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Towards the introduction of institution wide computer assisted assessment: a service department experience

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Towards the introduction of institution wide computer assisted assessment: a service department experience.

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Abstract

Workloads and lack of awareness, availability and knowledge of how to use the available tools are barriers to the use of new assessment opportunities. A range of resources and expertise is needed to optimise the effectiveness of computer assisted methods. These are infrequently found together in any single area. Teaching professionals know who and what they need to assess, computer professionals understand the resources required and learning professionals are able to advise on good question design. At the University of Huddersfield a partnership has been formed between one of its eight academic schools, the computing service and the staff development unit to explore and evaluate the opportunities of computer assisted assessment and to provide an academic and support framework on which the rest of the University can build. This initiative arose in response to an awareness in the computer centre of the activities of a few enthusiasts, a general interest amongst the teaching staff, the difficulty that teaching staff have in finding time to investigate alternative testing methods and the current assisted assessment opportunities.

Three generic assessment tools are used throughout the project, optical mark technologies, networked laboratory computers and the world wide web. The relevance of each to particular assessment situations is discussed and the resource requirement for implementation of each identified. The paper does not seek to address the costs and benefits of computer assisted assessment, this is covered adequately elsewhere. The issues discussed here are how different interests can be brought together to provide the procedures and support mechanisms necessary to enable effective implementation of institution wide computer assisted assessment. The needs of students and teaching staff are identified and alternative ways of providing an assessment service are discussed.

Introduction

The Dearing report (National Committee of Inquiry into Higher Education, 1997) makes clear the belief that C&IT presents great opportunities for improving quality, flexibility and effectiveness in higher education. There is potential to reduce future costs but a requirement for investment in the short term. In UCISA's response to the Funding Bodies Review of the Use and Dissemination of Communication and Information Technology (C&IT) Materials in Teaching and Learning in Further and Higher Education (UCISA, 1999), the importance of involvement of C&IT service providers is made clear. When institutions are implementing C&IT materials the C&IT service providers should be recognised as key players and such service providers should make major contributions to the development of C&IT strategies. Use of computer assisted assessment (CAA) methods is one opportunity that C&IT offers.

Although there is genuine interest amongst most teaching staff in the benefits that CAA may bring there is considerable effort involved in adapting from existing assessment methods and not all teaching staff are convinced that the benefits fully justify the effort. CAA offers the potential of saving time in the long term but places greater demands in the short term on staff already working under extreme pressure. Present CAA technologies do not support all assessment requirements so many teachers discount CAA entirely, to others the technology itself proves an obstacle.

To take advantage of the benefits of CAA whilst addressing the disadvantages needs institution wide investment to promote special consideration at the course development stage, a sufficient and robust IT infrastructure and an adequate support mechanism. CAA may take the pressure of marking away from teaching staff, but it gives rise to an increase in the workload of support staff and places extra demands on the technical infrastructure. If CAA is planned and implemented University wide there are many long term gains to be made from major short term investment.

Background

This paper describes the experiences of members of the Computing Services Department in their attempts to facilitate and encourage a move towards the establishment of CAA as a viable alternative within the University and to ensure that the necessary infrastructure is in place. The University of Huddersfield has eight academic schools each operating autonomously. Within several of these schools there are a few teachers already implementing CAA, several who are interested and many who do not have the time or interest to develop new approaches to assessment. On the support side there is a computer centre which provides networking facilities for the University, rooms of networked PCs for student use and an IT training, advisory and consultancy service. A Quality and Staff Development unit in the University offers training and consultancy for teaching and learning issues.

Requests were received at Computing Services in 1997 about the opportunities for academics to use computer assisted assessment in the University. At this time the University managers made it known that they wished greater use to be made of C&IT in the teaching and learning process. Computing Services believe they have much to offer to develop expertise, to provide a central resource and to facilitate the sharing of information and experiences as well as the installation and support of C&IT systems for use University wide. A pre pilot survey to assess current interest within the University was conducted. 620 academic staff at Huddersfield were asked to complete a short paper questionnaire on their use of C&IT for assessment. 82 responses were received and of these 78 expressed an interest in using computers to assist the assessment process. We assume the 538 academics who did not respond are not sufficiently interested in computerising their assessments, are not involved in the assessment process or wish to remain independent of Computing Services. After a series of demonstrations of the Question Mark Designer for Windows software 30 academic staff across seven of the eight University schools expressed a wish to use the software for testing students. Although the world wide web is seen as an alternative presentation method, at the time the web version of Question Mark did not have the full functionality of the Windows version. The decision was made to use Question Mark Designer for Windows in a pilot study and a bid was made for purchasing a site licence.

There was then time to consider the lack of response from over 500 hundred members of academic staff. There were potentially two problems to address: the need to persuade disinterested teaching staff that taking CAA on board could enhance teaching and learning opportunities and to persuade disaffected staff of the benefits of working with the service departments. A project was proposed for Computing Services to work with an academic school which had also expressed a commitment to promote the use of CAA. Whereas Computing Services are able to contribute technical knowledge and skills, there are also pedagogic issues which come under the remit of the University Quality and Staff Development unit. To provide support for all aspects of CAA this group also became involved with the project. Progression was put forward as a bid for a University Teaching Fellowship which was successful. The project in the form of a pilot service has been running since November 1998 and is due for completion in July. On completion experiences from the pilot will be shared with the rest of the University and it is anticipated that support systems will be in place to enable other members of the University to take advantage of CAA technologies with confidence and ease. At all stages it is made clear that CAA offers an additional learning support mechanism and does not directly replace other mechanisms. Brown (Brown, 1999) has noted that universities and colleges internationally use a very limited range of assessment methods, 80% of examinations being in the form of written exams, essays and reports, whereas the opportunities are far wider. Objective structured examinations are just one of the many other opportunities. Objective testing should be seen in the overall context as providing just one of many approaches that can be made.

Methods

Computer assisted assessment has been in use at Huddersfield University in isolated pockets for some considerable time using Question Mark software. Interest has also been expressed in the use of optical mark readers to aid the assessment process. At the same time there is enthusiasm for wider use of the world wide web.

A number of problems affect the attitudes of staff towards incorporating computer-based teaching methods and resources into their modules. Three are specifically identified as: many staff have a limited IT background and lack confidence; access to appropriate systems are restricted; poor perception of the benefits (Sosabowski, Herson, Lloyd, 1998). It is therefore sensible to choose simple tools available on the most common platform to promote CAA more widely. With this in mind and to take on board existing enthusiasts a three pronged attack was adopted using optical mark reader (OMR) technologies, locally networked and web based applications. These form the basis of the pilot service established to implement and evaluate CAA opportunities and procedures.

Three simple generic tools were chosen for the pilot, Question Mark Designer for Windows (Question Mark Computing, 1996), the Chatsworth model 1100 OMR with software written by Dr Andrew Booth (Booth, 1992-97) and the CASTLE web toolkit (CASTLE Project, 1998). Although these are piloted in a single academic school and staff within this school are actively encouraged to use one or more of these tools, staff from other academic schools expressing an interest in these methods are not discouraged and where possible are given the same level of support. The three methods piloted enable easy use and rapid marking of objective tests with multiple choice and multiple response type questions. There is continuing discussion about the usefulness of objective testing but the literature give many examples and recommendations for its use. Heard, Nicol and Heath (1999) in their guide to objective tests list the strengths and weaknesses. Although objective testing cannot test written expression or ability to develop an argument there are many benefits if well designed. A major advantage of objective tests is reliability (Adderly, Pearce, Williams, 1981). Objective tests can give better syllabus coverage due to the large number of questions that can be included which are all attempted by the student, marking is completely objective and results from year to year can be more accurately compared (City + Guilds, 1977). There is evidence that students enjoy completing short sharp tests and can be motivated by them (Bell, 1985).

Training, support and evaluation mechanisms need consideration for each of the supported tools. Training materials were developed early on in the project; this was a useful learning experience for the technical staff who would be supporting the applications. For the pilot, a service is offered to lecturers for conversion of MCQs to the package of their choice. This is to encourage

staff to try other ways of testing and so far requests have all been satisfied. Technical support is arranged but a review of the University infrastructure is needed to assess the ability to support large numbers of on-screen tests.

Tools

Optical Mark Reader

The system chosen is cheap and easy to use and has generated the greatest initial interest. Many lecturers already have MCQs in paper format and it is very easy to move from responses made on paper to responses marked on the OMR cards. Tests can be presented in the normal class or laboratory situation with no specialist equipment necessary and results produced within an hour, an attractive prospect. Although the process is simple some preparation is needed beforehand both for students and lecturers. The students need to be told exactly how to fill out the cards, student identification codes need to be marked and a soft pencil must be used to make correctly formed marks in the allowed areas. Support is given to lecturers wishing to use the OMR: acetates with full instructions to students can be borrowed from Computing Services and guidance notes and demonstrations are provided for staff. So far three separate cohorts of students have successfully used the system, some of them more than once. The need for a central support mechanism was demonstrated when for a fourth cohort of students the lecturer slipped through the system, managed to acquire some cards without any supporting documentation and presented a test to students who had not been prepared. Marking this test involved much time and effort as many cards were inadequately or wrongly completed. The cards were eventually marked and the results correctly allocated without needing to refer back to the students but the lecturer was left with negative feelings about the test experience. The OMR system used is suitable only for formal marking; the student is not able to assess his/her own work without the intervention of a staff member to process the responses.

Question Mark Designer for Windows

As this application is already in use there already exists some expertise in the University and early on in the project the service departments in the pilot were able to learn much about the requirements of the application from existing users. At the same time Computing Services were able to help and advise on best practices for storing, making secure and retrieving student answers when these needed recording.

Tests created or converted from previous versions by the technical support team all use the same screen style with common buttons so that students will become familiar with question appearance. As an aid to familiarisation Question Mark quizzes have been put in place on student networks. These are readily available to all users of the centrally resourced student networks and serve a dual purpose: to provide novel solutions to perennial problems and to familiarise students with the Question Mark interface.

Question Mark Designer for Windows is presented on local networked PCs and can be used for both formative and summative assessment with options to display a final score and to provide varying levels of feedback after each question.

The CASTLE toolkit

This is a web based tool for creating multiple choice and multiple response questions. Tests must be made available on a local web server but are marked at the toolkit site, Leicester University. There has been little take up of this application for use in conjunction with full time courses as it is in open competition with Question Mark for any tests that are presented on site. We are recommending its use for part time and distance learners and are currently negotiating its use for specific courses.

The tool is suitable in its present form for formative tests but not for summative tests. Test results are not stored, they are fed directly back to the student at the end of the test. Since the benefit of a web based system is its availability off site it may not be a suitable medium for summative assessment due to problems authenticating the candidate.

Question Database

In creating new objective tests many questions have been used. These questions should not be limited to one particular software platform and staff wishing to have tests created for them are asked to provide the questions as plain text documents. To keep these questions available for any future use a database has been created and all questions that pass through Computing Services, with permission from the academic member of staff, are added to the database. The database application used is Microsoft Access from which text can be exported in a number of different formats. Graphics associated with questions are also stored.

Writing Objective Tests

Heard, Nicol and Heath (1999) have produced a very useful document on setting objective tests that includes a guide to writing the questions. This comes with a floppy disc and is a self teaching tutorial. The learning tool “Better Testing” written for Question Mark also provides a useful guide to writing objective tests. As a preliminary to formal instruction in the pedagogic issues of objective testing both are recommended to interested staff. The Better Testing software is available to all staff through a site licence. The tutorial can be purchased from the University of Aberdeen. Before the start of the next academic year development in writing objective tests will be available to academic staff as part of the University Quality and Staff Development Group programme.

Summary
The tools chosen for the project were deliberately simple, generic and commonly available. The aim is to stimulate interest and establish CAA as an integral part of the teaching and learning environment then to test the suitability of the current University infrastructure to support inherent CAA. As new systems become available the institution will need constantly to assess their suitability for current needs. Ability to take on board new methods will be a constant requirement as ever changing technology continually offers new opportunities.

Support

Technical assistance
Arguably more important than supporting the development of tests is support of the test situation. Students and teaching staff need to be confident that tests can be carried through without interruption and that responses are correctly recorded and marked. The University needs to be confident that tests, responses and reports are securely stored. Procedures need to be in place to ensure reliability and security. For a common feel to all tests presented using the same methods, installation and management of software used should be uniform across the institution. Computing Services staff are ideally placed to advise and oversee these procedures and to ensure consistent application across all academic departments.

By being involved in the procedures relating to software use, presenting tests and security Computing Services staff are also best placed for providing technical support and advice to any teaching staff wishing to use CAA.

Training
Computing Services provides training in the use of a number of the core software used throughout the university. OMR and Question Mark Designer for Windows training have been added to the selection on offer to all staff but dedicated sessions are provided for staff within the pilot. The web tool is perceived to have limited use at present and although a guide to using the CASTLE toolkit has been produced, training is not offered. The objective of the training is to enable lecturers to take control of their own test development. Once CAA is introduced throughout the university the technical infrastructure could not support all test development so lecturers will need to take ownership of their own tests.

It became apparent whilst assisting lecturers to create and implement their objective tests that there is some lack of understanding of the principles of question design and the statistics commonly used to describe test results. It is not within the remit of the pilot to address these issues directly but they are important. This problem was discussed with the staff development group who will arrange appropriate courses. Meanwhile academic staff are reminded of

the complexities of writing objective tests and the software and tutorial described above are recommended to them.

Infrastructure

To present CAA to students there are minimum hardware and software requirements, the level of these depending on the method used. There also need to be accepted procedures for implementing any form of CAA. Infrastructure in this context is meant to include hardware and software provision, support services, procedures and regulations.

The OMR method places very little demand on hardware, using OMR technology requirements are minimal. A single PC attached to the reader with appropriate software is all that is needed and this PC need not be in an area used by students but there are staffing and geographical issues to address. Questions should be asked before implementing appropriate procedures:

- Will teaching staff process the cards or will this be done by administrative staff?
- If administration staff are involved should they be from the local teaching area or in central services?
- If there is heavy use of the system is one reader sufficient?
- Is it more efficient to place readers in each academic department or to have them available centrally?
- If centrally should they be permanently set up or available on loan when needed?

For on-screen tests students need to sit at a workstation. Clarification is needed on requirements and resources for effective implementation:

- Does the institution have sufficient workstations together in an area for testing of groups of students to be feasible?
- What size groups can be catered for and what are the typical sizes of groups for testing?
- In using resources for testing are other users disadvantaged?
- Are the institution systems and networks able to support demands of the software used?
- Is there sufficient technical support to manage and maintain the testing systems?
- Will students have sufficient opportunity to become familiar with a new test environment?
- Are special arrangements needed for disabled students?

The answers to these questions will vary between institutions.

In addition to these concerns further matters arise when on-screen methods are used for summative tests and examinations:

> Does your institution allow the use of on-screen examinations or do current regulations relate only to paper scripts?
>
> Is your institution amenable to making the necessary changes to regulations and who is best placed to take this forward?

Security and reliability are important and the service providers are best placed to advise and help in this. Discuss with them procedures needed to maximise security and what failsafe systems are needed to maximise reliability. Find out if there are technical staff to take responsibility for putting tests on systems and checking them.

Heard, Chapman and Heath (1997) have provided a very useful protocol for implementation of summative computer-assisted assessment examinations. Recommendations are made that when booking examinations spare capacity should be allowed both in numbers of PCs and time allocation and that a server is dedicated for examination use. Tasks are identified for staff from both the academic department and the service provider and these need to work closely together before, during and after examinations. This document makes no reference to regulations. I suggest that any institution should draw up similar procedures then seek agreement from its authoritative bodies before implementing on-screen examinations.

Communication

There are four stakeholders in any computer assisted assessment exercise: students; lecturers; service providers and the examinations or student record office. It is essential that communication occurs regularly, frequently and formally between these.

Students should be presented with systems that they feel able to use and that do not pose a threat or cause irritation. It is important therefore that students have ample opportunity to become familiar with and understand the tools they are expected to use. Although this applies to any technology a student may use throughout his/her course it is particularly relevant to the examination experience where the tool used could become a factor of their final mark in a subject with no intended IT relevance. Students should also have the opportunity to make their examination experiences, either positive or negative, known and this information should be used to improve the student experience.

The service providers must provide the right systems for the task. Inappropriate systems lead to student and staff disaffection and ineffective use of resources. It is imperative that academic staff let the services know of any changes in the teaching and learning processes. Even when there are no obvious IT implications there are often knock on effects in student use of

pooled resources. This is particularly true in the use of CAA. At the same time the service departments have a responsibility to monitor and report IT usage and to provide workable communication links with academic staff. The situation should never arise where an academic department introduces a new scheme reliant on specialist software only to find that the software does not operate as expected on the University's systems. This has been known.

Institutional bodies need links with students, academics and services and must be informed of processes and problems at the same time ensuring that University policies, procedures and plans are clearly understood by all.

Evaluation

Change is introduced to satisfy identified aims and objectives. That change is only beneficial if those aims and objectives are achieved, they must therefore be measured. When introducing CAA the uptake must be justified. It should:

benefit the stakeholders;

achieve the aims and objectives;

record any unforeseen problems.

Appropriate evaluation will address these issues.

To evaluate new methods consideration should be given to evaluation at the design stage, it is important that evaluation is integrated into any project. The benefit of evaluation is the opportunity it provides to make modifications. Discussion about evaluation can be found on http://www.elec.gla.ac.uk/TLTSN/evaluation.html. There are many methods available but of first consideration are the aims and objectives of the evaluation. The following questions should be asked:

Who is the evaluation for?

What do you what to know?

What will you do when you find out?

How will you get the information?

Evaluation is being applied to the CAA project at Huddersfield to find out student reaction to CAA tests, staff reaction to setting CAA tests and the effect it has on the Computing Services. Student evaluation will be by voluntary on-screen questionnaires and staff evaluation will be by interview.

Conclusion

Application of the tools

OMR technology: This is found to be particularly suitable for summative assessments carried out on a regular basis throughout the teaching period of a module. Tests can be carried out during class and if arrangements are made for marking by other staff a lecturer is able to start a session with a test then have the results back for the end of the session.

There is no practical reason why formal examinations in normal examination rooms should not have a multiple choice element using marked cards.

Web technology: This is suitable for formative assessment, particularly for students who are not able to use the University systems but have access to a computer away from the University. Within the University the web is perceived as slower than using applications directly from the University network. The CASTLE toolkit provides a convenient way of presenting MCQ tests over the world wide web.

In its present form the CASTLE toolkit is not suitable for summative assessments as results are not saved.

Windows based technology: the Question Mark for Windows software has been found to be useful for both formative and summative assessment as well as student evaluation of modules. Limitations of its use are due to general availability of computer seats and the small numbers of PCs per room for examination purposes. This places a high demand on invigilators in order to comply with the University regulations.

Problems and resolution

Academic interest: One of the aims of this project was to generate interest amongst academic staff in the possibility of using CAA but no enforcement was intended. Although many staff have expressed an interest there are some who do not wish to use CAA technologies immediately and others who do not anticipate using CAA at all. The views of these staff have been sought but no pressure has been placed on them to change their views.

Academic staff time: This was not an issue for converting questions in the initial stage of the pilot as most of the work setting up the electronic questions was done by technical support staff. As training and documentation becomes readily available it is anticipated that academic staff will do more of the preparation work themselves. Staff creating tests for new courses have found the need to create tests at the time of

writing course material to be time consuming but appreciate that this is a task which will not need doing again at a later stage and advantages are seen in the ability to build libraries of questions.

Software: The OMR and web technology involved little financial investment. To proceed with widespread use of Question Mark for Windows it was necessary to invest in a site licence.

Hardware: An OMR has already been purchased and this is used for the pilot. The software used with the OMR does not require a high specification PC and so a low specification redundant PC has been dedicated to use with the OMR. A second redundant PC acts as backup in the event of failure.

For web based tests very little space is needed and sufficient has been allocated on the University web server. Access to this service is currently restricted to the technical staff involved with the pilot. This arrangement will need reviewing if other staff wish to put up tests on this service.

For Question Mark formative assessment tests are put up on the student networks. It is felt that for summative tests a dedicated server is needed. For the purpose of the pilot a redundant, low specification server is used. Although this is adequate for the small number of tests currently under development it would not be sufficient to support University wide CAA.

Next stage

The pilot is not yet complete and the next stage is to implement all the summative, formative and evaluation systems that have been created in the early stages. On completion the experience gained will be shared with the whole university community. Recommendations will be made about the infrastructure Computing Services needs to put in place and the procedures needed to provide a CAA service.

There will be a continuing need to monitor availability of new CAA systems and student and staff needs so CAA can be kept up to date and effective.

Recommendations

Although the pilot project is not yet complete some lessons have already been learnt. For any University wanting to make more of CAA our initial experience suggests the following:

If you already have question papers of MCQs then think about using a simple OMR system in the first instance;

If you want to use networked PCs or web based systems then talk to your computing services provider, check that the systems can do what you want;

If you want to do examinations on-screen check with your service department to see if it is logistically possible and check with your examinations office to find out if it is acceptable;

Academic staff wishing to use objective testing should be encouraged to learn more about setting objective tests;

Put adaptable procedures in place. Technology is continually changing so do not risk becoming “locked in” to outdated systems.

A fail safe server should be dedicated to CAA use.

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