

# **DEVELOPING A ROADMAP FOR E-ASSESSMENT: WHICH WAY NOW?**

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## **Abstract**

e-Assessment is of strategic importance to the UK since it forms an integral part of the e-learning movement which is a major global growth industry. This paper reports results from a project commissioned by JISC which set out to develop a Roadmap for e-assessment.

This methodological approach was drawn from a range of 'roadmap' methodologies collected by Glenn and Gordon (2003). It facilitated the identification of the enabling factors and barriers to the use e-assessment through the construction of a survey which probed a number of experts opinions.

The analysis of the various sources suggest that in England and Wales it is policy pressure which is a main driver and it is affecting more of the FE sector than the HE sector. In the HE sector institutions have more control over the rate and uptake of e-assessment as they award their own degrees. However, there is a recognition in HE that with larger classes and less tutorial time, tutors can keep track of their students' progress through e-assessment systems. They can adjust their lectures accordingly after they have picked up the misconceptions of a cohort through e-assessment feedback. At a personal level teachers/enthusiasts are addressing pedagogical problems through e-assessment.

The barriers identified at a superinstitutional level, for example the . DfES, funding bodies, and examining bodies, are that of regulation, confidentiality and testing of these systems before they go across the UK. While the main drivers at a superinstitutional level are to move towards a new generation of learners engaged in self-reflection who will be able to identify their own learning needs. One of the major drivers for institutions to adopt e-assessment practices is that of student retention. HE and FE also see benefits with respect to attendance and achievement. This paper outlines the methods used and describes key barriers which will have to be overcome if e-Assessment is to be effectively deployed across UK HE and FE sectors. .

## **Introduction**

This project, based at the Open University, set out to review current policies and initiatives relating to e-Assessment across the UK, as documented by the funding councils, examination boards and accrediting bodies. Strategic priorities, projects and research activities were identified to assist with the development of recommendations for future coherent development in this field. This was achieved through not only suggesting ways to implement such policy documents as the DfES Harnessing Technology (2005) report, but also by adding value to the teaching and learning sector, through the advice of known experts gained during the development of the roadmap. This outcome was progressed through a modus operandi which selected a number of facets from a range of roadmap methodologies collected by Glenn and Gordon (2003).

e-Assessment is defined in its broadest sense, where information technology is used for any assessment-related activity. e-Assessment can be used to assess cognitive and practical abilities. Cognitive abilities are assessed using e-testing software, while practical abilities are assessed using e-portfolios or simulation software (Wikipedia) <http://en.wikipedia.org/wiki/e-assessment>.

This paper summarises the factors influencing the methods adopted, describes the methods, and gives an overview of some of the key findings in terms of barriers that have been identified.

## **Roadmapping Practice**

In general the aim of a technology roadmap is to provide a consensus view or vision of the future landscape available to decision makers. The roadmapping process should provide a way to identify, evaluate, and select strategic alternatives that can be used to achieve a desired science and technology objective (Kostoff and Schaller 2001). In the case of this roadmap, the science and technology objective can be summarised as 'effective implementation of e-Assessment within the post-16 and higher education sectors'. This roadmap seeks to present a vision of the future landscape that will help organisations and individuals in the post-16 and higher education sectors to make decisions about their future plans with respect to e-Assessment.

A chapter on science and technology roadmapping (Gordon, 2003) in an extensive survey of futures research methodologies (Glenn & Gordon, 2003) states:

"Since a roadmap is a diagram of interconnected nodes, it is necessary to consider what a node and the interconnections – that is the lines connecting the nodes – represent.

A node is a milestone on the road being mapped. It can be an element quantitatively determined (e.g. a document which is cited, a patent which is represented by other patents as a precursor) or subjectively defined (e.g. a future technology at some level of performance). When the node is

quantitative, the definition can be “looked up” in some data base; when it is qualitative, usually the node is determined by expert opinion.”

Roadmaps are used for both retrospective and prospective studies in time, the link vectors can assume forward and backward directions in time. Construction of a roadmap, thus, requires identifying the nodes, specifying the node attributes, connecting the nodes with links, and specifying the link attributes.

There can be many approaches to developing such a roadmap. However surveys of approaches (e.g. Gordon, 2003; Kostoff & Schaller, 2001) indicate that what is required in for considering future directions is a *prospective roadmap* i.e. a map to help find out where we are going, as opposed to a *retrospective roadmap* which is intended to tell how we got to our present position. Kostoff and Schaller identify two extremes of prospective roadmap

Requirements-pull roadmaps (which start with desired end products and fill in the remainder of the roadmap to identify the R&D necessary to arrive at these products)  
and

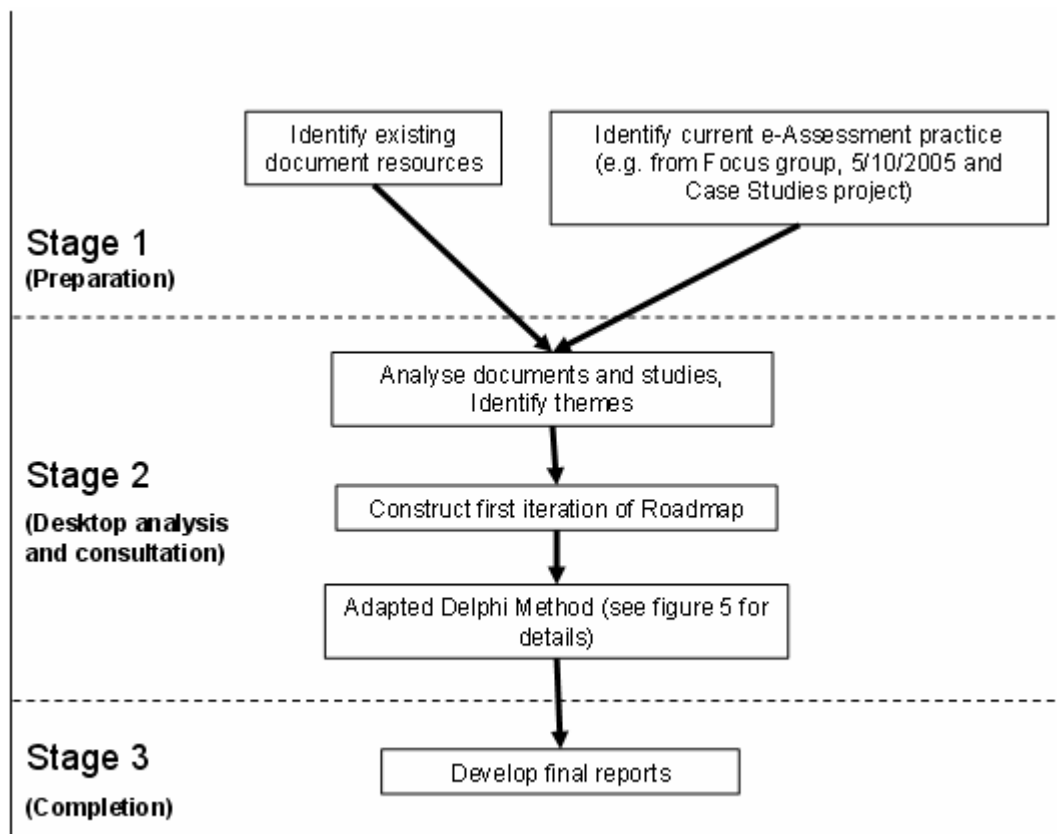
Technology-push roadmaps (which start with existing research projects, and fill in the remainder of the roadmap to identify the diversity of capabilities to which this research could lead).

For this project, we required a method that takes account of both requirements-pull and technology-push because we recognise that the development of this roadmap must consider political, pedagogical and business drivers for e-Assessment technology in addition to R&D showing how technology can be appropriated and used to support assessment. Factors influencing the choice of methods included

- Duration and budget of the project
- Availability of expertise outside the project team
- Reports and policies specified to be relevant by JISC.

## **Methodology**

The project divided into three main stages, as illustrated in Figure 1. The methods used within each stage are described in the next three sections.



**Figure 1: Graphical representation of the stages in the project**

### *Stage 1: Preparation Phase*

Stage 1, the preparation phase set out to achieve two goals.

1. Identifying key documents

In consultation with JISC a number of UK organisations considered to be important players with respect to assessment in general and e-Assessment in particular were identified. Policy and other documents which described the plans and policies of these organisations with respect to e-Assessment were identified and obtained, together with published academic papers, about the role of standards, development of automated marking systems and pedagogical drivers to adopt e-assessment. (HEFCE, 2005; 14-19 Education and Skills White Paper, 2005; QCA Blueprint for e-Assessment, 2004; The development of e-Assessment 2004-2-14 report, 2005; SQA Guidelines on e-Assessment for Schools, 2005; DfES Harnessing Technology, 2005)

2. Identifying current e-assessment practice

Sources of information about the current state of the art in practice, and the future plans of leaders in the field, were identified. This database of current e-Assessment practice was compiled through close co-operation with the JISC e-Assessment Case Studies project (Case studies of effective and innovative practice in the area of e-assessment <http://kn.open.ac.uk/public/index.cfm?wpid=4927>) which also involved members of the Open University's roadmap team.

## *Stage 2: Desktop Analysis and Consultation*

An analysis of the key documents and the database of current e-Assessment practice identified in Stage 1 was carried out, to identify the strategic issues and challenges and benefits of e-Assessment together with the institutional, operational and pedagogic enablers and barriers to the effective use of e-Assessment. This analysis led to the development of a framework for constructing a first iteration of the roadmap.

### *Roadmap Framework*

The outcome of the literature review and the analysis of the database of current e-Assessment practice inspired the framework shown in figure 1. This framework consists of two axes, 'Status' and 'Scope' each consisting of three cells. The cells along the 'Status' axis (i.e. 'Vision', 'Barriers' and 'State of the Art') represent the current status ('State of the Art'), a vision of a desirable future status ('Vision'), and barriers which will need to be crossed to reach this desirable vision from the current status.

The cells along the 'Scope' axis (i.e. 'Superorganisational', 'Organisational' and 'Personal') represent the organisational scope to which the roadmap nodes within the cells of the map will apply. 'Personal' scope means e.g. the scope of individual academics or students. 'Organisational' scope means e.g. the scope of academic or commercial organisations involved in e-Assessment activities. 'Superorganisational' scope means e.g. the scope of those bodies which represent the interests of more than one organisation. Examples of 'Superorganisations' include government departments (e.g. DfES), funding bodies, and examining bodies. In Figure 2 the text in each cell gives an example of the nature of the nodes which will occur in each cell.

Figure 3 extends the framework shown in Figure 2 to include an indication of the linkages which this form of map will show. These linkages are representative of strategies and facilitators that will help overcome the barriers and facilitate organisation, superorganisations and people change their status from their current state to the desirable vision.

Scope Status	Superorganisational	Organisational	Personal
<b>Vision</b>	What the superorganisational policy documents are aiming for in terms of e-assessment.	What organisations are aiming for in terms of e-assessment (make use of case studies?)	What individuals are aiming for in terms of e-assessment? Teaching staff, students, researchers, others?
<b>Barriers</b>	Misalignments between policies of various superinstitutions.	Misalignments between superorganisational policies and capabilities and/or policies of organisations.	Barriers which prevent (or reduce effectiveness of) individuals becoming involved in e-assessment.
<b>State of the Art</b>	Current situation in 2006	Current situation in 2006	Current situation in 2006

**Figure 2. Roadmap framework**

Scope Status	Superorganisational	Organisational	Personal
<b>Vision</b>	What the superorganisational policy documents are aiming for in terms of e-assessment.	What organisations are aiming for in terms of e-assessment (make use of case studies?)	What individuals are aiming for in terms of e-assessment? Teaching staff, students, researchers, others?
<b>Barriers</b>	Misalignments between policies of various superinstitutions.	Misalignments between superorganisational policies and capabilities and/or policies of organisations.	Barriers which prevent (or reduce effectiveness of) individuals becoming involved in e-assessment.
<b>State of the Art</b>	Current situation in 2006	Current situation in 2006	Current situation in 2006

**Figure 3. Roadmap framework showing linkages between nodes and cells**

The purpose of Figure 4 is to clarify the framework by describing the meaning of facilitators, strategies and barriers within each scope category.



	<b>Superorganisational</b>	<b>Organisational</b>	<b>Personal</b>
<b>Vision</b>	What the superorganisational policy documents are aiming for in terms of e-assessment.	What institutions are aiming for in terms of e-assessment (make use of case studies?)	What individuals are aiming for in terms of e-assessment? Teaching staff, students, researchers, others?
<b>Barriers</b>	Misalignments between policies of various superorganisations.	Misalignments between superorganisational policies and capabilities and/or policies of institutions.	Barriers which prevent (or reduce effectiveness of) individuals becoming involved in e-assessment.
<b>Facilitators</b>	Alignments between policies of superorganisations. E.g. systems not directly related to e-assessment, but the existence of which facilitates e-assessment.	Alignments between superorganisational policies and capabilities and/or policies of institutions.	Actions and processes which promote individuals involvement and/or gains from e-assessment.
<b>Strategies</b>	Suggestions about how to move through the barriers towards the vision.	Suggestions about how to move through the barriers towards the vision.	Suggestions about how to move through the barriers towards the vision.

**Figure 4. Table intended to clarify the Roadmap framework**

### Survey

The main test instrument was a survey sent to a group of experts, comprising of academics, commercial producers and personnel working for Government agencies such as SQA, Becta etc. This survey was an adaptation of the Delphi Method (Gordon, 2003) which makes use of a panel of experts and aims to build consensus over a range of issues. 40/50 returned the survey, a good response rate.

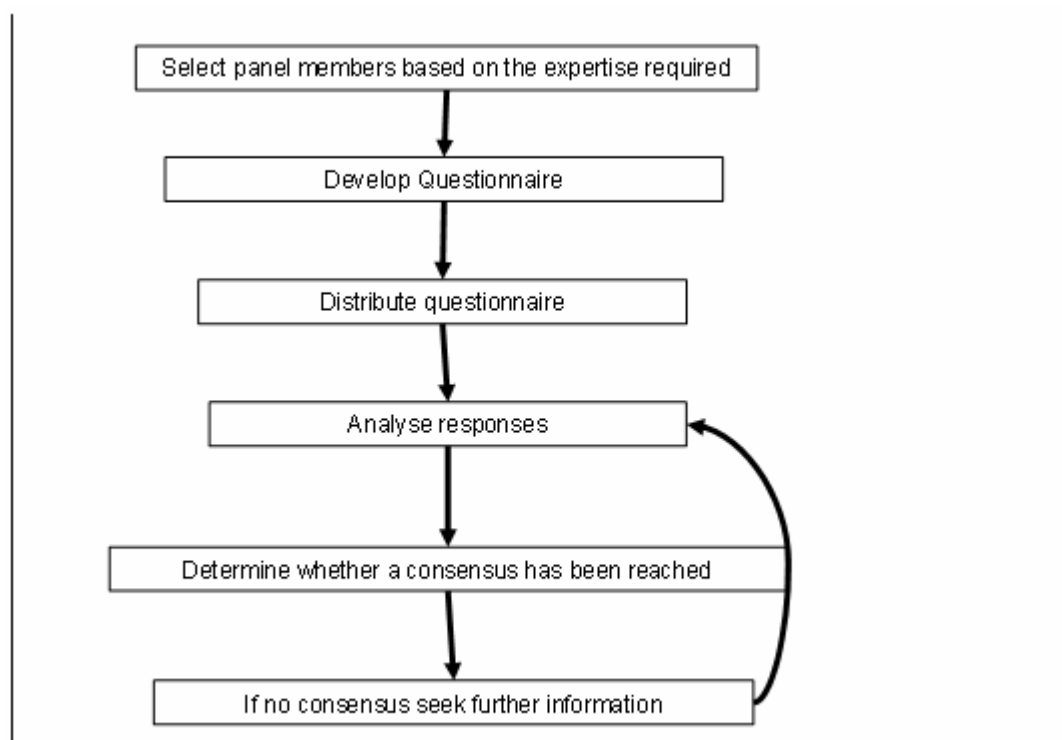
The survey (was designed after the literature review had been completed and key issues identified. Although termed 'Survey' it was more of an electronic consultation as the experts were asked to give their opinions and to write free text responses for 13/16 questions.

The survey probed experts' opinions on the following issues:

- (a) The timings of policy implementation i.e. their realisation in HE and FE (2009 deadline by QCA, not so in Scotland)
- (b) The way in which e-assessment can make a significant contribution to cutting the burden of quality of assessment

- (c) Ways in which e-assessment will make a significant contribution to improving quality of e-assessment
- (d) The implications for the vision set by the policy documents (some maybe unforeseen)
- (e) Visions for the future

The project's Steering Group and Advisory Group formed the basis of the group of experts for this consultation phase of the project. Please find current list of participants in Appendix 4. The Delphi method was used to test the project team's initial conception of the roadmaps, and to identify factors that may have been omitted.



**Figure 5. Illustration showing how the Delphi Method was used**

### *Stage 3: Completion phase*

Analysis of the results from the Delphi Survey and the literature review enabled the production of a roadmap that illustrates the planning of future e-assessment developments and strategic drivers and initiatives relating to e-assessment.

This includes a visual representation of the roadmap which was produced and implemented using a graphic design tool

## **Results: What do the experts think? Electronic Consultation (Survey ) Findings**

The purpose of the electronic consultation was to clarify whether the visions and directives issued by the policy makers in the UK were viewed, by a group of experts in the field, as realistic and matched current progress in the HE and FE sectors. The experts' opinion was also prompted about whether there were any unforeseen or undesirable consequences to the vision promulgated by the Superorganisations. Our group of experts were also asked to comment upon their own visions of the future and to articulate any barriers that they envisaged would deter or prevent educational institutions from piloting e-assessment applications. This section of the paper reviews the following issues:

- (a) The timings of policy implementation i.e. their realisation in HE and FE (2009 deadline by QCA,)
- (b) The way in which e-assessment can make a significant contribution to cutting the burden of quality of assessment
- (c) Ways in which e-assessment will make a significant contribution to improving quality of e-assessment
- (d) The implications for the vision set by the policy documents (some maybe unforeseen)

### *Synopsis of Findings*

- (a) Predicted timings of e-assessment

Most experts expect e-assessment to make a significant contribution to both the quality and usage of assessment in general by 2010. They also believed that ICT will be commonly accepted into all aspects of the student experience within 2/4 years. Students too will be able to access information, tutor support, expertise and guidance online and will be able to communicate with each other wherever they are within 2/4 years. The consensus view also contained a belief that tutors will have tools for course design and will be able to give better feedback electronically to students again within the next 2/4 years. Therefore, the timings to implement HEFCE strategies with respect to the above-mentioned technologies are considered to be imminent and to match HEFCE's predictions. The recent calls for software development by JISC also support this notion.

- (b) The way in which e-assessment can make a significant contribution to cutting the burden of quality of assessment

The experts believed that the introduction of technological change can facilitate reflection upon our practice and encourage a significant revision of current e-assessment customs. They acknowledge that the construction of good e-assessment questions requires change but in the long run good e-assessment would create efficiencies in results processing and transparency

of grading. It will produce faster feedback and that it's main effect will be seen in formative assessment practice which will encourage the students to take control of their own learning.

- (c) Ways in which e-assessment will make a significant contribution to improving quality of e-assessment

The experts agreed that regular feedback to students in both formative and summative assessments will particularly assist those who regularly under-perform. There will be more evident changes in the vocational sphere but a wider range of curriculum will be tested by e-assessment. This will be because more realistic assessment such as problem solving scenarios will be offered to students.

- (d) The implications for the vision set by the policy documents (some may be unforeseen)

Experts agreed that the over-use of results from on-demand testing does not always increase grades and can lead to a lack of confidence in standards by the general public. They also suggested that if the vision for on-demand testing, as set out by the Government, is implemented then this will mean e-assessment sites will be open 24 hours a day. One of the unforeseen implications for this policy could be that parents will over-pressurise children to take exams too early. Also more students will probably study university courses while still at school.

## **Visions of e-Assessment for 2014**

The experts have a coherent vision that e-assessment can assist learning and expect more formative e-assessment to be available to students. The effect of this development will be to encourage students to check their understanding of a given topic more frequently. The experts do not expect unassisted practice alone will aid learning but the quality of feedback given to the students will encourage reflection and enhance learning.

### *Delivery of e-assessment 2014*

#### Superorganisational

The experts agreed that on-demand testing will be available for AS and A Levels. They were less confident that this would be the case throughout the HE sector. They suggested that large-scale testing sites would be available as now organised for the theory driving test. These testing sites could be located in schools, colleges, universities and possibly supermarkets. e-Assessment will be prevalent from primary school through to university and other institutes of higher education. However high stakes assessments will still be available in traditional forms such as the final examinations taken at university level. They acknowledge there will be set backs which will reduce confidence in e-assessment and progress could be slower than expected.

## Organisational

The experts believe that e-portfolios will play a large role in the assessment of courses delivered both in FE and HE institutions. Formative and self assessment together with e-portfolios will make up a core of assessment tools. There will be a change in competence measurement as this will occur at random intervals rather than as a series of discreet controlled events.

## Personal

Some of the personal visions revealed some blue skies thinking where some of the experts predicted that e-portfolios could be exchanged as microchips in a business card, that e-assessment will replace everything except practical examinations and it will be integrated seamlessly into day to day learning and work environments.

## *Visions for Research and Development*

### Superorganisational

The experts suggested that a set of guidelines will be available to ensure the quality, accessibility, reliability and security of all e-assessment tasks. They did not believe that research and development of into standards should dominate the research agenda or slow down development of systems driven by pedagogical need.

### Organisational

This group proposed that the development of quality training programmes for teachers, developers and invigilators will be delivered electronically. There will be a set of excellent tasks available to assess group work electronically. There will also be peer e-assessment together with adaptive systems that respond to students' misconceptions during formative assessment tasks. They also believed that the use of virtual reality technology will increase the authenticity of certain assessments. More unusual uses of technology will also be prevalent to assist with learning that is more personal.

## **What are the Barriers to these Visions?**

The expert group contributed to a variety of issues which may hinder development and adoption of e-assessment. These are grouped into those that will:

- affect the widespread adoption of proven systems (i.e. systems which have been proved to work in pilot studies) and others which will
- hinder the initial research and development of e-assessment systems.

### *Barriers to Adoption: Superorganisational*

The superorganisational barriers identified by the experts were concerned with a lack of customer confidence in the awards accredited using e-assessment systems. Problems associated with e-assessment pilots will reduce confidence and also where people believe that current systems are doing a good job and therefore they do not need to be changed. To move e-assessment forward there needs to be enough resources available and appropriate technical infrastructure should be in place. There also needs to be a commitment at a technical level to achieve interoperability of systems across institutions. Another barrier is the lack of sharing of best practice among institutions.

### *Barriers to Adoption: Organisational*

The experts suggested that more institutional “buy in” is required and hence a culture shift is needed to change both the planning and business processes to fit new assessment practices. A lack of staff skills and expertise was noted and so training needs to be put in place. One of the major barriers recognised was the time required to develop good e-assessment tasks. Staff therefore need to be given time and recognition to carry out this work.

### *Barriers to Adoption: Personal*

At this level experts recognised the work pressures on academic staff to produce good e-assessments, that there were training needs that had to be addressed, together with learner attitudes. The latter need to have confidence in the security and marking of the e-assessment assignments. Learner scepticism that e-assessment can be a valid way of examining key skills to post degree level needs to be addressed.

### *Barriers to Research Development and Piloting: Superorganisational*

The experts mentioned the following two major barriers which included customer attitude and lack of public confidence in e-assessment. They also mentioned the lack of integration of institutional and Government policies to ensure that the key criteria of quality, accessibility, reliability and security are evaluated in future pilot activities.

### *Barriers to Research Development and Piloting: Organisational*

A lack of funding to encourage institutions to engage in pilot and/or research and development activities was mentioned. A lack of resources and suitable infrastructure to pilot e-assessments was also high on the experts’ list of barriers.

### *Barriers to Research Development and Piloting: Personal*

The barriers here fell into three major categories. Those of staff attitude where a lack of encouragement to individual practitioners was mentioned with respect to limited funding and time and recognition to continue working in this

area as opposed to personal research time which has more RAE status. A lack of infrastructure and also ICT skills in the student population to pilot projects was also recorded.

## **Summary**

Findings suggest that in England and Wales it is policy pressure which is a main driver and is affecting more of the FE sector than HE sector. HE has more control over the rate and uptake of e-assessment in their institutions as they award their own degrees. However, there is a recognition in HE that with larger classes and less tutorial time, tutors can keep track of their students' progress through e-assessment systems. They can adjust their lectures accordingly after they have picked up the misconceptions of a cohort through e-assessment feedback. At a personal level teachers/enthusiasts are addressing pedagogical problems through e-assessment.

The barriers identified at a superorganisational level are that of regulation, confidentiality and testing of these systems before they go across the UK. Also there is more reliance than expected on the private sector and small commercial businesses to achieve the vision. Providing e-assessment systems is expensive and some institutions have invested heavily in particular VLEs. They in turn have their own 'e-assessment systems'. In practice some of these are little more than quizzes and do not meet the aspirations of institutions who want to pursue interactive assessment systems which also provide instant feedback to students.

Teachers themselves are not convinced that e-assessment can test enough learning outcomes. They are also concerned about plagiarism and require more training to use and develop questions.

The main drivers at a superorganisational level are to move towards a new generation of learners engaged in self-reflection who will be able to identify their own learning needs. One of the major drivers for institutions to adopt e-assessment practices is that of student retention. HE and FE also see benefits with respect to attendance and achievement. Accreditation can also be tracked through e-assessment systems.

Tutors want to use e-assessment especially formative e-assessment as diagnostic tools to understand how their students are learning especially in larger groups. They can then adjust their teaching accordingly and we have noted changes in pedagogical practice with the introduction of e-assessment (case studies project). There is a recognition at University level that more research funding is needed for e-assessment especially in the area of text recognition and automated feedback. In a sense more joined up thinking is needed at superorganisational level where there should be more of a push to ensure technical standards are in place and that there is a code of practice developed with guidelines as well as industry standards. Institutions are developing but need to make more explicit their e-assessment policies and invest in staff training. Individual champions and teachers would like more

recognition of their work by the VLEs and other commercial software production houses because they are developing systems that address their own particular student needs. They would like these rolled out instead of trying to match their needs to a generic system. In one sense pedagogical needs are hampered by straight jacket software systems and this is where JISC funding can support local champions to build and then develop open-source products. This seed funding in turn fosters take up and further development by other institutions of these pedagogically pertinent systems.

All experts from this group believed in e-assessment becoming integral to teaching and learning in 2014. Although some scepticism about the timing of progress was evident the feeling from this group can be summarised by one member who said:

“I do share the vision expressed in the DfES report – I have done so all my working life really and despite the frequent experience of seeing hopes for the greater use of e-learning deferred, I really do think that ICT in society has now crossed a rubicon and rapid progress is inevitable.”



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