

Paper versus e-assessment: Biomedical students see advantages in moving away from traditional paper based in-semester assessments.

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Technology is becoming an integral part of the teaching and learning environment with e-assessment contributing to quality improvements in student learning experience. This research project investigated the potential effectiveness of using technology for summative assessment in an undergraduate Biomedical Science course. The results indicated that this cohort of students want choice in the location where the e-assessment is completed and choice in the device – personal or university owned. Biomedical Science students indicated that e-assessment is an effective alternative to invigilated, paper-based major in-semester assessments. Reliability of the technology and adequate feedback were also factors in the student's perception of e-assessment. Based on findings from this study, it is our view that e-assessments in this format offers a promising alternative to traditional assessment modes.

Keywords: e-assessment, validity, reliability, feedback, choice

Introduction

In the ever-changing higher educational landscape of entrepreneurialism, globalisation, internationalism and competition there is a need, and a challenge for academic staff to innovate and demonstrate evidence-based teaching practice. Over the last twenty years, technology has become an integral part of the teaching and learning environment and increasingly learning activities, including assessment, have moved into the 'online' space.

Benson (2003) strongly advocates that the 'principles of assessment' should not alter even if there is a move to the online environment. Using technology to assist with assessment practices (e-assessment) began in the late 1990's and can not only contribute to making quality improvements in student learning experience (Dermo, 2009), but also provides academic staff with valuable information on whether learning outcomes are being achieved (Benson, 2003; Alsadoon, 2017). This two-fold outcome, of evaluation and feedback, is an added bonus for both the student and teacher (Sorensen, 2013). The literature in e-assessment is quickly growing with Stodberg (2012) and Alsadoon (2017) providing a comprehensive account of the advantages and disadvantages of e-assessment that are relevant to students, teachers and the university in general. These extend to include cost, provision of feedback, flexibility and accuracy in marking to name but a few.

This paper will centre on the potential of using technology for summative in-semester assessment and investigate the perspectives of Australian undergraduate Biomedical Science students. The current Australian literature is scarce when considering this particular group of students and their perceptions of the known potential of e-assessment. This study aimed to:

- explore undergraduate student's perspectives on undertaking e-assessment using computerised software program for summative in-semester tests (MST);
- understand the advantages and disadvantages for students undertaking summative MST using e-assessment;
- build on existing knowledge of e-assessment in undergraduate Biomedical students.

The research study

The research, undertaken at a University in Victoria, Australia, involved students enrolled in two, second semester units in the Bachelor of Biomedical Science degree. The particular degree assists students to 'understand disease, how it occurs, what happens and how we can control, cure and prevent it' (University Website 2018). The overall cohort size of 550 enrolments had a familiarity with the Learning Management System (LMS), completing many tasks online; including formative assessments on a near weekly basis. Thus, using the software, on the same LMS platform, for this study was considered suitable. Increasing student



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enrolments and lack of appropriate large spaces at given times within the semester, has resulted in a need to look beyond invigilated paper-based assessments. Similar to the Hillier and Fluck (2017) study, the main drivers for implementation of e-assessment in this study was; academic interest in the scholarship of teaching and learning; innovation in assessment practice and; scale, size, and sustainability of increasing cohort numbers.

The chosen software program, Lockdown Browser, together with a supplementary add-on, Respondus Monitor integrated within the LMS, allows for various functions on the computer to be 'locked-down'. These functions include an inability to; print, email, capture screen content, and visit other web pages or apps during the testing period. The added bonus of multi-media (video and audio) recording, using a web camera, enabled accurate tracking that the right student was undertaking the e-assessment.

In semester 2, 2017, it was determined that two core first-year units, in the Biomedical Science degree would undertake the use of both products (outlined above) for the in-semester summative assessment (namely a mid-semester test). The table below indicates the timing, location, schedule and feedback provided to students for both units.

Table 1: Location, timing, Schedule and Feedback per unit

	<i>Unit 1 Neurobiology (U1NB)</i>	<i>Unit 2 Molecular biology (U2MB)</i>
Timing	Weeks 6 and 9 (45mins each)	Week 8 (45mins)
Location	Choice of : a) on-campus using a Monash device, b) off-campus using their own device, c) on-campus using their own device.	No choice - on-campus using a Monash device only
Completion Schedule	On the one day, but at various times. (<i>Approximately 10-14 students required a deferred assessment for various reasons - completed within the week following on from the original date of the in-semester assessment.</i>)	
Feedback	Summative grades and correct answer provided once the deferred assessments were completed.	

Methodology & Methods

It was determined that a 'pseudo-quantitative' study would be most appropriate and data was collected using previously validated questions from Dermo (2009) and Alsadoon (2017). All students enrolled in the two units became potential participants in the anonymous online questionnaire, which students accessed through Google forms. Likert scale questions covered the following six dimensions: affective factors (how students feel during e-assessment); validity (appropriateness for university studies); practicality (challenges and benefits); reliability and fairness (in comparison to paper-based assessments); security (in comparison to traditional assessments) and; pedagogy (importance in learning and teaching). Contact with students was via a general announcement in the LMS, which also contained the direct link to the questionnaire. The LMS also contained a dedicated information block on the right hand side of the unit page. The questionnaire remained open for approximately four weeks, with a reminder email sent out halfway through the timeframe.

Results and Discussion

In total, 39 students (7%) completed the questionnaire following their final in-semester assessment task using Respondus. Demographic data indicated a higher number of females (71.79%) completing the survey than males (28.21%). The majority of students were aged <19 years old (82.05%) followed by 20-24 years old (15.38%) and 30-34 years old (2.56%), reflective of the age demographic of the overall cohort.

For Unit 1 Neurobiology (U1NB) – Test 1, 61.54% of students chose to use a university device to undertake the test; this rose to 74.36% (Figure A) for Test 2. The reason for this was unclear however several students reported technical difficulties while using their own internet and/or devices at home which could account for this change. For Test 1, of the student who used their own device, the majority used them at home (28.21%), while the remainder chose to complete the test on campus (10.26%). The results showed a similar pattern for Test 2 with the majority of student who used their own computer completing the test from home (17.95%) and the remainder on campus (7.69%).

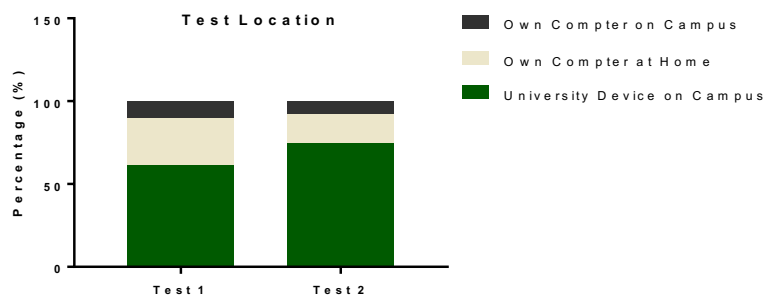


Figure A: Percentages of students in U1NB at each test location when given the choice to complete the test at home or on campus, either with their own device or with a university device.

In order to analyse the six dimensions of the Likert questionnaire, each item was coded to determine if students phrased it positively or negatively. Likert scores for negative statements were re-coded to align with the positive statements in each dimension, as per Dermo 2009. Statements scored less than three (3) were negatively perceived by students and scores greater than three (3) were deemed positive. Following this analysis, it appeared that ‘Pedagogy’ received the highest positive rating with a mean of 3.7 (Table 2). Cronbach’s alpha assisted in determining the internal consistency of each dimension. Of the six dimensions, four received reliable Cronbach’s alphas scores of >0.7: ‘Affective factors’, ‘Validity’, ‘Reliability and Fairness’ and ‘Pedagogy’ (Table 2), confirming consistency as described by Dermo (2009).

Table 2: Dimension-based analysis

<i>Dimension</i>	<i>n</i>	<i>Mean</i>	<i>SD</i>	<i>Cronbach's Alpha</i>
<i>Affective Factors</i>	39	3.3	1.3	0.841
<i>Validity</i>	39	3.3	1.3	0.753
<i>Practicality</i>	39	3.2	1.3	0.684
<i>Reliability and Fairness</i>	39	3.1	1.2	0.756
<i>Security</i>	39	3.3	1.1	0.317
<i>Pedagogy</i>	39	3.7	1.2	0.896

Responses from individual Likert scale items (Figures B & C) revealed that students expect e-assessment to be utilised at university (58.97%); believe that e-assessments play an important role in higher education (79.48%); is appropriate for Biomedical Science (79.48%) and; would like to see e-assessment implemented in further departmental modules (58.97%). Sorensen (2013) reported similar findings from a cohort of Chemical Engineering students. In our study, 33.33% of students stated that e-assessments is appropriate for all students. Further research such as focus groups would aid in determining why this is the case in this particular cohort.

From the practicality perspective (Figure B), students agreed that e-assessments were more accessible (58.97%) and that they did not require advanced technical skills (87.18%) to undertake the e-assessment. Students also agreed that e-assessments were just as secure as paper-based (53.84%) and that they did not facilitate cheating (53.84%). These findings are in line with previous studies into e-assessment (Alsadoon, 2017; Dermo, 2009; Sabbah, Saroit, & Kotb, 2012). As previously reported in the literature, one of the biggest concerns for students was the reliability of the technology (Deutsch, Herrmann, Frese, & Sandholzer, 2012; Sabbah et al., 2012). In the present study, 69.23% of students agreed that technical problems could make e-assessments impractical (Figure C). It is likely that the large proportion of students opting to do the test on-campus, on university devices, is due to this factor. This is clearly indicated by the statement ‘*I was too nervous to use the LockDown at home...*’ and ‘*...the stress of whether the program is going to malfunction is a distinct and unnecessary source of unease*’. In contrast, some students found the greater stressor to be the exam setting itself stating that ‘*it was much less stressful and more convenient than having to come into university*’ and that ‘*the stress of coming into the exam venue, public transport issues, difficulty finding the venue were reduced*’. This indicates that choice in location and device for the completion of e-assessment is important to this cohort of students.

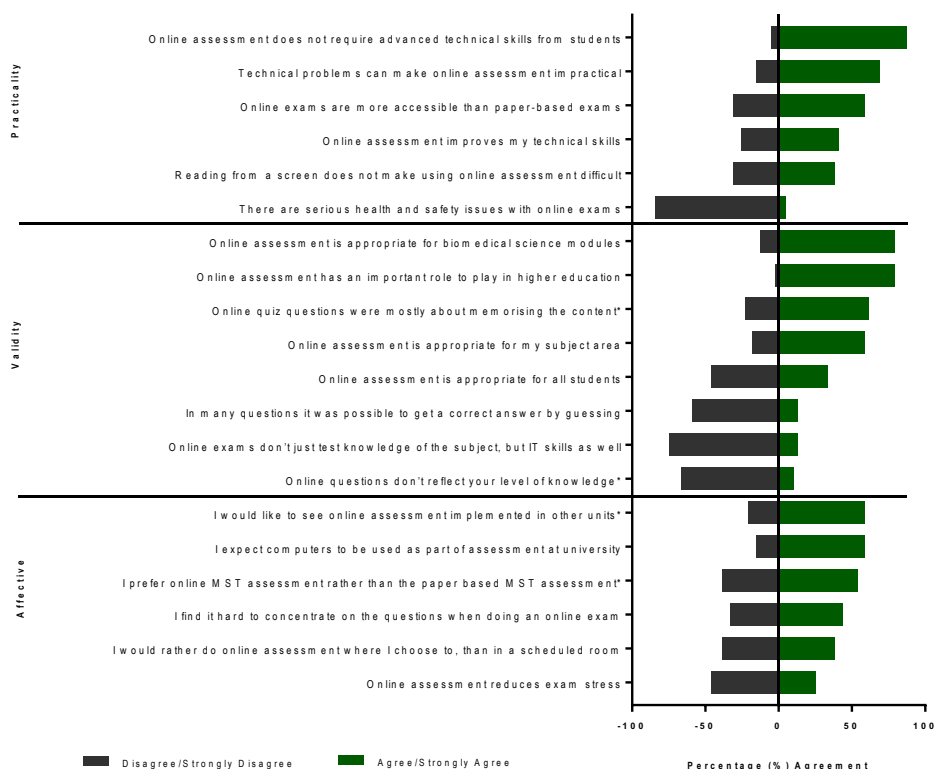


Figure B: Percentage of students (n=39) who agreed/strongly agreed with Likert scale items for the Affective, Validity and Practicality dimensions. * = statement has been summarised for data presentation, appeared differently in the questionnaire.

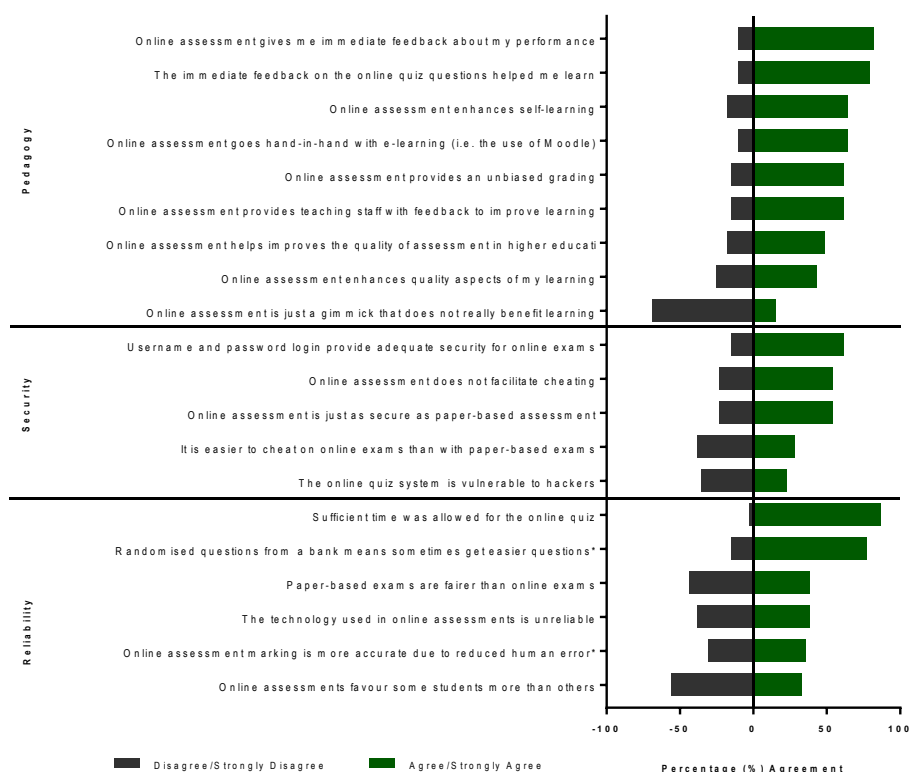


Figure C: Percentage of students (n=39) who agreed/strongly agreed with Likert scale items for the Reliability, Security and Pedagogy dimensions. * = statement has been summarised for data presentation, appeared differently in the questionnaire.

The majority of students (53.84%) agreed they prefer e-assessments to paper-based. However, a large percentage also disagreed with this (38.46%) indicating mixed preferences amongst the cohort. Furthermore, in response to the item *'I would prefer to do online assessments where I choose to, than in a scheduled room'*, it was evenly distributed between agree and disagree (38.46% each) (Figure B). The notion of choice appears again, with comments such as:

'It's a good idea to have an option/room for people without access to a computer to go to but the choice to do it at home would have been good too.'

'It was great how students had many option to complete the assessment...' and *'...please keep the option open of being able to do the MSTs at a university computer lab open'*.

In terms of the test itself, students felt that randomised questions, from a bank, meant that it was possible to get less difficult questions than their peers (76.92%) but disagreed that paper-based exams were fairer (43.59%) (Figure B). Dermo (2009) also found that fairness of question item banking was the biggest concern for students. The cohort in the present study has become familiar with online quizzes both formative and summative through the LMS and the general format of question banking. Students also had the option to complete the quiz in a semi-invigilated format, in on-campus computer labs so it is possible that this contributed to a reduced concern about the fairness of e-assessments.

Finally, from a pedagogical perspective (Figure C), most students felt that e-assessments enhanced their learning, with 69.23% of students disagreeing with that statement that *'Online assessment was just a gimmick that did not benefit learning'* (Figure C). Students agreed that e-assessments go hand-in-hand with e-learning (64.10%) and enhances the quality of assessment (43.59% agree, 25.64% disagree); and their learning (48.72% agree and 17.95% disagree). Students also agreed that e-assessments enhanced self-learning (64.10%) and that receiving immediate feedback (82.05%) assisted with their ability to learn (79.49%). Whitelock (2007) reported that due to the immediate feedback, students have the potential to become more reflective as learners. Students in the present study commented that *'they liked online testing as it allowed quick feedback... and made it easier to see we were lacking in terms of knowledge and preparation'* and that getting *"instantaneous" feedback allowed me to see gaps in my memory'* indicating that students do use feedback reflectively. It was noted by one student that the feedback *'is still really lacking'*, highlighting a key area of improvement for the academics when implementing e-assessments.

Conclusion

E-assessments appears well received by students and their inclusion in the Biomedical Science curriculum was valued as an effective learning tool. Students showed no major concerns about cheating or fairness of e-assessment but were apprehensive about the reliability of the technology, prompting many to choose to do the e-assessment on-campus using University devices and/or internet connections. An apparent finding from this study was that students greatly appreciated the opportunity to choose the location (home or on campus) and the device (University-owned or personal). Students had mixed opinions about which option they preferred but the ability to choose appeared to reduce the stress they experience with this type of assessment. Similar to the findings in Hillier (2014) it appears that any form of e-assessment needs to be tailored for the specific discipline. If university administration of e-assessment can allow an opportunity for choice, then e-assessment is a very attractive alternative to invigilated, paper-based summative in-semester assessments.

The limitation of the study is its low response rate and lack of qualitative data collection to investigate further student perceptions of e-assessment. In future studies, it would be ideal to investigate perceptions before and after student's exposure to e-assessments. Given the high positive rating towards the pedagogical dimension, there appears to be a strong necessity to not only the inclusion of feedback, which is effective, constructive and immediate but also a need to ensure that there is a presence of higher order thinking questions.

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