STUDENT EXPERIENCES OF REMOTE COMPUTER-BASED EXAMINATIONS

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Abstract
The evaluation of CAA has been a largely neglected activity and any evaluation that has been undertaken has been interested in the efficiency of CAA (Bull and McKenna, 2001). The picture remains much the same to-day. In this paper, we report on student experiences of remote computer based examinations. Our experiments have investigated the electronic examination process from the perspective of the institution, examiners and students, but in this paper we shall focus on students' views. We have observed a steady improvement in the students' rating of the experience to the extent that the majority prefer the electronic exam. The paper will examine the reasons for this result and present the students' views on specific aspects of the whole process including the design of an electronic examination paper, the process of downloading the exam paper and uploading the student answers in a synchronous environment, invigilation, and student induction to the process.

Keywords: remote electronic examinations, student experiences

Introduction
In this paper we shall describe some of the results of a number of experiments related to electronic examinations. In particular, we report on the students' views of taking electronic examinations remotely. A remote electronic examination has the following essential characteristics: it is time-constrained, typically of 3 hours duration, the examination paper is downloaded and presented on-screen, it requires the student to type their answers at a keyboard, student answers are free form (not responses to MCQs or their equivalents) and the student is located at a location that is remote from their institution. To facilitate our investigations we have had to look at issues related to:

- the complete examination process including examination paper design,
- on-screen presentation of an exam paper,
- downloading the exam paper and uploading the student answers,
- invigilation,
- automatic marking,
- feedback to students on their performance,
- student induction to the process,
- support for examiners.

We have long felt, particularly in a distance education setting, that the examination experience of attending an examination centre for a conventionally run time-constrained examination is so different to the students' normal study experience that we should aim to provide an examination experience that matches the students' learning environment. "The gap between the environment in which students learn and how they are assessed is widening … there is a radical discontinuity in their educational experience" (Race et al., 1999). One of our aims has been to bring the assessment culture experienced by students closer to the learning environment with which they are familiar and confident. This is particularly important for distance learners who could complete their studies entirely at home and remote from their institution [Mason, 1995]. Indeed, for some students, especially those with disabilities, this may be the only feasible option. The main strength of web-based assessment is the flexibility of access that it offers, which is especially advantageous for distance learners and part-time students (Bull and McKenna, 2001).

In this paper we shall describe our electronic examination process and report on the students' experiences. Space precludes more than a brief discussion of some of the more significant findings. Further details can be found on our web site (eap, 2003). Details of other aspects of our investigations, including automatic marking and feedback, are reported elsewhere: see, for example, (Thomas, 2003).

The examination process

Our investigations have been carried out in relation to a postgraduate course in Computer Science. This course is offered twice per year and is assessed through a combination of continuous assessment and a final examination. Since 1999 we have offered students on this course the opportunity to take a mock exam just before their final exam as a way of gaining examination experience and to complement their revision. The earlier mock exams were asynchronous in which, having downloaded the exam paper, students disconnected from the server and answered the questions off-line. Since 2001 we have offered synchronous examinations in which the student remains connected to the server for the 3-hour duration of the exam. In this paper, we concentrate on the synchronous examination of which there have been three offerings to-date: April 2001, April 2002 and October 2002.

From the students' point of view the process begins approximately half way through the course with an invitation to take part in an experiment. The volunteers are promised a mock exam that is equivalent to their final exam and that they will receive an automatically generated mark and feedback immediately on completion of the exam. They also receive tutor-generated marks and feedback a few days later. In exchange, students agree to complete three questionnaires. The first questionnaire is administered when volunteers register for the mock exam and gathers demographic information. The second questionnaire is quite short and gathers immediate reactions on completing the mock exam. The final questionnaire is administered just after the 'real' exam and collects mature reflections on the mock exam process when compared with the real exam process.

Volunteers for the electronic mock exam register their interest via a web site where they provide an e-mail address, and their university personal identifier and a password that are later used for access to the secure mock exam web server. The majority of volunteers take the mock exam at home, and have been located across the UK. A few students have been based in mainland Europe.

Once the registration period has closed, volunteers are given further information about the three essential features of the subsequent process:

1. Installation of publicly available synchronous messaging software for invigilation purposes;
2. Access to a 'test' exam paper for familiarisation purposes;
3. Instructions for access to and use of the mock exam paper.

During the mock exam we are in constant contact with all students using a synchronous messaging system that enables us to communicate using text, audio and video. All volunteers must have a sound card, microphone and speakers. If students have a web-cam, we encourage them to switch them on, but our experience is that only a very small proportion of our students have this equipment. We have adopted Yahoo! Messenger for synchronous communication because it is freely available: it has worked well.

Given that it is very unlikely that any of our students have experienced taking a remote examination we wanted to minimise the familiarisation period during the mock exam (although for the majority of students this was not an issue). Therefore, we made a simple test exam available for students to practice on prior to the mock exam. Most students took advantage of this provision.

On the day of the mock examination, for a period of about half an hour prior to the start of the exam, students are asked to use the messaging software to contact us to ensure that this software is functioning properly and can be used to solve problems that might arise during the examination.

Approximately ten minutes before the advertised examination start time, students are given access to the mock exam web site from which they can download the exam paper. Should anyone have difficulty accessing the site or downloading the paper we can use this time to solve the problem. Once a student had downloaded the exam paper s/he was free to start answering the questions. Access to the paper for downloading was restricted to the first half-hour of the exam period.

Throughout the examination period we contacted each student on several occasions to determine how they were progressing and whether they were facing any technical difficulties. Students could also contact us whenever a problem arose (of whatever kind – technical or exam related). Students were

encouraged to save the current state of their answers at regular intervals in order to minimise the effects of any failure of their PC or Internet service.

Towards the end of the exam period we broadcast several time warnings and finally instructed students that they must submit their answers before access to the server would be denied. Students could submit their answers at any time after the first half-hour of the exam period. Having submitted their answers, students are informed that they will receive automatically generated marks and feedback within a few seconds and while they wait they are asked to fill in a brief 'initial reactions' questionnaire. On completion of this questionnaire, students are given their marks and feedback.

The electronic exam paper

When designing an electronic exam paper for downloading and display in a web browser it is important to ensure that it is comparable to a conventional printed examination paper in terms of familiarity and flexibility in use as well as providing additional facilities appropriate to the new medium. Figure 1 shows a screen shot of the electronic paper used in the mock exam of October 2002 (the design has been modified after each mock exam).

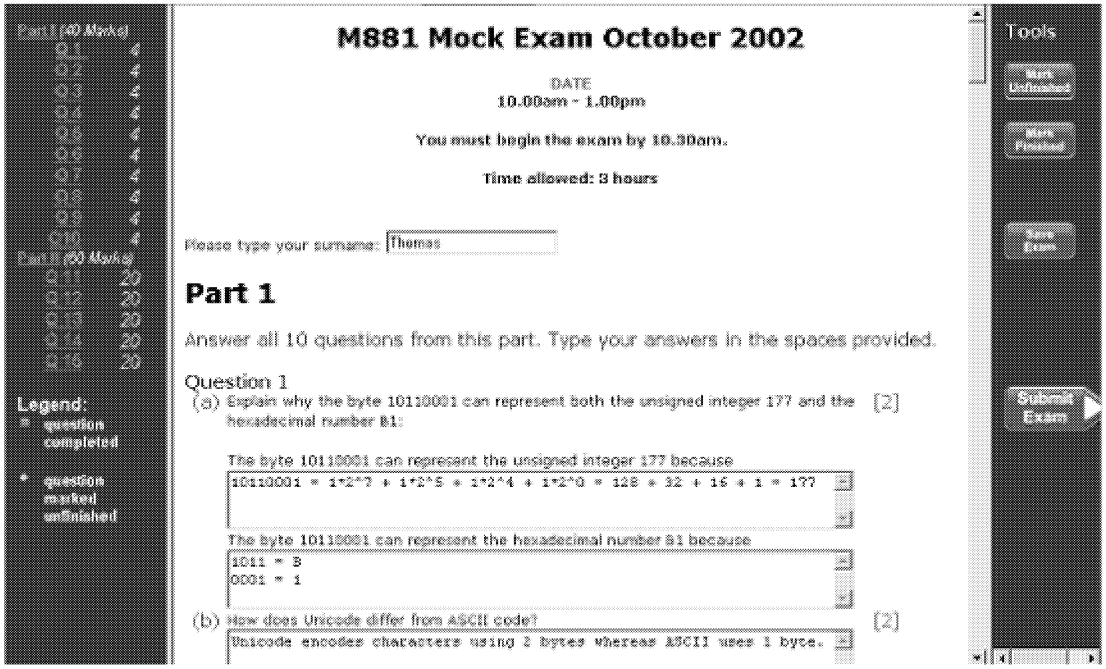

Figure 1 Electronic exam paper

The centre portion of the screen is devoted to the rubric and questions and has a text box for entering answers to each question part. All answers are entered as free-text, that is, there are no multiple-choice questions.

The left-hand frame has an index to the questions in the form of hyperlinks for ease of navigation and browsing. The latter is particularly important in Part 2 of the exam where students must select three out of the five questions on offer.

The right-hand frame contains a small number of tools. There are tools for recording the state of completion of each question. A marker can be placed against each question number in the index to indicate whether the student feels s/he has completed the question or wants to return to it later (see the Legend at the bottom of the left-hand frame).

The button labelled Save Exam causes a copy of the current state of answers to be saved on our server. This enables answers to be recovered in the event of a computer or communication failure. The final button, labelled Submit Exam, is used at the end of the exam to upload the student's final answers.

The design has been found to be acceptable to students. Most students said that they took less than five minutes to become familiar with the design.

Some students said that they would have liked a spell checker. In principle, there is no reason why such a facility can not be provided and we may well include one in a future trial.

There are a variety of other tools that could be included on an electronic exam paper (for example, a countdown clock) but a balance needs to be drawn between the usefulness of such tools and the overall complexity of the paper.

A substantial minority of students found it necessary to do some rough work on paper which, of course, was not submitted.

A small number of students had difficulty with some of the functionality of the electronic exam paper which we believe was related to problems with a particular version of a browser.

Student feedback on the process

In April 2001 we obtained feedback from 13 students to the question, "How do you rate this experience compared to a normal examination?" The results are given in Figure 2.

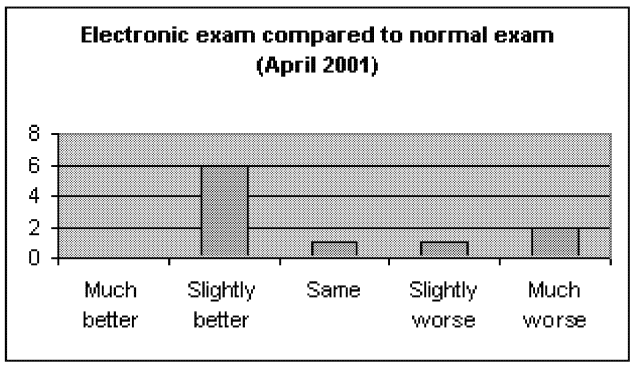

Figure 2 The mock and real exam experiences compared (April 2001).

Thus, 70% thought that the electronic exam was about the same or better than a normal exam and 30% thought it slightly or much worse. The responses from 23 students in April 2002 to the same question are shown in Figure 3.

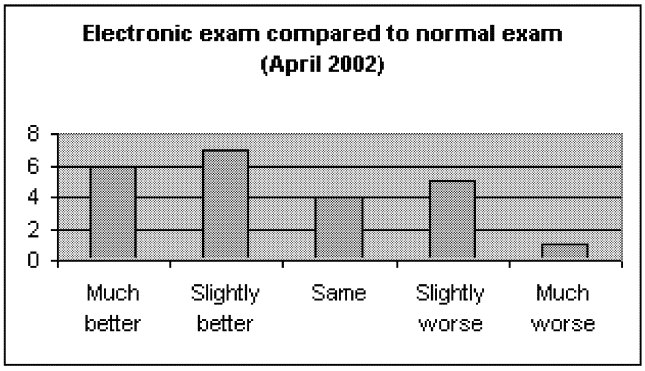

Figure 3 The mock and real exam experiences compared (April 2002).

Hence, 74% thought that the electronic exam was about the same or better than a normal exam and 26% thought it slightly or much worse. The responses from 14 students in October 2002 are shown in Figure 4.

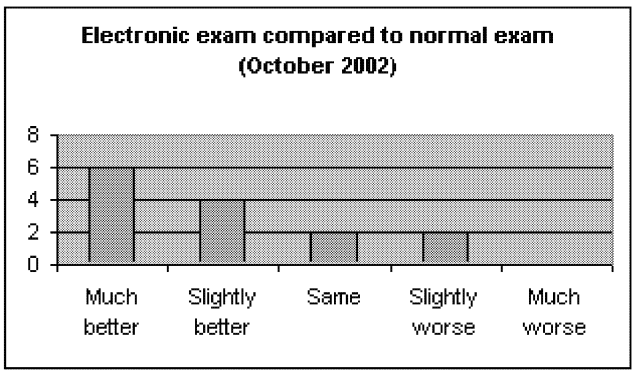

Figure 4 The mock and real exam experiences compared (April 2002).

This time, 86% thought that the electronic exam was about the same or better than a normal exam and 14% thought that it was slightly or much worse. Hence, we have seen a general improvement in satisfaction which we put down to improvements in our process and better Internet communications.
The reasons given by the students who rated the electronic exam as better (much better or slightly better) in the October 2002 mock exam were:

- typing is an advantage over hand-writing (mentioned 5 times),
- convenience: not having to travel to an examination centre (said 5 times),
- less stressful (said 4 times).

(The perceived advantage of typing over handwriting was cited by the majority of students whether or not they rated the experience as better than a normal examination.)

The students who rated the experience as the same as a normal examination gave the following reasons:

- there was no spell checker with the electronic exam (said once),
- a lack of time to complete the exam (said once).

These issues apply equally well to a conventional written exam. Indeed one student volunteered that,

"The mock is meant to represent the [final] exam. And it did just that."

The one student who said the experience was slightly worse than a normal examination stated that:

"The mock exam was harder to check over because [you] had to scroll through each answer in turn which takes time whereas in written exam you only have to turn page."

However, use of the index would have alleviated this problem.

Students were asked about the clarity of the screen design: their responses are given in Table 1.

Table 1 Responses to "Was the screen design of the examination clear?"

Cohort	No of students	Clear %	Not clear %
April 2001	10	70	30
April 2002	23	83	17
Oct 2002	14	86	14

Those that found the design to be unclear said that the main problems were to do with screen size – too small to render all the information simultaneously – and the need to scroll (generally, students dislike scrolling for whatever purpose).

Given that students would be typing their answers as opposed to hand-writing them, we were anxious to know whether typing in an examination would be perceived as a problem. Table 2 shows the responses to a question related to whether students had enough time to type their answers (the three exams were very similar in content).

Table 2 responses to "How do you rate the time allowed to type your answers?"

Cohort	Plenty of time %	Just enough time %	Not enough time %
April 2001	40	30	30
April 2002	39	52	9
Oct 2002	50	36	14

The results show that the majority of students had sufficient time to type their answers. On the one hand, this is not surprising given that they were used to

constructing their assignments as electronic documents but on the other hand, the fact that some students would appear to be disadvantaged by typing is of concern. However, when we examined the reasons given for non-completion of the exam in October 2002 by the three students in this category, we found that one student had not revised sufficiently to answer all the questions, one student had technical problems starting the exam and so lost time and the third student said that there were too many questions to complete in the time and only managed to complete 30% of the exam. It would be interesting to know what the corresponding statistics would be for a conventional hand-written exam.

We have performed a number of other analyses that examine the effects of typing in an examination which compare behaviour in the mock exam with behaviour in the subsequent real exam. These are the subject of another paper but the results can be viewed on our web site [eap, 2003].

Table 3 summarises the responses to a question about how long it took in the actual mock exam to become familiar with the exam paper (this question was not asked in this form in April 2001).

Table 3 Responses to "How long did it take you to become familiar with the electronic exam to be able to start answering questions?"

Cohort	Less than 5 mins	5 to 10 mins	10 to 15 mins	more than 15 mins	Looked at Test Exam
April 2002	22	1	0	0	22 from 23
Oct 2002	11	2	0	0	10 from 13

Although we did not ask this question in April 2001, one student in that cohort reported taking a considerable time, that is, more than 15 minutes, to become familiar with the paper. The data in Table 3 indicates that familiarisation was not a major issue for these students but we do not know whether accessing the test paper contributed significantly to this effect.

Finally, we looked at the use of a synchronous messaging system and the effect it had on the students' ability to concentrate on the examination. Our interest in being able to communicate with students during the exam is two-fold: to be warned of problems and to offer solutions quickly, and to investigate its potential for use as an aid in authentication. Table 4 gives the students' responses to questions related to ease of use and intrusion into the students' work.

Table 4 Responses to how easy was it to use the messaging system and whether its use was intrusive.

Cohort	Easy to use*	Not easy to use	Not intrusive	Slightly intrusive	Very intrusive
April 2001	9	1	8	2	0
April 2002	20	3	19	3	0
Oct 2002	12	1	6	7	1

* In April 2001 we used Microsoft NetMeeting; in April 2002 and October 2002 we used Yahoo! Messenger.

The results suggest that very few students found the software difficult to use and that its use was at worst slightly intrusive. Only one student to-date has felt that its use was very intrusive.

Work in progress

We shall be repeating the experiments reported upon here. Our next electronic exam was offered in April 2003 where we trialled an improved feedback mechanism and a diagramming system that allowed students to draw diagrams that could be subsequently marked automatically. We will also had a slightly revised design of exam paper. The results from this trial are currently being analysed.

We are currently comparing the results from the October 2002 mock and real exams looking further into the issue of typing in a formal examination (a draft paper can be found on our web site (eap, 2003)).

References

Bull, J. and C. McKenna (2001) *Blueprint for Computer Assisted Assessment*. Available online at <http://caacentre.ac.uk/blueprint.shtml http>

eap web site (2003) <http://mcs.open.ac.uk/eap>

Erkut, E (1999) *Experiences with online exams*. In: HyperDispatch. Available online at <http://www.ualberta.ca/CNS/PUBS/hyperDispatch/hyperDispatch22/exams.html>

Mason, R. (1995) Using Electronic Networking for Assessment. In: Lockwood, F. (Ed) Open and Distance Learning Today. Routledge, London.

Thomas, P.G., B. Price et al (2001) *Experiments with electronic examinations over the Internet*. Fifth International Computer Assisted Assessment Conference, Loughborough University, Loughborough, UK.

Thomas, P.G., B. Price, C. Paine, and M. Richards (2002) *Remote Electronic Examinations: an architecture for their production, presentation and grading*. British Journal of Educational Technology, **33** (5) 539-552.

Thomas, P.G. (2003) *Evaluation of Electronic Marking of Examinations.* Proceedings of ITiCSE, Thessaloniki, Greece, July 2003.

Thomas, P.G. and C. Paine (2003) *The effect of typing on student behaviour in remote electronic examinations*. Available online at <http://mcs.open.ac.uk/eap>