eAssessment Review Report 2016/17

Contents

Executive summary 1

Introduction 2

Background and Review of Literature 3

Methodology 6

Research findings 8

Discussion 15

Conclusions and recommendations 18

Appendix I: Learner Experiences of E-assessment and Pen and Paper Assessment 19

Appendix II: International Practices 67

Executive Summary

This research was undertaken to identify what guidance regulators could provide for consideration by awarding organisations (referred to in Wales as awarding bodies) in their development of appropriate qualification assessment. This research considered the benefits and good practice in different assessment approaches used in the summer 2016 series of GCE Applied Business and GCE Applied ICT. The research analyses the development and delivery of qualification assessment through the use of e-assessment and pen and paper assessment and learners' experiences of these assessments.

Research into learner experiences suggests that e-assessment is associated with a more positive emotional experience for candidates and lower indicators of generalized test anxiety. Enhanced cognitive and organisational functioning, communication, efficiency and productivity for the candidate along with reduced physical strain, are potential benefits of using e-assessment. Candidate preference for e-assessment is strong, where it is used.

Awarding Organisations considered their methods of assessment to reflect the specification in terms of validity. However, the on-screen assessment allows candidates to interact with items and contexts in ways that are not possible on paper. The use of in-built simulations and other varieties of assessment materials may be beneficial and engaging with regard to the testing of objectives, allowing candidates to demonstrate wider skills.

In this study, the on-screen assessment can provide greater opportunities for reliability than the paper-based system. There are potentially fewer barriers to assessment with the e-assessment systems which have many built-in features to support accessibility. The requirement to provide paper-based alternatives to on-screen assessment significantly inhibits innovation in the development of engaging and valid assessments.

1 Introduction

In 2007, the then regulators, the Qualifications Curriculum Authority, the Welsh Government, the Scottish Qualifications Authority and the Council for the Curriculum Examinations and Assessment published the Regulatory Principles for E-assessment (Ofqual 2007). Since then, with the exception of SQA, the regulators have changed to become Ofqual in England, Qualifications Wales in Wales and CCEA Regulation in Northern Ireland. E-assessment practices have developed and many qualifications are undergoing reform. It has been timely to revisit the Regulatory Principles in light of these developments to identify what (non-mandatory) guidance regulators could provide for consideration by Awarding Organisations (referred to as awarding bodies in Wales) in their development of appropriate qualification assessment.

As qualifications in the UK are gradually diverging and to support the development of such guidance, CCEA and Qualifications Wales took a final opportunity to consider different assessment approaches employed by qualifications based on the same subject criteria in order to identify good practice.. This opportunity was provided by the summer 2016 series of GCE Applied Business and GCE Applied ICT. This opportunity facilitated a review of both e-assessment and pen and paper assessment development and delivery relating to two units from each subject, based on the same subject criteria. Whilst this review could be subject agnostic, the use of assessments based on the same subject criteria will support a clearer focus on the benefits of the different assessment approaches in terms of assessment development and learner experience.

This review seeks to analyse the development and delivery of qualification assessment through the use of e-assessment and pen and paper assessment and learners' experiences of these assessments. This analysis will inform further research and the development of a good practice guide to supplement and/or aid a review of the 2007 Regulatory Principles for E-assessment.

This report provides an analysis of assessment materials, the learner experience and makes recommendations to inform the development of guidance for Awarding Organisations (AOs).

Background and Review of Literature

E-assessment is used in around 1942 qualifications and by 75 Awarding Organisations on the Register of Accredited Qualifications for England, Northern Ireland and Wales as at March 2016. Early development in the use of e-assessment in qualifications tended to focus on vocational qualifications, but in more recent years e-assessment has been developed in a range of high-stakes qualifications – starting with early adopter subjects such as ICT and then moving on to subjects that could benefit from the more innovative methods of assessment that on-screen offers. In Northern Ireland and in Wales there are five GCE and 31 GCSE qualifications that feature e-assessment. E-assessment is used as an overarching term, defined as;

> *"the use of electronic systems for the development, operation and delivery of accredited qualification assessment or the collection of performance evidence, which contributes to the awarding of a unit or an accredited qualification" (Ofqual 2007)*

Although there is a lot of published research available on the use of pen and paper (traditional) assessment methods, there is limited research into the use of e-assessment in high stakes/general examinations. The main research was initiated by QCDA in 2007-9[1], which commented on the low uptake of e-assessment within general qualifications.

In 2011 AQA commissioned a study of comparability of on-screen and pen and paper tests in collaboration with the qualification regulators[2]. The AQA study looked at research into objective testing items, but not into longer assessment tasks. It concluded that there is no significant difference in assessment experience. Unless speed of reaction is part of the skill tested (for example, as might be expected in a test for driving or flying), there is no significant difference between the results obtained by on-screen or paper-based assessment methods. The main concern expressed is the possibility of candidate performance being detrimentally affected by unfamiliarity with the method of assessment used. However, this research was limited to observations around objective testing only and not an investigation into extended responses or development of assessment for skills.

In 2014 CCEA Accreditation, Welsh Government and SQA investigated centre readiness to use e-assessment. Also, AOs have made significant progress in developing the use of e-assessment in high-stakes assessment, such as GCSE and GCE. E-assessment approaches in use range from specifications offering on-screen assessment as an optional alternative to those that are completely e-assessed.

The issues identified are those that might be expected; for example:

- technical problems such as linking IT systems and broadband speeds, especially in rural areas;
- skills and training of teachers;
- concerns by teachers about time available to develop approaches to e-assessment.
- There is existing guidance on use of e-assessment in qualifications.

In 2007 QCA, the Welsh Government, CCEA and SQA published Regulatory Principles for e-assessment. This is the main regulatory guidance document for Awarding Organisations using

[1] QCDA: Technology Enabled Assessment; desk research into the use of eA within qualifications, prepared by Jon Batterham, Edcoms 2009.

[2] Wheadon, C The Comparability of On-screen and Paper and Pencil Tests: No Further Research Required, Centre for Education Research and Policy, 2011.

e-assessment. This document concentrates upon technical issues. It might be useful to further develop this guidance to update technical and legal aspects and give further guidance on how e-assessment might contribute to the development and assessment of skills. In 2010 Ofqual, the Welsh Government, CCEA Accreditation and SQA carried out a survey to evaluate the usefulness of these principles.

The feedback included:

- concerns about the Regulatory Principles being 'not specific and difficult to use';
- requests for more guidance about conditions for e-assessment and use of new technologies such as Personal Digital Assistants (PDAs) and smartphones;
- there was general acknowledgement of the possibility of cost savings being generated by use of e-assessment, although most AOs had additional costs for pen and paper back-ups for e-assessment;
- AOs requested that any revised Regulatory Principles allow for innovation in the development of e-assessed accreditation.

Ofqual, CCEA Accreditation and Welsh Government, published Applied Business Subject Criteria revised 2011 and Applied ICT Subject Criteria 2011. These Criteria do not contain any specific reference to e-assessment. ICT skills mentioned in Section 6 and the use of software is mentioned in the subject content. Section 28 refers implicitly to e-assessment 'All specifications must require learners to show their knowledge, understanding and skills in a variety of ways, including extended writing. Any reference to 'writing' or 'written communication' should be interpreted as the production of text by any means, for example pen, word processor and so on'.

Through a sequence of case studies The JISC (Joint Information Systems Committee) developed an effective practice guide, providing an overview of e-assessment practice in further education (FE) and higher education (HE) institutions in the UK. The guide suggests that e-assessment can add value to assessment practice in a variety of ways:

> *"If used with skill and imagination, e-assessment – defined in its broadest sense to refer to both computer-assisted and computer based assessments – can increase the range of what is tested. It can provide evidence of both cognitive and skills based achievements in ways that are durable and transferable. It can enhance the validity of assessment systems and encourage deeper learning."*
>
> *"Looking to the future, e-assessment can offer a broader palette of tools for awarding bodies, developers and academic staff to work with. Some significant projects in 14-19 and higher education indicate that more valid and imaginative assessment and learning experiences could ensue."* (JISC 2007)

A review was carried out by CCEA Regulation and SQA in 2015, looking at e-assessment practices in a sample of countries, including; Canada, Switzerland, Singapore and Australia. The use of ICT in education in general is increasing and it appears to be encouraged across a number of education systems. There is more evidence for the use of e-learning; however, there are developments noted that indicate a move towards e-assessment, made possible by developments in technology.

In these countries, e-assessment offers the opportunity to respond to the cry for 'real world' education by enabling alternative assessment environments. A number of benefits were identified, such as:

- Increased flexibility (e.g. distance learning)
- Supports those with additional needs
- Practically feasible (as evidenced by pilot studies)

- Instant records of progress for future planning
- Distinctive adaptive features
- Relevant to today's learners; potentially more engaging

In addition to summative e-assessment, there is evidence for formative e-assessment practices via the wholesale implementation of an e-portfolio approach. Continuous assessment and record keeping through e-portfolios is thought to promote self-regulation and metacognition in learning; this form of assessment is relatively new and represents a cultural change for most countries, i.e. a shift from traditional teaching methods and increased collaboration between learner and teacher. E-portfolio models may represent an alternative to terminal/high stakes examination, however, this again requires a cultural shift from traditional examinations. Despite the potential benefits, there are a number of challenges to undertake. There is a need for ongoing and sustained support for e-learning and e-assessment to be developed and implemented effectively.

The following recommendations are derived from the experiences of the countries investigated:

- Upskilling in ICT for teachers and students
- Changing attitudes through examples of best practice/ pilots
- System-wide approach or a network model / one provider only for e-assessments
- Time to allow a shift in practice to encode and embed

Finally, there is a need for a sound ICT infrastructure and an acknowledgement of the financial, practical and political obstacles which are pertinent to individual countries and subjects.

2

Methodology

The regulatory authorities (RAs), CCEA Accreditation and Qualifications Wales worked together to examine paired GCE qualifications where one qualification has been designed to be wholly e-assessed and another to be assessed using traditional pen and paper, and carry out a review of the assessment materials and learner experiences for each qualification. The RAs worked collaboratively with WJEC and CCEA AO to complete the study.

Two units from each of the following qualifications were selected[3]:

	CCEA	WJEC
GCE Applied Business	Pen & Paper assessment	wholly e-assessed
GCE Applied ICT	Pen & Paper assessment	wholly e-assessed

The units identified as providing the best evidence for the purposes of this study were:

	CCEA	WJEC
GCE Applied Business	A2 Unit 7 Finance	Units 1 &5 Investigating Business and Finance & Business Decision-Making
	A2 Unit 12 Global Markets	A2 Unit 7 Managing Business in an International Context
GCE Applied ICT	A2 Unit 7 Investigating systems	AS Unit 1 Part A E-business
	A2 Unit 13 Networking and Communications	A2 Unit 7 E-connect

A review of learner experiences was undertaken for the June 2016 cohort for the selected units. The main focus was based on access issues, including the suitability and readiness of candidates, and took account of previous QCA/AQA[4] research outcome themes of;

- Test anxiety
- Software interface
- Familiarity

A pulse survey for 3600 learners and four subsequent focus groups across 188 centres in Wales and Northern Ireland were developed and administrated by CCEA Research and Statistics to evaluate the learner experiences. Surveys were distributed in centres by invigilators immediately after examinations. The exam centres returned completed surveys with a 41% response rate. X^2 tests

[3] The qualifications selected are based on the same GCE subject criteria which can be found at http://ccea.org.uk/sites/default/files/docs/accreditation/gce_gcse/gce/5.%20Applied%20Information%20and%20Communication%20Technology%20%28ICT%29.pdf

[4] Christopher Wheadon and Carolyn Adams, 'The comparability of on-screen and paper and pencil tests: no further research required?', last modified unknown, http://www.iaea.info/documents/paper_1162d20de8.pdf

and t-tests were used to test for significant group differences. Focus groups were held in Wales and Northern Ireland for GCE Applied Business and GCE Applied ICT candidates immediately following examinations. Visual Analogue Rating Scales were used to gauge the magnitude of their feelings in addition to free discussion. Data analysis was carried out using SPSS V22.

This work was carried out in the lead up to and during the summer 2016 awarding season.

The review looked at previously used assessment materials for 2015 using the Regulatory Principles of e-Assessment[5] as a framework for;

- Reliability – from test production through to test taking
- Validity – on how it tests the knowledge and skills needed to achieve the qualification
- Security – including procedures in place to assure the security of hardware and software and the integrity of test data for e-assessed units

Interviews with the Awarding Organisations were held during 2016. CCEA and Qualifications Wales staff and subject specialists followed an agenda around the themes above with awarding organisation subject officers and senior examination personnel. A list of prompt areas was developed, with the intention to allow the conversation to include other areas raised by the awarding organisation officers and examination teams.

Prompt list – where appropriate

- Test security integrity/contingency
- Operation of the assessment/scalability- including design, delivery, marking, evaluation of the assessment process
- Access/barriers
- Test conditions/environment/test familiarisation
- Use of e-portfolio
- Coverage of the assessment objectives within unit/qualification assessment

A review of sample assessment materials was undertaken prior to each visit, including; examination papers, mark schemes, examiner and moderator reports, and guidance provided to teachers and candidates.

[5] Regulatory Principles for e-Assessment, April 2007, QCA on behalf of QCA, Welsh Assembly Government, CCEA and Scottish Qualifications Authority.

3 Research findings

Learner experiences

The findings are based on 1476 pulse survey respondents with approximate 50/50 split of male to female and an average age of 18. Focus groups comprised of a representative sample of these learners. All focus group participants owned a smart phone, tablet and or laptop, and had good access to ICT facilities at school. A full research reporting on findings is included in Appendix 1, findings include;

GCE Applied ICT

Enjoyment of assessment: Pen and paper (P&P) GCE Applied ICT respondents found the exam significantly less enjoyable than e-assessment (E-A) respondents (mean enjoyment rating of 3.11 vs. 2.53).

Affect during the assessment: A significantly higher proportion of E-A respondents reported feeling happy (24.7% vs. 7.8% P&P); and well-prepared (29.7% vs. 18% P&P).
P&P respondents were significantly more likely to report feeling worried (38.6% vs. 20.3% E-A); scared (12.6% vs. 3.8% E-A); and panicky (26% vs. 15.8% E-A), during their assessment.

Ease of use of assessment: Approximately four times the proportion of P&P respondents reported Ease of Use issues: 8.2% answered 'No' to their question variant compared to 1.9% of E-A.

Assessment preference: The ratio of P&P respondents who preferred paper-based assessment to online assessment was approximately 2:1. In contrast, E-A respondents showed a marked preference (more than 6 times) for online assessment compared to P&P assessment.

GCE Applied Business

Enjoyment of assessment: P&P assessment respondents did not find the exam significantly more enjoyable than E-A.

Affect during the assessment: A higher proportion of E-A candidates reported feeling relaxed (30.3% vs. 23.1% P&P) and fewer were worried (24.2% vs. 31.8% P&P) during their assessment.

In focus group discussion, P&P assessed students reported feeling somewhat less confident and prepared during the exam than E-A students. These group differences in confidence and preparedness were also present immediately after the exam was over. E-A participants reported feeling significantly more pleased, confident, content, and well-prepared about their assessment and also showed signs of greater fear reduction over time at a group level. E-A assessment methods may have contributed to these experiences.

Ease of use of assessment: Candidates were asked if they found the format of the examination easy to follow/easy to use. Approximately twice the proportion of E-A respondents reported ease of use issues.

Technical difficulties: The proportion of E-A respondents who reported having experienced centre related operational or technical problems (not due to WJEC system issues) was approximately four times greater than the proportion who completed a P&P assessment (16.5% vs. 4%P&P).

Assessment preference: E-A respondents to the pulse survey showed no preference for paper-based or online assessment (ratio approximately 1:1). Comments from the focus group discussion would suggest students' assessment preference is influenced by their familiarity with the form of assessment.

Awarding organisation provision

CCEA and WJEC subject officers and examinations teams provided information around the themes of validity, reliability and security, and additional conversation included development of the qualifications and future plans/considerations.

GCE Applied Business

The two specifications looked at for Applied Business were provided by CCEA and WJEC. These accredited qualifications will continue to be offered over the next few years, but are planned to be replaced/removed or amended by the Awarding Bodies.

WJEC Applied Business specification is taken by centres in Wales only. The specification is delivered by a range of types of schools – some of the units are only taken by a smaller number of candidates for a range of reasons including more specialist unit content. In 2016, the qualification was taken by 1272 candidates and the units included in this research were taken by 538 candidates. CCEA Applied Business Specification is taken by learners in Northern Ireland only. In 2016, the qualification was taken by 2316 candidates and the units included in this research were taken by 708 candidates.

Sample examination papers for the two specifications were slightly different, although much of this might be attributed to the subject content. In general, papers for both specifications included a variety of closed and open, short-response and long-response items. There is a considerable amount of detailed guidance for teachers, candidates, examiners and moderators. Apart from some technical points for the WJEC specification, there was no substantial difference between the guidance given for either specification.

Discussions with WJEC

Test security Integrity/contingency: Centres can access the exam on the day of the examination and have time to check correct operation. WJEC can monitor when a centre accesses the examination. Assessment responses are uploaded to WJEC. The operation of the examination automatically cuts out any other use of computers, thus protecting against unauthorised communication by candidates. Paper copies of the examination paper are provided so that the examination could run in the case of IT system failure; however, no examples are reported of the examination being interrupted.

Operation of the assessment: These assessments follow standard WJEC quality assurance processes and operational procedures for more 'traditional' assessments in relation to design, delivery, marking, evaluation of the assessment process; submission of paper, reviser comments, ***Question Paper Evaluation Committee (QPEC);*** submission of samples by assistant Examiners and scaling of marks. Candidate responses are uploaded on the day of the examination and are therefore immediately available to the examining team.

Scalability: The extension of e-assessment to larger numbers is not believed to be a particular problem. The hardware requirements are considered relatively straightforward; any room with a Wi-Fi connection and sufficient room to provide minimum space for normal examination requirements can be used.

Access/barriers: Significant effort has been made to ensure that candidates with disabilities or other protected characteristics are not disadvantaged. An Equality Impact Assessment was carried out when the specification was produced including consultation was held with organisations such as RNIB. Centres provide larger monitors for magnification, extra time, there is a built-in help facility on-screen and an ability to alter screen colours and other attributes.

Test conditions/environment/test familiarisation: All of the past assessments (15 to date) are available for centres to download, providing opportunity for test familiarity. The test conditions and environment are very simple and would be easy to replicate. Teachers have commented that students seemed happy with taking the assessment electronically; teachers also were generally in favour of the assessment method. e-Portfolio provides a suitable opportunity to assess skills such as decision-making and teamwork.

Some other discussions included possible constraints that can arise from centres not using specific software, and WJEC needing to provide paper-based assessment as a back-up limiting the use of video

Other ways in which e-assessment could be innovative in assessing skills required by the subject criteria for Applied Business and other specifications were discussed, for example more interactive assessment to test decision-making skills, in-tray exercises, use of blogs to assess teamwork.

Discussions with CCEA

Arrangements for test security integrity/contingency and the design, delivery (including test conditions), marking, evaluation of the assessment process are well established in pen and paper assessments. These arrangements are partly governed by regulatory and JCQ guidelines and integrated into awarding organisation processes, including access arrangements – for both pen and paper and electronic assessments

Ways in which e-assessment could be innovative in assessing skills required by the subject criteria were discussed for Applied Business and other specifications. There was a willingness to explore alternative methods of assessment using ICT. As the Applied Business qualification is coming to an end such innovation is more likely to occur in future specification development such as the new A-level Professional Business Services.

GCE Applied ICT

The two specifications looked at for Applied ICT were provided by CCEA and WJEC. These accredited qualifications will continue to be offered over the next few years, but are planned to be replaced/ removed or amended by the Awarding Organisations .

WJEC Applied ICT specification is taken by centres in Wales and England. The specification is delivered by a range of different school types – some of the units are only taken by a smaller number of candidates for a number of reasons, including more specialist unit content. In 2016, the qualification was taken by 1053 candidates and the units included in this research were taken by 444 candidates. CCEA Applied Business Specification is only taken by learners in Northern Ireland. In 2016, the qualification was taken by 3403 candidates and the units included in this research were taken by 1214 candidates.

Discussions with WJEC

Test security Integrity/contingency: Online assessments can be downloaded over the web or downloaded to the centre network 3 days in advance of the examination, although the actual test cannot be started until the allocated time. In this way a centre can assure operational readiness

of the assessment. Presently WJEC provides centres with a paper copy of the assessment for all candidates taking the units. This is a precautionary backup. Candidates entered for the Welsh medium option are provided with the Welsh version of the assessment on-screen in addition to a Welsh medium back-up paper copy.

Operation of the assessment: For the online assessment the exams officer (EO) logs into the system used and subsequently the Invigilation Pack. The EO then allocates the seat number and candidate number of each student requiring the assessment and the software generates a key code which is unique to each candidate, including external candidates. Before candidates can start the examination they enter their unique key code and this automatically completes the name and centre number on the on-screen assessment. All candidates start at the same time, as the Exam Supervisor has a computer click to start the exam when all students have successfully entered and confirmed their personal details. All exams must be invigilated by invigilators. Exam supervisors can pause the exam individually for a candidate, in extenuating circumstances, as the system automatically times each individual candidate. Once a candidate has saved the assessment it is directly uploaded up onto the assessment server. The assessment server will retain a backup copy for 48 hours.
Scalability: No processes within WJEC would be impacted upon if the units needed to be scaled up significantly. A growth in the use of personal devices has been anticipated along with the use of cloud based operating systems to support devices (with appropriate security measures). WJEC are confident that this well-tested software and servers can cope with vastly increased numbers.

Access/barriers: The specification for Applied ICT states that there are no pre-requisite skills and WJEC reported that they have not experienced any issues with candidate skills. However, the specification does identify the following as a potential barrier to access "arising from the assessment of skills and understanding that are considered essential to the subject, as defined by the subject criteria: essential use of computer keyboard, monitor and audio function."

A number of relevant organisations were consulted during development, such as RNIB and TechDIS, to reduce and mitigate candidate access barriers.

Several features are available within the system which assists with candidate access:

- Technicians and candidates can set different colours of writing and backgrounds for specific candidates.
- Extra time can be configured in by centre staff, in line with JCQ regulations.
- A larger number of candidates need readers. Instead of listening to the avatars a human-recorded version of the entire paper is available. WJEC use an embedded video version. These clips can be stopped and started if a candidate needs to listen again but only within the overall time of the assessment so not as to give the candidate extra time. This new facility has been tested and the only complaint is that once started the recording cannot be stopped. This however is only when audio players are used and is not an issue when video players are used.
- Enlarged text.

There are still however some access barriers:

- Toggling between languages such as Welsh to English and vice versa on-screen is not possible nor desirable.
- The system tends to use clicking and this can be difficult for people with serious visual impairments, for example, drag and drop.
- Non digitally competent individuals could be disadvantaged by on-screen assessment delivery.
- If a screen needs to be enlarged, it is more suitable for candidates to use a bigger screen rather than changing the appearance of screen.

These barriers however do not seem significant as when centres with candidates of wide ranging and significant needs were offered paper-based versions they all requested to complete the assessment online.

Test conditions/environment/test familiarisation: The set time for the examination is usually May of the Summer series.

For the online assessment the invigilator has to click start the examination so that all students can be logged in at this stage. The invigilator can control what happens from a central machine and if necessary machines can be paused centrally or individually by candidate, or machine, without increasing the assessment time and unfairly advantaging the candidate

Should an interruption occur in a candidate assessment, for a candidate with agreed access arrangements, this is recorded on paper and the invigilator has central access to the pupil's screen and can add on extra time for that candidate. Extra time can also be built by the exams officer if agreed in advance and follows JCQ procedures. At the end of the assessment the machine automatically stops the candidate and all candidate work is logged to the assessment system server.

Some other issues were discussed including;

Marking On-screen: Examiners attend a face to face standardisation meeting, referring to 10 provisionally marked scripts and appropriate completed marking forms. Here they work through the questions of one paper, looking in detail at the assessment and highlighting any challenging marking areas highlighted during the provisional marking process. The mark schemes are then reviewed and amended if necessary and further responses checked. Examiners then work through marking candidate responses to an agreed standard to ensure marking quality.. Markers have both paper copy and on-screen mark schemes.

The principal examiners then sample any 10 scripts from a marker and take a further sample of 25 half way through the process.

Because it is computer-based, principal examiners can monitor the rate of marking in real time. Examiners can start marking and discussing within five minutes of assessments being completed. There are no postal issues or delays as everything is on the server.

It is to be noted that WJEC appoint bilingual examiners to mark Welsh-language papers. They do not translate them.

Evaluation of marking process: On-screen standardisation simplifies sampling and removes any bias in script selection. If a reviewer disagrees with a mark (and they are marking outside of tolerances) markers can be stopped. There is a 'levels of achievement' approach, with banded marking accommodating QWC assessment – it is a 'best-fit' approach. In terms of validity, item level data is available; centres can see their pupils average scores and how well they did, which is helpful to teacher support sessions . Unit 1 Sections A and B are treated as two separate assessments which can cause reporting challenges.

Discussions with CCEA

Test security Integrity/contingency: Throughout the paper-based assessment production process the production team adhere to strict CCEA guidelines when passing materials to and from each other. These are communicated via post using CCEA approved packages and delivery. Test security relies on the centre examination officer and the distribution of paper-based materials to and from CCEA as well as the invigilator. CCEA employ centre inspectors to check centre test conditions from time to time. A centre only receives one paper-based assessment per student entered for the assessment.

Operation of the assessment: Unit 7 is designed based on a case study. The case study is released via the CCEA website to schools 2 months in advance of the examination. This unit is subject to the CEA quality assurance

channels with a reviser, QPEC team, and scrutineer. The case study mirror images a real life business situation. The production of the assessment follows the logical walk-through of system development. The paper-based assessment has set answer spaces although candidates can have extra writing paper if required. The reasoning behind the limiting writing space was that it was felt that the skills of consolidating and constructing answers are also important. The Unit 7 team feel it is very discriminating as candidates are able to apply knowledge and it does not apply rote learning.

Unit 13 is a largely knowledge-based assessment using high-end skills. School hardware constraints, especially with regard to the C2K network, make this unit difficult to deliver practically. It is believed that practical simulations would be very constraining but this depends on the simulation software available. There are a lot of extended writing pieces which allow for student flexibility because of the range of candidates taking this unit. The centres require specific hardware or software to take either paper-based unit assessments. The Education Manager for ICT is the main source of support. As there is no practical element, there are no support meetings for either of these units. However, schools can have access through the CEA website to a large store of past papers and chief examiners' reports.

Unit 7 Case study is released to centres two months prior to the assessment. Although this case study is available to read, it cannot be brought into the actual assessment. A new clean copy is provided at the assessment. No testing is carried out as this is deemed unnecessary due to CEA production processes prior to the examination.

Scalability: The numbers entered for the CCEA specification have increased year on year and with regard to scalability the method of delivery and assessment tends not to be an issue.

Access/barriers: With regard to paper-based assessment production, although the design of the papers considers the level of language and student accessibility, no consideration at this stage is given to any other forms of accessibility by the Production team. Should a centre require a specially modified paper-based assessment a request is sent to CEA prior to the assessment and the original assessment altered to meet this one off request. This is then made available to the examination officer along with the other non-modified papers at the specified time.

CCEA produce papers in English and Irish as requested and candidates can either respond in Irish or English. Irish papers are produced as requested beforehand by schools. No member of the Applied ICT production team see these prior to the assessment being carried out. Completed assessments are translated into English as appropriate by Irish translators, not necessarily subject specialists. These translated papers are then marked by examiners.
Test conditions/environment/test familiarisation: The set time for the examination is usually May of the summer series.

Previous paper-based assessments are available for download from CEA website for familiarisation. These units are all paper-based and thus paper-based assessments arrive to secure areas in centres as prescribed by CEA regulations and are then distributed on the day of the assessment by the examinations officer. All paper-based assessments for both Unit 7 and 13 are delivered to the centres examination officer a week prior to the examination

Some other issues were discussed including;

Marking: Examiners are posted 20 pre-standardised meeting scripts. 10 scripts are marked prior to the standardisation meeting, at which one script is collectively marked and the mark scheme agreed. At least a further three are then table marked and any problem areas are looked at in further samples. All examiners leave the meeting with a paper-based, updated mark scheme and the papers to mark.

Examiners then have to mark a team marked set of three scripts and then a further 12 of their own scripts. These are then posted to the team leader with the appropriate forms. A duplicate copy of the posted results is held by the examiner. The team leader looks at all 15 scripts, decides on the necessary action, contacts the examiner as necessary and then posts the scripts back to the examiner.

Half way through the process the examiner posts a further 25 scripts for checking. Examiners are required to choose different mark ranges and centres for these samples. Team leaders have no further method of checking examiners unless more samples are requested. On completion of marking all scripts are returned to CEA via post or in person. These scripts are signed into CEA and OMR forms containing marks only are returned separately from the scripts. Item banking is not considered because of the Unit 7 case study life span.

4 Discussion

The background and literature review shows an increase in the use of e-assessment overall and also more specifically in general qualifications. The qualifications included in this study have given a first look at the use of e-assessment for whole qualifications alongside pen and paper assessment of qualifications based on the same subject criteria. This has been carried out in the light of previous findings for centre readiness, which recognises continued technical and teaching staff skill issues but, in the responses, shows progress in the challenges that these present. A review of international practices shows a move toward the development of e-assessment in qualifications (including high-stakes qualifications), and an embracing of the opportunities it can bring for effective and efficient assessment and skills development.

This was a focused piece of work, allowing the opportunity to look at general qualifications taken in schools across Northern Ireland and Wales. The research allowed for a large sample of post-16 learners to be included, which provides a significant contribution to the body of understanding on learner issues in general, but recognises the limitations of the findings across learners taking vocational, professional and technical and other types of qualifications. Other UK studies, including the eA Forum previous research into Centre Readiness for E-assessment and the recently published JISC FE study would add to the discussion.

Previous research has suggested a potential detrimental effect of the use of e-assessment on candidate performance. This research had allowed questioning of a large sample of learners based on their experiences of using both pen & paper and e-assessment to investigate this more fully.

Learner Experiences

This evaluation aimed to examine the assessment enjoyment and preferences of learners undertaking the summer series of GCE Applied Business and GCE Applied ICT.

GCE Applied ICT respondents found their assessment was significantly more enjoyable if they had undergone e-assessment and GCE Applied Business respondents found their assessment no more or less enjoyable on the basis of the form it took. Content-Assessment Consonance (Test Validity) may influence assessment enjoyment. Respondents noted that the form of assessment 'can match' content material to good effect. Contributors also noted that the form of assessment can restrict what is being assessed, for example, certain question types and assessment methods can only assess knowledge recall rather than application of knowledge.

GCE Applied ICT respondents taking e-assessment demonstrated a strong preference for online assessment and GCE Applied Business respondents indicated no particular preference for online assessment. Pen and paper candidates undertaking GCE Applied Business reported a stronger preference for pen and paper assessment than e- assessment. It may be concluded that assessment preferences could be content-dependent and influenced by prior exposure to the form of assessment/mode of delivery.

The primary emotion reported by exam candidates was nervousness during assessment, and this did not vary according to the form of assessment used, suggesting test anxiety is a stable feature of 'high-stakes' examinations, affecting approximately one in every two candidates. A greater portion of e-assessed candidates recorded positive emotions, including feeling relaxed and happy, and less unprepared. A greater proportion of Pen and Paper candidates recorded negative emotions including; nervous, scared, worried and panicky. Overall, this research found e-assessment to be

aligned with a more positive emotional experience and lower generalised test anxiety.

All e-assessment focus group contributors reported a relatively difficulty-free assessment experience but noted the potential for technical problems as a concern that could raise candidates' test anxiety. However, as noted, e-assessment had a more positive emotional experience and lower indicators of test anxiety despite higher levels of reporting of 'operational or technical difficulties' by e-assessment Pulse Survey respondents. This suggests that e-assessment candidates may demonstrate greater awareness in relation to operational and technical problems and difficulties and may be more likely to note and report these, regardless of their actual impact on their assessment experience and/or performance.

Focus group contributors emphasised physical ergonomics/strain [hand] as an issue of concern in handwritten exams but also noted physical ergonomics/strain [eyes and posture] and adverse effects on information processing [attention/concentration] as potential issues with computer assessment. Pen and Paper candidates were aware of the potential disadvantages that poor handwriting and 'mistakes' could have on their performance, and that handwriting lowered their overall efficiency and productivity during pen and paper assessments: almost all of contributors reported that their typing speed exceeded their handwriting speed. Focus group contributors also noted the extra time that could be gained from typing answers and the benefits of the e-assessment platform for candidates' cognitive and organisational functioning in the exam, including executive functioning assistance.

Approximately twice as many pen and paper Applied Business Pulse Survey respondents reported feeling 'unprepared' during the exam compared to all other groups. Applied Business pen and paper focus group contributors felt less prepared and confident about their assessment compared to Applied Business e-assessment contributors. Understanding the nature of respondents' 'preparedness' and its contributing factors, may be essential to understanding their assessment enjoyment and preferences.

Awarding organisation provision

Awarding Organisations consider that their particular methods of assessment do reflect the specification in terms of validity (here regarded as a measure of how an assessment reflects the content and learning aims of a particular syllabus or specification). However, it is evident in these practical subjects that the on-screen assessment allows candidates to interact with items and contexts in ways that are not possible on paper. The use of in-built simulations and other varieties of assessment materials appears to be beneficial and engaging with regard to the testing of objectives which school hardware and software constraints might not let them do as realistically. Candidates are able to demonstrate skills reflected in the world of work. The on-screen scrolling text boxes allow pupils to express themselves in a way which is familiar and welcomed.

Awarding Organisations have instilled confidence in their assessment systems. In this study the on-screen assessment can provide greater opportunities for reliability than the paper-based system. The following are reported to be some of the added benefits of the on-screen marking system with regard to reliability:

- The production team communicate electronically and instantly and have the ability to electronically modify papers as they progress.
- Translation of papers are carried out and considered very early in the process with the production team having an input rather than just relying on quality assurance. Examiners are also language specialists.
- Within the marking process no seeds are needed; seeds are time consuming and not deemed appropriate for these specific assessments due to the nature of the content being assessed – other quality control methods are deemed more suitable and provide reliable outcomes.

- Papers are marked electronically and available immediately. There are no postal delays, therefore there is no potential for lost papers or costs implications.
- Computerised assessment systems generally count correctly; marks are not missed out and marks are transferred without error.
- Timing and requirements of examinations can be controlled more efficiently.

There are potentially fewer barriers to assessment with e-assessment. E-assessment systems have many built-in features to support accessibility, such as replay, video, readers, enlarged text, and different screen colours, which allow for enhanced student support.

Conclusions and recommendations

The evaluation of learner experiences of e-assessment and Pen and Paper assessment found that:

- the e-assessment for Applied ICT is more enjoyable than pen and paper assessment; whereas the e-assessment for Applied Business is no more or less enjoyable than pen and paper assessment. Candidates' assessment preferences may be content-dependent and influenced by prior exposure to the form of assessment/mode of delivery and low insight regarding the potentialities of e-assessment;
- e-assessment candidates showed a more positive emotional experience for Applied Business and Applied ICT candidates and lower indicators of Generalised Test Anxiety;
- the benefits of e-assessment may include enhanced cognitive and organisational functioning, communication, efficiency and productivity for the candidate and lower physical strain;
- e-assessment 'ease of use' issues may reflect a lack of familiarity with all aspects of the e-assessment interface and challenges relating to user expectations;
- e-assessment candidates may be more alert to operational and technical difficulties and more likely to note and report these difficulties than pen and paper candidates.

The analysis of awarding organisation provision found that:

- legacy regulatory qualification criteria do not allow the assessment of high stakes assessments to consist of only objective questions. Therefore, if on-screen testing is to be used in high-stakes assessments, the on-screen assessments would need to be capable of assessing a construct in other ways than objective questions;
- further exploration is needed also of the requirements to provide paper-based alternatives to on-screen assessment significantly inhibits innovation in the development of engaging and valid assessments.

Some observations from this research:

- candidates should be provided with greater access to sample content and the e-assessment interface ahead of e-assessment;
- operational and technical difficulties should be fully examined and logged to determine their characteristics and impact on candidates' assessment enjoyment, preferences and performance and improve e-assessment systems;
- the standard operating procedures for e-assessment centres should include advice on whether or not there is a need for the distribution of paper copies of exam papers.

Key recommendations

1. The research shows the need for updated guidance, including the following:

    - E-assessment should be considered in future qualifications development where it provides the opportunity to meet the assessment objectives in a more relevant and purposeful way for the learner;
    - E-assessment should be considered where it appropriately provides enhanced reliability;

2. Assessment development should take account of learner preferences and the potential benefits of lower test anxiety and increased productivity.

Appendix 1

Learner Experiences of E-assessment and Pen and Paper Assessment

CCEA RESEARCH AND STATISTICS UNIT

Research Report:

Learner Experiences of E-assessment and Pen and Paper Assessment

Creation Date: 26.08.16

Version: 3.0

Contents

Section Heading		Page
1.	**Executive Summary**	24
2.	**Introduction**	25
	2.1 Background	25
	2.2 Project Scope	22
3.	**Method**	27
	3.1 Qualification Pairings	27
	3.2 Data Collection Methods: Learner Experiences	27
	3.3 Distribution of Surveys	28
	3.4 Response Rates	28
	3.5 Focus Groups	29
	3.6 Data Analysis	29
4.	**Results**	30
	4.1. GCE Applied Business	30
	*4.1.1. **GCE Applied Business Pulse Survey: Demographics*** *Focus Groups: Demographics and Background*	30
	*4.1.2. **GCE Applied Business Pulse Survey: Enjoyment of Assessment***	32
	*4.1.3. **GCE Applied Business Pulse Survey: Affect During the Assessment*** *Focus Groups: Preparation, Confidence and Assessment Experience*	32
	*4.1.4. **GCE Applied Business Pulse Survey: Ease of Use of Assessment*** *Focus Groups: Ease of Use and Accessibility of Assessment*	36
	*4.1.5. **GCE Applied Business Pulse Survey: Operational and Technical Difficulties*** *Focus Groups: Operational and Technical Difficulties*	37
	*4.1.6. **GCE Applied Business Pulse Survey: Assessment Preference*** Focus Groups: Assessment Preference	38

Section Heading	Page

4.2. GCE Applied ICTl 40

4.2.1. GCE Applied ICT Pulse Survey: Demographics
Focus Groups: Demographics and Background 40

4.2.2. GCE Applied ICT Pulse Survey: Enjoyment of Assessment 41

4.2.3. GCE Applied ICT Pulse Survey: Affect During the Assessment
Focus Groups: Preparation, Confidence and Assessment Experience 41

4.2.4. GCE Applied ICT Pulse Survey: Ease of Use of Assessment
Focus Groups: Ease of Use and Accessibility of Assessment 45

4.2.5. GCE Applied ICT Pulse Survey: Operational and Technical Difficulties
Focus Groups: Operational and Technical Difficulties 47

4.2.6. **GCE Applied ICT Pulse Survey: Assessment Preference**
Focus Groups: Assessment Preference 49

5. Discussion 51

5.1 Assessment Enjoyment 52

5.2 Assessment Preference of Learners 52

5.3 Emotional Experience of Candidates 52

5.4 Ease of Use and Operational and Technical Difficulties 53

5.5 Ease of Use and Access, including the Suitability and Readiness of Candidates 55

5.6 Limitations 56

6. Conclusions and Recommendations 57

7. References 58

8. Appendices 67

Supplementary Tables A-F (VARS)

List of Tables

		Page
Table 1:	*Qualifications and Assessment Method*	26
Table 2:	*Qualification Pairings*	27
Table 3:	*Response Rates and Number of Surveys Returned*	28
Table 4:	*Applied Business Pulse Survey: Demographics*	30
Table 5:	*Applied ICT Pulse Survey: Positive and Negative Emotions according to Assessment Type*	33
Table 6:	*Applied Business Pulse Survey: Ease of Use of Assessment*	36
Table 7:	*Applied Business Pulse Survey: Operational and Technical Difficulties*	37
Table 8:	*Applied Business Pulse Survey: Assessment Preference*	38
Table 9:	*Applied ICT Pulse Survey: Demographics*	40
Table 10:	*Applied ICT Pulse Survey: Positive and Negative Emotions according to Assessment Type*	42
Table 11:	*Applied ICT Pulse Survey: Ease of Use of Assessment*	46
Table 12:	*Applied ICT Pulse Survey: Operational and Technical Difficulties*	48
Table 13:	*Applied ICT Pulse Survey: Assessment Preference*	49

List of Graphs

		Page
Graph 1.	*GCE Applied Business: Distributions of ratings for respondents' enjoyment of their exams (Pen and Paper Assessment)*	32
Graph 2.	*GCE Applied Business: Distributions of ratings for respondents' enjoyment of their exams (E-assessment)*	32
Graph 3.	*GCE Applied ICT: Distributions of ratings for respondents' enjoyment of their exams (Pen and Paper Assessment)*	41
Graph 4.	*GCE Applied ICT: Distributions of ratings for respondents' enjoyment of their exams (E-assessment)*	41

1. Executive Summary

The aims of the research was to investigate assessment enjoyment and preferences of learners, advantages of the assessment method from the learners' perspective; and, access issues (i.e. equity and equality of provision), including the suitability and readiness of candidates.

Findings

- E-assessment is associated with a more positive emotional experience for Applied Business and Applied ICT candidates and lower indicators of Generalised Test Anxiety.
- Candidates' assessment enjoyment and preferences may be content-dependent and influenced by prior exposure to the form of assessment/mode of delivery and levels of insight regarding the potentialities of e-assessment in those with low prior exposure (pen and paper candidates).
- Benefits of e-assessment may include enhanced cognitive and organisational functioning, communication, efficiency and productivity for the candidate and lower physical strain.
- E-assessment ease of use issues may reflect a lack of familiarity with all aspects of the e-assessment interface and challenges relating to user expectations;
  e-assessment candidates may be more alert to operational and technical difficulties and more likely to note and report these difficulties than pen and paper candidates.

Research recommendations

- candidates are provided with greater access to sample content and the e-assessment interface ahead of e-assessment;
- operational and technical difficulties are fully examined and logged to determine their characteristics and impact on candidates' assessment enjoyment, preferences and performance and to improve e-assessment systems;
- the standard operating procedures for e-assessment centres include advice on the distribution of paper copies of exam papers.

2. Introduction

2.1. Background

In April 2016, CCEA Regulation and Qualifications Wales requested that CCEA Research and Statistics (R&S) Unit conduct an evaluation of learners' experiences of both
e-assessment and pen and paper assessment in 'high stakes' GCE examinations.
E-assessment is currently used in approximately 2017 qualifications and by 66 awarding organisations on the Register.

This evaluation forms part of a larger joint project that the regulators are conducting in order to revisit and revise the 2007 *Regulatory principles for e-assessment* (1). This is taking place in light of recent developments in e-assessment practices, and the reform of qualifications since the publication of these principles.

The overarching purpose of the larger joint project is to exploit a final opportunity the regulators have to identify what (non-mandatory) guidance they could provide for consideration by awarding bodies in their development of appropriate qualification assessment. The larger joint project aims to inform the development of a good practice guide to supplement the 2007 *Regulatory principles for e-assessment* (1).

This study could be subject agnostic. However, the current evaluation of learner experiences focussed on the use of assessments for GCE Applied ICT and GCE Applied Business, with electronic and pen and paper assessed specifications based on the same subject criteria. The research aimed to determine the benefits of the different assessment approaches in terms of learner experiences for the summer series for the specifications.

The evaluation of learner experiences was undertaken between May and August 2016 for the summer series cohort. Two paired units for each qualification were selected to compare the assessment experience for the learner.

At the request of the Regulators, the evaluation sought to investigate:

1. the assessment enjoyment and preferences of learners: the concept of "assessment preferences" refers to students' opinions, attitudes, and preferences of assessment methods and its properties (2);
2. advantages of the assessment method, online and e-assessment, from the learners' perspective; and,
3. access issues (i.e. equity and equality of provision), including the suitability and readiness of candidates.

The research plan took account of previous QCA/AQA (3) research outcome issues of: Test anxiety; Software interface; and, Familiarity.

2.2. Project Scope

Information on learners' experiences of e-assessment and pen and paper assessment was sought for the following paired GCE qualifications:

Table 1: Qualifications and Assessment Method

	CCEA	WJEC
GCE Applied Business	Pen and Paper assessment	wholly E-assessed
GCE Applied ICT	Pen and Paper assessment	wholly E-assessed

3. Method

3.1 Qualification Pairings

For the purpose of the research, qualifications were paired for the following units:

Table 2: Qualification Pairings

	CCEA	WJEC
GCE Applied Business	A2 Unit 7 Finance	Units 1&5 Investigating Business and Finance & Business Decision-Making
	A2 Unit 12 Global Markets	A2 Unit 7 Managing Business in an International Context
GCE Applied ICT	A2 Unit 7 Investigating systems	AS Unit 1 Part A E-business
	A2 Unit 13 Networking and Communications	A2 Unit 7 E-connect

3.2 Data Collection Methods: Learner Experiences

The methods employed to gather learner experiences of e-assessment and pen and paper assessment were:

- a 'Pulse Survey' for learners distributed to all centres; and,
- four thirty-minute focus groups conducted with candidates immediately following their GCE examination. The researcher conducted one focus group for each qualification and assessment combination detailed in Table 1.

3.3 Distribution of Surveys

Surveys were distributed to a total of 135 exam centres in Northern Ireland (Applied ICT=83 centres; Applied Business=52 centres) and 53 centres in Wales (Applied ICT=28 centres; Applied Business=25 centres). A total of 3,635 surveys were distributed to candidates undertaking the summer series of GCE Applied ICT and GCE Applied Business. A total of 2,620 surveys were distributed to CCEA candidates (Applied ICT=1065 surveys; Applied Business =1555 surveys) and 1015 surveys were distributed to WJEC candidates (Applied ICT=541 surveys; Applied Business=474 surveys).

The surveys were distributed in the exam centres by the invigilators. Candidates completed the surveys immediately after they had completed their examination within the exam centres. The exam centres were responsible for returning the surveys by post to CCEA Research & Statistics Unit.

3.4 Response Rates

The response rate for the survey was 40.94% (n=1,009).

Response rates by awarding body and by qualification were as follows:

Table 3: Response Rates and Number of Surveys Returned

	CCEA	WJEC	Total
GCE Applied Business (response rate; n surveys returned)	38.46%; (n=598)	48.73%; (n=231)	40.86%; (n=829)
GCE Applied ICT (response rate; n surveys returned)	47.04%; (n=501)	29.21%; (n=158)	41.03%; (n=659)
Total (response rate; surveys returned)	41.95%; (n=1,099)	38.33%; (n=389)	40.94%; (n=1,488)

3.5 Focus Groups

The pen and paper assessment focus group for GCE Applied Business took place on the 24th June 2016 in Carrickfergus College, Northern Ireland. The e-assessment focus group for GCE Applied Business took place on the 19th May 2016 in Pontypridd High School, Wales. For the purposes of this report, these focus groups are referred to as BUS_P&P and BUS_E-assess, respectively.

The pen and paper assessment focus group for GCE Applied ICT took place on the 23rd May 2016 in St Ronan's College Lurgan, Northern Ireland. The e-assessment focus group for GCE Applied ICT took place on the 27th May 2016 in St Cenydd, Bedwas, Wales. For the purposes of this report, these focus groups are referred to as ICT_P&P and ICT_E-assess.

Participants had completed their GCE Applied Business and Applied ICT exams immediately prior to participation in the focus groups. Within the focus groups, participants were also requested to complete Visual Analogue Rating Scales (4, 5) to gauge the magnitude of their feelings during their assessment, after their assessment and following participation in the focus group. Contributors were instructed that the midpoint of the scales indicated that their feelings were 'Neutral'.

Feedback collated from focus groups is reported within the questionnaire items for comparison/contrast.

3.6 Data Analysis

Data collected from the Pulse Survey were analysed using SPSS V22. The learner experiences of pen and paper assessment respondents were compared to those of e-assessment respondents using X^2 tests for nominal data and independent samples t tests for interval data. Feedback from the focus groups was coded, themed and collated with the quantitative findings to address the research brief.

4. Results

4.1 GCE Applied Business

4.1.1 GCE Applied Business Pulse Survey: Demographics

Table 4 shows the age and gender/sex of respondents undertaking GCE Applied Business (n=829) using pen and paper (CCEA; n=598) and e-assessment (WJEC; n=231) methods.

The average age of respondents was 17.76 years (SD = 0.7 years). E-assessment respondents were significantly younger than pen and paper respondents (mean difference = 1.12 years).

Table 4: Applied Business Pulse Survey: Demographics

	Pen and Paper	E-assessment	Test Statistic
Age (Mean, SD)	18.07 (0.42)	16.95 (0.63)	t(822)=29.34, p<0.001
Sex/Gender Male/Female/Do not identify as either/missing data)	309/285/2/2 51.7%/47.7%/0.3%/0.3%	113/116/0/2 48.9%/50.2%/0%/0.9%	$X^2(1)=2.22$, p=n.s.

Focus Groups: Demographics and Background

The two focus groups for GCE Applied Business differed in terms of their gender composition.

BUS_P&P comprised a total of twelve students (3:9 - Male: Female/average age = 17 years). BUS_E-assess comprised a total of eight students (5:3-Male: Female/average age = 17 years).

The focus groups also differed in terms of the proportion of participants who had studied Business at an earlier stage, suggesting **a possible difference in student preparedness for learning** at intake in the two regions.

Three of the twelve BUS_P&P participants had studied Business Studies at GCSE. Seven of the eight participants in BUS_E-assess had studied Business at GCSE; one participant had not.

Groups also differed in terms of their reported reasons for choosing to study Applied Business and their intentions to use the qualification for further work and/or study.

Participants were asked to discuss their subject choice and how they planned to use their GCE qualification in Applied ICT after leaving second level school.

BUS P&P participants expressed a lack of certainty as to why they had chosen to study Applied Business at GCE. Reasons for their selection of this subject included the participant(s): liked business (n=1); had 'nothing else to do' (n=1); lacked options (n=1). Eleven participants did not want to do anything further with their qualification. One participant wanted to use it to teach Business Studies.

All BUS_E-assess participants agreed that studying Applied Business at GCE provides them with "useful life skills". All participants indicated that they planned to use their GCE qualification in Applied Business to apply for further study and/or University. One participant specified that s/he would use the qualification for entry to Accounting and Finance.

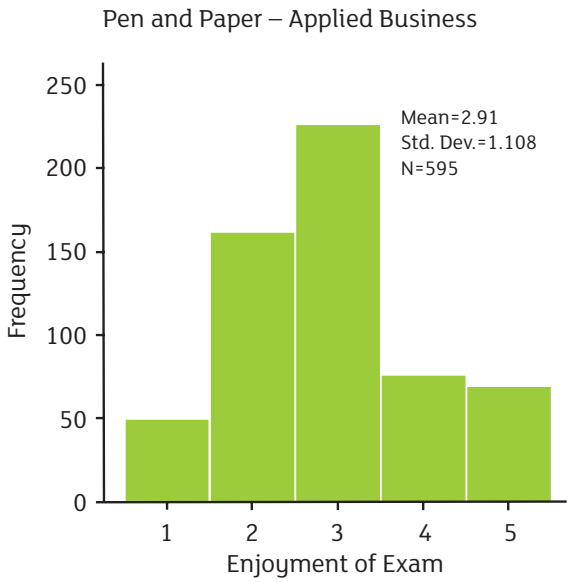
Participants were asked about the access they currently have to technology/online facilities at home, at school and for personal/mobile use.

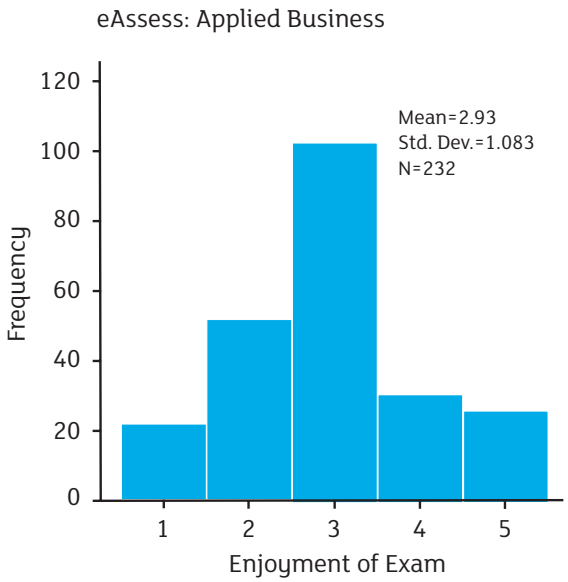
All BUS participants indicated that they owned a smartphone, a tablet computer and/or laptop, and had access to the internet at home. All BUS_P&P students used their technological devices extensively to support their research and studies. BUS_E-assess participants had access to computers at school in free periods whenever a computer room was not in use for teaching for additional study. The content they could access using their own device and the school Wi-Fi was restricted.

4.1.2 GCE Applied Business Pulse Survey: Enjoyment of Assessment

The distributions of scores for respondents' enjoyment of their assessments are shown in Graphs 1 and 2. Exam enjoyment was rated on a scale of 1 (Very Good) to 5 (Very Poor). Average enjoyment of the exam for all candidates was 2.87 (SD = 1.31; Good = 2; Okay = 3). Pen and paper assessment BUS respondents (CCEA) did not find the exam significantly more enjoyable than e-assessment (WJEC) BUS respondents, t(827) = 2.95, p = n.s.

Graphs 1 and 2: Distributions of ratings for respondents' enjoyment of their exams





4.1.3 GCE Applied Business Pulse Survey: Affect During the Assessment

Respondents were asked to select, from a range of descriptors, the feelings they experienced during their examination. The survey instructed respondents to circle as many of the descriptors as they wanted. Table 5 shows the proportions of pen and paper and e-assessment respondents who selected these positive and negative emotion descriptors.

Table 5: GCE Applied Business Pulse Survey: Positive and Negative Emotions according to Assessment Type

	Pen and Paper n=598	E-assessment n=231	Total n=829
Positive Emotions: % selected			
Relaxed*	23.1% (n=138)	30.3% (n=70)	25.1% (n=208)
Happy	14.2% (n=85)	11.3% (n=26)	13.4% (n=111)
Content**	31.9% (n=191)	19.5% (n=45)	28.5% (n=236)
Fortunate**	10% (n=60)	4.3% (n=10)	8.4% (n=70)
Relieved**	26.4% (n=158)	12.1% (n=28)	22.4% (n=186)
Well-prepared	18.7% (n=112)	18.2% (n=42)	18.6% (n=154)
Negative Emotions: % selected			
Nervous	50.8% (n=304)	50.6% (n=117)	50.8% (n=421)
Scared	15.1% (n=90)	11.7% (n=27)	14.1% (n=117)
Worried*	31.8% (n=190)	24.2% (n=56)	29.7% (n=246)
Unlucky	14.4% (n=86)	13.9% (n=32)	14.2% (n=118)
Panicky	25.8% (n=154)	19.5% (n=45)	24% (n=199)
Unprepared**	19.7% (n=118)	10% (n=23)	17% (n=141)
(*p<0.05; **p<0.01)			

The most common emotion felt by all respondents during their assessments was **nervousness**: 50.8% of respondents reported experiencing this negative emotion while completing the GCE Applied Business exam.

Pen and paper respondents were highly significantly more likely to report feeling:

- **Content** (19.5% of e-assessment respondents compared to 31.9% of pen and paper respondents);
- **Fortunate** (4.3% of e-assessment respondents compared to 10% of pen and paper respondents);
- **Relieved** (12.1% e-assessment respondents compared to 26.4% of pen and paper respondents), ***but also***
- **Unprepared** (10% e-assessment respondents compared to 19.7% of pen and paper respondents)

A higher proportion of e-assessment candidates reported feeling:

- **Relaxed** (30.3% e-assessment respondents compared to 23.1% of pen and paper respondents)

and fewer were

- **Worried** (24.2% e-assessment respondents compared to 31.8% of pen and paper respondents) during their assessment.

Focus Groups: Preparation, Confidence and Assessment Experience

Students discussed how they had prepared for the GCE Applied Business exam over the six weeks prior to the event and were asked to detail the learning and support materials that were beneficial to them when preparing for their GCE Applied Business exam.

BUS_P&P participants had prepared by engaging in traditional preparatory methods, such as: studying the paper notes they had made over the length of the course; asking themselves questions; reciting information; engaging in classroom activities, such as drawing spider diagrams; attending revision classes every week for the previous six weeks.

BUS_P&P participants stated that they had made use of the CCEA website/microsite to gain access to past papers, specifications and mark schemes. Participants indicated that they held the support materials in both paper format and as pdfs. The participants varied in how often they accessed the CCEA microsite to obtain learning and support materials. Answers ranged from 'Not very often' (n=3) to 'accessing it a few days every week' (n=3). One participant stated that s/he had accessed the microsite for the first time just prior to sitting the exam. The majority of the participants (n=10) had commenced using the website within the previous 6 weeks. Participants also made use of videos to assist their learning (videos *"that talk you through a topic…or methodology"*). The group agreed that this was their favoured method of learning and

would like CCEA to provide more by way of video content as learning and support materials for Applied Business.

BUS_E-assess participants had prepared together in class for their GCE Applied Business exam and through individual revision sessions at home (n=8). They had used revision booklets purchased from school and revision cards made in school to prepare for the exam. Students had also made use of an unlimited number of WJEC past papers, which they would print off. They prepared for their examination using mixed media i.e. pen and paper and typing answers on a computer. The participants generally held WJEC mark schemes in pdf format: they found this quicker and it minimised their costs. They rated the supporting materials produced by WJEC to support this qualification highly but noted the limitations of reliance on them. Two students noted that they did not always feel equipped to judge the standard of their answers, even with the availability of mark schemes. Their teacher's guidance was useful in this regard.

All of the BUS participants agreed that they did not find it costly to complete the qualification: printing facilities were available to them in school at no cost to themselves.

Focus group participants were asked to fill in Visual Analogue Rating Scales (VARS) to gauge their emotions during and after the exam and focus group participation.

BUS_P&P students reported feeling somewhat less confident and prepared (VARS; $p<0.1$, trend) during the exam than BUS_E-assess students (Supplementary Table A). These group differences in confidence and preparedness were also present immediately after the exam was over (Supplementary Table B).

The BUS_E-assess participants reported feeling significantly more pleased, confident, content, and well-prepared ($p=$ or <0.05, two-tailed) following the focus group discussion about their assessment and also showed signs of greater fear reduction over time at a group level (see Panicky/Fearless: Supplementary Tables B and C). Notably, the variability in participants' anxiety levels was greater in the BUS_P&P students than in the BUS_ E-assess students following the exam and after focus group participation (Supplementary Tables B and C).

In focus group discussions, BUS_P&P participants expressed differing levels of confidence in relation to their preparation for the exam: an approximately balanced number of participants stated that their confidence was *'low', '50/50'* and *'medium' (4:4:4).* Approximately half of the BUS_P&P participants felt that a sizeable amount of the content they encountered in the exam *"was novel":* they were asked to answer questions they had never encountered before.

In contrast, BUS_ E-assess participants expressed feeling confident about the exam they sat ahead of completing it. BUS_ E-assess participants also felt their *"preparation was good".* They did however perceive the last question in the exam to be *"worded much differently to any question... [they] ... had ever seen before in a past paper"* and that caused time problems for some of the participants in the focus group. The last question had *"a different format"* to what they had expected.

4.1.4 GCE Applied Business Pulse Survey: Ease of Use of Assessment

Candidates were asked if they found the format of the examination easy to follow (question variant 1 for pen and paper respondents) or if the on screen examination was easy to use (question variant 2 for e-assessment respondents). The frequencies and proportions for responses to these question variants are shown in Table 6.

Table 6: Applied Business Pulse Survey: Ease of Use of Assessment

	Pen and Paper	E-assessment	Test Statistic
Ease of Use (Yes/No/missing data)	537/60/1 89.8%/10%/0.2%	168/45/18 72.7%/19.5%/7.8%	$X^2(1)= 59.72, p<0.001$

Approximately twice the proportion of e-assessment respondents reported Ease of Use issues: 10% of pen and paper candidates answered 'No' to their question variant compared to 19.5% of e-assessment respondents. A larger proportion of e-assessment respondents failed to answer this question (7.8% [n=18] of e-assessment respondents compared to 0.2% [n=1] of pen and paper respondents).

Focus Groups: Ease of Use and Accessibility of Assessment

Focus group participants were asked whether they were familiar with the format, structure and duration of the Applied Business exam before they completed it. The group was also asked to comment on how accessible the Applied Business exam is to all students e.g. SEN/Language groups.

None of the BUS_P&P participants had attempted to complete a practice exam, either with or without exam conditions. They had practiced exam questions using pen and paper, primarily using a topic-based approach to preparation.

BUS_E-assess participants felt they were familiar with the format, structure and duration of the exam in advance of sitting it. They reported a very low level of prior exposure to the platform: participants had one trial run with the e-assessment interface a month before the exam. They stated that they had *"no way to become more familiar with the interface… and… exam conditions"* ahead of the assessment. Access to the interface was dependent on the time available, their school's resources and the availability of a technician: one session was provided. They engaged in further practice using pen and paper and an unlimited numbers of past papers.

BUS_E-assess participants felt that the absence of word processing functions *"can be strange"* for candidates undergoing e-assessment: the platform is idiosyncratic in terms of HCI design. The software they encountered did not conduct spellchecks, correct capital letters or perform other grammar checks. This could potentially result in lost time and cause *"a sense of time pressure".* Notably, BUS_E-assess students reported that they had sufficient time for their exam but went *"to the last second"* to complete it.

BUS_E-assess participants did not like features of the *'data sheet'* icon. Participants described problems with its location and remembering its purpose: its positioning was *"hidden beside the calculator"* and *"I kept thinking it was just a calculator".* They suggested the information contained within *"would be better in a side panel… [or]… the icon was presented in a different colour… [or]… was highlighted in some way*", for the candidate. Participants felt that practice versions of the exam, placed online on the microsite, would be useful to Applied Business candidates.

Regarding accessibility, the BUS_P&P group was aware that it may be possible to sit their exam in Irish medium. A participant made the following comment in relation to pupils with Special Educational Needs (SEN): *"they're given extra time to do the exam and they [SEN candidates] can type their answers".* The candidate did not view this as fair: s/he felt the special arrangements disadvantaged non-SEN candidates. Participants also expressed a desire for an open book exam and the provision of all ratios instead of some to assist them in the assessment.

4.1.5 GCE Applied Business Pulse Survey: Operational and Technical Difficulties

Candidates were asked if they experienced any operational or technical difficulties during the examination. The frequencies and proportions for responses to this question are shown in Table 7. The proportion of e-assessment respondents who reported having experienced operational or technical problems was approximately four times greater than the proportion that completed a pen and paper assessment (16.5% of e-assessment respondents compared to 4% of pen and paper respondents).

Table 7: Applied Business Pulse Survey: Operational and Technical Difficulties

	Pen and Paper	E-assessment	Test Statistic
Op & Tech Diffs. (Yes/No/missing data)	24/572/2 4%/95.7%/0.3%	38/181/12 16.5%/78.4%/5.2%	$X^2(1)=40.46$ $p<0.001$

Focus Groups: Operational and Technical Difficulties

BUS_E-assess participants identified the potential for the screen freezing and disrupting a candidate's assessment as a concern. It was noted that it was *"not a simple matter"* to close and restart the GCE Applied Business examination on a computer.

BUS_E-assess participants also commented on the potential for *"a slow load time"* when moving through questions, resulting in lost time for a candidate.

BUS_E-assess participants also thought the icons at the bottom of the interface were *"not obvious"*. Contributors felt that it should be made *"more obvious"* that there is information contained within the data sheet icon that is relevant to answering a question.

4.1.6 GCE Applied Business Pulse Survey: Assessment Preference

Table 8 shows the frequencies and proportions of GCE Applied Business respondents according to their preferred examination assessment method. Pen and paper BUS respondents showed a clear preference for pen and paper assessment. The ratio of pen and paper BUS respondents who preferred paper-based assessment to online assessment was approximately 3:1. E-assessment BUS respondents showed no preference for paper-based or online assessment (ratio approximately 1:1).

Table 8: Applied Business Pulse Survey: Assessment Preference

	Pen and Paper	E-assessment	Test Statistic
Assessment Preference (Online Assessment/Paper-Based Assessment/missing data)	138/455/5 23.1%/76.1%/0.8%	114/117/0 49.4%/50.6%/0%	$X^2(1)=53.26$ $p<0.001$

Focus Groups: Assessment Preference

Focus group participants were asked, *"overall, do you think this unit is best assessed using e-assessment or would you prefer a pen and paper exam?"*

Similar to the findings of the survey, eight of the twelve BUS_P&P participants thought their GCE Applied Business unit was best assessed using pen and paper assessment while four participants would have preferred to complete the assessment online and/or using a computer (a ratio of 2:1). None of the twelve participants had encountered examples of this qualification conducted by e-assessment. In contrast, eight of the nine BUS_E-assess felt that the GCE Applied Business unit is best assessed using e-assessment. One candidate would have preferred to complete the exam by pen and paper assessment. Comments would suggest students' assessment preference is influenced by their **familiarity with the form of assessment**.

Advantages of e-assessment identified by the BUS focus group members included a range of **physical, information processing and organisational ergonomic factors**: less physical strain (hand) and discomfort from typing compared to producing large volumes of handwritten script; e-assessment is "less daunting"; the form of assessment matches some of the content material/the medium of assessment matches the qualification; typing/a quicker typing speed provides the candidate with more time to complete the examination, produce more content, and reduces the sense of time pressure; the platform provides unlimited *'virtual writing space'* and the ability to edit and rearrange answers to improve them, which is preferable to "scribbling all over your work"; type-written answers assist marker comprehension of the answers written by the candidate, reducing barriers to understanding; the user-friendly interface and additional features, such as data sheets, are helpful; additional functionality from the e-assessment platform, such as the timer, flag and progress bar, assist the candidate with organising their answers and managing their time. Candidates can move forwards and backwards between questions, return to partially completed answers and the timer in red acts as a warning/reminder of how long they have left to complete the exam.

Advantages of pen and paper assessment identified by BUS focus group members included: students can prefer to write something out to learn it; it is easier to match pen and paper exam conditions and become familiar with the format when preparing for assessment; less physical strain on the eyes; formulas and workings out are often easier to conduct using pen and paper; minimal fear of/reduced frequency of Ease of Use and Operational and Technical Difficulties that could inadvertently cause performance issues or spoil the assessment; no distracting typing noises during assessment.

4.2 GCE Applied ICT

4.2.1 GCE Applied ICT Pulse Survey: Demographics

Table 9 shows the age and gender/sex of respondents undertaking GCE Applied ICT (n=659) using pen and paper (CCEA; n=501) and e-assessment (WJEC; n=158) methods.

The average age of respondents was 17.79 years (SD=0.92 years). E-assessment respondents were significantly younger than pen and paper respondents (mean difference=0.97 years). There were also a significantly greater proportion of males in the e-assessment group. The ratio of males:females was approximately 1:1 in the pen and paper group compared to approximately 3:1 in the e-assessment group.

Table 9: Applied ICT Pulse Survey: Demographics

	Pen and Paper	E-assessment	Test Statistic
Age (Mean, SD)	18.02 (0.87)	17.05 (0.66)	12.9(656), p<0.001
Sex/Gender (Male/Female/Do not identify as either)	238/263/0 47.5%/52.5%/0%	115/42/1 72.8%/26.6%/0.6%	$X^2(1)$= 34.93, p<0.001

Focus Groups: Demographics and Background

The two focus groups for GCE Applied ICT differed in terms of their gender composition. Focus group ICT_P&P comprised a total of nine students (3:6; Male: Female; average age = 17) from Northern Ireland who were undertaking their GCE Applied ICT by pen and paper assessment. Focus group Applied ICT_E-assess comprised a total of ten students (7:3; Male:Female; average age = 17) from Wales.

A larger proportion of ICT_E-assess participants had studied ICT-related subjects at an earlier stage, suggesting **a possible difference in student preparedness for learning** at intake in the two regions. Six of the nine ICT_P&P participants had studied ICT at GCSE and three participants had not. Six of the ten ICT_E-assess participants had studied ICT at GCSE, one participant had studied computer science and three participants had taken both ICT and Computer Science at GCSE.

Participants were asked to discuss their subject choice and how they planned to use their GCE qualification in Applied ICT after leaving second level school.

ICT_P&P participants indicated that they planned to use GCE Applied ICT for entry to university (n=8) and to find employment after leaving school (n=1). One student was motivated to take this subject as s/he had been told that Applied ICT would be an *"easy subject to pass"*. Another participant thought Applied ICT was a good general subject that is *"necessary for every workplace"*.

ICT_E-assess participants (n=10) agreed that GCE Applied ICT would be useful for entry to university. One student viewed it as a way to get an office job rather than an outdoor job. All participants agreed that Applied ICT is a practical/pragmatic subject that is helpful *"in the real world"*.

Participants were asked about the access they currently have to technology/online facilities at home, at school and for personal/mobile use.

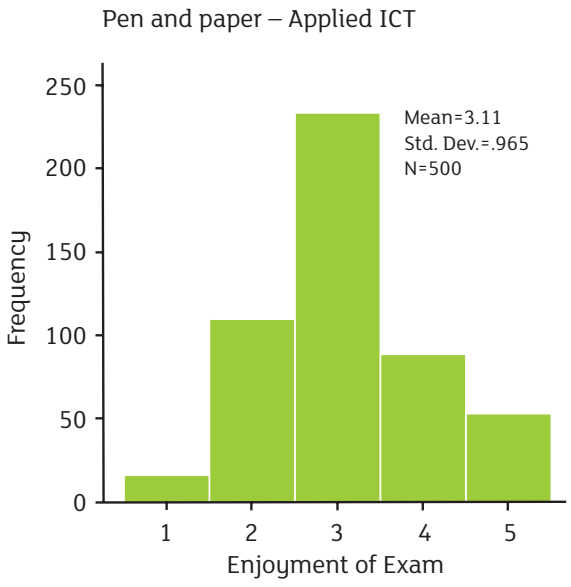
ICT_P&P participants indicated that they owned a smartphone, a tablet or computer and had access to the internet at home. Students noted that they completed all of their coursework for GCE Applied ICT using computers.

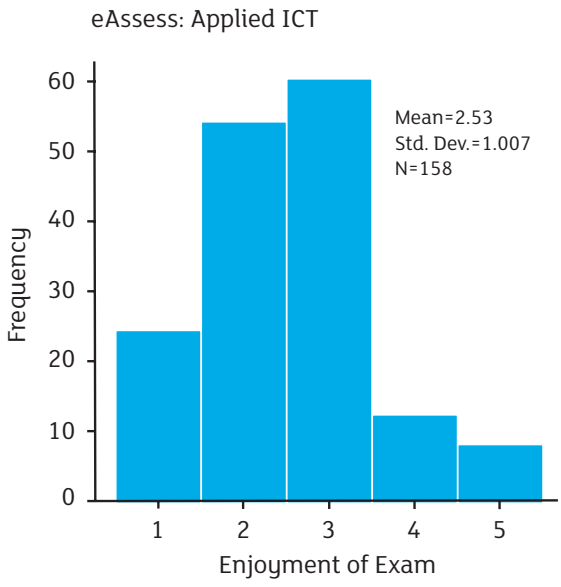
Nine ICT_E-assess participants owned a smartphone. All participants (n=10) had access to the internet at home and owned a tablet or computer. One also owned a laptop.

4.2.2 Applied ICT Pulse Survey: Enjoyment of Assessment

The distributions of scores for respondents' enjoyment of their assessments are shown in Graphs 3 and 4. Exam enjoyment was rated on a scale of 1 (Very Good) to 5 (Very Poor). Average enjoyment of the exam for all candidates was 2.95 (SD=1.11) Pen and paper GCE Applied ICT respondents found the exam significantly less enjoyable than e-assessment respondents, $t(627) = 5.61$, $p<0.001$.

Graphs 3 and 4: Distributions of ratings for respondents' enjoyment of their exams





4.2.3 Applied ICT Pulse Survey: Affect During the Assessment

Respondents were asked to select, from a range of descriptors, the feelings they experienced during their examination. The survey instructed respondents to circle as many of the descriptors as they wanted. Table 10 shows the proportions of pen and paper and e-assessment respondents who selected these positive and negative emotion descriptors.

Table 10: Applied ICT Pulse Survey: Positive and Negative Emotions according to Assessment Type

	Pen and Paper n=500	E-assessment n=158	Total n=658
Positive Emotions: % selected			
Relaxed	27.2% (n=136)	32.9% (n=52)	28.6% (n=188)
Happy***	7.8% (n=39)	24.7% (n=39)	11.9% (n=78)
Content	26% (n=131)	22.8% (n=36)	25.2% (n=167)
Fortunate	9.2% (n=46)	12% (n=19)	9.9% (n=65)
Relieved	23.8% (n=119)	20.9% (n=33)	23.1% (n=152)
Well-prepared**	18% (n=90)	29.7% (n=47)	20.8% (n=137)
Negative Emotions: % selected			
Nervous*	52.6% (n=263)	42.4% (n=67)	50.2% (n=330)
Scared**	12.6% (n=63)	3.8% (n=6)	10.5% (n=69)
Worried***	38.6% (n=193)	20.3% (n=32)	34.2% (n=225)
Unlucky	11.4% (n=57)	10.1% (n=16)	11.1% (n=73)
Panicky**	26% (n=130)	15.8% (n=25)	23.6% (n=155)
Unprepared	16.4% (n=82)	11.4% (n=18)	15.2% (n=100)
(*p<0.05; **p<0.01; ***p<0.001)			

The most common emotion felt by all respondents during the assessment was **nervousness**: 50.2% of respondents reported experiencing this negative feeling while being assessed.

A highly significantly higher proportion of e-assessment respondents reported feeling:

- **Happy** (24.7%of e-assessment respondents compared to 7.8% of pen and paper respondents); and
- **Well-prepared** (29.7% of e-assessment respondents compared to 18% of pen and paper respondents).

Pen and paper respondents were highly significantly more likely to report feeling:

- **Worried** (20.3% e-assessment respondents compared to 38.6% of pen and paper respondents);
- **Scared** (3.8% e-assessment respondents compared to 12.6% of pen and paper respondents); and,
- **Panicky** (15.8% e-assessment respondents compared to 26% of pen and paper respondents), during their assessment.

Focus Groups: Preparation, Confidence and Assessment Experience

Students discussed how they had prepared for the GCE Applied ICT exam over the six weeks prior to the event and were asked to detail the learning and support materials that were beneficial to them when preparing for their GCE ICT exam.

ICT_P&P participants had primarily studied alone for their GCE Applied ICT exam (n=9). Participants engaged in the following preparatory behaviours ahead of their exam: made notes on the computer (n=4); used help sheets (n=9); completed 'mindmaps' (n=1). Participants completed example exam paper questions using pen and paper (n=9). None of the students typed answers at any stage in preparation for the exam: all used pen and paper preparatory methods, mirroring the form of assessment.

ICT_E-assess participants (n=10) had mainly completed questions from past papers and had studied mark schemes to prepare for the exam. They had also received guidance and assistance from their teacher. Nine participants had used pen and paper preparatory methods. One student had also typed exam question answers on the computer.

ICT_P&P participants (n=9) had acquired a revision booklet and mark schemes from the CCEA microsite: they rated these highly (9 on a scale of 1-10). They accessed the online materials on a need-to-retrieve basis i.e. as and when they needed a paper or mark scheme. All participants (n=9) had accessed the CCEA microsite in the previous week to access past papers and mark schemes for GCE Applied ICT. Five participants held their past exam papers and mark schemes in pdf format, three held printed copies of past exam papers and one student held paper copies of test papers and pdfs of mark schemes.

ICT_E-assess participants (n=10) had used a revision guide and their own notes to prepare for the exam. None of the participants had accessed the WJEC microsite to obtain learning and support materials: materials had been downloaded to a local student drive, which they accessed in the school. All participants tended to hold past papers in paper form and mark schemes in pdf format.

All of the ICT focus group participants agreed that they did not find it costly to complete the unit: printing facilities were available to them in school at no cost to themselves.

Focus group participants were asked to fill in Visual Analogue Rating Scales (VARS) to gauge their emotions during and after the exam and focus group participation.

ICT_E-assess students reported feeling significantly less tired, more confident and happy ($p<0.05$ (two-tailed)) during the exam than ICT_P&P students (Supplementary Table D). ICT_E-assess students also showed evidence of feeling less anxious ($p<0.1$ (trend)) during the assessment (Supplementary Table D).

After the assessment was over, ICT_E-assess students reported feeling significantly more relieved, happy and pleased ($p<0.05$ (two-tailed), Supplementary Table E) and also showed evidence of feeling more calm and less anxious ($p<0.1$, trend; Supplementary Table E). Following the focus group, ICT_E-assess students reported feeling significantly more calm, confident, pleased, happy and content than ICT_P&P students ($p<0.05$ (two-tailed); Supplementary Table F): mean values were close to the maximum, indicating highly positive emotions in the ICT_E-assess group.

Verbal feedback from the focus group indicated that ICT_P&P students had mixed feelings about how they had prepared for this exam. The biggest problem they encountered was 'Data Flow Diagrams': students felt they were guessing when answering questions on this topic.

ICT_P&P participants stated that the topic 'Critical Path Analysis' made them nervous ahead of the exam as the learning and support materials for this topic are inadequate. A contributor stated that it is difficult to find learning resources that match their exam questions for this topic. They also expressed dissatisfaction with *"the disconnect"* between their coursework and the exam: they did not feel that the two related well to each other.

ICT_P&P participants did not feel that the form of assessment itself affected how they prepared or performed in their exam. They felt the mode of assessment, the Summative Case Study, made it difficult to prepare and perform well rather than the mode of delivery.

They also thought the mark schemes for topics were a lot more detailed than the content students had encountered and explored in class. The group felt that students are dependent on their own research skills to obtain learning and support materials –participants did not feel this was always adequate as the resources they find do not match exam questions or are inappropriate. The group did not see the benefit of a coursebook as it would date too quickly. ICT_P&P participants would like CCEA to develop videos and extra notes as supplementary materials for GCE Applied ICT topics. They requested CCEA provide: more learning and support materials on 'Network Diagrams'; a list of technical definitions; further guidance on how to complete 'Critical Path Analysis' questions; the exam itself is made *"more relevant to coursework"*.

In contrast, all ICT_E-assess participants had felt confident that their preparation for this exam *"was good"*. Overall, the ICT_E-assess participants in the focus group thought the GCE Applied ICT e-assessment went *"very smoothly"*. Two ICT_E-assess students reported being anxious about the potential for their computer screen to *'freeze'* and for the system to crash during the exam as a result of their experiences during their test session. A third ICT_E-assess student had worried about *"logging in and accidentally logging out during the exam and ruining the assessment"*. The group did not feel they required any additional help or support for this qualification.

4.2.4 Applied ICT Pulse Survey: Ease of Use of Assessment

Candidates were asked if they found the format of the examination easy to follow (question variant 1 for pen and paper respondents) or if the on screen examination was easy to use (question variant 2 for e-assessment respondents). The frequencies and proportions for responses to these question variants are shown in Table 11.

Approximately four times the proportion of pen and paper respondents reported Ease of Use issues: 8.2% of pen and paper candidates answered 'No' to their question variant compared to 1.9% of e-assessment respondents.

Table 11: Applied ICT Pulse Survey: Ease of Use of Assessment

	Pen and Paper	E-assessment	Test Statistic
Ease of Use (Yes/No)	460/41 91.8%/8.2%	155/3 98.1%/1.9%	X^2 (df)=7.62(1), p<0.01

Focus Groups: Ease of Use and Accessibility of Assessment

Focus group participants were asked whether they were familiar with the format, structure and duration of the Applied ICT exam before they completed it. The group was also asked to comment on Format/Platform Ease of Use and how accessible the Applied ICT exam is to all students e.g. SEN/Language groups.

Eight of the nine ICT_P&P participants agreed that they were very familiar with the structure and duration of the exam prior to sitting it. One student mistakenly thought the exam was two hours long, underestimating the duration by thirty minutes. The participants did not complete a trial version of the GCE Applied ICT exam with or without exam conditions before completing it (n=9). They stated that they had completed a selection of questions from past papers in the six weeks prior to their exam, once they had completed all coursework for the subject.

The ICT_E-assess group agreed that they were familiar with the format, structure and duration of the exam. All participants had completed a single practice session in the previous fortnight with the e-assessment delivery platform to become familiar with the interface. The practice session was conducted in an available ICT suite in the school: this was not the room in which participants were assessed. The practice session lasted ten minutes and did not include completing questions under exam conditions. The purpose of the session was *"to know what to expect and how it was going to be laid out"*. All participants found this session very helpful.

ICT_P&P participants agreed that, in general, the exam was accessible to all students. They noted that they had difficulty understanding some of the novel vocabulary they encountered on the exam paper, for example, the word *'incremental'*. The group agreed that the unfamiliar terms they had encountered were not present in the booklet they had used to prepare for the exam. The participants reported that the formatting of the exam was good: the font was legible in all places and there was enough differentiation between the different headings and sections in the paper. Participants felt the method of assessment did not affect their time management in the exam: all reported having had plenty of time to complete the assessment. Some of the participants thought minor changes were needed regarding the formatting of answer sheets: the spaces for filling in missing words were not big enough for the words themselves.

The ICT_E-assess group agreed that their assessment was accessible to all students: they did not feel they encountered any access problems during the e-assessment. Participants did not feel under extreme pressure in the exam: they felt there was more than an adequate amount of time to complete the assessment. The group was vaguely aware of the ability to opt to sit the exam in Welsh. All opted by default

to sit the exam in English: they did not see any need to request information about the availability of the exam in Welsh nor, did they recall being provided with much information regarding this issue. All participants agreed that the e-assessment font was legible, the questions were laid out quite simply, and the questions were clear and easy to understand. They all agreed that the e-assessment interface they encountered *"was nice",* simple and user-friendly, and all participants felt that the provision of pen and paper for workings out was helpful.

ICT_E-assess contributors were able to move through questions in the order of their own choosing and were able to access questions through the sidebar. They particularly liked that they could omit answering or partially complete questions, use the flag function to identify these questions and return to complete them at a later point. Five of the group found the absence of a spellcheck annoying. This meant that they needed to read their answers carefully and edit them at length. Some candidate lost time trying to recall how to spell certain words. The group was not sure if they would lose marks for poor spelling and/or grammar.

Three ICT_E-assess group contributors did not like excessive/repeated use of the timer to remind them of how long they had left to complete the exam. They felt this could induce alarm and anxiety in candidates and cause the examinee to panic. They would have preferred a single reminder *("such as 5 minutes to go").*

One ICT_P&P participant stated that she would have difficulty with e-assessment as she struggles to concentrate for two hours when working on a computer. She felt excessive screen use caused her to become distracted and she experienced problems reading from a computer screen. This necessitated her using offprints for study. Other ICT_P&P contributors mentioned their poor sitting posture at computer workstations and the relief they experience getting away from the computer screen.

All ICT_P&P participants agreed that they did not like sitting for extended periods in front of a computer because of the physical discomfort that eventually arises: all participants were taking two or more GCEs that were computer intensive.

4.2.5 Applied ICT Pulse Survey: Operational and Technical Difficulties

Candidates were asked if they experienced any operational or technical difficulties during the examination. The frequencies and proportions for responses to this question are shown in Table 12. E-assessment respondents reported having experienced significantly more operational or technical difficulties during their assessment (25.3% of e-assessment respondents compared to 2.6% of pen and paper respondents).

Table 12: Applied ICT Pulse Survey: Operational and Technical Difficulties

	Pen and Paper	E-assessment	Test Statistic
Op & Tech Difficulties (Yes/No)	13/488 2.6%/97.4%	40/118 25.3%/74.7%	X^2 (df)=83.85(1). p<0.001

Focus Groups: Operational and Technical Difficulties

ICT_E-assess participants noted the following potential problems with e-assessment: (i) unreliability of technology and (ii) encountering technical difficulties. The group did not experience technical difficulties during their exam but two participants had experienced a screen *'freezing'* during the practice session. They noted that the examination timer continued even though they could not interact with the interface during the *'freeze'*. Some participants expressed concern that this could result in a time penalty that cannot be rectified for the candidate. Participants felt that fear of unreliable technology could cause preparation and exam anxiety.

An ICT_E-assess contributor felt that *"a paper copy of the exam would have been helpful for certain questions".* During the ensuing discussion, it became apparent that some of the students (n=6) were unaware they were in possession of a paper copy of the exam while completing the e-assessment. They were *"not told"* that a paper copy of their exam was among the materials distributed by the invigilator. Those who were unaware thought they were holding Exam Part B: some noted the "error" when the exam materials were being collected. They did not veer from the instructions the invigilator had given them and had not investigated the materials they were holding.

The ICT_E-assess group agreed that it would be beneficial if WJEC informed them about what materials they would be provided with on the day. The group was informed that *all* examination materials would be made available to them on the computer.

4.2.6 Applied ICT Pulse Survey: Assessment Preference

Table 13 shows the frequencies and proportions of GCE Applied ICT respondents according to their preferred examination assessment method. The ratio of pen and paper respondents who preferred paper-based assessment to online assessment was approximately 2:1. In contrast, e-assessment respondents showed a marked preference for online assessment compared to pen and paper assessment, with more than six times as many respondents choosing the online option.

Table 13: Applied ICT Pulse Survey: Assessment Preference

	Pen and Paper	E-assessment	Test Statistic
Assessment Preference (Online Assessment/Paper-Based Assessment/missing data)	166/332/3 33.1%/66.3%/0.6%	136/21/1 86.1%/13.3%/0.6%	$X^2(1)=136.43$, $p<0.001$

Focus Groups: Assessment Preference

Focus group participants were asked, *"overall, do you think this unit is best assessed using e-assessment or would you prefer a Pen and Paper exam?"*

Familiarity with the form of assessment was important to ICT_P&P students: all (n=9) opted to *"stick to what…[you]…are most familiar with"*. They unanimously agreed that they would choose pen and paper assessment rather than e-assessment for this exam. The group focussed their discussions on the effect that the form of assessment can have on the formatting of questions and the type of questions that might be set for an examination. An ICT_P&P participant identified that the type of assessment may influence the kinds of questions that can be set by the examiner/examining body. For example, it may influence whether the examiner/examining body opts to use multiple choice questions or essays. Another member of the group noted that the type of assessment may influence how questions on an exam paper are formatted. The group discussed match the item/fill-in–the-blank questions. They noted that on their exam script, the blank spaces in the fill-in-the-blank statements are uniform in size, possibly to avoid inadvertently giving the examinee extra information that could facilitate guessing. A contributor thought this type of question would be difficult to set in an e-assessment. The group showed low insight regarding the potentialities of e-assessment, possibly due to a lack of prior exposure to the alternative assessment form.

In contrast, the ICT_E-assess participants (n=10) unanimously agreed that GCE Applied ICT is *"best assessed using e-assessment"*. However, nine students felt that certain questions are easier to plan and complete using pen and paper assessment e.g. the 'Information Flow' question. One contributor stated that it is preferable to have this question written on paper as *"you can go through it easier and underline all the important bits rather than flicking forward and backward"* (9 of the group were in agreement/1 had 'no opinion').

Advantages and disadvantages of the form of assessment identified by the ICT focus group members included a range of physical, information processing and organisational ergonomic/HCI factors: physical strain from lengthy pen and paper exams: *"Two hours is a long time to be writing…Hands get sore"*; physical discomfort from (poorly designed/misused/excessive use of) computer stations; removal of any adverse effect of poor handwriting on marker comprehension of student submissions, potentially resulting in better grades for e-assessment candidates; more time and increased content produced through typewriting; ability to edit answers and delete mistakes rather than crossing mistakes out; e-assessment platform functionality, for example, the flag function, assists candidates memory functioning and navigation (executive functioning) in the exam.

5. Discussion

This evaluation aimed to examine the assessment enjoyment and preferences of learners undertaking the summer series of GCE Applied Business and GCE Applied ICT.

5.1 Assessment Enjoyment

The findings from the Pulse Survey indicate that:

- GCE Applied Business respondents did not perceive their assessment to be significantly more or less enjoyable on the basis of the form of assessment;
- on average, GCE Applied Business respondents rated their enjoyment of their assessment as 'okay';
- GCE Applied ICT respondents found their assessment was significantly more enjoyable if they had undergone e-assessment (averaging 'good-okay');
- Applied ICT candidates who underwent e-assessment had the most enjoyable exam experience relative to all of the groups examined.

The results would suggest that the e-assessments under scrutiny are, at worst, no more or less enjoyable than pen and paper assessment and at best, more enjoyable than pen and paper assessment for these Applied subjects. Content-Assessment Consonance (Test Validity) may influence assessment enjoyment.

The current evaluation did not fully explore learners' perception and experience of the magnitude of consonance between the subject content and the form of assessment. However, in discussions about the advantages of e-assessment, Applied Business contributors briefly raised Content-Assessment Consonance and Test Validity: they noted that the form of assessment 'can match' content material to good effect. Contributors also noted that the form of assessment may alter or limit the questions asked of the candidate or change how learning is assessed, potentially resulting in more or less effective pedagogical and assessment practice.

5.2 Assessment Preference of Learners

The findings from the Pulse Survey were:

- Applied Business respondents indicated *no preference* for online assessment if they had been e-assessed;
- Applied ICT respondents demonstrated *a strong preference* for online assessment if they had been e-assessed ($p<0.001$, (two-tailed));
- Pen and paper candidates undertaking GCE Applied Business and Applied ICT reported *a stronger preference* for pen and paper assessment than e-assessment (ratios of 3:1 and 2:1, respectively);
- Overall, a greater proportion of Applied ICT candidates selected online assessment as their preferred choice of assessment compared to Applied Business candidates (+15.5%).

It may be concluded that assessment preferences could be content-dependent and influenced by Prior Exposure to the Form of Assessment/Mode of Delivery.

5.3 Emotional Experience of Candidates

The primary emotion reported by exam candidates was nervousness during assessment: notably, the prevalence of the reporting of this emotion did not vary appreciably according to the content of the exam (Applied Business and Applied ICT) or the form of assessment (pen and paper and e-assessment), suggesting Test Anxiety is a stable feature of 'high stakes' examinations, affecting approximately one in every two candidates.

When Pulse Survey respondents were asked about their emotions during the assessment:

- A greater proportion of e-assessment Applied Business respondents reported feeling relaxed (+7.2%);
- A greater proportion of Pen and Paper Applied Business respondents reported feeling content (+12.4%), fortunate (+5.7%), relieved (+14.3%) but also, unprepared (+9.7%);
- A greater proportion of e-assessment Applied ICT respondents reported feeling happy (+16.9%) and well-prepared (+11.7%);
- A greater proportion of Pen and Paper Applied ICT respondents reported feeling nervous (+10.2%), scared (+8.8%), worried (+18.3%) and panicky (+10.2%).

Overall, results would suggest that e-assessment is associated with a more positive emotional experience for Applied Business and Applied ICT candidates and lower Generalised Test Anxiety. Issues worthy of further exploration and research are: whether the positive emotions more frequently reported by Pen and Paper Pulse Survey candidates (particularly 'Good Fortune' and 'Relief') are post-assessment positive conditional statements arising from a better-than-expected performance on the day following greater uncertainty/lower exam preparedness pre-assessment; how e-assessment influences content preparation.

These conclusions are supported by additional information obtained from focus group participants:

- Applied Business Pen and Paper contributors reported feeling less confident and prepared before and during their exam and their affect was significantly less positive on completion of the focus group compared to e-assessment contributors;
- Applied ICT Pen and Paper contributors reported feeling more tired and less confident and happy during the assessment and were significantly less pleased, happy and relieved following the assessment.

Numerous variables could potentially contribute to ratings of assessment enjoyment and emotional experience during an assessment. Possible factors include: assessment design and validity (including content-assessment consonance, ease of use/operational and technical design, including access provision); exam content and context preparedness, including familiarity with the form of assessment/mode of delivery; environmental conditions; level of assessment challenge and performance expectations; and, additional intrinsic and extrinsic individual factors, including candidates' combined skills and motivations, as well as their physical and mental fitness on the assessment day.

5.4 Ease of Use and Operational and Technical Difficulties

The findings from the Pulse Survey indicate that:

- Applied Business respondents were *more likely* to report Ease of Use difficulties if they had been assessed by e-assessment rather than pen and paper assessment (+9.5%);
- Applied Business respondents were *more likely* to report assessment Operational and Technical Difficulties if they had been assessed by e-assessment compared to pen and paper assessment (+12.5%);
- Applied ICT respondents were *more likely* to report Ease of Use problems if they had been assessed by pen and paper assessment (+6.3%);
- Applied ICT candidates were *more likely* to report Operational and Technical Difficulties if they had completed their exam by e-assessment (+22.7%);
- Overall, a greater proportion of Applied Business respondents reported Ease of Use issues compared to Applied ICT respondents (+6%);
- Overall, there was little difference in the proportion of Applied ICT and Business respondents reporting Operational and Technical Difficulties (0.5%).

Ease of Use issues raised by Applied Business e-assessment focus group contributors included a Lack of Familiarity with all aspects of the e-assessment interface and issues relating to User Expectations: these included the absence of word processing functions and candidate confusion regarding the data sheet icon and/or interacting with the information contained within the datasheet when answering exam questions. Ease of Use problems may have been double registered as 'Operational or Technical Difficulties' by Applied

Business respondents as challenges posed by the datasheet icon were also discussed when focus group contributors were questioned about 'Operational or Technical Difficulties'.

Applied ICT pen and paper focus group contributors primarily complained of the Physical Strain assessment could cause and raised issues of concern regarding how the form of assessment affected their Communication i.e. the ill effects of producing extensive hand written content and/or illegible handwriting in a lengthy examination. User Expectations were also a feature of discussions for Applied ICT focus group contributors: some reported annoyance with the absence of a spellcheck and a dislike of the timer reminders. An 'Operational Problem' flagged by Applied ICT focus group contributors was the instructions provided to them concerning the materials present for use in their assessment: some candidates were aware they also had a paper copy of the exam, which they considered beneficial for answering certain questions.

All e-assessment focus group contributors reported a relatively difficulty-free assessment experience but noted the *potential* for technical problems as a concern that *could* raise candidates' Test Anxiety (for example, the screen freezing; slow load times; challenges relating to safely logging in and logging out). However, as noted, e-assessment was related to a more positive emotional experience for candidates and lower indicators of test anxiety *despite* higher levels of reporting of 'Operational or Technical Difficulties' by e-assessment Pulse Survey respondents. This suggests that e-assessment candidates may demonstrate greater prescience in relation to operational and technical problems and difficulties and may be more likely to note and report these, regardless of their *actual* impact on their assessment experience and/or performance. They may more readily recognize themselves as an element within the HCI assessment system than pen and paper assessment candidates and be behaviorally primed to provide corrective feedback into that HCI system. However, the Pulse Survey did not collect information on the nature and severity of the difficulties respondents encountered. Future research may benefit from logging and examining these to determine their characteristics and potential impact on assessment experience and/or candidates' performance.

5.5 *Ease of Use and Access, including the Suitability and Readiness of Candidates*

Pen and Paper focus group contributors emphasised Physical Ergonomics/Strain [hand] as an issue of concern in handwritten exams but also noted Physical Ergonomics/Strain [eyes and posture] and Adverse Effects on Information Processing [attention/concentration] as potential issues with computer assessment.

Pen and Paper candidates were aware of the potential disadvantages that poor handwriting and 'mistakes' (grammar/spelling/editing) could have on their performance in pen and paper examinations, including on their Communication. Moreover, focus group contributors felt that handwriting lowered their overall Efficiency and Productivity during pen and paper assessments: almost all of contributors reported that their typing speed exceeded their handwriting speed. Focus group contributors also noted the extra time that could be gained from typing answers and the benefits of the e-assessment platform for candidates' Cognitive and Organisational Functioning in the exam, including Executive Functioning Assistance. A pen and paper focus group participant also voiced the opinion that the option to type in exams is a provision often made for SEN candidates, which s/he viewed as unfair to non-SEN candidates. It may therefore seem surprising that pen and paper candidates showed a preference for pen and paper assessment.

'Preparedness' during the exam emerged strongly as a feeling that differentiated pen and paper and e-assessment GCE Applied ICT and Applied Business candidates. A higher proportion of e-assessment Applied ICT Pulse Survey respondents reported feeling "well-prepared" for the exam compared to pen and paper Applied ICT respondents, and pen and paper and e-assessment Applied Business respondents. Approximately twice as many pen and paper Applied Business Pulse Survey respondents reported feeling 'unprepared' during the exam compared to all other groups. Applied Business pen and paper focus group contributors felt less prepared and confident about their assessment compared to Applied Business e-assessment contributors, (as measured by the VARS).

Understanding the nature of, and contributing factors to, respondents' 'preparedness' may be essential to understanding their assessment enjoyment and preferences.

Regarding Content Preparedness, focus group contributors did not vary appreciably in terms of their access to online support materials and/or technological study aids. Pen and paper candidates did complain about the inability to find 'good examples' of learning resources that matched expected exam questions. Pen and paper candidates generally felt less prepared for the content they would be examined on. Information gathered from the focus groups suggests that the learning/subject history of GCE Applied Business and Applied ICT students is worth collecting in future surveys as there were indications that subject selection pathways may differ between regions: this may affect students' preparedness for learning, impact readiness for assessment at GCE and influence data gathered on students' assessment preferences and enjoyment of their assessments.

Regarding Context Preparedness, familiarity with the form of assessment/mode of delivery emerged as a strong theme in the focus groups. Those who had been assessed by pen and paper were more likely to report minimal exposure to e-assessment and show a preference for pen and paper assessment. Those who had been e-assessed expressed a desire to have greater access to the e-assessment platform for assessment preparation. Notably, focus group contributors were conscious that it is currently easier in assessment preparation to match pen and paper exam conditions, which may contribute to performance in assessments

by way of assisting content recall. A focus group participant also noted Emotional Preparedness for assessment as an advantage of e-assessment. An Applied Business e-assessment contributor stated that e-assessment was “less daunting”: this judgment is clearly exposure/experience-dependent, a variable that is likely to influence candidates’ stated assessment preferences.

Issues that may therefore be worth exploring in future research are the effect of prior exposure to e-assessment sample content and interface on: (i) candidates’ assessment preparation and behaviour; (ii) assessment preferences and (iii) candidates’ Test Anxiety. Pen and paper focus group contributors demonstrated lower insight to the potential advantages of e-assessment on their preparedness, assessment experience and performance: lack of exposure to e-assessment may be the primary reason why pen and paper candidates show a strong preference for pen and paper assessment.

Pen and Paper candidates may perceive pen and paper as the ‘low risk’ option in ‘high stakes’ examinations. A lack of exposure may result in student conservatism regarding their assessment preferences and low levels of Openness to New Experiences in relation to the format of ‘high stakes’ exams. Information on specific and non-specific exposure to
e-assessment should be probed in future research to differentiate the possible effects of Context Preparation for the Assessment on General Test Anxiety and Technology-related Fears and Phobias.

5.6 Limitations

It should be noted that preferences assume a choice. However, the Pulse Survey candidates who were studied could not choose between assessment formats: their preferences were based on a hypothetical situation where assessment choice was an option. It was not possible to fully determine what influenced respondents’ answering in a short survey.

Focus group feedback suggests that Pulse Survey results may have been influenced by contextual confounding variables: e-assessment candidates, particularly those sitting Applied ICT, may have benefitted from having had access *to both* pen and paper and
e-assessment formats. Some candidates may have been able to maximise their assessment performance using all the available materials provided to them in the ‘e-assessment’ condition. Applied ICT participants focus group members noted that a paper copy of the exam would have been beneficial to candidates for answering certain questions. The advantage gained from having had access to both exam formats simultaneously is a topic worth exploring in future research and for the production of guidelines as its influence on individual and regional assessment outcomes is ‘an unknown’.

This finding may also suggest a need to improve standard operating procedures for conducting e-assessment as not all focus group contributors were aware of the materials they were in possession of during their assessment. If paper copies of exam papers are present at exam centres to specifically mitigate against the risk of technological problems, it may be sensible to recommend that they are withheld/their distribution is avoided unless needed, or to make their planned distribution explicit to teachers, invigilators and candidates.

6. Conclusions and Recommendations

The evaluation of Learner experiences of e-assessment and Pen and Paper assessment found that:

- e-assessment is associated with a more positive emotional experience for Applied Business and Applied ICT candidates and lower indicators of Generalized Test Anxiety;
- candidates' enjoyment and assessment preferences may be content-dependent and influenced by prior exposure to the form of assessment/mode of delivery and low insight regarding the potentialities of e-assessment;
- the benefits of e-assessment may include enhanced cognitive and sorganisational functioning, communication, efficiency and productivity for the candidate and lower physical strain;
- e-assessment ease of use issues may reflect a lack of familiarity with all aspects of the e-assessment interface and challenges relating to user expectations; e-assessment candidates may be more alert to operational and technical difficulties and more likely to note and report these difficulties than pen and paper candidates.

Key recommendations based on the research are that:

- candidates are provided with greater access to sample content and the e-assessment interface ahead of e-assessment;
- operational and technical difficulties are fully examined and logged to determine their characteristics and impact on candidates' assessment enjoyment, preferences and performance and improve e-assessment systems;
- the standard operating procedures for e-assessment centres include advice on the distribution of paper copies of exam papers.

7. References

(1) Regulatory principles for e-assessment. QCA on behalf of QCA, Welsh Assembly Government, CCEA and Scottish Qualifications Authority, April, 2007.

Available at:

http://ccea.org.uk/sites/default/files/docs/accreditation/guidance/Regulatory%20Principles.pdf [last accessed 22/08/2016].

(2) Gijbels D., Dochy F. (2006) Students' assessment preferences and approaches to learning: can formative assessment make a difference? *Educational Studies, 2006,* ***32(4),*** 399-409.

(3) Wheadon C, Adams C. The comparability of onscreen and paper and pencil tests: no further research required? Centre for Education Research and Policy, 2011.

Available at: http://www.iaea.info/documents/paper_1162d20de8.pdf [last accessed 22/08/2016].

(4) Vautier, S. Measuring change with multiple visual analog scales: Application to tense arousal. *European Journal of Psychological Assessment, 2011,* ***27(2),*** 111-120.

(5) Lishner D.A; Cooter A.B. and Zald D.H. Addressing measurement limitations in affective rating scales: Development of an empirical valence scale. *Cognition and Emotion, 2008,* ***22(1),*** 180-192.

Supplementary Table A: Visual Analogue Rating Scale

How you felt during the exam	Exam Type & Region	N	Mean	Std. Deviation	Std. Error Mean	t(df)=, p
Relaxed/ Anxious	BUS_E-assess BUS_P&P	8 12	3.425 5.142	2.5331 2.2937	.8956 .6621	1.57(18),p=0.13
Tired/ Energetic	BUS_E-assess BUS_P&P	8 6	5.937 3.233	2.9880 2.7624	1.0564 1.1277	1.73(12),p=0.11
Nervous/Calm	BUS_E-assess BUS_P&P	8 12	6.050 5.392	3.0024 2.6138	1.0615 .7545	0.52(18),p=0.61
Well Prepared/ Unprepared	BUS_E-assess BUS_P&P	8 12	2.950 4.950	1.8936 2.6353	.6695 .7607	1.85(18),p=0.08
Scared/ Confident	BUS_E-assess BUS_P&P	8 12	7.150 5.425	1.6596 2.1278	.5868 .6142	1.93(18),p=0.07
Worried/ Relieved	BUS_E-assess BUS_P&P	8 12	5.688 5.617	2.3302 2.3253	.8238 .6713	0.07(18),p=0.95
Fortunate/ Unlucky	BUS_E-assess BUS_P&P	8 12	3.625 5.042	1.5782 2.2488	.5580 .6492	1.54(18),p=0.14
Happy/Sad	BUS_E-assess BUS_P&P	8 12	2.938 4.183	1.5268 1.6375	.5398 .4727	1.71(18),p=0.1
Annoyed/ Pleased	BUS_E-assess BUS_P&P	8 12	6.950 5.550	1.2705 2.4307	.4492 .7017	1.49(18),p=0.15
Confident/ Meek	BUS_E-assess BUS_P&P	8 12	3.300 4.292	1.2294 2.3831	.4347 .6879	1.08(18),p=0.3
Content/ Dissatisfied	BUS_E-assess BUS_P&P	8 12	3.775 3.992	1.4577 2.4032	.5154 .6937	0.23(18),p=0.82
Panicky/ Fearless	BUS_E-assess BUS_P&P	8 12	6.075 6.275	2.0070 3.2247	.7096 .9309	0.16(18),p=0.88

Supplementary Table B: Visual Analogue Rating Scale

How you feel now	Exam Type & Region	N	Mean	Std. Deviation	Std. Error Mean	t(df)=, p
Relaxed/ Anxious	BUS_E-assess BUS_P&P	8 12	1.163 3.133	.7463 3.2553	.2639 .9397	1.67(18),p=0.11
Nervous/Calm	BUS_E-assess BUS_P&P	8 12	8.338 7.092	2.1967 3.4408	.7767 .9933	0.9(18),p=0.38
Well Prepared/ Unprepared	BUS_E-assess BUS_P&P	8 12	2.038 3.558	1.8306 1.8476	.6472 .5334	1.81(18),p=0.09
Scared/ Confident	BUS_E-assess BUS_P&P	8 12	7.350 5.908	1.6266 1.6925	.5751 .4886	1.9(18),p=0.07
Worried/ Relieved	BUS_E-assess BUS_P&P	8 12	7.488 7.533	1.2041 2.6952	.4257 .7780	0.05(18),p=0.97
Fortunate/ Unlucky	BUS_E-assess BUS_P&P	8 12	4.150 3.350	1.7550 2.4251	.6205 .7001	0.8(18),p=0.43
Happy/Sad	BUS_E-assess BUS_P&P	8 12	2.850 2.917	.6845 2.7921	.2420 .8060	0.07(18),p=0.95
Annoyed/ Pleased	BUS_E-assess BUS_P&P	8 12	7.663 6.867	1.3627 2.3027	.4818 .6647	0.88(18),p=0.39
Confident/ Meek	BUS_E-assess BUS_P&P	8 12	3.912 3.892	1.2017 1.8273	.4249 .5275	0.03(18),p=0.98
Content/ Dissatisfied	BUS_E-assess BUS_P&P	8 12	3.738 3.242	2.1407 1.6855	.7569 .4866	0.58(18),p=0.57
Panicky/ Fearless	BUS_E-assess BUS_P&P	8 12	7.063 7.142	1.2317 1.9911	.4355 .5748	0.1(18),p=0.92

Supplementary Table C: Visual Analogue Rating Scale

How you feel after the focus group	Exam Type & Region	N	Mean	Std. Deviation	Std. Error Mean	t(df)=, p
Relaxed/ Anxious	BUS_E-assess BUS_P&P	8 12	.600 3.075	.5928 3.5201	.2096 1.0162	1.95(18),p=0.07
Nervous/Calm	BUS_E-assess BUS_P&P	8 12	9.300 6.992	.7231 3.6958	.2557 1.0669	1.73(18),p=0.1
Well Prepared/ Unprepared	BUS_E-assess BUS_P&P	8 12	1.313 3.442	1.0329 2.0106	.3652 .5804	2.75(18),p=0.01
Scared/ Confident	BUS_E-assess BUS_P&P	8 12	7.425 6.008	3.0387 1.6774	1.0743 .4842	1.35(18),p=0.2
Worried/ Relieved	BUS_E-assess BUS_P&P	8 12	8.337 7.433	1.5892 2.7237	.5619 .7863	0.84(18),p=0.41
Fortunate/ Unlucky	BUS_E-assess BUS_P&P	8 12	2.775 3.067	1.7078 2.6355	.6038 .7608	0.28(18),p=0.79
Happy/Sad	BUS_E-assess BUS_P&P	8 12	2.025 2.842	1.4974 2.7451	.5294 .7924	0.77(18),p=0.45
Annoyed/ Pleased	BUS_E-assess BUS_P&P	8 12	9.013 7.058	.9342 2.3987	.3303 .6924	2.18(18),p=0.04
Confident/ Meek	BUS_E-assess BUS_P&P	8 12	1.825 3.642	1.8030 1.9374	.6374 .5593	2.11(18),p=0.05
Content/ Dissatisfied	BUS_E-assess BUS_P&P	8 12	1.675 3.000	1.0152 1.6028	.3589 .4627	2.07(18),p=0.05
Panicky/ Fearless	BUS_E-assess BUS_P&P	8 12	8.650 7.017	.9957 2.1071	.3520 .6083	2.03(18),p=0.06

Supplementary Table D: Visual Analogue Rating Scale

How you felt during the exam	Exam Type & Region	N	Mean	Std. Deviation	Std. Error Mean	t(df)=, p
Relaxed/ Anxious	ICT_P&P ICT_E-assess	9 10	6.111 3.800	2.3380 2.8414	.7793 .8985	1.92(17),p=0.07
Tired/ Energetic	ICT_P&P ICT_E-assess	9 10	2.678 5.900	2.0620 2.0742	.6873 .6559	3.39(17),p=0.003 3
Nervous/ Calm	ICT_P&P ICT_E-assess	9 10	3.478 5.210	2.7887 2.8719	.9296 .9082	1.33(17),p=0.2
Well Prepared/ Unprepared	ICT_P&P ICT_E-assess	9 10	4.733 4.840	1.6363 3.1380	.5454 .9923	0.09(17),p=0.93
Scared/ Confident	ICT_P&P ICT_E-assess	9 10	4.111 6.220	2.5736 2.2851	.8579 .7226	1.89(17),p=0.08
Worried/ Relieved	ICT_P&P ICT_E-assess	9 10	3.644 4.990	1.9957 2.5423	.6652 .8039	1.28(17),p=0.22
Fortunate/ Unlucky	ICT_P&P ICT_E-assess	9 10	4.956 3.670	1.6591 2.5184	.5530 .7964	1.3(17),p=0.21
Happy/Sad	ICT_P&P ICT_E-assess	9 10	5.044 2.850	2.1149 1.9386	.7050 .6131	2.36(17),p=0.03
Annoyed/ Pleased	ICT_P&P ICT_E-assess	9 10	4.878 6.390	2.0529 1.8071	.6843 .5714	1.71(17),p=0.11
Confident/ Meek	ICT_P&P ICT_E-assess	9 10	5.467 2.870	2.3200 1.8756	.7733 .5931	2.7(17),p=0.02
Content/ Dissatisfied	ICT_P&P ICT_E-assess	9 10	3.011 2.660	5.2088 2.0134	1.7363 .6367	0.2(17),p=0.85
Panicky/ Fearless	ICT_P&P ICT_E-assess	9 10	3.644 5.610	3.0138 2.4777	1.0046 .7835	1.56(17),p=0.14

Supplementary Table E: Visual Analogue Rating Scale

How you feel now	Exam Type & Region	N	Mean	Std. Deviation	Std. Error Mean	t(df)=, p
Relaxed/ Anxious	ICT_P&P ICT_E-assess	9 10	2.711 .670	3.2644 .7484	1.0881 .2367	1.93(17),p=0.07
Nervous/Calm	ICT_P&P ICT_E-assess	9 10	6.367 9.190	4.2620 .7709	1.4207 .2438	2.06(17),p=0.06
Well Prepared/ Unprepared	ICT_P&P ICT_E-assess	9 10	3.811 3.330	2.2172 3.1149	.7391 .9850	0.38(17),p=0.71
Scared/ Confident	ICT_P&P ICT_E-assess	9 10	6.289 6.640	2.5973 5.6457	.8658 1.7853	0.17(17),p=0.87
Worried/ Relieved	ICT_P&P ICT_E-assess	9 10	5.811 8.310	2.6835 1.5982	.8945 .5054	2.5(17),p=0.02
Fortunate/ Unlucky	ICT_P&P ICT_E-assess	9 10	3.633 1.990	1.6583 2.6405	.5528 .8350	1.6(17),p=0.13
Happy/Sad	ICT_P&P ICT_E-assess	9 10	3.567 1.480	2.2760 .9987	.7587 .3158	2.64(17),p=0.02
Annoyed/ Pleased	ICT_P&P ICT_E-assess	9 10	6.356 8.340	2.0150 1.5436	.6717 .4881	2.43(17),p=0.03
Confident/ Meek	ICT_P&P ICT_E-assess	9 10	2.200 1.400	4.7165 1.0154	1.5722 .3211	0.53(17),p=0.61
Content/ Dissatisfied	ICT_P&P ICT_E-assess	9 10	2.078 1.080	4.6073 1.4133	1.5358 .4469	0.65(17),p=0.61
Panicky/ Fearless	ICT_P&P ICT_E-assess	9 10	5.700 8.160	3.0344 1.9716	1.0115 .6235	2.12(17),p=0.05

Supplementary Table F: Visual Analogue Rating Scale

How you feel after the focus group	Exam Type & Region	N	Mean	Std. Deviation	Std. Error Mean	t(df)=, p
Relaxed/ Anxious	ICT_P&P ICT_E-assess	9 10	2.211 .650	2.0811 1.0395	.6937 .3287	2.1(17),p=0.05
Nervous/Calm	ICT_P&P ICT_E-assess	9 10	7.067 9.370	3.2062 .6584	1.0687 .2082	2.23(17),p=0.04
Well Prepared/ Unprepared	ICT_P&P ICT_E-assess	9 10	3.978 3.070	1.6932 3.5808	.5644 1.1324	0.69(17),p=0.5
Scared/ Confident	ICT_P&P ICT_E-assess	9 10	6.289 9.200	3.0937 1.0077	1.0312 .3187	2.82(17),p=0.01
Worried/ Relieved	ICT_P&P ICT_E-assess	9 10	7.400 8.580	3.4267 1.4156	1.1422 .4477	1.0(17),p=0.33
Fortunate/ Unlucky	ICT_P&P ICT_E-assess	9 10	3.167 1.490	2.8249 1.5438	.9416 .4882	1.63(17),p=0.12
Happy/Sad	ICT_P&P ICT_E-assess	9 10	3.033 .440	2.7382 .7662	.9127 .2423	2.88(17),p=0.01
Annoyed/ Pleased	ICT_P&P ICT_E-assess	9 10	6.422 9.430	3.0768 .8706	1.0256 .2753	2.97(17),p=0.01
Confident/ Meekg	ICT_P&P ICT_E-assess	9 10	4.478 .680	3.3026 1.2017	1.1009 .3800	3.4(17),p=0.01
Content/ Dissatisfied	ICT_P&P ICT_E-assess	9 10	3.178 .600	2.8486 1.0231	.9495 .3235	2.68(17),p=0.02
Panicky/ Fearless	ICT_P&P ICT_E-assess	9 10	6.044 8.470	3.6136 1.9108	1.2045 .6043	1.86(17),p=0.08

Acknowledgements

CCEA Research & Statistics Unit is grateful to those who have contributed to this research. We would like to thank all of the exam centre staff, teachers and students for their assistance, feedback and support.

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Appendix 2

CCEA eA Desktop International Literature Review (August 2015): Canada, Switzerland, Singapore and Australia

Context

This report documents a range of e-learning and e-assessment[6] methods in a number of different countries. A general investigation of how the different countries have implemented this within their education systems has been carried out. The objective is to identify any commonalities or disparities, in terms of challenges and/or successes, in order to begin to ascertain examples of best practice in e-learning and e-assessment.

E-learning and E-assessment initiatives: benefits and challenges

Canada

Abrami et al. (2008) provide a snapshot of professional and public opinion on e-learning in Canada. The general public consensus is that e-learning has a positive effect on those who are involved with it, i.e. teachers, learners, parents etc. Canadian policy makers view e-learning as at least as effective as traditional methods but emphasise that there is a need for sustained and on-going support. There is also a need for upskilling in IT to enable learners to use technology effectively. Use of IT in education settings is encouraged.

Theoretical support for the use of e-portfolios (a form of e-learning) has been highlighted by Wade, Abrami & Sclater (2005) via an e-portfolio project introduced in Quebec. The objective of this project was for the Quebec region to become 'e-reliant'. In theory e-reliance is thought to improve competencies through an increased involvement in personal learning and processes of self-evaluation and reflection. Enabling a learner to plan, monitor and assess outcomes through an e-portfolio is one way to promote self-regulation and metacognition. Importantly, for self-assessment to be successful, there must be agreed and intended learning goals to work towards. In addition to improving learner outcomes, authors also highlight that the e-portfolio system is used over a period of time, hence enabling the tracking of progress and attainment. The dual nature of the e-portfolio offers increased opportunities for collaboration between learner and teacher.

Despite the benefits of e-portfolios, a number of issues and lessons can be learned from the experiences of the teachers and students who participated in the e-portfolio project. Firstly, a comparison of ways of introducing e-Portfolios was undertaken and it was discovered that when the e-Portfolio ran alongside a traditional approach to learning students were unsure what was expected of them and the focus remained on personal achievement in relation to other students' accomplishments, along with a low emphasis on self-reflection. Conversely, when students focused less on tasks and more on personal development and long-term goals, and learned in conjunction with other e-learning approaches (as opposed to traditional), greater improvements to areas of weakness were made.

[6] The use of information technology for assessment activities, for example, computer-based assessments and online marking.

Additionally, positive feedback was received from parents in response to a student-led conference session (as opposed to a traditional parent-teacher evening). It was also felt that this presented enhanced benefits for students with special education needs via a more positive engagement with learning and an appropriate platform from which to archive their achievement.

The Quebec initiative suggests that for e-portfolios to improve outcomes there must be a shift in traditional teaching methods and an emphasis on planning and reflection. Additionally, Wade et al. argue that implementation should be school or area based, rather than subject or class, so that teachers and students see the change as widespread, rather than as an 'experiment'; this is likely to increase the authenticity of the initiative and the shift in teaching practice. Due to a significant shift, changes should be long term and supported by ongoing in-service training for the teachers involved.

A Canadian Council on Learning report (State of E-learning in Canada; May 2009) highlights a number of tools which are being developed and used for e-learning assessments which are integrated into the classroom. One such tool is Concordia University's Centre for the Study of Learning and Performance 'ABRACADABRA' programme.

ABRACADABRA (A Balanced Reading Approach for Canadians Designed to Achieve Best Results for All) software is used across Quebec, Ontario, Alberta and Manitoba and uptake is increasing in other countries also, for example, in Australia. When using the programme, student reports are generated, providing an instant record of pupils' progress on developing reading skills. Basic statistics and error reports allow assessment reading level which, in turn, allows for easier planning. There is evidence to suggest that ABRACADABRA can improve outcomes for some students.

Another programme, 'ELM' (Early Literacy in Mathematics'), has distinct adaptive features. Teachers can modify settings dependant on the ability of the students. Activities increase in complexity to develop a full range of skills.

Post-primary schools have also started to make use of e-assessment though 'e-PEARLS' (Electronic Portfolio Encouraging Active and Reflective Learning); this is a more formative programme whereby students set goals and are encouraged to reflect on their learning using the portfolio. The e-PEARLS programme is arguably flexible and self-regulatory; it also mimics the layout and functionality of social media platforms, therefore, it is also student-friendly, relevant and promotes ownership (CSPL Learning Toolkit Newsletter; spring, 2014).

Switzerland

The Swiss Virtual Campus programme (SVC) was a major e-Learning initiative at University level, concentrating on virtual mobility of learning processes via accessible teaching modules on the internet.

The SVC concluded in 2008. At this time, a political shift meant that development of e-learning as an inherent component of teaching is now the responsibility of each Higher Education Institution, financed via their general budget.

AAA/Switch (2008-2013) recognised the disparity that this shared responsibility could bring to the education system and put a national e-learning database in place to increase cohesion; the aim was to structure and bundle information on e-assessment tools, test the systems and simplify deployment via the creation of an e-assessment portal. The Switch programme is in line with the argument that it is more beneficial to implement a system-wide approach (Wade et al., 2005).

The Switch programme concluded in 2013 and e-assessment tools are currently offered independently in Switzerland by Higher Education Institutions (HEIs) to a number of users. These programmes have been developed by academics within HEIs, rather than by small businesses. This gives rise to a number of issues such as the market for e-assessment in Switzerland being relatively small. Large Scale Assessment (LSA) in a smaller country is more expensive per capita than in a larger country. Base costs for development, maintenance, support and administration are affected by high average salaries and relatively few outlets, factors which should be taken into consideration during planning phases.

Existing assessment tools include the 'SEB' (Safe Exam Browser) which is a web browser designed to enable secure online examinations; 'Academe', a free tool for Swiss students and teachers to write, edit and share learning for modules and final exams; and 'OSCE-Manager', another free tool which is aimed at Objective Structured Clinical Examinations, developed by the University of Basel.

In addition to the various e-assessment tools, there also exists a central-government led ICT initiative (European Schoolnet: Country report on ICT in education, Switzerland 2013). The main objective is to integrate ICT at all levels as a tool and as a resource. The policy has led to an increasing use of Interactive Whiteboards, the use of students' own devices and the use of Cloud technology.

Singapore

Jacobson et al. (2010) provide details of research undertaken in Singapore during 2006. This was a large-scale project and included almost 2000 teachers across almost 60 schools.

Some of the barriers for using computers in the classroom mentioned included lack of resources, lack of time, and lack of flexibility in a packed curriculum. Additional issues included teachers being unhappy or constrained by not being allowed to install programs themselves and general lack of access issues. The limited number of support staff meant that short notice requests for access to particular programs could not be honoured. Therefore, although the introduction of technology use was generally seen as a positive step forward, the administration was perceived as ineffective. It was also highlighted that age negatively affects the effective use of technology; older teachers appeared more fearful of technology and remained more comfortable with non-technology related pedagogy.

The participants suggested that technology itself does not improve learning, but that its use in conjunction with various teaching methods can. Additionally, it was suggested that ICT could be particularly useful for engaging students with a lower academic ability ICT; rather than traditional didactic instruction, lower ability students may be more engaged via the use of simulation and modelling tools, multi-user virtual environments and collaborative learning technologies.

Overall, the use of ICT in teaching and learning is perceived as useful but external constraints, such as the assessment system and the breadth and depth of the curriculum, have potentially reinforced teacher-led rather than student centred approaches to learning using ICT.

In 2011, Infocomm Development Authority (IDA) of Singapore and the Singapore Examinations and Assessment Board (SEAB) made the decision to pilot e-testing. A commercial company (RM Results) won the tender and trialled an initial, non-live, on-screen test environment in 2012 followed by a live test in 2013. RM results acknowledges that, even though their pilot of 300 students is relatively small-scale, it has evidenced that e-assessment is possible and can be carried out successfully; furthermore, it is viewed positively by students, further supporting its use.

Australia

Newhouse (2013) points out that whilst fewer work-related tasks are done using pen and paper, most high stakes assessments in schools continue to use this method. It is argued that there is a specific need for a better method of assessment for practical 'performance' subjects such as Applied Information and that the use of ICT may provide an authentic platform. Furthermore, for subjects such as Applied Information, students spent the majority of their time using digital technologies to develop information solutions and are then summatively assessed with a three hour paper-based exam.

In addition to emphasising the rationale for e-assessment in practical subjects, Newhouse also highlights challenges. The lack of technology used in high stakes examinations is possibly due to a perceived lack of validity and/or reliability, alongside high costs and administrative difficulties. Newhouse's report also comments on the implementation of a computer based production exam in Applied Information Technology for final year secondary students. Despite concerns regarding the reliability and availability of hardware, it was concluded that the benefits of moving to an e-approach to assessment outweighed the few identified concerns and that high stakes summative assessments could be implemented on an e-basis and, despite some additional costs compared with the paper-based system, the computer based system was a more suitable approach for this subject. There are likely to be subject-specific factors when arguing a case for e-assessment and it is important to consider this during development.

Summary

E-learning is generally viewed as positive and beneficial for users. It is thought to be as least as effective as traditional teaching methods. The use of ICT in education in general is increasing and it appears to be encouraged across a number of education systems.

E-learning is a concept which is well comprehended and practiced within different education systems; however, e-assessment is a relatively new term. There is more evidence for the use of e-learning; however, there are developments noted that indicate a move towards e-assessment, made possible by developments in technology.

E-assessment offers the opportunity to respond to the cry for 'real world' education by enabling alternative assessment environments. A number of benefits were identified, such as:

- Increased flexibility (e.g. distance learning)
- Supports those with additional needs
- Practically feasible (as evidenced by pilot studies)
- Instant records of progress for future planning
- Distinctive adaptive features
- Relevant to today's learners; potentially more engaging

In addition to summative e-assessment, the review also provides evidence for formative e-assessment practices via the wholesale implementation of an e-portfolio approach. Continuous assessment and record keeping through e-portfolios is thought to promote self-regulation and metacognition in learning; this form of assessment is relatively new and represents a cultural change for most countries, i.e. a shift from traditional teaching methods and increased collaboration between learner and teacher.

E-portfolio models may represent an alternative to terminal/high stakes examination, however, this again requires a cultural shift from traditional examinations.

Despite the potential benefits, there are a number of challenges to undertake. There is a need for ongoing and sustained support for e-learning and e-assessment to be developed and implemented effectively. The following recommendations are derived from the experiences of the countries investigated:

- Upskilling in ICT for teachers and students
- Changing attitudes through examples of best practice/ pilots
- System-wide approach or a network model / one provider only for e-assessments
- Time to allow a shift in practice to encode and embed

Finally, there is a need for a sound ICT infrastructure and an acknowledgement of the financial, practical and political obstacles which are pertinent to individual countries and subjects.

References

Abrami, P. C., Bernard, R., Wade, A., Schmid, R. F., Borokhovski, E., Tamin, R., ... & Peretiatkowicz, A. (2008). A review of e-learning in Canada: A rough sketch of the evidence, gaps and promising directions. Canadian Journal of Learning and Technology/La revue canadienne de l'apprentissage et de la technologie, 32(3).

Canadian Council on Learning. ***State of E-Learning in Canada***; retrieved (April 2015) from: http://www.ccl-cca.ca/pdfs/E-learning/E-Learning_Report_FINAL-E.PDF

CSPL Learning Toolkit Newsletter; spring, 2014; retrieved (April 2015) from: http://doe.concordia.ca/cslp/cslp_cms/sites/all/themes/jframe/downloads/PDF/LTK_newsletter_web_20140624.pdf

European Schoolnet: Country report on ICT in education, Switzerland, 2013; retrieved from: http://www.eun.org/c/document_library/get_file?uuid=72efc032-2b83-4313-9793-1c47f945d8a3&groupId=43887

Jacobson, M. J., So, H. J., Teo, T., Lee, J., Pathak, S., & Lossman, H. (2010). Epistemology and learning: Impact on pedagogical practices and technology use in Singapore schools. Computers & Education, 55(4), 1694–1706.

Newhouse, C. (2013). Computer-based practical exams in an applied Information Technology course. Journal of Research on Technology in Education, 45(3), 263–286.

Wade, A., Abrami, P., & Sclater, J. (2005). An electronic portfolio to support learning. Canadian Journal of Learning and Technology/La revue canadienne de l'apprentissage et de la technologie, 31(3).

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