E-ASSESSMENT: TOOLS AND POSSIBILITIES FOR ELECTRONIC ASSESSMENT IN HIGHER EDUCATION

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Abstract

Technology deployment in higher education is at a thriving stage, with an increasing number of institutions embracing the possibilities afforded by technological tools and a mounting interest from teachers who are becoming more familiar with the intricacies of technology. There are several aspects of higher education that have been digitalised and transformed by the constant technological advancements of key tools for learning. Assessment, as an integral part of learning, has also been adopting a growing number and variety of tools to assist the measurement of the learning outcomes of the students. This paper intends to examine the technology that is available to develop effective e-assessment practices. It reviews key literature about the use of technology to develop assessment in higher education to provide a comprehensive account of the tools that teachers can use to assist the assessment of their students' learning outcomes. The e-assessment instruments that are presented in this paper have different degrees of complexity, ranging from simple e-exams to the use of complete gamified learning and assessment experiences. They represent varied solutions that can be adapted to an ample assortment of assessment scenarios and needs, and they extend the possibilities of assessment far beyond the limits of conventional grading, offering a more current and more adequate answer to the demands of the contemporary higher education sector.

Keywords: E-assessment, higher education, learning technology.

1 INTRODUCTION

Assessment is a core aspect of learning, allowing teachers to have a depiction of what knowledge the students have acquired and what aspects of the content need further support. It determines what parts the course are more important and on which resources the students will invest most of their time. With the emergence of new learning environments, assessment practices need to be reinvented [1]. Furthermore, technological developments are assisting the promotion of e-assessment in higher education and the students themselves also seem to be generally accepting and showing a positive stance toward its use [2]. Even though technology is making progress in terms of its pervasiveness in the higher education sector, e-assessment remains far from being entirely explored [3].

E-assessment is more cost effective [4], it allows personalised and adaptive testing [5], it can reach a higher number of students [6] and be delivered more often[7]. Also, it enables grading automation [8, 9] and the exchange of questions among teachers in question banks [10]. At the same time, e-assessment challenges can pertain to the technological infrastructures that are available [4], to insufficient security of e-exams [11], to the lack of digital skills [12], to the difficulty that the assessment of open questions [13] and high-order thinking constitute [5] and to the question of validity of certain types of electronic assessment [12].

Assessment should consider the learning objectives of the students and assist them to mature the skills that they will require, on the long-term, to become active members of society [14]. Some of the factors that influence e-assessment's success include authenticity, consistency, transparency, practicability and accessibility [15]. E-assessment's effectiveness is equally contingent on accounting for a multifaceted approach involving aspects of human, managerial, social and technological nature and also data collection [16].

E-assessment activities, both formative and summative, can be developed with the assistance of a panoply of technologies, such as e-assessment systems, e-portfolios, online quizzes, gamification, Web 2.0 tools such as wikis or blogs. The rate at which e-assessment is evolving can lead teachers to feel
overwhelmed in trying to be updated with all existing possibilities [17]. This paper aims to explore the technology that is available to assist the development of effective e-assessment practices. It begins by presenting an overview of e-assessment in the context of higher education. It then reviews relevant literature about the type of tools and technology that are available to support the implementation of e-assessment in higher education and concludes with final considerations.

2 E-ASSESSMENT IN HIGHER EDUCATION

Traditional assessment is progressively being regarded as an unsuited approach in the context of contemporary higher education [3]. There are several advantages that e-assessment has over conventional assessment approaches. Electronic assessment presents an important resource for online learning environments and for coping with high number of learners [6]. Also, not only it can be delivered to more students, but it can also be delivered more often via formative assessment tasks [7]. There are also financial benefits with a reduction of the cost of assessment [4]. At the same time, it facilitates personalisation through the deployment of adaptive testing, enabling the adjustment of the questions that the students’ answer, depending on the results of their responses to the previous items [5]. The use of technology to support assessment enables teachers to develop and use questions deriving from templates, to add multimedia features to their tasks, to resort to question banks to share questions and to simplify the marking process with automation [10]. Automation is particularly advantageous because it increases reliability, saves time that the teacher can use to develop other activities [8] and allows feedback to reach the students more rapidly [9].

On the other hand, there are challenges to the deployment of e-assessment that require thorough analysis before teachers can fully engage with it. Firstly, it is necessary to acknowledge that the existing technological infrastructures may be unsuitable for the development of e-assessment and that the lack of connectivity soundness may equally affect its feasibility [4]. Secondly, not all types of assessment can be easily applied to an electronic format. Assessment tasks that involve essay-type questions represent a difficulty for automated grading systems [13]. Thirdly, inadequate digital skills and the necessity to guarantee training can pose an obstacle [12]. It is essential to identify the level of students’ digital literacy to ensure that they have the ability to master digital resources [18]. Fourthly, there is some reticence as to the ability for e-assessment to evaluate high-order thinking abilities, creativity, problem solving [5]. Finally, some types of e-assessment lack validity [12] and e-exams constitute student authentication problems [19].

In the context of higher education, e-assessment is reaching high adoption rates and positive acceptance levels from both the teachers that develop it and the students that complete it [20]. To thrive in higher education e-assessment requires novel paradigms and methodologies. Also, it is essential that e-assessment moves beyond the use of methods that are based in conventional assessment such as multiple-choice testing and advances into the development of authentic assessment tasks which promote the application of knowledge to real-work scenarios [3]. E-assessment needs to be authentic in the sense that it should relate to real-life scenarios and competences; coherent with the learning outcomes and the criteria that have been defined for assessment; transparent in what concerns its clarity and fairness; practical in its implementation, by guaranteeing the existence of the necessary resources to its completion; and accessible to the students [15].

3 TOOLS AND POSSIBILITIES FOR E-ASSESSMENT

E-assessment refers to “the use of digital devices to assist in the construction, delivery, storage or reporting of student assessment tasks, responses, grades or feedback” (p.5) [21]. According to Duda and Walter [22] e-assessment focuses on “two types of users and three types of processes. First, the examiner constructs an assessment. Then the examinee completes the assessment. Finally, the evaluation of the results of each examinee is made” (p. 467-468). Furthermore, JISC’s e-assessment glossary defines e-assessment as the “end-to-end electronic assessment processes where ICT is used for the presentation of assessment activity and the recording of responses. This includes the end-to-end assessment process from the perspective of learners, tutors, learning establishments, awarding bodies and regulators, and the general public” (p. 43) [23].

There are essentially three types of e-assessment: diagnostic, which provides insight into the students’ knowledge at the start of the course; formative, which occurs during the course and tests what the students have learned and what requires further teaching; and summative, the type of assessment that is taken at the end of the course to determine the students’ grades [24].
E-assessment enables the use of various technologies and tools such as Web 2.0 (blogs, wikis), role-play embedding, virtual worlds (Second Life) [21] and e-exams [10]. It also subsumes assessed e-portfolios, peer-assessment and online computer-graded quizzes [8]. E-assessment can encompass several activities namely closed or open questions, portfolios, discussions or products such as prototypes. It can be used in both online and blended learning [25]. E-assessment can also include rubrics [9].

3.1 E-exams

It is important to view electronic exams not only as a method that is financially appealing, but as an opportunity to really improve examination and grading [10]. E-exams are a valuable solution for balancing the growing budgetary constraints and the increasing number of students. Also, it helps institutions deal with the shortage of examination facilities [26]. Authenticity, privacy, secrecy and correction are some of the main requirements to implement a secure exam [27].

There are numerous solutions for the administration of e-exams. It is possible to incorporate e-exams in LMSs, although they require strict invigilation, due to the access to other tools, and the use of campus’ devices. The e-exams can also be completed in computer labs, but their capacity is limited, thus restricting the number of students that can take the exam. Another option for e-examination is the employment of proprietary software that is designed for e-exams. One downside of using this type of software is the fact that it might be limited to a specific operating system. E-exams can be taken at outsourcing examination centres, even though this is an expensive option. Finally, it is possible to use online proctoring, although these services raise the issue of exam taking in uncontrolled settings [26]. Some universities use exam aquariums, which are rooms where students can take e-exams and the teacher supervision is replaced by video surveillance [24].

3.2 E-Portfolios

E-Portfolios constitute an electronic form of the traditional paper portfolios. They are generated in computer settings and can include information in multiple formats such as text, video and audio. They require the active engagement of the students and provide a depiction of their skills and learning. They can be digitally stored and can serve various assessment purposes [28]. E-portfolios have the capacity to aggregate the entirety of the evidences in one location facilitating access and they ensure scalability. This electronic version of portfolios is also beneficial for the exchange of content, the inclusion of information in a panoply of formats and for the support of collaborative learning [29]. E-portfolios are important for the development of information literacy competences and they are a valuable tool for students’ reflection [30].

According to JISC’s e-assessment glossary, e-portfolio management systems can be understood as systems that employ ICT for e-portfolio management. These systems can have multiple features and allow the creation, recording, storing and overall editing, presentation or exchange of e-portfolios [23]. E-portfolio systems are diverse and they vary from a simple feature of file storage which is included in another system to more advanced online products. They can also be included in a VLE [29]. There are several e-portfolio systems, such as SpringBoard, TaskStream, FolioLive, LiveTech, TK20, TrueOutcomes, ePortfolio, Foliotek [30] and Mahara [31]. The rising number of e-portfolio systems means that the selection of the most relevant system should account for particular characteristics. An appropriate e-portfolio system needs to guarantee the security of its use and access authentication, it should be user-friendly, it should support several data formats, its bandwidth should support the expected volume of traffic and it should have a feature for user training [29].

3.3 E-Assessment Systems

E-assessment systems can assume a variety of forms. They can be integrated with a LMS, like Blackboard and Moodle or it can be a stand-alone system, like Questionmark Perception [21]. Regardless of the type of systems that is chosen it is important that teachers use defined criteria to select the system that is going to be deployed for the purpose of e-assessment. Isaias, Miranda and Pifano [32] proposed a framework comprised of eight main criteria to guide the analysis and comparison of these systems: variety of design options, scalability, security, access and usability, feedback features, personalisation, cost and interoperability.

LMSs, despite not being designed for e-exams, do have functionalities that can be used for assessment [24]. The use of a VLE for assessment presents many benefits, namely it is supported and developed on secure servers and both the staff and the learners are comfortable with its use. On the other hand,
there are concerns in terms of their reliability and robustness, since they are accessed simultaneously from different locations and by a large number of learners [33]. Released in 2002, Moodle is an open source system for e-Learning. Although it does not offer an independent exam component, it includes task and objects for potential employment in e-assessment. With Moodle the teachers are able to use their institutional log in for access, but since it includes a panoply of different features, selecting the appropriate options and learning how to use them is a complex task for teachers [24]. The Blackboard Learn system, also has assessment functionalities. It offers a wide variety of question types and the results of the assessments can be viewed in the area where they were developed with different degrees of detail [34]. Optima was presented in 2000 and it is a commercial learning platform. Its exam functionality provides automated assessment for elemental types of questions. Teachers can equally use surveys, return boxes and diaries for assessment. It simplifies the creation of exams, but it also narrows the questions to three types. The teachers can use external resources in a text format to generate multiple choice items for exams, but the students' access to particular tasks at a particular time frame needs to be facilitated by the teacher, since the system does not offer a reservation calendar [24]. ViLLE was created in 2004 and it is a platform for collaborative learning, where teachers have the possibility of creating online courses and automatic assessment. ViLLE allows teachers' access via their institutional credentials and exam rounds do not provide immediate feedback [24].

Systems that have been developed specifically for e-assessment, despite being more complex and requiring more staff and setup efforts, are robust and have the capacity to deliver assessments at any given time [33]. One of the downsides of using a commercial system is that it might be difficult to adapt the system to fit the required assessments [35]. There are several e-assessment systems currently available. QuestionMark Professional was released in 1993 and it was progressively overcome by Questionmark Perception [8]. Questionmark Perception has received contradictory reviews in previous studies. On the one hand, it seems to have some disadvantages in terms of cost, connection to authentication system and several of its authoring settings [34]. On the other hand, some studies have classified it as a financially effective system that is both solid and flexible [33]. The OpenMark assessment system runs within Moodle and it offers varied question types, namely drag-and-drop, free text and multiple choice. The data that students generate during the e-assessment tasks can be saved and forwarded to the tutors' so they can take the appropriate action. OpenMark not only offers the students the possibility to have several attempts at each item, but it also provides a feedback system that increases its assistance with each attempt. In each attempt the student will receive increasingly more detailed hints to answer the question [6]. The Tripartite Interactive Assessment Delivery system (TRIADS) was developed by the University of Derby, the University of Liverpool and the Open University around 1996 [34]. This system allows the randomisation of questions and it can run online, within a LAN or via CD. It also provides detailed information about the students that assists the detection of misconduct [36].

The e-assessment system DEWIS was developed at the University of the West of England in 2007. It allows for summative and formative assessment and it is an entirely stand-alone online system available as open-source. It is appropriate for multiple subjects and so far it has been used namely in Mathematics, Business, Computer Science. Students can access it with their institutional credentials [37]. Its main characteristics include: fully algorithmic question creation, grading and feedback, different types of questions, lossless data collection, features that are easy to use by students and an academics' management page [38].

Soft Tutor is a commercial web application created in 2006. It has a feature that controls which IP locations are valid for completing the exams. On the one side Soft Tutor requires its own credentials for access, but in the other, the teachers can add standard resources, such as articles or presentations, to the questions. Overall issues concerning usability have deterred teachers from using it [24]. The diagnostic test system entitled DIAGNOSYS constitutes an example of adaptive testing. It uses an expert system to choose questions based on students' previous answers [8].

PeerWise was developed at the University of Auckland and it allows the learners to create their own multiple-choice items. It also enables the students to answer and assess the questions that their colleagues authored [8]. Hot Potatoes is an e-assessment program that was released by Half-Baked Software Inc. [39]. The program has the ability to offer the student swift and immediate feedback, it is available in several languages, it allows teachers to publish and share the tests and incorporates its JOZ (short answer) quizzes in web-based course modules. Furthermore, the program is user-friendly, which facilitates the students' interaction with it. In terms of disadvantages, it does not offer enough interactivity, it lacks features of access control and it fails to provide teacher-students synchronous interaction [40]. Tettis was presented in 2006 and it is an e-exams internet application whose
development was founded on Moodle. With Tenttis the teacher can use their institutional log in, but they can solely use PDF or JPG files in questions [24].

3.4 Other instruments

Gamification can be used to enhanced formative assessment [41], since it has the capacity to endow assessment with authenticity [42]. Moreover, gaming technology can assist the design of engaging assessment activities [43].

E-assessment tasks can be successfully delivered and completed in mobile devices such as iPads [44] and tablets [45]. Mobile assessment is in its early stages, but it brings several benefits to assessment. It is particularly valuable for authentic learning settings, like museums, but it can also be useful inside the limits of a classroom. Also, it allows assessment to be ubiquitous [46].

E-voting systems or audience response systems were designed for classroom use and enable the students to respond with a hand-held device to multiple-choice questions. Online learning environments like Blackboard Collaborate allow for this type of voting to occur virtually [8]. Rubrics can be developed with the assistance of online resources, for example Rubistar.4teachers and landmark-project [30]. It is also possible to develop interactive assessment task with: Hapyak (quizhud.avid-insight.co.uk), a platform that can be used for higher education and offers interactive video, personalisation and advanced analytics; and H5P (h5p.org), which allows the creation of rich and interactive content and it is supported for Moodle and is available as a Moodle plugin.

Transforming Assessment [47] suggests a collection of several tools that can be used for the development of e-assessment activities:

- Second Life (secondlife.com) can be used in its capacity of user friendly 3D environment;
- QuizHUD (quizhud.avid-insight.co.uk) is used with Second Life and it is open source;
- WordPress (wordpress.org) can a resource for the creation of blogs;
- SLOODLE (www.sloodle.org) incorporates Second Life and/or OpenSim with Moodle and it is available free and it is open source;
- Scenario Based Learning Interactive (SBLi) (sblinteractive.org) is a software for creating and delivering scenarios to assist problem or inquiry based learning and it is free to download;
- MediaWiki (mediawiki.org/wiki/MediaWiki) is a wiki tool that can be used for e-assessment;
- iPeer (lthub.ubc.ca/guides/ipeer/) is a peer review application developed by the University of British Columbia’s Centre for Teaching, Learning and Technology, that can be used with the university’s primary learning platform, Connect;
- OpenSimulator (opensimulator.org/wiki/Main_Page) is a 3D application server that can be used to generate virtual environments similar to SecondLife and it is available in open source;
- NanoGong (gong.ust.hk/nanogong) is an applet to record, playback and save an individual’s voice into a web page that can be used with Moodle and it is open source;
- PhpBB (phpbb.com) is a free open source bulletin board software that can be used for hosting discussions.

There is abundant evidence of Web 2.0 value within the context of educational environments, including the higher education sector, which is the stage for the application of a variety of these technologies [48]. The use of Web 2.0 tools for student authoring activities such as podcasting, microblogging, wiki writing is increasingly assuming a legitimate role in higher education practices. This trend is demanding further consideration in terms of determining what are the appropriate assessment standards and practices to address the particularities of these learning environments [49]. Furthermore, its pervasiveness has led teachers to resort to Web 2.0 tools to design e-assessment activities. Wikis and blogs, for example have significant potential to promote student reflection and also self-assessment [50]. Additionally, Web 2.0 tools provide opportunity for teachers to evaluate students’ deployment of these tools’ interactivity features and also to assess social interaction between the learners [51].
4 CONCLUSIONS

In general terms, e-assessment can be defined as the deployment of technology to support the assessment process. Through the use of technology, e-assessment represents the opportunity to not only develop assessment activities more frequently, but also to reach more students, which can be valuable for teachers facing the challenges of assessing courses with a high enrolment number. Moreover, the benefits of e-assessment are equally felt at a financial level, in the possibility to develop adaptive testing activities and in all the affordances that grading automation offers. The extent of available tools for the development of e-assessment initiatives constitutes an important basis of resources to suit both the needs of teachers and students and a variety of assessment requirements. While this variety of tools brings immeasurable possibilities, some teachers may experience certain difficulties in face of such diversity. It can be particularly challenging to select the most adequate technology to address their particular assessment needs and the most adequate to suit the nature of the courses they teach. Additionally, they also have to consider the level of complexity of the e-assessment tools to ensure that they have the skills to master them and that their students can effortlessly use them. A deeper and more detailed understanding of the array of tools that is available for e-assessment can assist teachers to make better and more informed choices about the technology that they deploy for the support of the e-assessment activities that they develop.

REFERENCES


