Computer Aided Assessment using WebCT

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Abstract

During the last decade, academic workloads have been perceived to be growing in all aspects of the learning/teaching process. In addition, access to technology has spread in most subject areas within educational establishments as the 'push' to join the 'information age' has gained in political support and emphasis. Not surprisingly, therefore, the potential for using computers to aid assessment is attracting increasing interest from educationalists. However, the impetus behind such moves to adopt the technology seems to stem from other factors too, such as the expected benefits of using computer aided assessment (CAA) in terms of ease of use, reusability, editability, efficiency gains, cost reduction, improved 'image', both for staff and students. Nevertheless, in using Web based assessment, several issues arise concerning pedagogic, technological, social and ethical implications and this paper focuses on a subset of these. The paper first discusses how a summative assessment was set up using WebCT as an environment and proceeds to outline some of the motivation underpinning the adoption of this approach. This discussion also addresses some of the pedagogical and ethical issues that were considered in the development of the Web-based assessment together with the inter-institutional collaboration that was necessarily required. The paper continues with a description of the conduct of the actual assessment, using reporting and observational techniques. An analysis of Web-captured feedback gained from students regarding their experiences of undertaking CAA using WebCT is then provided. Finally the paper undertakes a comparison of using Web based CAA with existing methods, noting some of the issues raised by both staff and students involved.

Keywords

Computer Assisted Assessment, WebCT.

Background

In the first semester of their University programme at DMU, a number of student cohorts study a Computer Systems module, a familiarity course in the basics of computer hardware and networking. The material is both knowledge and skills based. The latter are assessed by means of an assignment whereas the students' ability to absorb the factual content has traditionally been tested by use of a multiple choice phase test and it is the techniques employed for the latter that are discussed here.

Why use a computer aided approach for the assessment?

A WWW-based on-line system was chosen for the following, largely pragmatic, reasons. It would

a) provide automatic marking and the possibility of rapid feedback for the students;
b) facilitate rapid statistical analysis of results.
c) enable a large number of potentially different tests to be generated from a stored pool of possible questions;
d) facilitate access to students taking the module at more than one campus;

Thus, use of CAA could, it was felt, result in significant efficiency gains as well as offering the potential to motivate students, thus enhancing their learning experience. This was felt to be of particular importance as there is "a growing indication that CAA is increasingly being implemented with the primary purpose of motivating students and enhancing their learning." (Bull, 1999). Also, "while emphasis is still placed on efficiency gains, it is evident that this is underpinned by the desire to provide valid and reliable assessments which motivate students to learn" (Bull, 1999). It seemed, therefore, that if our primary reasons for adopting this approach were to benefit the students concerned, many of the ethical and social concerns of using CAA might be allayed, provided also that consideration was given to such other issues as privacy, security and intellectual property rights.

WebCT was chosen because it provides the required functionality and was available, a copy having already been installed on a university server at the Leicester campus. No thorough analysis of the relevant merits of other possible packages was undertaken, although research has reported that WebCT compares very favourably with similar tools (Wisdom Tools, 1997, ULT Canada, 1999). In addition, no parallel control group, taking a test by a more traditional method, was set up at this time because, as noted earlier, it has been 'custom and practice' to include a paper-based multiple choice phase test in the assessment for the Computer Systems module. Results for this were previously generated using OMR techniques.

Structure of the test

The WebCT environment itself allows for the creation of a number of question pools, each including a number of multiple-choice questions, of equivalent focus and difficulty, covering one topic in the module. When a test is generated, WebCT picks one question at random from each pool and presents them to the student as a test. Hence 2 students sitting at adjacent terminals could be presented with different tests, minimising the possibility of any copying. This feature is, self-evidently, a significant benefit of using WebCT. Furthermore, a student needing to resit a given test is unlikely to receive the same combination of questions.

For the purpose of this particular test, 25 pools of questions were created, with 5 questions included in each pool, making it necessary to load the system with 125 questions some time in advance. This required a significant amount of staff time but it was felt that, in the long term, considerable benefits would accrue through re-use of the question 'bank' for future cohorts of students. A concern may be perceived here with respect to intellectual property rights in that this resource was being set up electronically for use both within the university and at the franchise centre. However, such issues arise in disseminating academic materials regardless of the media used, although electronically held resources are more accessible and therefore, in some senses, more vulnerable.

Validation of the questions

Most of the questions for the test were taken from a Teachers Supplement supporting the course text. It was necessary to adjust some of these questions and create others in order to ensure the test's alignment with the material delivered. Questions were relatively straightforward and focused on recall of factual material or operating simple binary number systems. One perceived benefit of using WebCT was, however, that all 3 lecturers involved in the module were able to contribute to and inspect the questions, regardless of time or place. This proved to be a significant efficiency gain: staff could more readily ensure that the questions were appropriate, and no further validation was considered necessary.

Practical difficulties

It was envisaged that there might be some potential problems with running test sessions in this environment. For example:

a) A student's performance might be unduly affected by the technology. We wanted to assess ability in Computer Systems rather than ability to cope with the technology.

b) The copy of WebCT was installed at the Leicester campus on a server catering for a variety of other applications around the university, implying 'competition' for server time during periods of high usage, and resulting in a marked deterioration in system performance.

c) Similar performance problems were due to the transmission links between (i) the Milton Keynes campus and Leicester and (ii) Bedford and Leicester, which have limited bandwidth and were not dedicated to this assessment.

Using a dedicated server located on the same site would obviously help to obviate the latter two problems although this was not an option open to us for this particular exercise.

d) Access and security were important issues that needed to be considered in the setting up and co-ordination of the test situation at the two locations.

Preparation

To try to minimise the impact of the technology itself, it was considered both sensible and ethically responsible to prepare the students in advance for what was to be an unfamiliar environment for an assessment. By running a practice test a week before, both the staff and the students were able to explore the mechanics of operating the technology and also experience possible system performance problems at first hand. This then allowed staff to explain the nature of any potential problems and how students should react if they occurred. Students were also made aware that the possibility of a problem was 'factored in' to the time allowed. This was felt to be important in reassuring the students.

Administering the test

The test was administered to all 1st year undergraduate students within the Department of Computer & Information Sciences on both the DMU Milton Keynes and Bedford College campuses during one of their scheduled computer laboratory sessions. Numbers of students within each session varied but all students on both campuses completed their test within one week.

Steps were taken to ensure co-ordination of and access control to these sessions across both sites by means of administrative tools and the use of the telephone. Further security was imposed by limiting the number of attempts per student to 'one' and recording the names of students physically present at each session. Through use of such procedures one could eliminate the possibility of a student 'sampling' a test in advance whilst a test session for another group was being conducted.

50 minutes were allowed for the test that an average student should have been able to complete in half that time, given reasonable system performance.

In only one session did system performance cause any significant delays but students seemed quite comfortable with the need to wait until the system 'caught up'. This, however, might have been more of a problem if time had been short or the questions more complex.

Observations of the test

Three sessions were observed with group sizes of 11, 12 and 15. Sessions were run under examination conditions and were all completed well within the generous time allotted. Where no technical problems were encountered the group included students finishing within 25 minutes, where there were problems, some students did not leave the room until 57 minutes after the start. The problems all appeared to stem from slow response times from the server, due either to other calls on the server, or bandwidth congestion on the links. Specifically, some students were irritated (rather than disconcerted) by having to wait from 2 to 5 minutes before being able to continue. They would have appreciated faster response especially where acknowledgement of an answer having been chosen was concerned, and considered it would be helpful to have acknowledgement of the recognition by the system of a changed answer.

All students were issued with a piece of lined paper for 'rough' working and it was interesting to observe that all but 1 of the 38 students made use of this during the test for a variety of purposes such as 'doodling' whilst thinking, performing rough calculations, jotting down notes.

In addition, most students were observed to work through the questions sequentially, especially initially, although most went on to adopt a strategy of missing out questions they could not answer and then revisiting them. This is not surprising, indicating instead that use of WebCT facilitates the variety of strategies that might be adopted by students in completing such tests. This is an important consideration not always addressed in the design of CAA.

It was also noted that no students attempted to leave the WebCT environment although this might have been possible given the actual set-up. However, in the session with server problems, some students did attempt to check with their neighbour as to whether they were experiencing similar problems which may have compromised the 'exam' situation slightly.

The test results

Most students scored quite highly; the technology seemed to have no negative effect on their performance. These high scores may, it is recognised, have been due to the level of questions posed although this is not an unusual problem in the setting of any multiple choice tests whatever the implementation medium. It may, however, have been the case that as staff knew that this assessment was to be administered in a new environment, they consciously/unconsciously compensated for this in the question setting.

Student feedback

General

Thirty-nine from a potential eighty students completed Web-based feedback questionnaires after provisional assignment grades were published. Students completing such feedback were unsupervised and assured of anonymity in their response in the hope that this would encourage a more honest appraisal of their experience.

The intention was to capture student feedback as soon as possible after the CAA experience, but mainly because of administrative problems, this proved impossible. Nevertheless, the judgement is that the integrity of the responses has not been compromised, as all but one of the questions should not have been influenced by achievement.

Although the date of submission was not captured on the returned, completed questionnaire, there is an inherent date order in the 39 responses. This characteristic enabled detailed scrutiny to detect any patterns, such as change over time in level of enthusiasm, use of comments, negative/positive bias of comments. Another concern was whether awareness of provisional, generally high grades, positively influenced the feedback more in early responses than in later responses. No such patterns were, however, detected.

Questionnaire Analysis & Findings

The range of students' experience in using Multiple Choice (M/C) assessment can be seen (Figure1) to vary from 49% who had little or no experience through to only 10% who claimed to have had a lot.

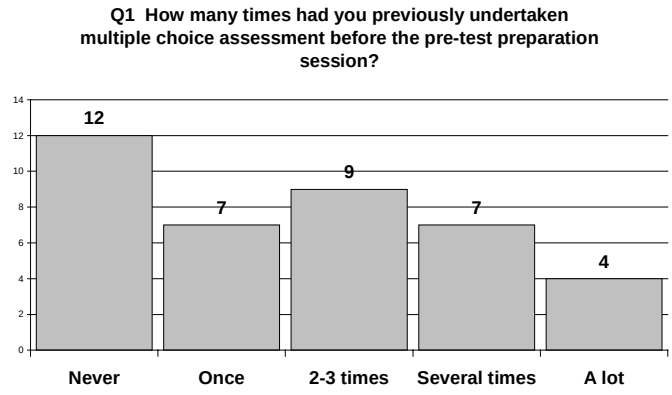

Figure 1

The majority of students (87%) felt that the pilot test was valuable experience as preparation for M/C assessment, with only 13% stating that it was of little or no use to them (Figure 2). Of these five, two who had used M/C assessment once before, found the pilot of little use; two who had previously used M/C assessment either several times or a lot, also found the pilot to be of little use; only one student, who had never previously undertaken M/C assessment, responded that the pilot was of no use. The remaining 11 students who had never used M/C assessment (ref. question 1) found the pilot either very useful, quite useful or of some use.

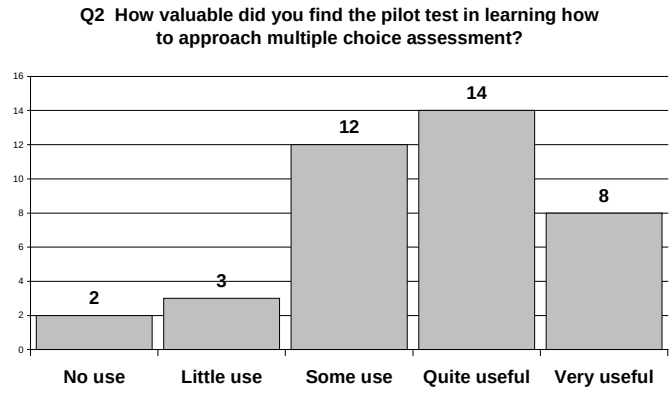

Figure 2

Similarly the pilot test, used as a means of gaining some experience of the "use of technology in assessment", was seen to be of positive benefit to most students (85%) (Figure 3). Of the six who claimed that the pilot was of no use or little use, three also gave the same negative response to question 2. Only one of these three added any comments and these were expressing concern about the server and speed of the system. Interestingly, the one student who answered that the pilot was of "no use", had not undertaken M/C assessment before. Yet (s)he actually found the pilot "very useful" as a learning experience for approaching M/C assessment (question 2). (S)He did comment that (s)he was unsure what question 3 meant, so this response may perhaps safely be ignored!

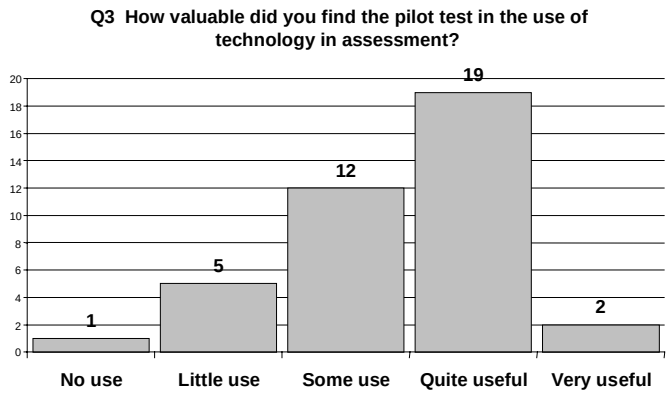

Figure 3

(The expectation that the students across both franchise and main campuses would have a range of experiences was borne out by the responses from question 1, and the use of the pilot proved a valuable means of ensuring some exposure to both Multiple Choice and electronic assessment. (Question 2 &3))

With reference to student expectations of the technology (Figure 4), almost half of the replies (46%) judged that the technology performed as expected and the vast majority voted strongly for future use. 41% said that it was slightly/much worse than expectations and eight of the sixteen noted their reasons as speed and server performance issues. Despite these problems, a few of these individuals submitted very positive written comments regarding future use. Question 4 was the only question that returned a negative trend overall.

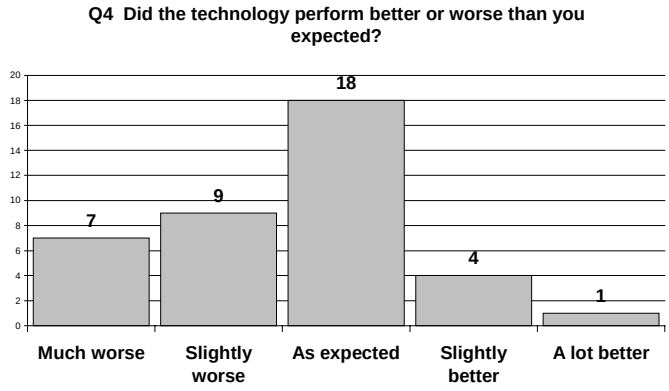

Figure 4

With regard to how they felt about using the WebCT application 54% felt very comfortable and in control. (Figure 5). No students claimed that they were “not in control” and only 2 (5%) stated that they did not feel completely in control. One flagged the server issues as the contributing factor whilst the other cited the speed of the system.

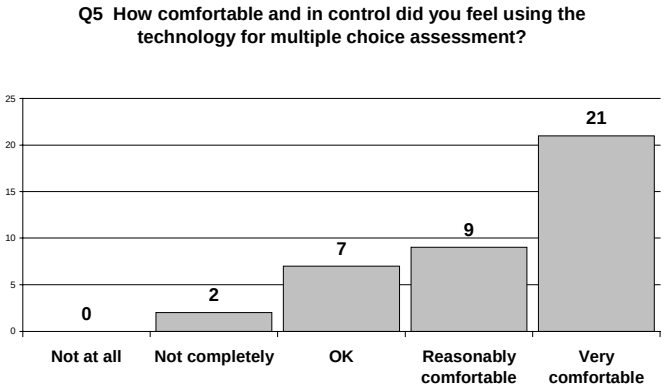

Figure 5

When questioned about the technology and how much it interfered with performance (Figure 6), two-thirds of students stated no significant interference and of the other 33%, 6 mentioned speed as an influencing factor. One ticked the “considerable impact” response and further commented that (s)he found the system was slow but it probably did not affect her/his performance.
(Some of the comments were also relevant to question 4 above)

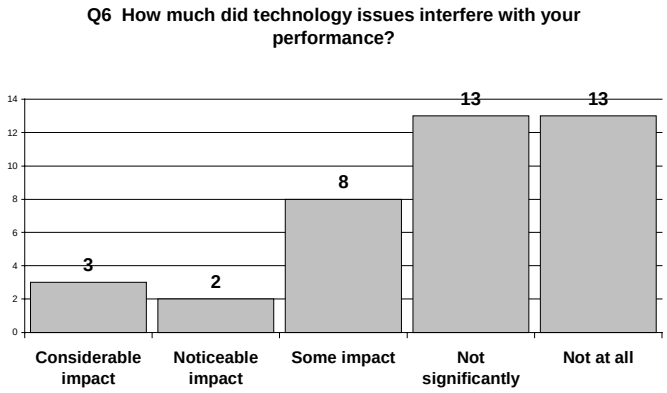

Figure 6

The responses to question 7 were interesting. 82%, believed that the availability of paper was of at least some use, (Figure 7), with 49% claiming that it was "very useful". One student who said that the paper was of no use at all was generally positive in all her/his other feedback.

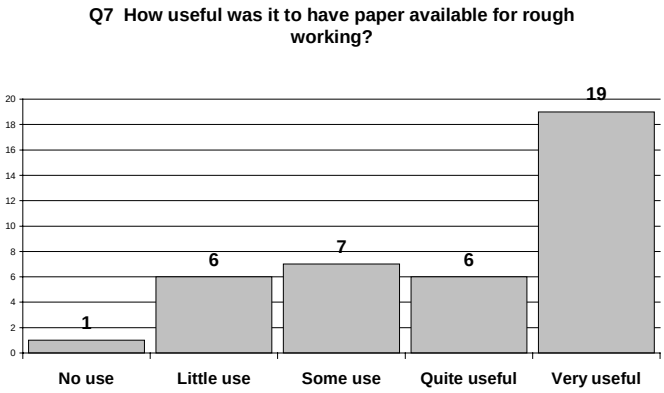

Figure 7

All students felt that there was at least some scope to check/recheck their work in the assessment exercise with 92% of students responding within the top three categories (Figure 8). Of the 3 students who claimed only "some scope", one indicated her/his concern that a changed answer was not visibly acknowledged by the WebCT software. It was also noted that there is no limit on the number of times a response can be changed.

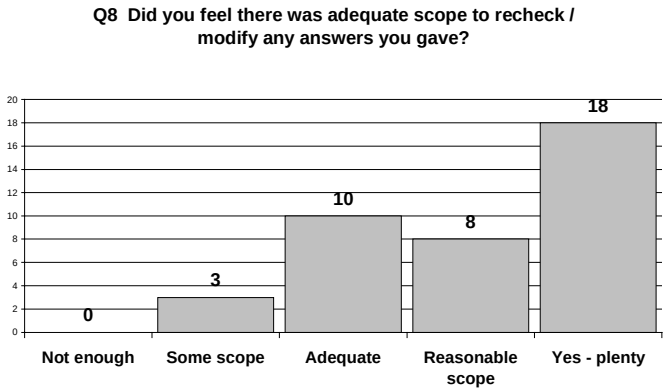

Figure 8

(Staff actually recognised this as an issue during the observation of the sessions.)

Generally students expressed considerable support for the use of CAA (Figure 9). In fact 64% rated it in the highest category i.e. very comfortable with the further use of CAA. No one said that they did not want CAA and only one student stated some concerns that were largely related to the speed of the system. The remaining 33% spread over "OK" to "comfortable".

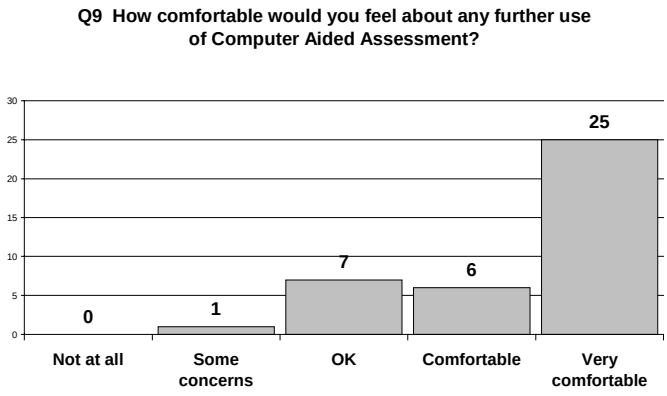

Figure 9

Further Student comments:

Several students commented that they found this exercise more relaxing and less competitive than other forms of assessment. One dyslexic student, in particular, provided a very positive feedback and commented that it had provided a "more level playing field" in which (s)he could demonstrate his knowledge alongside other students. Many expressed a wish to have immediate feedback, both in confirmation that an answer had been recorded and as an indication that a changed answer had been registered.

Overall, the general level of enthusiasm and support for a repeat of this type of computer assisted assessment was very high.

Conclusions

As might be expected, experience of using WebCT for CAA seems to have highlighted a number of issues in comparison with more traditional methods. These may be categorised as administrative/technical, those related to WebCT in particular, and feedback questionnaire use and design.

In terms of administrative and technical issues it seems that:

- As with the initial setting up of any multiple choice question 'bank', much staff time is required. Benefits of electronic storage will, however, accrue with time, as questions can be added/edited more easily and more students can be assessed using the same facility via the immediacy of random generation direct to screen
- Problems with the communications link at Milton Keynes need to be resolved
- Scheduling of sessions is an important consideration with regard to network traffic
- If using the system across different sites there is a need for a telephone link between the sites to turn the test on and off
- Time needs to be 'factored into' the test sessions to allow for potential technical problems
- Security is important but WebCT offers a variety of facilities to ensure this
- The ability for students to stray outside of the WebCT environment needs to be disabled
- Complexity of the test itself needs to be considered
- It seems desirable that students are thoroughly prepared for using WebCT as a vehicle for administering CAA. This can be accomplished through the setting up of a trial session within which potential problems are made explicit and discussed
- Invigilation by a module tutor or technical assistant is required
- Students benefit by having a piece of paper available for 'rough' working
- The speed and range of analyses (in terms of student performance) facilitated by use of WebCT is a valuable learning and teaching aid

With regard to WebCT issues it would seem that;

- Students prefer to gain immediate feedback regarding their results. As noted earlier, WebCT's facility for this was disabled for this particular exercise, because the module tutors wished to retain control of this particular aspect
- It was noted that there was no limit on the number of times a response can be changed so it would seem to be useful to investigate the scope for signalling the recording of changed answers. This might, however, raise other questions such as "How many colours could be used in such an environment?" "How would students reference what each colour signified?"

The use and design of the feedback questionnaire, as always, posed further issues. The medium chosen here was the Web, to facilitate feedback from both the campus-based students and those at the distant franchise centre. However, in addition to the standard issues implicit in any feedback questionnaire design, it was felt that the following factors need to be considered;

- Feedback needs to be prearranged with other staff to enable immediate capture of response to experience and ensure this precedes return of provisional results
- It would prove useful to capture the date of feedback response

As a consequence it is acknowledged that two factors, namely awareness of provisional grade results and non-supervised completion of the feedback questionnaire may have had some impact on the very positive response that was gained. However it is believed that the only real impact would have been on question 9 (reference Figure 9) but this question does not show a particularly different pattern of response to the other questions. In addition, the written comments and generally positive responses to other questions seem to indicate that these results are genuine.

It seems evident, therefore, despite some of the issues outlined in this paper, that the students are positive and enthusiastic in their support for the use of WebCT M/C assessment. It is felt, therefore, that further development of WebCT would be a worthwhile undertaking in terms both of efficiency gains and of enhancement of the learning experience.

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