

e-Assessment :Using ICT to measure skills, understanding and knowledge

e-learning is providing organisations and individuals with the tools to use technology to support learning. There is now a serious and substantial market place out there dedicated to providing the systems and the content to enable individuals to learn at their own pace, in their own environments and to meet their own learning objectives. E-Assessment takes this movement a stage further by providing systems to measure both the performance of the students and the delivery of that learning.

In February 2003, a major conference and exhibition will examine the practical issues involved in selecting, implementing and using computer based assessment and testing. The e-Assessment Question (London, February 27th and 28th, www.e-assessment-question.co.uk) will see leading speakers from the world of education, industry and the public sector share their views and experience on what is becoming a major element in the delivery of digital learning. It is timely then to review what we mean by e-Assessment and what it offers.

What is e-Assessment?

e-Assessment is the use of computers to set, deliver and often mark tests of a student's skills, understanding and knowledge of a subject. Also called computer assisted assessment or computer based testing and assessment, there are probably as many names for e-Assessment as there are companies eager to sell you software. Software that ranges from 'quiz-writing' systems to high-stakes, high performance test creation and delivery packages.

One thing is certain, its importance and its impact on learning is growing rapidly. From diagnostic or formative tests within managed learning environments to the delivery of assessment for vocational and professional qualifications, the UK is following the example set in the US over the last couple of decades. Many of the systems around concentrate on multiple choice questions but as we shall see in a moment that is far from being the limit of e-Assessment.

e-Assessment has been successful in the US for many years providing the basis for a range of academic and college entry qualifications in the educational sphere and professional licensing and accreditation tests in business and commerce. Despite reservations this has begun to translate into the UK, particularly in the delivery of skills and competency based testing for the delivery of professional and technical qualifications (including interestingly the QTS tests for teacher training) and more publicly recognised testing such as for the Driving Standards Agency. Many of these applications use formal, permanent testing centres which have the IT and invigilation infrastructure to delivery a large number of frequent, secure tests.

How can e-Assessments be used?

Firstly Formative (or Continuing) Assessments are presented within the context of a continuing programme of study and allows the tutor or teacher to regularly determine how well elements of a course have been understood, or to motivate students and maintain commitment. A second use is self-assessment or diagnostic testing. It provides a low risk, non-threatening method by which a student (with or without the tutor) can measure their own achievements or can identify gaps in knowledge. The final category is Summative, where the assessment is presented as the culmination of a programme of study, typically in the award of a qualification.

One interesting use of the technology is in the development of Adaptive tests. Here a single test contains questions at differing levels of demand for the student. As questions are answered the system is able to decide if questions at a lower, similar or higher level should be presented to the student. The result is that by being navigated through different routes of a test the system can give feedback on the level of proficiency of the test taker.

We are also beginning to see the use of e-Assessment beyond the confines of the examination, and the beginning of its use in wider vocational assessment and verification. We have seen this particularly in the deployment and verification of on-line portfolios, in the delivery of NVQ's and in continuing professional development.

The challenge for e-Assessment professionals will be to realise the potential of the technology to delivery innovative assessments that are motivational, raise commitment and improve the educative experience for the student.

What are the elements of e-Assessment?

There are no hard and fast rules here. The systems that have been developed over the last twenty years, many of which are commercially available, offer most if not all of the following activities.

- To **write** and store items (questions or tasks) in an item bank (or repository of those questions or tasks).
- To **produce** a test or select a subset of those items and gather them together in an electronic test.
- To **deliver** or display the computer stored questions for the candidate to answer, and then to collect and process the responses.
- To **mark** automatically or allow the computer to apply a pre-determined marking scheme. The individual marks and cumulative totals are stored. This might also involve supporting human marking of the responses giving examiner indications of performance against previously stored criteria.
- To **feedback** results to candidates and administration systems, either manually or electronically
- To **review** the performance of the individual items, to measure the validity and performance of the questions, and also the success of a course of study in delivering its learning outcomes.

Why use e-Assessment?

The simple answer is flexibility. The systems allow assessments to be delivered frequently, maybe even on demand. A significant volume of marks and outcomes can be collected and automatically stored on management information systems. Just as importantly they can be rapidly fed back to the student. The range of assessment methods and the range of knowledge, skills and understanding assessed can be greatly increased whilst the heavy burden of marking can be radically reduced.

Questions or tasks within item-banks can be classified and linked through common strands. The systems then enable many tests of 'equal' value to be created from the one bank of questions. These can then be released or set for different groups or even different individuals. Within these tests, the order of the questions can be randomised, or even the list of responses randomised. There is obviously great potential here for reducing the risk or opportunity for cheating.

With more versatility than the printed page, we are able to use the power of information technology to include multimedia within the items. This reinforces the all ready well-observed phenomenon that students generally respond very well to assessments presented through the computer and find them much more rewarding than their paper counterparts.

The systems can collect and store large volumes of data about how each item is answered. This data can then be analysed and presented in many formats and reports to refine the questions.

e-Assessment is part of a spectrum of activities from OMR (optical mark reading to capture simple responses) through to formal e-learning and increasingly including Blended Learning. Blended learning is the provision of a range of learning, teaching and training facilities that combines the power of the latest technology driven learning and assessment tools allied to the personal, focussed power of direct human to human interaction. This interaction typically being through individual and group training, coaching, mentoring and tutor support Whilst most current examples of successful e-Assessment are as stand-alone events, it is when e-Assessment can be incorporated within a recognised learning programme that its greatest benefits of flexibility, motivation and analysis will be best realised.

Why shouldn't you use e-Assessment?

There are also costs and disadvantages to using e-Assessment. Not the least of these is that selecting and implementing an e-Assessment solution can itself be a costly and time-consuming process.

The infrastructure to construct, store and deliver the tests can be a real challenge for an educational institution or body that is working with hardware and software that is both limited and mixed sometimes to the point of incompatibility. Whilst there are many commercial testing centres around, it is going to be sometime before a school in the UK is in the position to offer banks of pc's in an electronic examination room which is usable and secure.

The process of assessment is changed by the introduction of the technology. A whole new set of skills for examiners (and invigilators) needs to be taught. You will also be faced with the inevitable question of the IT skills of the students. All the evidence suggests that this is not an issue, but you will still have to convince the sceptics about that.

What types of questions can you use?

As we said earlier, the types of questions used in e-Assessment are no longer limited to multiple choice, indeed the range is quite extensive. The list that follows is not intended to be exhaustive but shows some of the styles that are used. The range of item types offered by a software package may well be one of your key selection criteria.

- Multiple Choice – where a candidate expected to point and click or type a selection number from a presented list.
- True or False or Right or Wrong - where the student must indicate whether a statement is correct or incorrect, usually on a point and click basis.
- Multiple Response Questions – where the candidate must select one or more from a list, and possibly be allowed marks for part answers.
- Insert words – where the candidate types a textual or numeric response, sometimes with the option to allow for alternatives, misspellings or part answers.
- Move a list of objects into the correct order – where the candidate is presented with a list and asked to sort it in to a particular order.
- Move a list of objects in to matching pairs – where the candidate is presented with two lists of items and asked to link items from each list.
- Move a list of objects in to positions to fill gaps within a piece of text or picture.
- 'Hotspot' - enabling the mouse to highlight a position on a screen in a map, graph or diagram in response to a question or prompt from the system.
- Sore-finger - which are often Hotspots but expect the candidate to identify areas that are incorrect in a narrative or diagram.
- Manipulations/composing diagram – allows the candidate to compose a picture, diagram or map from a 'tool box' of images.
- Short answer and essay – allow the candidate to type long passages of text where the computer then attempts to mark or perform an analysis for a human marker in terms of linguistic and content evaluation.
- Simulate IT products – is used to test candidates' abilities with standard software while in the background the assessment monitors their use of the software's functionality
- Simulations and modelling – which uses sophisticated simulation packages to test understanding and skills in measuring, monitoring, analysing, interpreting or controlling events

What are the Delivery Systems?

The most common delivery system is the pure web based system using a standard web-browser. Easy to set up, it is also prone to all the problems of using the web, in terms of security, delay and lost lines.

A more robust, and controllable method is to use the web to deliver a secure copy of the test, which is then presented to the candidate via local software, isolated from the vagaries of the web. However, by putting more processing down at the 'client' end, the greater the cost in installation and management. The responses will need to be collected at the end of the test and either analysed there and then, or returned via the web. The web can be taken out of the equation even more by publishing the test on to a disk that is then activated locally.

There are also various options that involve using paper, either to print the test locally or to collect responses from paper by using OMR or more advanced technologies.

Whichever of these techniques is used there are three areas that need to be considered. The first is the cost, both the initial implementation and then the running costs. The second is the whole area of security and authentication of the candidate. Finally the logistics of setting up and running the tests, the location, the infrastructure, the robustness of the systems.

What to do next?

Computers are good at running tests; for all sorts of reasons. They are consistent and able to repeat the same task endlessly and impartially, and perform multi-tasking. They generally provide a rewarding experience for the candidate, far removed from the normal reaction to a 'written' test. They offer versatility and flexibility, providing new and varied ways of presenting information. They are adept at analysing and reviewing data, and they can hold great volumes of tests, responses and data.

However, selecting a package to develop and deliver e-Assessment is far from simple. Indeed the range of options and the choice in the marketplace can be daunting. There are a few free sources of information around on the web such as www.itembank.co.uk; government agencies are beginning to extend their definition of e-Learning to include e-Assessment and there are over seventy web sites from suppliers. There are certainly consultants out there all too happy to advise you, and salesmen all too happy to demonstrate their wares. However, the key to selecting and using e-Assessment systems is the same as for any project. The rules are simple. Be clear at the start about what you need and want to do, the resources and facilities that you have at your disposal, and that you can involve and engage with the users. Plan what you are going to do, manage the process and be clear that the objectives you set at the beginning are achieved.