

# **IS COMPUTER BASED ASSESSMENT GOOD FOR STUDENTS?**

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## Abstract

One of the benefits of computer-based assessment is that, if used for formative assessment, it can improve student performance in summative assessments (Charman & Elmes 1998; Sly & Rennie, 1999). During the introduction of computer-based assessment in a first-year module on numeracy and statistics in Biology, on-line assessment was used to replace OMR-marked multiple-choice tests. The on-line system was used to provide improved feedback to students, rather than formative or pre-testing.

Analysis of student results in two successive years shows that students using on-line assessment did not perform as well as those using OMR-marked multiple-choice questions, even when the same questions were given to the students. The difference in performance cannot be attributed to a weaker student cohort, as their performance in other areas showed no differences. This suggests that students may be slightly disadvantaged by the introduction of on-line assessment.

This drop in performance took place in the face of general student acceptance of the introduction of on-line assessment. Students generally (66%) felt that they had been given enough preparation, and had not (78%) prepared differently for this examination. The most striking finding was that 88% of students liked having their mark instantly available.

A few students felt that on-line examinations were more stressful or had disadvantaged them because they hate computers. This is in line with the comments of Brosnan (1999) about computer anxiety affecting performance.

However, it is interesting to note that one dyslexic student found the on-line examination an advantage. In addition, a number of other students remarked that this format was less stressful than other exams.

The most common negative remark from students related to the difficulty of interacting with the assessment because it was presented on a computer screen. We therefore suggest that the mode of presentation of assessments can significantly influence student performance, and that appropriate screen design is an important factor in on-line assessment.

## Keywords

Student performance, summative assessment, computer anxiety, screen layout.

## Background

In the Academic Year 1998-9 the teaching of Numeracy and Statistics to first-year Biology students moved from self-contained modules which students had to pass to being integrated into a number of larger "Skills" modules which included a variety of topics. The assessment for the "Numeracy and Statistics" strand consisted of an in-class test at the end of semester 1 and a formal examination at the end of semester 2, both using multiple-choice questions marked using an optical mark reader (OMR). The student cohort had a particularly poor performance overall which staff largely attributed to their remarkably poor attendance.

As Brown, Race & Bull (1999) note, "... assessment is the engine which drives a great deal of student learning." It was agreed that a change in assessment strategy could increase motivation and that more frequent feedback could be helpful for students in evaluating their progress. It was also hoped that more frequent assessment would increase student performance, as noted by Charman & Elmes (1998) and Sly & Rennie (1999). Because of the large number of students and small number of teaching staff involved, this needed to be done efficiently, and so it was hoped to use on-line assessment.

A number of problems prevented on-line assessment being introduced at the start of the academic year. Rather than lose all the benefits of frequent assessment, and because the "Numeracy and Statistics" strand had 3 lectures every 4 weeks, it was possible to use the fourth lecture slot for assessment. A system of multiple-choice questions marked using an optical mark reader (OMR) was introduced in the first semester of the 1999-2000 academic year. It was realised that this failed to give good feedback to students and hence had little formative value.

Computer-based on-line assessment was available for the second semester, and was used for both the in-class tests and the final examination. The introduction of on-line assessment seemed beneficial for the students, as it would give more flexibility in the time of the assessment, could provide useful feedback, and could

enable students to work through tests as often as they wanted for the purpose of learning. As part of the evaluation of the introduction of on-line assessment, we undertook a comparison of student performance in the two years, and an evaluation of student attitudes to computer-based assessment.

## Methods

In both years the course content was the same, and the material was delivered by the same lecturer. A variety of staff assisted in computer-based tutorials. Course-work was used to assess students' communication skills in written and oral presentation, and to assess their IT skills. The students' final examination consisted of a set of multiple-choice questions on Numeracy and Statistics, together with a biological interpretation question based on a scientific article. In 1999 the multiple-choice questions were presented on paper and marked using an OMR, whereas in 2000 the questions were presented and answered on-line, using Question Mark Perception.

Students were given experience of the software initially by having an opportunity to re-take the OMR-marked test at the end of Semester 1 and get feedback on-line using the Perception software. During Semester 2 they also had two in-class tests on-line, for which the feedback was also given on-line. The examinations did not cover entirely the same material, as some of the examined material in 1999 was assessed by the in-class tests in 2000. However, 28 of the 50 questions were identical over the two years, with only the method of presentation changing. Prior to the examination, students in both years were given the same practice examination questions, paper-based in 1999 and computer-based in 2000.

## Student performance

One of the original objectives was to improve students' learning, and hence examination performance, by increased frequency of testing and better feedback. A simple analysis of the 5 modules with large numbers of students (Table 1) shows that the median marks for Numeracy and Statistics in the summer examination were generally lower when on-line assessment was used.

Table 1

Median marks using on-line assessment (2000) compared with OMR (1999)

Module	BBIO100	EBIO100	HBIO100	MBIO100	MBIO101
2000 (on-line)	40	47	43	43	43
1999 (OMR)	53	66	62	50	55

The average of these differences is about 14%, showing a large drop in

performance.

One possible explanation for this change is a weaker student cohort in 2000. However, there was no difference in either the mark in the interpretative part of the examination, nor in the IT skills assessment (Table 2).

Table 2

Median marks on interpretative part of examination and IT skills for the two student cohorts.

Module	BBIO100	EBIO100	HBIO100	MBIO100	MBIO101
Interpretative question					
2000	60.0	66.0	60.5	60.0	62.0
1999	56.5	61.5	60.5	66.3	62.5
IT skills					
2000	64.0	63.0	65.5	72.5	70.5
1999	65.0	66.0	68.5	72.5	66.0

As the difference in performance does not seem to be attributable to a change in the competence of the student cohort, it is possible that the assessment design produced a harder examination in the second year. This is because part of the material examined in 1999 was assessed by in-class test in 2000, giving a different balance to the examination in 2000. So, a question-by-question comparison was undertaken of the 28 questions which were identical in the two examinations. There were differences in performance in both directions, so that some questions were answered better in 1999 and other questions answered better in 2000. However, overall there were 48% correct responses using the OMR in 1999 and 42% using CBA in 2000. Given the large sample of students, this decrease is statistically significant ( $P < 0.001$ ).

### Student feedback on computer-based assessment

There was no formal attempt to evaluate the student experience of on-line computer-based in-class tests by questionnaire or other approach. However, all staff running the assessment sessions solicited comments from the students. For many students who are used to using computers, the use of on-line assessment produced mainly a shrug. A small number of students commented that they found the time constraint more threatening on the computer. Others commented that they found the whole set-up more relaxing. Students generally make critical comments on any aspect of the University which they are not happy with, so the lack of adverse comments was regarded as a general acceptance of the approach by the students.

We did undertake a formal evaluation by students at the end of the examination.

The main findings (Table 3) are that students are equally divided between preferring on-line examinations and not, and between wanting more on-line examinations and not. Students generally (66%) felt that they had been given enough preparation, and had not (78%) prepared differently for this examination. The most striking finding was that 88% of students liked having their mark instantly available.

Therefore, this formal evaluation showed that students found the use of on-line assessment acceptable, and did not feel that its use had affected their performance.

Table 3

Percentage of students responding positively, negatively, or indifferently to the use of on-line assessment (sample size 129).

Yes	No	Indifferent
Q1) Did you prefer this form of exam delivery to other methods e.g. paper based or optical mark reader forms?		
38%	39%	23%
Q2) Did you feel that you were given enough preparation for taking this exam using a computer?		
66%	22%	12%
Q3) Did you feel that you were given enough support during the examination?		
85%	6%	9%
Q6) Did you like the fact that your mark was instantly available?		
88%	10%	2%
Q7) Would you like more of your exams to be delivered using computerised assessment?		
40%	38%	22%
Q8) Did you prepare differently for this exam knowing that it was to be delivered by computer?		
17%	78%	5%

### Possible explanations for poorer performance

A few students felt that on-line examinations were more stressful or had disadvantaged them because they hate computers. This is in line with the comments of Brosnan (1999) about computer anxiety affecting performance. However, it is interesting to note that one dyslexic student found the on-line examination an advantage. A number of other students remarked that this format was less stressful than other exams.

Observations from lecturers running the in-class tests through the semester included comments on students not taking the assessment seriously, but rather behaving as though, because it was on a computer, it was more like a game. Therefore,

students may not approach on-line assessments in the same way as they do paper-based exams.

The most common negative remark from students (20 students out of 129) related to the difficulty of interacting with the assessment because it was presented on a computer screen. Thus, some questions occupied more than one screen, so that students needed to scroll up and down to complete the question, and students found this a disadvantage. Some students commented on the difficulty of reading from a computer screen for long periods of time. Others commented that their usual approach of scanning the exam paper and answering questions in their chosen order, rather than in the order they were presented, was not possible. We therefore suggest that the mode of presentation of assessments can significantly influence student performance, and that appropriate screen design is an important factor in on-line assessment.

## Discussion and conclusions

Charman & Elmes (1998) provide some evidence that students perform better when computer-based assessment is used, especially for frequent formative testing. The main aim of this project was to improve student performance through more frequent assessment using on-line testing and feedback. Unfortunately, the student cohort which used on-line assessment performed worse than the cohort using OMR.

The use of computer-based assessment is generally acceptable to students who particularly appreciate the speed of marking and feedback. The performance of students needs to be carefully monitored to ensure that any changes in delivery are seen to be fair and consistent. Although the change observed here may not be large compared with other differences in assessment practice, the impact of the human-computer interface needs further investigation. This reinforces the general philosophy that a mixture of assessment methods is essential if students are to be assessed fairly.

The benefits of computer-based assessment, both for staff and students, are well documented. They include (Brown, Race and Bull, 1999) rapid formative feedback to students, reduced marking load for staff, and a closer match between the assessment and learning environments. However, we have shown that issues relating to student performance should be carefully considered when computer-based assessment is introduced.

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