Using tablets for e-assessment of project-based learning

Lead Author: Elvira Bolat [1], Co-author: Dr Milena Bobeva[2]
[12]Bournemouth University, Bournemouth, United Kingdom
[1]ebolat@bournemouth.ac.uk
[2]mbobeva@bournemouth.ac.uk

Abstract: Technology is confirmed to be an effective tool for assessment and feedback, in particular for computer-assisted assessment (Irons, 2008; Challis, 2005), producing feedback (Heinrich et al., 2009) and publishing feedback (Bloxham and Boyd, 2007; Denton, 2003; Denton et al., 2008). The arrival of affordable mobile devices has introduced a new means for enhancing the above practices (Fabian and MacLean, 2014; Plimmer and Mason, 2006; Salem, 2013). Student preferences to smart phones and tablet devices steer the technological innovation towards ubiquitous mobile connectivity. Inspired by the benefits of such life and study style, educators have started exploring the use of these technologies. Tablet computers prove to become their preferred choice as they resolve some of the limitations associated with the design, readability and comprehensiveness of the feedback for mobile devices with smaller screens (Strain-Seymour, 2013, Rootman-le Grange and Lutz, 2013).

This paper reports how tablets and the Form Connext mobile app have been used for engaging a sample of 300 Business Studies students in in-class online assessment and designing and providing timely comprehensive feedback. The study has followed an action research strategy that is grounded on a continuous and dynamic process of reflection (Carr and Kemmis, 2003) on the effectiveness of assessment of student projects documented electronically through wikis and electronic portfolios. It refines the use of tablets for summative and formative assessment of the project-based learning tasks through three review cycles, each of which incorporated a Reflection and Improvements stage. The experience resulted in enhancement of assessment strategies and contribution to the development of contemporary models of learning through effective assessment and feedback (Carr and Kemmis, 2003).

The results of the work confirm that tablet computers are an effective tool in assessing e-materials in larger classes for two primary reasons. Firstly, design of e-forms facilitates rigorous process of reflection and understanding assessment criteria that in turn benefit students when preparing for the assessment. Hence, legible and detailed feedback is produced anytime anywhere with synchronous updates within the marking team. Secondly, students benefit from immediate comprehensive feedback allowing them to reflect on and improve their understanding of subject matters, as well as to engage in discussing specific details of the work that are captured through the form. An unexpected outcome was the enhanced reputation and respect to the tutors amongst students, the triggering of student curiosity and enthusiasm in applying similar approach to their own work. The diffusion for the practice amongst other units and identifying other purposes for which the mobile app could be used are also seen as achievements exceeding the expectations of the project team.

Keywords: tablets; assessment; project-based learning

Introduction

Effective pedagogic practice focused on developing pedagogic innovations in using technology to connect and encourage engagement between such traditional concepts as a feedback and students. This is in line with the connectivism (Siemens, 2005) pedagogical paradigm that reflects that through digital means educators can facilitate not only a connection among learning participants but a connection between learning objects (feedback from) and learning participants. Such connections then result in co-creation of knowledge, effective and engaged learning. Tablet computers are found to be an effective tool in assessing group presentations in class for two primary reasons. Firstly, design of e-forms facilitates rigorous process of reflection and understanding assessment criteria that in turn benefit students when preparing for the assessment. Secondly, students benefit from immediate in nature, creative and personalised feedback allowing them to reflect on and improve their understanding of the subject. Hence, students are motivated to engage with and action the feedback. Previous study by Denton et al. (2008) proves that immediacy of the feedback is critical factor in engaging students with the feedback when results are meaningful.

This paper reports on the process, outcomes and challenges of the use of tablet computers for formative and summative assessment of student individual and group work.

Theoretical background

Educators' digital literacy as part of an effective student engagement

Within a higher education environment digital revolution has become a catalyst for the reconsideration of pedagogical paradigms that ground the institutional approaches to learning. This reconsideration happens on all level of activities that build modern model of scholarship, which integrates teaching, research and engagement with industries (Burdick and Willis, 2011). Primary focus, however, is to aim at the development of skills and competencies required by the 21st century digital citizen whose daily activities encompass consumption of social networking and sharing information (Olsen and Horgen, 2013) and multitasking (Ie et al., 2012) enabled by bring your own device (BYOD) culture and accessible digital tools. In addition Professor Stephen Heppell (2013) in his blog wrote about a meaning of curriculum in contemporary education practices emphasising that content is not a critical underpinning to the effectiveness and students' performance. In turn focus on pedagogical approaches and generic skills, which students require in future employment, grounds a design and development of curriculum. Apart from skills in using and applying technology, integration of digital literacy in a curriculum is proven to foster critical thinking (Marty et al., 2013), collaboration skills (Mercier and Higgins, 2014; Raes et al., 2012) and independent self-directed learning (Heppell, 2013).

Digital literacy that more often than not defined as ability to use digital technology (Buckingham, 2010) extends its impact on students' ability to utilise digital technology in a critical manner with effective fit between requirements of the task and analysis of what digital tools are appropriate to assist in a completion of task. Buckingham (2010) names digital technology as cultural forms which digital citizens use in their daily lives to enable interaction with the world, exchange of information and creative problem solving. Educators are these who are to help students in understanding how use of such cultural forms can be extended to a professional context. To do so effectively educators themselves required to understand digital technology by using them in educational processes and demonstrating innovative approaches to an enhancement of educational and learning practices. Ubiquitous digital literacy and digital competences among educators, according to Krumsvik (2008), remains a milestone in an aspiration to a modernisation of educational systems globally but mostly importantly in engaging with 21st century students in an effective and familiar to them manner.

Although the role of educator as the one to guide and assist in the learning process very much remains even in a digital world (Spires et al., 2011), increasing students' engagement with the teaching content and preparing them for the professional career become even more interesting creative and challenging. Saddik (2008) illustrates that by using technology (MS Photo Story) Egyptian teachers were able to engage students with the content making it interesting and visual. The concept of digital storytelling is something increasingly adopted by brands globally (Tesseras, 2014). Moreover, Rich and Hannafin (2009) show that simple feature of video

annotations as means to provide a feedback to students enables increased engagement with the feedback among students but also assisted in educators' reflections on a curriculum design.

Irrespective of an underlying device, system or software application, technology has held the potential of a mechanism for fostering creativity and, most importantly, for supporting lifelong learning. Benefits for an educator are two-fold: external and internal.

(1) External benefits are in relation to students where students engage with the learning content (Saddik, 2008; Mercier and Higgins, 2014) and co-create knowledge (Raes et al., 2012). Mercier and Higgins (2014) argue that content is the third critical party involved in the educator-students interaction and demonstrate that technology enables access to this key constituent of the relationship.. Irrespective of technological devices used in learning processes (due to the fact that new technologies emerge continuously), content is a critical element which through transformations over solving learning problems, turns into a shared and co-created knowledge. Therefore, technology needs to be perceived as a facilitating mechanism and as a tool to be embraced by educators to keep curriculum and its delivery in tune with changes that concern professional environments today. Furthermore, digital learning spaces supported by technology (examples include social networking sites or tools such as Wikis, discussion boards) became a powerful mechanism in facilitating collaborative, participative and informal learning experiences, wherein students feel more comfortable to communicate, take risks and demonstrate ownership for their learning activities and outcomes. Higher education institutions in the UK have not yet fully realised the breath of opportunities afforded by digital technology for generating greater student engagement with the learning content, increasing interaction and connection with peers and educators, providing a more inclusive learning experiences, facilitating a shift away from passive toward more active learning (Draskovic et al., 2013; Patrut et al., 2013).

(2) Internalbenefits of integrating technology into educational practices cover professional development of education providers through self-reflection (Rich and Hannafin, 2009) and continuous evolution of pedagogical paradigms in line with the recent notion of connectivism introduced by Siemens (2005). Connectivism reflects that through digital means educators can facilitate not only a connection among learning participants but a connection between learning objects (feedback from, digital content) and learning participants (Siemens, 2005). Such connections result in co-creation of knowledge, effective and engaged learning.

Technology-assisted assessment and feedback is one activity within a learning process that illustrates both internal and external benefits of utilising technology for an educator. Technology is confirmed to be an effective tool for assessment and feedback. The obvious and simple way to integrate technology into computer-assisted assessment and feedback process is to publish and produce (Bloxham and Boyd, 2007; Challis, 2005; Denton, 2003; Denton et al., 2008; Heinrich et al., 2009) feedback using technological tools. Denton (2003) and Denton et al. (2008) report on advantages and drawback of MS Office tools developed to assist in assessment. In particular two papers report educators' enthusiasm to produce electronic feedback that allow building a database of comments that can be used across written assignments to save time in typing similar comments that are evident across the cohort; hence, decreasing time in producing the feedback. HEFCE in 2007 emphasised the importance of the time in assessment in producing good quality comprehensive feedback. Moreover, technology enables clarity in producing the feedback where students engage more with the typed, 'legible' text over the handwritten comment (Bloxham and Boyd, 2007; Irons, 2008). Publication of feedback through online means, most importantly, enables flexibility and increases students' engagement with the feedback due to opportunities to access the feedback anywhere anytime (Bloxham and Boyd, 2007; Denton, 2003; Denton et al., 2008).

Additionally computer-assistance in the assessment and feedback process goes beyond production and publication of grades but improves assessment setting itself (Maclellan, 2001; Parkin et al., 2012). In particular building the database of comments and communicating assessment criteria to students in advance prompt educators to carefully think about assessment and its link to intended learning outcomes (Parkin et al., 2012). Despite the fact that substantial scholarly work focuses on personal (stationary and fixed network desktop) computer assisted assessment and feedback (Bloxham and Boyd, 2007; Challis, 2005 Denton, 2003; Denton et al., 2008; Heinrich et al., 2009; Parkin et al., 2012). Hepplestone et al. (2011) conclude that such literature is of limited nature with description of practices and no reflection on implications for pedagogic practices given.

Although being in part the description of an action learning process this paper's authors went through, reflection on outcomes and lessons learned through the prism of existing pedagogical paradigms is provided when discussing results.

Deploying mobile technology in teaching practices

The arrival of affordable mobile technologies has introduced a new means for enhancing the assessment and feedback practices. Examples include effective use of student response system via mobile devices to formatively assess students' understanding and providing immediate formative feedback via mobile phones (Rootman-le Grange and Lutz, 2013). The latter study, however, raised concerns about the readability of the feedback and warned that screen size could challenge both tutors and students who would like more comprehensive assessment feedback. Tablet computers address some of the limitations of mobile devices with smaller screens and have been used for designing and developing content as part of assessment (Fabian and MacLean, 2014), as well as for providing feedback (Plimmer and Mason, 2006; Salem, 2013).

In overall mobile technology brings the possibility to transmit information irrespective of time and location (Balasubramanian et al., 2002). Mobile technology invaded all the aspects of social existence with education setting being a perfect context to expand opportunities for independent and mobile learning (Donelly, 2009). Bolat (2014) reports that mobile technology is unique and distinct technology in comparison with stationary and fixed network stationary computers. In particular, mobility is a distinctive characteristic of mobile technology, which is specifically evident in the use of mobile technology (Bolat, 2014). By using mobile technology individuals/users experience a set of four values:

- Functional value indicates that irrespective of underlying mobile technology devices and software applications intuitive in nature, easy to use technical features of mobile technology enable fast and flexible transmission and exchange of data in different formats, multitasking, and ability to communicate on demand anywhere anytime.
- Social value covers purposes of communication where immediacy in response and, therefore, relevance of timely engagement are benefits for an individual/user.
- Independence of time and location that encourages exercising freedom in creative thinking: when using mobile technology users are not constrained by time and specific locations.
- Finally, controversially mobile technology allows balancing personal and professional lives.

Education research has focused on the impact of mobile devices on student engagement and demonstrates how set of four values derive through practical applications. Existing studies report that tablet computers are proven to motivate students through interactive learning (Geist, 2011; Manuguerra and Petocs, 2011; Shifflet et al., 2012; Schreiber and Hunt, 2013) and improve students' performance through effective problem-solving learning experiences in class (Enriquez, 2010; Kruger and Bester, 2013; Strain-Seymour et al., 2013) wherein functional, social and creative values derive from integrating mobile technology into educational practices.

In relation to application of mobile technology in the assessment and feedback process Strain-Seymour (2013) published a study reflecting on experience of using touch screen devices to assess students in class with the feedback form that has been developed on computer first. Strain-Seymour (2013) reports that developing forms on stationary and fixed network desktop computers prevents educator to think about characteristics of devices to be used and contextual settings in which the assessment will take place. Hence, using such forms on touch screen devices was found to be challenging due to screen size limitations, not taking into consideration differences between the uses of keyboard and touch screen. To the authors' knowledge no published study reports on experiences in integrating tablets into the assessment and feedback practices taking into account distinct nature of mobile technology. This study, therefore, addresses this gap in the educational literature by focusing on using tablets for engaging students in in-class online assessment, designing the feedback form using tablets, and providing timely comprehensive feedback through tablets.

Method

This study follows an action research strategy that is grounded on a continuous and dynamic process of reflection (Carr and Kemmis, 2003) on the effectiveness of assessment of student projects documented electronically through wikis and electronic portfolios. Action learning process, according to Dall'Alba (2005), is a continuous 'must' exercise for transforming and enhancing educational practice. Teaching in the scenario of

action learning process for both an educator and the student implies ongoing learning for the educator to be able to reflect and transform approaches to teaching students how to learn (Dall'Alba, 2005). This paper illustrates action learning educational practice where reflective analysis of existing literature urges changes and innovation to improve students experience and pedagogical paradigms to reflect such contextual changes as a digitisation and the way young generation access and engage with feedback.

Teaching team of two academics has used tablets in the assessment and feedback exercise for the unit that is designed around the project-based learning (PBL) model. In particular students are working on set of four main projects, which involve complex tasks that students autonomously solve and investigate individually or in groups (Thomas, 2000). When assessing PBL tasks the teaching team has used tablets for summative and formative assessment through three review cycles:

(1) In-class individual formative assessment

(2) In-class individual summative assessment

(3) Summative assessment of online group portfolio delivered via a wiki.

With each cycle actions were followed by reflections and improvements to both the design of the marking form, the assessment of student learning and the related administration process. A purposive sample of 300 first year Business Studies undergraduates was used for the study and to inform of student experiences and views on the innovation in assessment and feedback.

Assessment was completed using a software application (app) for iPads, called FormConnect (http://www.formconnections.com/). FormConnect allows designing assessment and other types of forms to be used for learning, business and personal purposes. The forms and assessment records could be shared in a number of formats, including PDF, Excel spreadsheet and HTML, and channels (Dropbox, email, Skype). The app allows designing forms and sharing these and the assessment records in a number of formats and channels. Thus given number of students final results were converted into Excel spreadsheet with detailed data with all criteria listed (see Figure 1). This enabled various mathematical manipulations with data including calculation of final individual results as well as filtering data to allow publish results online anonymously.

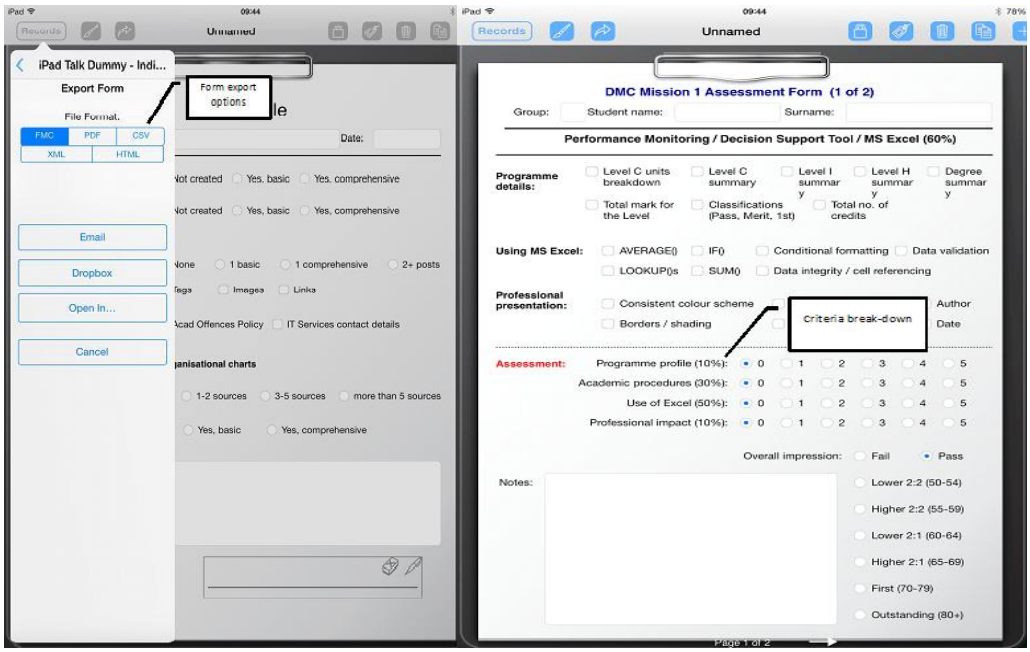

Figure 1: FormConnect – Exporting options and example of criteria break-down

Forms developed were customised to include title of the unit, text field to type student's name, group number and date. Apart from that, available functions, in-class assessment context, use of tablets urged the teaching team to think on criteria of assessment that could be captured using drop-down, radio button options for

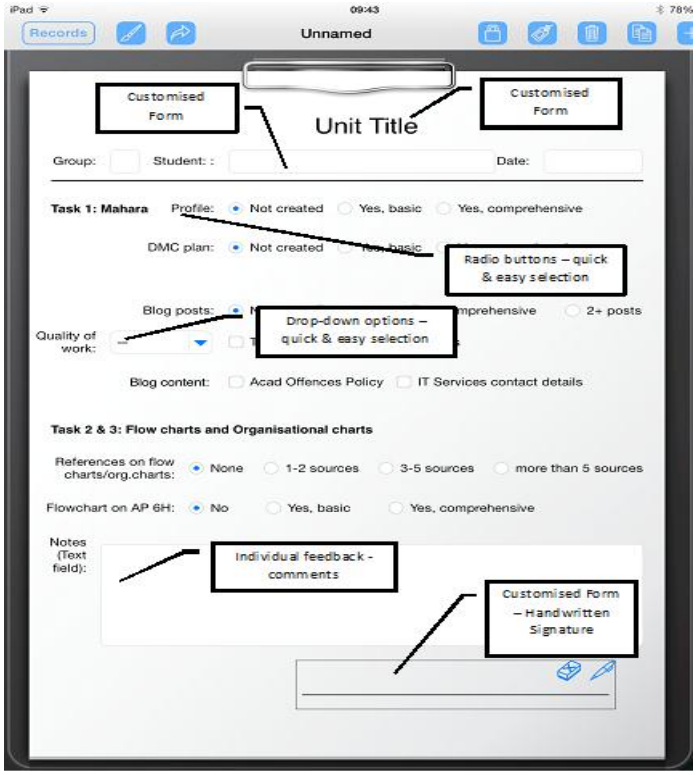

Figure 2: FormConnect – Design elements and customisation tools

quick and easy selection when assessing students' work (see Figure 2). Nevertheless, customisation using text boxes where short individual comments can be types is also possible in a mobile marking context.

Results and Discussion

The experience with using tablets for assessment and feedback resulted in enhancement of assessment strategies and contribution to the development of contemporary models of learning through effective assessment and feedback.

Bolat's (2014) model of mobile technology values was used below to summarise the findings of the project (Table 1):

Table 1: Values experienced throughout the project

Values	Students	Tutors	Other stakeholders
Functional	- Results were shared with students immediately after the completion of the assessment. - Legible and detailed feedback was produced, covering both the elements of the content and how the intended learning outcomes for the assignment were achieved. - Photo evidence/Screenshot of the work helped to highlighting any elements of good practice or such in need of improvement - The design of the form could accommodate both a checklist on how complete the work is and also reflect the assessment criteria. Whlst it span over a few pages, using the tablet computer allos for going through these very swiftly.		Administrative arrangements were streamlined by sharing the excel version of the results with the Learning technologist who enabled automatic upload of the feedback onto the Virtual Learning Environment (VLE)
Social	- Establishing rapport between tutors and	- The use of the app has been reported at staff development	

	students that enables future co-creation and co-production	workshops and TEL (Technology Enhanced Learning) events. This offered more opportunities for networking at professional level and using the FormConnect and similar apps for other in-class and offline assessments.	
Independence from time and location constraints (Independence)	- Assessment results were published online through the VLE and students engaged with tutors for clarification and discussion immediately upon their release.	- Tutors were able to conduct the offline assessment in an environment of their choice and discuss the progress with assessment using the latest records	- Feedback forms were submitted to Admin immediately upon completion of the assessment.
	- Assessment in class through the mobile devices allowed for a more personal approach, immediate confirmation of student's competencies and resolution of any concerns about the originality of the work. Formative feedback was initiated by studnets with the opportunity for immediate aplllication and clarification of student comprehension of the advice.		
Balancing personal and professional lives (Wellbeing)		- Completing the feedback in a timely fashion and the automaton of uploading the results on to the VLE has freed up time for other personal and professional engagements	

Thomas (2000) reported that PBL has two issues to be resolved by educators, integration of technology into the classroom and challenges of developing assessment that can capture students' understanding. Table 1 clearly illustrates that use of tablets can be a solution to the above-mentioned issues. In particular use of tablets in PBL enabled:

- Rigorous process of reflection and understanding the assessment criteria.
- Immediacy, relevance, customisation, and creativity in the assessment and feedback process.
- Triggers for student and colleagues curiosity and enthusiasm.

Drawbacks of using this method for assessment include:

- Free format text feedback in in-class settings are not easy to add due to the mobility of the tutor and the time constraints of the schedule.
- Immediacy of the feedback should be done with due care to any emotions that students could go through.
- Tutors could be subjected to influences of individual student behaviour and should be mindful of this threat to the objectivity of their assessment.
- If the assessment form is very detailed, tutors could inadvertedly miss out on completing elements of the form.
- Quality assurance through second marking needs to be agreed up front and communicated to students through appropriate disclaimer.

Conclusion

Innovative solutions, particularly, use of mobile devices to assess and provide feedback, are in line with the High Education Academy (HEA)'s (2014) strategic goal of encouraging academics to adopt and integrate digital technologies to support contemporary pedagogic practice. The findings of the project on using tables for assessment reported here confirm that tablet computers have been an effective change tool for diffusing innovation in educational practices, and in particular, in assessing larger classes. Their impact extends beyond the functional benefits to cover social, independence and wellbeing values. Tablets are found to be an effective technology to be incorporated in the PBL classroom as well as assist in the design and implementation stages of the assessment and feedback practices. An unexpected outcome was the enhanced reputation and respect to the tutors amongst students, the triggering of student curiosity and enthusiasm in applying similar approach to their own work.

The diffusion for the practice amongst other units and identifying other purposes for which the mobile app could be used are also seen as achievements exceeding the expectations of the project team. An extension of the project could be through a longitudinal study that focuses on analysing student development as evidenced by their reflections. Applicability for students with additional learning needs (ALNs) could also be explored in depth to understand how mobility element allows accommodating needs of such students. Applicability of tablets to different forms of learning and assessment could be investigated further to understand whether tablet is a task-specific technology to be integrated into educational practice. This will help to prove whether educators and mobile technology have provided opportunities for students to develop *"the skills, knowledge, ethical frameworks, and self-confidence"* to learn within more participatory cultures (Jenkins, 2006).

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