

A Formative eAssessment Co-Design Case Study

Abstract—Formative eAssessment can be very helpful in providing high quality higher education assignments. However, there are obstacles restricting the uptake of formative eAssessment in higher education including both cultural and technical issues. When a university is encouraging the uptake of formative eAssessment internally it is useful to have case studies from academic schools detailing how academics enthusiastic about formative eAssessment have used it in their modules. It is particularly helpful if these case studies document: *i.*) the principle obstacles that these champions had to deal with; *ii.*) a cooperative-design process through which these obstacles have been dealt with by the champions (with assistance from e.g. learning technologists); and *iii.*) an evaluation of the effectiveness of the resulting formative eAssessments. However there is a shortage of such real-world long-term case studies. This paper helps fill this gap in the literature by describing the case of a Modern Languages module within a Russell Group university (Southampton). The formative eAssessment solution resulting from the case study utilises our QTI, mobile QTI, accessibility, and web 2.0 tools and can be positioned at the cutting edge of formative eAssessment practice. We have evaluated this with undergraduate student volunteers from Spanish modules and received positive feedback.

Keywords: *formative eAssessment, wireless and mobile eAssessment, higher education, modern languages, eAssessment obstacles, web 2.0, accessibility, repository*

1. INTRODUCTION

There is significant evidence that formative eAssessment can be helpful in providing high-quality higher education assignments [8,14]. In addition to doing eAssessments at a desk students can also use mobile devices, giving the student more flexibility in where they do the eAssessment and on what device [24]. However, there are obstacles restricting the uptake of formative eAssessment in higher education including both cultural and technical issues [21]. Models and studies of these obstacles include general technology uptake studies [25, 11, 13] and higher education-specific studies [1, 20, 21, 22].

When a university is encouraging the uptake of formative eAssessment internally it is useful to have case studies from a range of academic schools detailing how academics enthusiastic about formative eAssessment (known as “champions”) have applied formative eAssessment (or attempted to apply it) to their modules.

It is particularly helpful if *three key case study requirements* are met. These involve documenting:

- i.*) the principle obstacles that these champions had to deal with;
- ii.*) a cooperative-design process through which these obstacles were dealt with by champions with assistance from e.g. learning technologists; and
- iii.*) an evaluation of the effectiveness of the resulting formative eAssessments.

Examples of previous case studies include [15, 18, 9]. However, there is a shortage of real-world long-term case studies that meet the three key case study requirements as listed above. This paper helps fill this gap in the literature by describing a case study that meets these three requirements. The case study focuses on the Spanish Language module in the School of Humanities at the University of Southampton (a Russell Group university) lead by Irina Nelson. In this module the students take a small number of formative eAssessments each week for two semesters. This School of Humanities case study is particularly relevant to the understanding of e-Assessment uptake because it is: *i.*) lead by a non-IT specialist academic who is making significant use of formative eAssessment whilst not being involved in e-Assessment research outside of this case study; *ii.*) because it is conducted within a university having a strong interest in the uptake of formative eAssessment at an institutional level; and because *iii.*) formative eAssessment has been used on the module for 10 years.

The contributions of this paper are: *i.*) the co-design process and discussion of the obstacles; *ii.*) the subsequent implementation using our QTI, mobile QTI, accessibility, and web 2.0 tools; and *iii.*) the evaluation of the resulting eAssessments with undergraduate students from Spanish modules. This paper is structured into the following sections: (2) the case study and obstacles; (3) the co-design; (4) the implementation; and (5) the evaluation.

2. THE CASE STUDY AND OBSTACLES

The University of Southampton School of Humanities “Spanish Language Stage 7” module, for final year undergraduates, is used as a case study. The module lasts for two semesters, with three classes each week. Typically there are 20-30 students on the module. Prior

to the work described in this paper the optional independent study web-based formative eAssessments were as follows, with typically one or more eAssessment per study week. They were implemented using Hot Potatoes and accessed via Blackboard, the module virtual learning environment (VLE). They required the students to first play an audio/video media file (in Spanish) before undertaking the assessed questions. Categories of eAssessment that could be automatically marked included: *i.*) assessing understanding of the media file (typically multiple choice questions); *ii.*) transcribing the media file using close procedure (fill in the gap) questions; and *iii.*) a vocabulary test (also multiple choice). During the last 10 years, this kind of eAssessment solution has been found to be something very motivated students can use independently to practice their language skills.

Obstacles to the enhancement of this process based on interviews with the course lecturer included the following cultural/institutional issues: (1) lack of confidence in university eAssessment support for Hot Potatoes (not the university recommended system); (2) difficulty motivating students to take full advantage of eAssessments; (3) the need to improve eAssessment accessibility and usability, especially for students with specific learning difficulties including dyslexia; and (4) difficulty writing high quality questions due to lack of examples of good and bad subject specific eAssessment questions, and associated guidance. Technical obstacles included: (5) interoperability of different eAssessment software; (6) how to choose the infrastructure technologies to use; and (7) the need to increase usability of eAssessment systems for the lecturer. A final technical obstacle (8) was how to present results from a significant number of eAssessments in a form that allows them to be understood and made use of in a short period of time. These obstacles and the strategies we used to work through them, are discussed throughout sections 3 to 5.

3. THE CO-DESIGN

We engaged with the course lecturer in our co-design process (described in [12]). Our goals included dealing with the obstacles from section 2; creating a realistic eAssessment solution that is an interactive part of the course used by students, lecturers and teaching assistants; and creating a solution that could also be used outside of the module. This process, conducted over 5 months, involved developing personas, scenarios, design documentation etc. and involved approximately eight hours of face to face meetings with the module lecturer. Changes to the course were informed by recommended University literature on good pedagogic design (e.g. [3]). We also made the decision to update the course Intended Learning Outcomes so they were structured as advised in the literature survey in [7].

Figure 1 gives an overview of the design of our solution for formative eAssessment. We note that the author would typically be the lecturer and the user typically the student. A desk user accesses the eAssessment using a workstation or laptop; a mobile user via a mobile phone or PDA. As has been mentioned, the original eAssessments were written in Hot Potatoes, not QuestionMark Perception –which is now the University of Southampton’s standard supported eAssessment infrastructure (see obstacle 1). We manually converted the eAssessments into Perception format so as to be fully supported by the University. To help address obstacle 5 we also exported the Perception eAssessments into the standard IMS Global Learning Consortium Question & Test Interoperability (QTI) Specification format, so they can be run in any QTI-compliant delivery engine. Perception exports directly to QTI v1 and the JISC QTI migration tool then converts this into the current QTI v2 (specifically QTI v2.1). To help further address obstacle 5 we wrote custom connectors that synchronise the eAssessment data in the Perception and Blackboard/Moodle (VLE) databases. We note that eAssessment technology interoperability is a known issue but by taking these steps we provided functionality to help simplify the process of moving the eAssessments to other delivery engines. Addressing obstacle 6 (“choosing the infrastructure technologies to use”) thus involved choosing the standard university infrastructure including Perception, the Blackboard VLE and the EdShare repository. (Given that via QTI support, our recently developed tools and also the QTI migration tool it is significantly more interoperable than it used to be.)

QTI v2 questions can also be edited directly using a QTI editor (such as our web-based Southampton QTI editor). The QTI questions are then combined into a QTI test, for example using our Constructr tool. The Perception/QTI eAssessment is done by a student using a delivery engine, for example the internal Perception or our QTI Engine, respectively. The eAssessment is typically stored in a repository (in our system EdShare or

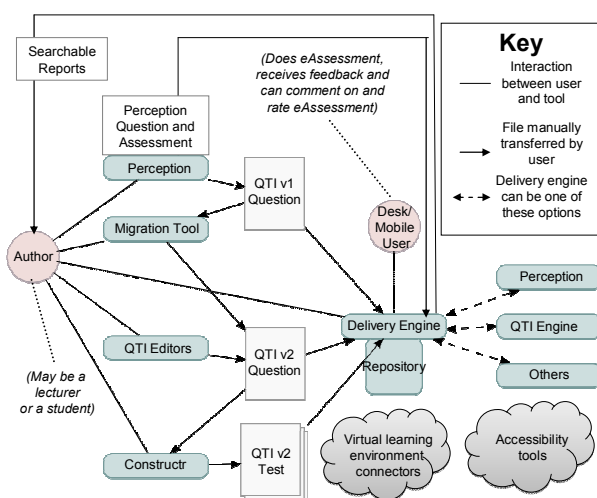


Figure 1: Overview of the design of our solution for formative eAssessment.

alternatively MiniBix), and given to the student via a VLE (e.g. Blackboard or alternatively Moodle).

We have found that the suite of tools discussed in this paper, combined with the support provided by the University, helps improve the usability of eAssessments for the lecturer (obstacle 7) by minimising the tasks that need to be done manually. To help improve usability for the student, especially students with learning difficulties or disabilities (obstacle 3) we have: *i.)* followed human computer interaction advice where possible (e.g. [16]) and advice from our JISC LexDis project [17] on making content accessible; *ii.)* conducted a usability evaluation (with students with learning difficulties represented - see section 5); and *iii.)* incorporated accessibility tools for students with access difficulties via our JISC TechDis ToolBar [19] The latter can be installed in most modern browsers, or be turned on without any installation in a single web browser click. Once turned on it allows the user in a couple of clicks to use tools to change the fonts/colours etc of the web page (e.g. the VLE/eAssessment), read out the text etc.

Another obstacle in the original system was motivating the students to take full advantage of it (obstacle 2). Improving the usability of the system and moving to the standard university supported infrastructure helped with this (see above). To further help address this we classify all eAssessment percentage marks via a red/yellow/green traffic light system and feed this information back to both the student (immediately) and lecturer (via Perception/QTI Engine reporting functionality). The lecturer can then work with the students to help minimize the number of students in the red for each eAssessment. This approach, combined with categorizing each eAssessment by subject, difficulty and question type (understanding/transcribing etc), also helped to address obstacle 8 (how to present results from a significant number of eAssessments in a form that allows them to be understood and made use of in a short period of time). For example, the students can see the question categories they are getting red results in. In addition, in Web 2.0 fashion we allowed students to provide feedback on, rate and help improve eAssessments via the EdShare commenting facility. The final obstacle not yet discussed is obstacle 4 - difficulty writing high quality questions due to lack of examples of good and bad subject specific eAssessment questions, and associated guidance. To help address this we are extending the University's eAssessment training programme to include a workshop on pedagogically based eAssessment design. The recording of this workshop and the associated written guidance we will provide, will be made available to the eAssessment community.

4. THE IMPLEMENTATION

We have implemented a prototype eAssessment solution using the design from section 3, for the case study from section 2. This involved configuring the software we and others have created previously, so it functions in an integrated manner. It also involved creating new software when none was available. This includes a version of our QTI Engine delivery engine so eAssessments can be done from a (currently Android only) mobile device without a network connection; creating connectors to synchronise VLE (Blackboard/Moodle) and eAssessment (Perception) software databases; and creating the web-based Southampton QTI editor.

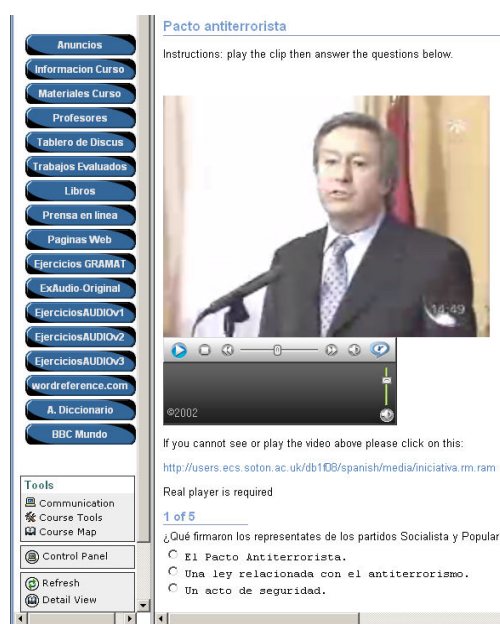


Figure 2a: Example screenshot - doing a Perception eAssessment on a PC via the Blackboard VLE.

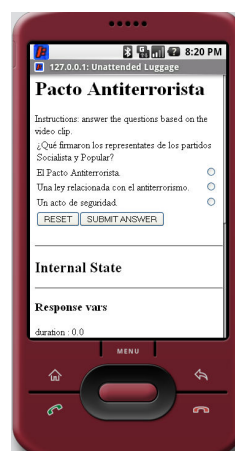


Figure 2b: Example screenshot - doing a QTI Engine eAssessment on a mobile.

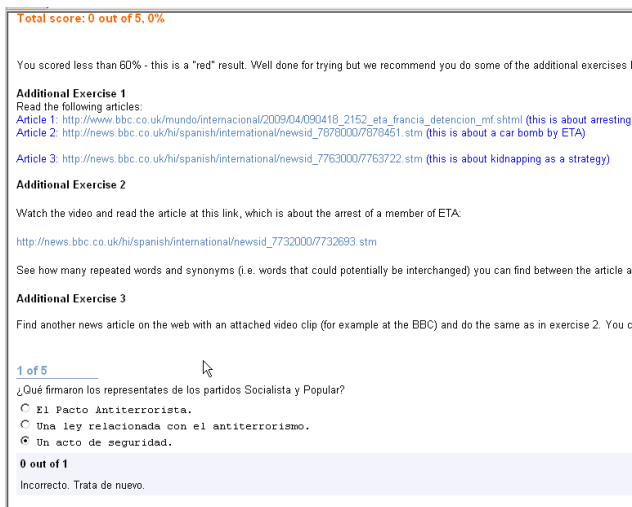


Figure 2c: Example feedback to the student.

Screenshots¹ can be seen in figure 2. As recommended in [7] the feedback is *specific* (both per-question and per-eAssessment), appears *immediately*, and is *contingent* on each student's answers. In the prototype the content is provided by the lecturer, although in "Web 2.0" style we have other case studies where the students have worked on both questions and feedback. The detailed design and implementation of this software is not described here for brevity, and because it is documented elsewhere (e.g. [2, 24]). However, the following key features are noted. There is support for a subset of QTI that, in our experience, authors are likely to use. That is, multiple choice, multiple response, extended matching item (multiple multiple response with a common stimulus and list of options), and question matrix (multiple true or false) items. It should also be noted that as with many multi-stage editing and conversion processes, creating the QTI in as few transformation steps as possible helps create less verbose QTI. Verbose QTI can create a problem for tools that use this QTI, especially for question types other than multiple choice and multiple response. Further information about our tools (and in many cases full source code download) is available online².

5. EVALUATION

The evaluation of the eAssessments was guided by [10] and took place at level 1 (the reaction level); that is, the reaction of the student. Each student evaluation (taking 1-1.5 hours) involved *i.*) the interviewer explaining what is required; *ii.*) the student doing a pre-selected set of Perception eAssessments; and *iii.*) the students answering the evaluation questions (shown in table 1). The evaluation questions were decided upon after consultation with the module lecturer as well as

learning technologists and the university CAA officer. Students on Spanish modules were invited to attend by the course lecturer, and a gift voucher was provided as inducement. All those responding to the course lecturer's email invitation who could attend the evaluation sessions were included.

TABLE I. THE EVALUATION QUESTIONS, ANSWERED ON A FIVE-POINT LIKERT SCALE

1. The exercises helped me learn
2. The exercises contributed to my general knowledge of what is going on in the Spanish speaking world
3. The exercises helped me learn new vocabulary
4. The exercises helped me improve my grammar
5. The system is easy to use
6. Compared to studying Spanish without any interactive exercises, I feel that the interactive video enhanced my learning
7. I would recommend that other modules or other languages courses provide some exercises like this

Five students were recruited to undertake the evaluation interviews. Three of these evaluations were conducted as described above. All these students answered "strongly agree" or "agree" to questions 1-5 and "strongly agree" to questions 6 and 7 - with the exception of one "disagree" response to question 6. All the students liked how the eAssessments helped motivate them in their independent learning. Dislikes included the material could be "more fun", and one student was "not a big fan of multiple choice". All students made comments implying that more care should be taken in classifying the difficulty of each eAssessment, as there are many factors (e.g. accents in video, student language background) that can affect this. We also asked two students to do a Perception eAssessment on a mobile device; both students found this straightforward and were positive about this experience. The final two interviews were about eAssessment accessibility. These highlighted technical requirements such as the importance of being able to automatically change fonts, colours and background (e.g. using our TechDis Toolbar). Also, cultural/institutional requirements were highlighted. For example lecturers on other modules being more aware of accessibility issues (e.g. by following the advice of our LexDis project [17]), such as using accessible page templates and keeping page layout and structure simple where possible.

Overall, the student response to the eAssessments was positive, in particular in recommending that this kind of eAssessment be used on other modules.

6. CONCLUSION

It is useful to have case studies from academic schools detailing how academics enthusiastic about formative eAssessment have used it in their modules. In this paper we have described the case of a Modern Languages module within a Russell Group university.

¹ Screencast is available at users.ecs.soton.ac.uk/db1f08/span_demo/

² At www.lsl.ecs.soton.ac.uk

We identified eight technical/cultural obstacles restricting the use of formative eAssessment on the module. We followed a co-design process (including learning technologists, the course lecturer and the university IT department), so as to deal with these obstacles. The formative eAssessment solution resulting from the case study utilises our QTI, mobile QTI, accessibility, and web 2.0 tools and can be positioned at the cutting edge of formative eAssessment practice. We have evaluated this with student volunteers from the module and received positive feedback. Future work includes publishing the results of our second evaluation, helping embed the results of our work within the university (scheduled for April 2010 to March 2011), helping increase the uptake of formative eAssessment within the University, and publishing the results of case studies we have conducted in other schools.

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REFERENCES

- [1] ALT, The Future of Higher Education: The Association for Learning Technology's response to the White Paper, 2003. Available at: www.alt.ac.uk/docs/he_wp_20030429_final.doc [last accessed 1-8-03]
- [2] D Bacigalupo, B Warburton, L Gilbert, G Wills, The EASIHE Project: Walk-through of Selected Technical Work, 2010, Available at: http://wiki.easihe.ecs.soton.ac.uk/images/EASIHE_bpc_report_dec09_1.0_as_sent.pdf
- [3] J Biggs, C Tang, Teaching for Quality Learning at University (3rd edn.), Open University Press, 2007
- [4] J Bull, C McKenna, I Hesketh, Computer-Assisted Assessment (CAA), National Survey Questionnaire. CAA Centre, University of Luton, 1999.
- [5] J Bull, C. McKenna, Blueprint for Computer-Assisted Assessment, RoutledgeFalmer Press, 2004
- [6] G. Conole, M. Oliver, Contemporary Perspectives in E-Learning Research, Routledge Press, 2007
- [7] L Gilbert, V Gale, Principles Of E-Learning Systems Engineering, Chandos Publishing 2007
- [8] E Heinrich, J Milne, M Moore, An Investigation into E-Tool Use for Formative Assignment Assessment – Status and Recommendations. Educational Technology & Society, 12(4): 176–192, 2009
- [9] JISC Pattern Language Network, case studies wiki, available at: <http://purl.org/planet/Cases/>, 2010.
- [10] DL Kirkpatrick, Evaluating Training Programs: The Four Levels, 2nd Ed., Berrett-Koehler Press, 1998.
- [11] K Lewin, Group Decisions and Social Change. In Readings in Social Psychology, Swanson, G. E., Newcomb, T. M. and Hartley, E. L. (Eds.) New York: Holt, Rhinehart and Winston, 1958
- [12] D Millard, Y. Howard, L. Gilbert, G. Wills, Co-design and Co-deployment Methodologies for Innovative m-Learning Systems, In Multiplatform E-Learning Systems and Technologies: Mobile Devices for Ubiquitous ICT-Based Education, IGI Global, 2009
- [13] GA Moore, Crossing the chasm (2nd edn), Oxford, Eng.: Capstone Publishing, 1999
- [14] N Pachler, H Mellar, C Daly, Y Mor, D Wiliam Scoping a vision for formative e-assessment: a project report for JISC, JISC project report, 2009. Available at www.jisc.ac.uk
- [15] N Pachler, C Dalya, Y Mora, H Mellar, Formative e-assessment: Practitioner Cases, Computers & Education, Elsevier, 2009. In Press.
- [16] J Preece, Y Rogers, H Sharp, D Benyon, S Holland, T Carey. Human-Computer Interaction, Addison Wesley, 1994.
- [17] J Seale, EA Draffan, M Wald, Exploring disabled learners' experiences of e-learning: LEXDIS Project Report. University of Southampton. Available at: <http://eprints.soton.ac.uk/64850/>
- [18] K Shephard, B Warburton, P Maier, A Warren, Development and evaluation of computer-assisted assessment in higher education in relation to BS7988, Assessment & Evaluation in Higher Education, 31:5(583-595), Routledge Press, 2006
- [19] S Skuse, EA Draffan, M Wald, JISC Techdis Toolbar manual installation and user guide, available at: <http://access.ecs.soton.ac.uk/ToolBar/instructions>, 2010
- [20] E Sommerlad, M Pettigrew, C Ramsden, E Stern, Synthesis Of TLTP Annual Reports, Tavistock Institute, London, 1999
- [21] W Warburton, Towards a grounded theory of computer-assisted assessment uptake in UK universities, University of Southampton PhD Thesis, 2006
- [22] W Warburton, Quick Win or Slow Burn? Modelling UK HE CAA Uptake, Assessment & Evaluation in Higher Education, 2009
- [23] R Yin, Applications of Case Study Research, Second Edition, Applied Social Research Methods Series, Vol. 34, Sage Publications, 2003. Available at: <http://www.paperfree.co.uk/>
- [24] P Zhang, GB Wills, L Gilbert, B Warburton, D Bacigalupo, IMS QTI Engine on Android to Support Offline Mobile Learning, International Conference on e-Commerce, e-Administration, e-Society, e-Education, and e-Technology, Macau, China, 2010
- [25] EM Rogers, Diffusion of Innovations (5th edn.), New York:Free Press, 2003

