security. The chapter ends with a discussion of the meaning of 'exam conditions' for the context of computer-assisted assessment.

Chapter 3, by Norma Pritchett, picks up the issue of effective question design in more detail. A series of illustrated guidelines is proposed for the design of multiple-choice questions. The final part of the chapter examines the kinds of cognitive skills that can be tested by multiple-choice formats and includes discussion of the element of chance unavoidably present in such tests. Chapter 4, by Alan J Cann and Ellen L Pawley, takes us into Web-based assessment format design and the use of summative and formative online tutorials. The level of complexity is moved from multiple-choice question to a tutorial-type environment, which the authors claim to be much better suited to a resource-rich open learning environment, including open access to the WWW, than multiple-choice formats.

Chapter 5, by Mark Brosnan, moves back to consideration of some of the disadvantages accompanying computer-based learning and computer-assisted assessment, in particular in the context of student computer anxiety and assessment. Biases that can affect computer-assisted assessment are discussed and some suggestions for minimizing anxiety and biases are proposed.

The remaining chapters in this section all offer advice about test design and the implementation of computer-assisted assessment. Chapter 6, by Malcolm Perkin, focuses on validating both formative and summative assessment, exploring how the need to make assessment both valid and reliable extends to computer-assisted assessment. Distinctions are drawn between task-centred and construct-centred performance assessments and suggestions are offered about how computer-assisted assessment processes can best be evaluated. Chapter 7, by M Thelwall, focuses on the design and use of randomly generated tests based on relatively large banks of questions and explores security issues and pedagogical implications of such tests. The relative suitability of randomly generated tests for procedure mastery and fact acquisition is compared. Chapter 8 ends this section of the book by further developing the discussion of random factors. This is contributed by J H Sims Williams, J Maher, D Spencer, M D J Barry and E Board and explores ways in which lecturers can set tests from a large database of questions just by making a specification of the test they require and then allowing the computer to generate a potentially large number of equivalent tests matching the specification.

SECTION TWO: USING CAA FOR FORMATIVE ASSESSMENT

This short section brings together four contributions where the principal theme is using computer-assisted assessment primarily for formative purposes. Discussion of the use of computers in formative assessment is included in many of the chapters in this book, but this section brings together four chapters where formative assessment is spotlighted. In Chapter 9, Dan Charman considers critical issues in writing and delivering formative assessment using computers and compares student performance on summative assessment before and after changing formative assessment from conventional to computer-based formats. The benefits of repeatability, immediate feedback to students and immediate marks to staff are discussed, along with a wide range of further benefits relating to using computers for formative assessment and feedback to students. Chapter 10, by Jennifer M Robinson, is about using networked computers to enhance the role of the horizontal flow in learning: that of multi-reviewer anonymous peer review. The chapter focuses on the peer review of 'complex works': substantial assignments that defy simple objective assessment and which place high demands on conventional marking processes. Chapter 11, by Christine Steven and Ian Hesketh, reviews creative development of the use of one particular piece of software, Question Mark, concentrating on its application to formative assessment and feedback. The authors claim that students can be shown to have benefited from the feedback and, at the same time, to have improved as autonomous learners. In Chapter 12, Leith

Sly and Léonie J Rennie look in particular at the use of computer managed learning and student tracking for situations where large numbers of student assessments are to be handled. Particular features of computer managed learning are explored, which can be used to promote opportunities for formative assessment, backed by case-study data in discipline areas of economics and psychology from Curtin University, Australia.

SECTION THREE: CAA: LEARNING FROM EXPERIENCE

Some common themes pervading the chapters in the final section of this book can be described in terms of 'how we did it', 'what we found', 'how it works in our particular discipline' and 'what we plan to do next'. This section brings together a series of contributions with case-study dimensions, covering a considerable range of experiences of using computer-assisted assessment in a variety of contexts and disciplines. In Chapter 13, Myles Danson gives an account of the use of optical mark reading (OMR) at Loughborough University, UK, advocating that this technology, which began in the 1950s, can become a vital tool in the implementation of modern computer-assisted assessment. The author gives comparative details of four types of stationery used for computer-assisted assessment and discusses the various formats of report in which the results of the associated assessments can be presented. In Chapter 14, R D Dowsing explores the benefits that can be realized by the computer-assisted assessment of practical IT skills. He discusses the various types of assessment that can be applied to IT skills, focusing on what lends itself to assessment in this context, and illustrates the use of a word-processing assessment system developed at the University of East Anglia. Chapter 15 is contributed by A Patel, D Russell and Kinshuk, examining the cognitive apprenticeship-based learning environments (CABLE) approach to designing tutoring systems, and their development into an intelligent tutoring system (ITS).

In Chapter 16, we return to Web-based assessment with a contribution from Meg O'Reilly and Chris Morgan, gathering experience from the UK, Australia, South Africa and the Netherlands. Their discussion illustrates convergence between on-campus, off-campus and off-shore student groups in the context of online assessment, and the growth of online learning communities resulting from changing assessment practices associated with open and flexible learning development. Chapter 17, by Roy Seden, considers the planning and delivery of automated, innovative assessment in the climate of higher education review policies in the UK and the context of the construction discipline as delivered at De Montfort University. In Chapter 18, Stan Zakrzewski proposes a generic, structured model for computer-based assessment and gives an account of the implementation in three stages of such a system based on Question Mark Designer at the University of Luton, UK.

To end this final section, we return to students' perceptions with Chapter 19, contributed by Kay Sambell, Alistair Sambell and Graham Sexton. They discuss students' reactions to computer-assisted assessment developments in engineering education at the University of Northumbria in Newcastle, UK,

including a broad discussion of the role of assessment in student learning. They link a range of suggestions about good practice for computer-assisted assessment to a variety of direct extracts from student feedback that they gathered and analysed. The book concludes with a chapter from Joanna Bull looking to the future of CAA.

Overall, this book presents a compilation on computer-assisted assessment that starts with lecturers' words about 'why it can't be done' and ends with students' words about 'what happened when it was done'. Between these extremes, we believe you will find in this book a wealth of experience about computer-assisted assessment and a wide range of suggestions about good practice, which we hope will help you to implement such assessment effectively, efficiently and productively.

Phil Race, Sally Brown and Joanna Bull (1999)

SECTION ONE:

Pragmatics and Practicalities of CAA

1

Pragmatic issues when integrating technology into the assessment of students

Jen Harvey and Nora Mogey

PERCEIVED PROBLEMS AND SOLUTIONS

Increased student numbers over the last few years, together with course pressures such as modularization have resulted in many academic staff having to spend an increasing amount of their time marking student assessments and collating the resultant data. Concurrently there have been changes to the technologies available to support the teaching and learning process. But to be effective, technology must be fully embedded and integrated with the wider student learning experience and the reasons for using technology must be clearly identified and understood. Taking the decision to use technology to support assessment and the subsequent first exploratory steps can often be the biggest hurdles to address.

This chapter aims to explore a range of different ways in which academics might consider integrating technology into courses and to discuss some of the issues relating to the use of technology to support assessment.

We do not propose that all assessments should be computer based, rather that using technology to support assessment can provide a number of options not always provided by paper-based methods. For example:

- large numbers of assessments can be marked quickly and accurately;

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- students' responses to questions can be monitored;
- assessments can be provided within an open-access system;
- assessments can be stored and reused;
- immediate feedback on performance and advice can be provided;
- assessment items can be randomly selected to provide a different paper for each student.

Each of the following sections begins with a reason that might be given by staff as to why they feel they can't use technology to support assessment and goes on to suggest ideas as to how they might overcome such perceived problems.

MY VALIDATING BODY WON'T PERMIT IT

This is simply not true. Degree-awarding authorities and validating bodies insist on consistent and objective assessment methods, although there is perhaps some pressure to stick with a familiar and well-tested style for assessment. The presentation of a clear and convincing argument in favour of the use of technology, supported by examples of its successful and efficient use in other courses and other institutions, will rarely be rejected out of hand.

Strategies:

- **Present technology as the most appropriate assessment tool for the aims and objectives of the module.** The introduction of technology should always be motivated by how appropriate it is as a tool to support learning and teaching. If other assessment methods match more closely with the learning objectives then they should be used. But a strong case can be made for the appropriate use of technology that is able to deliver a valid test at times that allow flexibility for part-time or distant learners, which provides immediate feedback to students and can assist staff in analysing areas of weaknesses within student cohorts or course delivery methods.
- **Argue the long-term educational and efficiency gains due to the introduction of technology.** The introduction of computer-based assessment methods should always result in long-term efficiency gains, but this will not necessarily be without the investment of short-term effort. However, computer-based assessment, used thoughtfully, can enrich the learning environment for students by being used to promote reflection, which in turn can lead to longer-term deeper learning.
- **Present examples of other courses where technology is an accepted part of the assessment process.** In particular, other chapters in this book give a number of useful examples for presentation in support of this case.

NONE OF THE REST OF MY COURSE IS COMPUTER BASED

Strategies:

- **Induct your students.** If none of the rest of *your* module is computer based, perhaps some of the rest of the course is. If it isn't, it is possible to make sure that your students have some instruction on how to use a computer, prior to sending them off to work through an independent package. Some institutions provide IT beginners' courses, but if not, you could consider running a short introductory course yourself. In addition, you might want to make sure that someone is going to be there to help should students require assistance and/or suggest that students work together in small groups during their first session. It is important if you are introducing a computer-based summative assessment that none of your students are disadvantaged because they are unfamiliar with the technology involved.
- **Use computer-assisted assessment for integration.** Assessment can be used to integrate a variety of teaching and learning innovations into your course. If a particular part of a course is not going to be assessed then students are not so likely to make the effort to learn it. Equally, if the innovation being introduced is computer-supported assessment then it is vital that the material being assessed through the technology is a core part of the course rather than an option.
- **Provide a range of assessment methods.** Providing a range of different types of assessment for your students can also provide a more stimulating learning environment by introducing some variety as well as providing your students with the opportunity to develop a range of different skills. However, appropriate types of assessments should be selected for measuring the attainment of particular course objectives and not just used for the sake of it. A range of different types of computer-based assessments are now available that can be geared towards students of different abilities. For example, Modified Essay questions can lead a student through the different stages of a case study or a package can select out a set of questions designed for students who have covered only parts of a course and at the same time provide them with appropriate feedback.

I'VE ONLY GOT 20 PCS IN THE LAB, BUT I'VE 86 STUDENTS IN MY CLASS

This is only a problem if you require all your students to be in the room at the same time. If all your students do not require a separate machine at the same time then a variety of options are available.

Strategies:

- **Assess students in groups.** Why not try some kind of group-based assessment, where students work on a computer-based problem together?

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You can then bring the whole class together and the solutions reached by the different groups can be discussed.

- **Carousel assignments.** Times can be set aside when one large group of students works in the lab but another group carries out a paper-based exercise in a tutorial room and a further group carries out an information retrieval exercise in the library. Thereby students could be provided with a range of different types of assessments for one course.
- **Assess students at different times.** If the assessments are set up on a file-server, each student can be asked to work through the assessments in their own time. By asking students to type in their name and matriculation number, you can monitor when and who has completed the exercise.
- **Phase access to assessments.** Another possibility might be to let one section of the class out one door of the examination room while another section of the class comes in another door. This is widely done at Luton University, for example.

I DON'T LIKE USING IT

Strategies:

- **Review your own resistance.** Think about why you don't like using learning technology. Everyone has some horror story, for example of how they were intending to use a computer package with a group of students but the network went down. Equally so, there may have been times when you had bad experiences when a group-based activity just hasn't gone to plan, but this hasn't stopped you trying out a similar but amended type of exercise on another occasion. If your bad experience was some time ago then perhaps you should give the technology another try. The software and hardware, as well as the institutional support, have moved a long way during the last five years and you might be surprised, firstly at what is available and, secondly, how much built-in support is available within computing packages.
- **Just do it!** Sometimes you simply have to do things that you just don't like. Some people never liked using overhead projectors, but in some lecture theatres it is the only realistic option. When it is the best tool for the job, personal preference shouldn't really come into it.

THINGS ARE WORKING FINE AT THE MOMENT, WHY SHOULD I CHANGE?

If things are working well then maybe you are right and there is no need to change. But maybe a different assessment strategy would be even better. How long can you be sure that the current system will maintain its effectiveness? Will the profile of the student body change and will this have implications for what assessment strategies would be appropriate?